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Formation of the Arctic Ethno-Economic Cluster as a Condition for Sustainable (Ecological and Ethno-Preserving) Development of the Region (On the Example of the Arctic Territories of the Krasnoyarsk Krai)

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Abstract. The paper considers the issues of ethno-demographic development and settlement of small-numbered indigenous peoples of the Arctic zone of the Russian Federation in the period between the 2002 and 2020 population censuses. The article analyzes the current state and development of the ethno-economic areas of the Arctic zone of the Krasnoyarsk Krai, assesses the potential for the development of traditional economic activity of indigenous peoples and identifies hindering factors. It is shown that the key mechanism for achieving the goals of sustainable development of traditional economic activities in the Arctic region is an active balanced cluster approach adapted to the specifics of ethno-economic habitats of indigenous minorities of the Arctic. The prerequisites and prospects for creating an ethno-economic cluster in the Arctic zone of Krasnoyarsk Krai are assessed. Promising areas of investment development of socio-economic potential and cooperative relations of traditional economic activities of indigenous minorities are identified. The results of the cluster formation will be increase in the degree of processing and in the output of traditional economic activities, increase in employment and improvement of the standard of living of indigenous small-numbered peoples, transformation of traditional economic activity into a full-fledged sector of the economy of the Arctic zone of the Krasnoyarsk Krai.
Keywords: *Arctic zone, indigenous peoples, ethno-economic area, traditional economic activity, ethno-economic cluster*

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Introduction

The Arctic territories of Russia are historical places of traditional residence of small indigenous peoples of the North, Siberia and the Far East (SIPN).

Preservation of the cultural, historical and ethnographic identity of these peoples and formation of a sector of traditional economic activities create additional opportunities for sustainable socio-economic development of the Arctic region.

The traditional economy of indigenous peoples is a set of economic activities, historically developed on a certain territory and evolutionarily adapted to local resource conditions, aimed at ecological, rational use of fauna and other reproducible natural resources through methods and forms passed on from generation to generation [1, Gladun E., Nysten-Haarala S., Tulaeva S., pp. 2–4; 2, Datta R., Hurlbert M.A., Marion W., p. 556].

The significance of the traditional economic activities of SIPN for the sustainable development of the Arctic is determined by the following circumstances.

On the one hand, traditional economy can be considered as a commodity sector of the economy, historically developed in territories with harsh natural and climatic conditions and limited opportunities for economic diversification, which provides employment (self-employment) and income for the majority of the population of remote northern villages, supplies market with in-demand products and contributes to food security in the Arctic regions.

On the other hand, being a way of life for indigenous peoples, traditional economic activity performs an ethnic-preserving function, contributes to the preservation of language and culture, and supports the ethno-social and ethno-demographic stability of these peoples.

Traditional economic activity, focused on the rational use of renewable natural resources, based on traditional values, providing self-employment and living conditions for indigenous peoples, is one of the aspects of the inclusive and sustainable development of the Arctic territories; it also plays a decisive role in preserving northern natural complexes for future generations [3, Brock T., Reed M.G., Stewart K.J.; 4, Meadows J., Annandale M., Ota L.].

Peculiarities of modern settlement of indigenous peoples in the Arctic zone of the Russian Federation

The Russian Federation is one of the largest multinational states in the world, formed on a federal basis. According to the All-Russian Population Census of 2020, representatives of 194 ethnic communities live in Russia: 145 groups and 49 subgroups [1]. 47 of them are small indigenous peoples of the Russian Federation (SIP) — special population groups (up to 50 thousand people)

[1] In accordance with the methodological explanations of Rosstat for volume 5 of the Results of the All-Russian Population Census 2020 “National composition and language proficiency”, the national composition takes into account the grouping categories formed by the Institute of Ethnology and Anthropology named after N.N. Miklouho-Maclay of the Russian Academy of Sciences (IEA RAS) and agreed upon by the FANA of Russia, Rosstat, the Administration of the President of the Russian Federation, the Government of the Russian Federation (minutes of the meeting dated October 25, 2022 No. P-18). Rosstat. Methodological explanations for volume 5 “National composition and language proficiency”. URL: https://rosstat.gov.ru/storage/mediabank/Tom5_Metodolog_VPN-2020.docx (accessed 25 June 2023).

living in the territories of the traditional settlement of their ancestors, preserving their traditional way of life, economy and crafts [2]. The total number of small indigenous peoples of the Russian Federation (according to the All-Russian Population Census of 2020) was 315.2 thousand people, of whom 306.3 thousand people (97.2%) lived in the territories of primary residence [3].

A special place among the indigenous peoples of the Russian Federation belongs to the indigenous peoples of the Arctic, who have accumulated a wealth of experience of survival in extreme climatic conditions and have preserved their unity and harmony with nature, which is reflected in the nature of their traditional environmental management and culture.

Despite the large number of legislative and strategic documents on the development of the Arctic adopted in the Russian Federation in recent years, there is no unified and generally accepted definition of the boundaries of the Arctic zone of the Russian Federation (AZRF) and the indigenous peoples living on its territory. There are two interpretations:

- "basic" (in accordance with the "Fundamentals of the state policy of the Russian Federation in the Arctic until 2035", approved by Decree of the President of the Russian Federation dated March 5, 2020 No. 164, Decree of the President of the Russian Federation dated May 2, 2014 No. 196 "On the land territories of the Arctic zone of the Russian Federation" (as amended by Decrees No. 287 dated June 27, 2017, No. 220 dated May 13, 2019, No. 164 dated March 5, 2020));
- "extended" (in accordance with Federal Law No. FZ-193 dated July 13, 2020 "On state support for entrepreneurship in the Arctic zone of the Russian Federation").

The difference between them is significant, especially in terms of the boundaries at the level of constituent entities of the Russian Federation. These differences affect the interests of four Arctic subjects of the Russian Federation — the republics of Karelia and Komi, the Arkhangelsk Oblast and the Krasnoyarsk Krai (Table 1).

Table 1

Territorial structure of the Arctic zone of the Russian Federation according to the "basic" and "extended" interpretations

Regions	Territorial composition of the Arctic zone of the Russian Federation according to	
	"basic" interpretation (Decree of the President of the Russian Federation No. 164 dated March 5, 2020 "Fundamentals of the state policy of the Russian Federa-	"extended" interpretation (Federal Law No. FZ-193 dated July 13, 2020 "On state support for entrepreneurship in the Arctic zone of the Russian Federation")

[2] The unified list of indigenous peoples of the Russian Federation, approved by Decree of the Government of the Russian Federation of March 24, 2000 No. 255 (as amended on December 18, 2021), includes 40 peoples of the North, Siberia and the Far East (approved by Decree of the Government of the Russian Federation of April 17, 2006 No. 536-r "On approval of the list of indigenous peoples of the North, Siberia and the Far East of the Russian Federation" (as amended on December 26, 2011); 7 peoples of other regions of Russia (mainly living in Karachay-Cherkessia, Udmurtia, Leningrad, Chelyabinsk, Pskov oblasts and Krasnodar Krai).

[3] Rosstat. Results of the 2020 All-Russian Population Census. Volume 5 "National composition and language proficiency". Table 17. Population of indigenous peoples of the Russian Federation. URL: https://rosstat.gov.ru/storage/mediabank/Tom5_tab17_VPN-2020.xlsx (accessed 25 June 2023).

	tion in the Arctic until 2035", Decree of the President of the Russian Federation No. 196 dated May 2, 2014 "On the land territories of the Arctic zone of the Russian Federation")	
1. Murmansk Oblast	all municipal districts	all municipal districts
2.Nenets Autonomous Okrug	all municipal districts	all municipal districts
3. Chukotka Autonomous Okrug	all municipal districts	all municipal districts
4. Yamalo-Nenets Autonomous Okrug	all municipal districts	all municipal districts
5. Republic of Karelia	3 municipal districts	6 municipal districts
6. Komi Republic	1 municipal district	4 municipal districts
7. Republic of Sakha (Yakutia)	13 municipal districts	13 municipal districts
8. Krasnoyarsk Krai	3 municipal districts	3 municipal districts fully and 1 municipal district partially
9. Arkhangelsk Oblast (excluding Nenets Autonomous Okrug)	7 municipal districts	9 municipal districts
10. Lands and islands located in the Arctic Ocean (Resolution of the Presidium of the Central Executive Committee of the USSR dated on April 15, 1926 "On declaring lands and islands located in the Arctic Ocean as the territory of the USSR" and other legal acts of the USSR)	All lands and islands located in the Arctic Ocean that have been discovered or may be discovered in the future, which did not constitute the territory of any foreign states recognized by the government of the USSR by the time of the publication of the Decree of the Central Executive Committee of the USSR dated on April 15, 1926	No data
11. Marine area	Internal sea waters, territorial sea, exclusive economic zone and continental shelf of the Russian Federation	Areas of the continental shelf of the Russian Federation for which state support measures are applied

The ambiguity (inconsistency, variability) of approaches to identifying the boundaries of the Arctic zone of the Russian Federation according to climatic, geographic, economic, management and other criteria has been repeatedly pointed out in the scientific literature [5, Zhukov M.A.; 6, Lukin Yu.F.; 7, Zhukov M.A., Krainov V.N., Telesnina V.M.; 8, Lukin Yu.F.]. In some cases, the official boundaries include areas that do not meet the Arctic criteria (for example, the southern part of the Turukhanskiy region) [9, Zhukov M.A., Krainov V.N., Popov D.A.].

Currently, 108.5 thousand representatives of 19 small-numbered indigenous peoples (35.4% of the total number of small-numbered indigenous peoples of the Russian Federation, accounted for by their areas of predominant residence) live in the Arctic zone of the Russian Federation, which in the "expanded interpretation" includes, fully or partially, the territories of 9 constituent entities of the Russian Federation (Fig. 1–2).

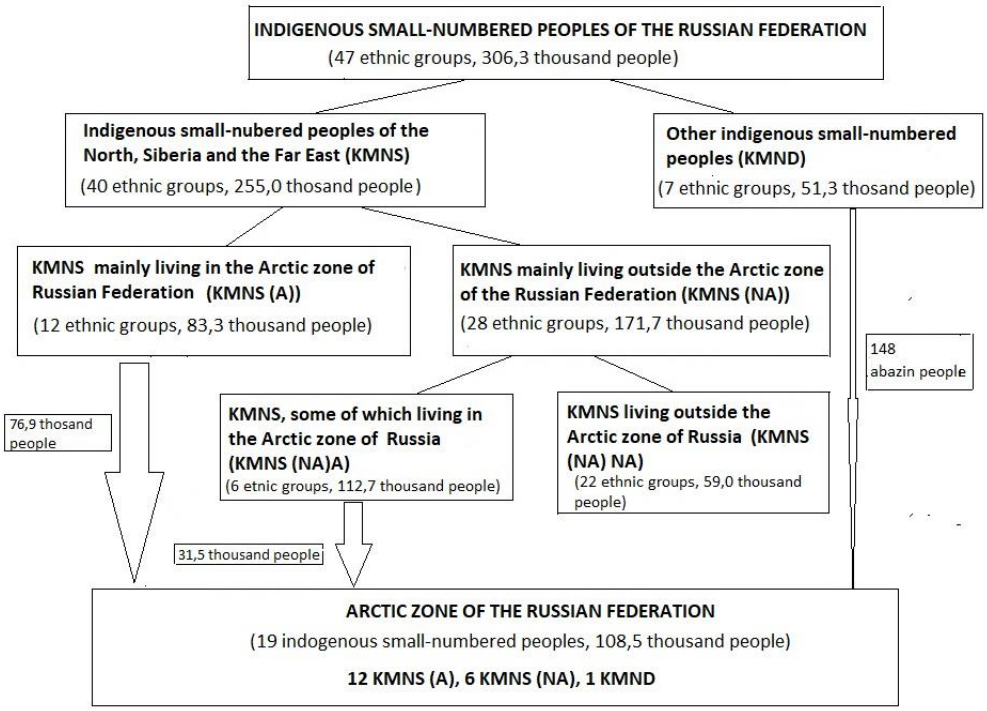

Fig. 1. Distribution of indigenous peoples of the Russian Federation by areas of predominant residence (calculated on the basis of data from the 2020 All-Russian Population Census [4]).

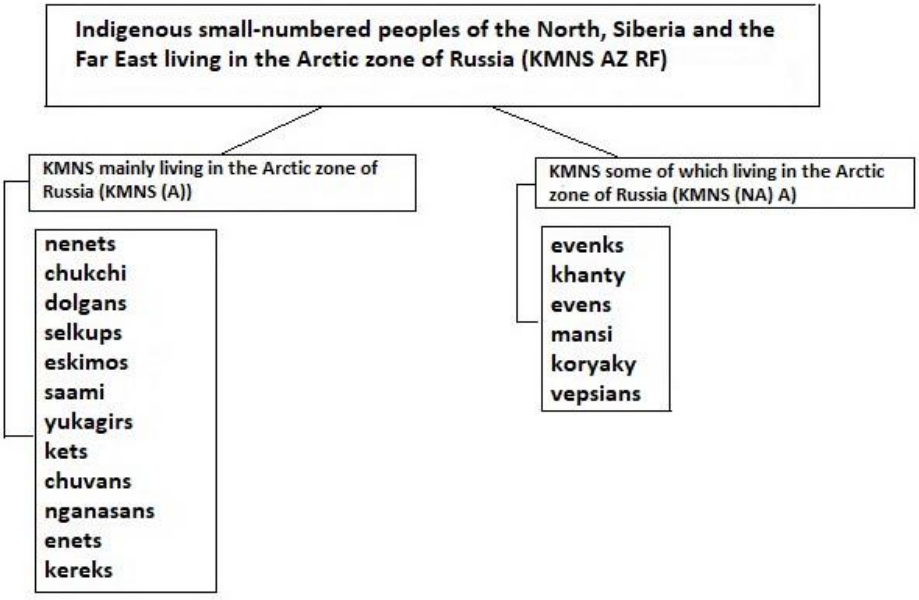

Fig. 2. Composition of small indigenous peoples of the North living in the Arctic zone of the Russian Federation.

More than 98% of indigenous peoples of the Russian Arctic live in 5 Arctic regions:

- Yamalo-Nenets Autonomous Okrug — 48,277 people;
- AZ of the Republic of Sakha (Yakutia) — 20,787 people;
- Chukotka Autonomous Okrug — 17,000 people;
- AZ of the Krasnoyarsk Krai — 13,647 people;

[4] Rosstat. Results of the 2020 All-Russian Population Census. Volume 5 "National composition and language proficiency". Table 17. Population of indigenous peoples of the Russian Federation. URL: https://rosstat.gov.ru/storage/mediabank/Tom5_tab17_VPN-2020.xlsx (accessed 25 June 2023).

- Nenets Autonomous Okrug — 6,722 people.

The remaining four Arctic regions of the Russian Federation (Murmansk Oblast, the Arctic zones of the Republics of Karelia and Komi, the Arkhangelsk Oblast without the Nenets Autonomous Okrug) account for less than 2% of the indigenous minorities of the Russian Arctic.

The largest indigenous small ethnic groups (85% of the total number of indigenous peoples of the Russian Arctic) are:

- Nenets — 47,070 people;
- Chukchi — 13,844 people;
- Evenks — 11,805 people;
- Khanty — 10,051 people;
- Evens — 9,382 people.

The share of indigenous minorities, predominantly living in the Russian Arctic (SIPN (A)), currently accounts for 70.9% of the total number of indigenous minorities in the Russian Arctic; the share of indigenous minorities partially residing in the Russian Arctic (SIPN (NA) A) is 29.0% (Table 2). The share of other small peoples partially living in the Russian Arctic (Abazins of the Yamalo-Nenets Autonomous Okrug (148 people)) is insignificant (less than 1%).

Table 2

"Arctic" and "non-Arctic" peoples in the total number of SIPN of the Russian Arctic

Indigenous small-numbered peoples of the North, Siberia and the Far East living in the AZRF	Total number in the Russian Federation, people	including residents of		Share of indigenous ethnos living in the AZRF, % of the total number in the Russian Federation	Share of indigenous ethnos living outside the AZRF, % of the total number in the Russian Federation
		AZRF	other regions (northern territories, SFD and FEFD regions)		
Arctic SIPN (SIPN (A)), total	83 336	76 874	6 462	92.25	7.75
including					
Nenets	48 985	47 070	1 915	96.09	3.91
Chukchi	15 638	13 844	1 794	88.53	11.47
Dolgans	8 032	7 360	672	91.63	8.37
Selkups	3 412	2 319	1093	67.97	32.03
Eskimos	1 487	1 460	27	98.18	1.82
Saami	1 370	1 370	0	100.00	0.00
Yukagirs	1 739	1 266	473	72.80	27.20
Kets	1 028	590	438	57.39	42.61
Chuvans	776	743	33	95.75	4.25
Nganasans	667	651	16	97.60	2.40
Enets	196	195	1	99.49	0.51
Kereks	6	6	0	100.00	0.00
Non-Arctic SIPN AZRF (SIPN (NA) A), total	112 745	31 495	81 250	27.93	72.07
including					
Evenks	38 740	11 805	26 935	30.47	69.53
Khanty	31 006	10 051	20 955	32.42	67.58
Evens	19 522	9 382	10 140	48.06	51.94
Mansi	11 983	117	11 866	0.98	99.02
Koryaks	7 214	54	7 160	0.75	99.25
Vepsians	4 280	86	4 194	2.01	97.99

The division of indigenous peoples of the Russian Arctic into “Arctic” and “non-Arctic” is quite conditional and may vary with changes in the borders of the Arctic zone. Some SIPN classified as “Arctic” in Table 2 (Selkups, Yukagirs, Kets) have a fairly high concentration of residence outside the Arctic zone (25–45% of their total population). This is largely due to the “border” area of their traditional residence, which combines “Arctic” and “northern” features of economic and life-supporting activities. Given that the borders of the Arctic do not always allow the identification of strictly scientifically justified territories, the attribution of indigenous small-numbered ethnic groups living there may also be conditional.

Between the 2002 and 2020 All-Russian Censuses, 4 peoples had positive population growth (more than 10%); 6 peoples — relatively small changes (from -10% to +10%); 4 peoples had a significant decrease in numbers (by more than 10%). The Vepsians, Mansi, Koryaks, and Kereks were not taken into account (due to their small numbers on the territory of the Russian Arctic) (Table 3).

Table 3

Change in the number of SIPN in the Russian Arctic in 2020 compared to 2002 (according to population census data)

Extended reproduction (4 peoples)	Ordinary reproduction (6 peoples)	Constricted reproduction (4 peoples)
Nenets (+8579 people, +22.3%) Evens (+1648 people, +21.3%) Khanty (+1251 people, +14.2%) Yukagirs (+279 people, +28.3%)	Evenks (+778 people, +7.1%) Chukchi (+724 people, +5.5%) Dolgans (+622 people, +9.2%) Selkups (+161 people, +7.5%) Eskimos (-74 people, -4.8%) Enets (-14 people, -6.7%)	Saami (-399 people, -22.6%) Kets (-255 people, -30.2%) Nganasans (-152 people, -18.9%) Chuvans (-208 people, -21.9%)
Total: +11 775 people, +20.3%	Total: +2 197 people, +6.3%	Total: -1 014 people, -23.2%
Total population according to the Russian census 2020: 69789 people	Total population according to the Russian census 2020: 36983 people	Total population according to the Russian census 2020: 3354 people

In general, during the period under review (2002–2020), positive changes in the number of SIP of the Russian Arctic prevailed, with an increase of 12,960 people (+13.6%). Positive population growth was due to a relatively high birth rate and a relatively low mortality rate.

More than half of the total increase in the population of SIPN of the Russian Arctic (66.2%) was provided by representatives of one ethnic group — the Nenets.

The number of some peoples (Eskimos, Enets, Saami, Kets, Nganasans, Chuvans) has decreased, which is explained both by the general negative demographic dynamics in the Arctic regions of the AZRF, and by the low economic attractiveness of traditional activities in the current conditions and current legislation, taking into account the prospects for their development.

The migration factor also has a significant impact: highly mobile (nomadic and semi-nomadic) ethnic groups can easily change their place of residence depending on the favorable conditions for their activities in different territories.

Thus, the main limiting factor in the ethno-demographic development of indigenous minorities in the Russian Arctic is the crisis state of traditional economic activities.

In this regard, the dynamics of the number of indigenous peoples in various regions of the Russian Arctic is of interest (Table 4).

Table 4

Changes in the number of indigenous peoples in the Arctic regions — constituent entities of the Russian Federation [5]

Arctic regions of the AZRF	Number of SIPN, people		Population growth for 2002–2020, %
	2002	2020	
Regions with relatively favorable conditions of traditional economic activities (TEA)			
Yamalo-Nenets AO	37 320	48 277	+29.4
AZ of the Republic of Sakha (Yakutia)	16 556	20 787	+25.6
Regions with relatively satisfactory TEA conditions			
Chukotka AO	16 757	17 000	+1.5
Regions with relatively unsatisfactory TEA conditions			
AZ of the Krasnoyarsk Krai	14 181	13 647	-3.8
Nenets AO	7 754	6 722	-13.3
Murmansk Oblast	1 932	1 482	-23.3

With a certain degree of confidence (with reservations about the conditionality of such a conclusion [6]) it can be stated that the Arctic regions with high growth rates in the number of indigenous minorities have more favorable conditions for their traditional economic activities, and vice versa.

In the Russian Federation and its regions, a fairly comprehensive legal framework has been created in the field of protecting the rights and traditional way of life of the small peoples of the North, Siberia and the Far East. Issues in the field of protecting the rights of national minorities are comprehensively regulated by the Federal Law “On guarantees of the rights of indigenous minorities of the Russian Federation” dated April 30, 1999 No. 82-FZ (as amended on July 13, 2020).

At the federal level, there are also federal laws “On the general principles of organizing communities of indigenous peoples of the North, Siberia and the Far East of the Russian Federation” dated July 20, 2000 No. 104-FZ (2000) (as amended on October 20, 2022), “On the territories of traditional environmental management of indigenous peoples of the North, Siberia and the Far East of the Russian Federation” (2001); the Concept of sustainable development of indigenous peoples of the North, Siberia and the Far East of the Russian Federation (Order of the Government of the Russian Federation dated February 4, 2009 No. 132-r) and the Federal program of state support for traditional economic activities of indigenous peoples of the Russian Federation carried out in the Arctic zone of the Russian Federation (Order of the Government of the Russian Federation dated April 15, 2021 No. 978-r) were approved. In addition, the constituent entities of the Russian Federation independently resolve the problems of ethnic minorities living in their territories.

[5] Regions with a population of indigenous minorities of more than 1000 people are shown.
[6] The economic attractiveness of TEA in the region may decrease not only if the conditions for its implementation deteriorate, but also if alternative, more competitive and attractive types of employment appear, for example, in the industrial, social and service sectors of the economy.

At the same time, an analysis of existing experience shows that the rights of small indigenous peoples engaged in traditional economic activities are not always clearly and specifically defined in current legislation.

In particular, the issues of securing the right of ownership of ancestral lands, preferential granting of indigenous minorities the right to use hunting and fishing grounds, the use of allocated quotas for wildlife and aquatic biological resources for children and elderly relatives, compensation for damage to traditional economic activities as a result of industrial development of territories, and granting the status of small businesses to indigenous communities are not sufficiently disclosed [7].

Ethno-economic potential of the Arctic zone of the Krasnoyarsk Krai

The territory of the Arctic zone of the Krasnoyarsk Krai is the place of traditional residence and traditional economic activities of small indigenous peoples — Dolgans, Nenets, Evenks, Kets, Nganasans, Selkups, Entsy, Evens. 86–87% of indigenous minorities of the Krasnoyarsk Krai live within the Arctic zone (Table 5).

Table 5

Territorial distribution of the indigenous minorities of Krasnoyarsk Krai (territories of predominant residence)

Territories of Krasnoyarsk Krai	Number of SIP, people		As a % of the total number of SIP	
	2002 Census	2020 Census	2002 Census	2020 Census
Norilsk Municipal District	327	350	2.0	2.2
Taimyrskiy Dolgano-Nenets Municipal District	9 864	10 155	59.8	64.5
Turukhansk Municipal District	1 336	952	8.1	6.1
10 rural settlements of the Evenki Municipal District	2 654	2 190	16.1	13.9
Arctic zone of the Krasnoyarsk Krai — total	14 181	13 647	86.0	86.7
Other territories of the Krasnoyarsk Krai	2 228	1 981	14.0	13.3
Krasnoyarsk Krai as a whole	16 409	15 628	100.0	100.0

About 93–95% of the total area of the Arctic zone of the Krasnoyarsk Krai belongs to the zones of traditional environmental management and economic activity of SIPN.

The existing structure of settlement of indigenous peoples and its dynamics are explained by historical and geographical reasons, the duration and stages of development of the territory, as

[7] Annual reports of the Commissioner for the Rights of Indigenous Minorities of the Krasnoyarsk Krai "On the realisation of the constitutional rights and freedoms of indigenous minorities in the territory of the Krasnoyarsk Krai". URL: https://www.ombudsmankk.ru/about/report/ (accessed 25 June 2023).

well as the features of the modern transformation of the ethno-economic areas formed in the region [10, Klokov K.B.] [8].

Currently, four ethno-economic areas of traditional economic activity can be distinguished in the Arctic zone of the Krasnoyarsk Krai (Table 6).

Table 6

Ethno-economic areas of traditional economic activities in the Arctic zone of Krasnoyarsk Krai

Ethno-economic area	Core ethnos (co-ethnos)	Geographical and territorial boundaries; base settlements	Main types of traditional nature use	Way of life
1. Yenisei Nenets	Nenets (Enets)	Lower reaches of Yenisei and its tributaries (Taimyrskiy Dolgano-Nenetskiy District) Base settlements: Nosok, Tukhard, Karaul, Ust-Port, Vorontsovo, Baikalovsk, Potapovo	1. Tundra and forest-tundra large herd reindeer husbandry 2. Semi-nomadic fishing and reindeer herding 3. Semi-nomadic fishing and hunting	nomadic/ sedentary
2. Taimyr Dolgano-Nganasan	Dolgans and Nganasans	Central part of the Taimyr Peninsula, Khatanga River basin in the Eastern part of the Taimyr Peninsula (Taimyr Dolgano-Nenets District) Base settlements: Kresty, Novaya, Kheta, Zhdaniha, Katyryk, Novorybnaya, Syndassko, Popigai, Volochanka, Levinskie Peski, Ust-Avam, Khantai Lake	1. Tundra nomadic reindeer husbandry (in combination with fur-bearer and fishery) 2. Forest-tundra nomadic farming combined with wild reindeer hunting 3. Hunting-fishing economy 4. Fishing	sedentary
3. Ilimpi Evenki	Evenks (Essei Yakuts [9])	Base settlements of the Arctic part of the Evenki District: Yesey, Chirinda, Ekonda, Yukta, Nidym, Tutonchani, Kislokan, Uchami, Surinda	1. Taiga reindeer herding 2. Hunting 3. Fishing	sedentary
4. Turukhan Kets-Selkups	Kets and Selkups	Local habitats in the Turukhanskiy District Base settlements: Kellog, Surgutikha, Maduika, Farkovo	1. Hunting 2. Fishing	sedentary

The potential for the development of traditional activities (TA) and traditional way of life (TWL) of each ethno-economic area is determined by a set of base settlements, the criteria for identifying which are the following indicators (Fig. 3):

[8] Ethno-economic area — a geographically isolated area of environmental management of ethnic groups or individual ethno-territorial groups of the indigenous population [10, Klokov K.B.].

[9] Note: * Essei Yakuts have been leading a lifestyle separated from the main mass of the Yakut ethnos for more than 300 years. Compact living, absence of assimilation processes, high rates of native language proficiency, well-formed ideas about the differentiating and consolidating factors of ethnic identity allow classifying this group as the indigenous peoples of the North [11, Bakhtin S.A.].

- the size of ethnic group relevant for the given area (at least 50 people);
- the share of small indigenous peoples (SIP) in the total population of the settlement (at least 50%);
- the share of the core ethnos (at least 15%) [12, Koptseva N.P., Shishatskiy N.G., Bryukhanova E.A.].

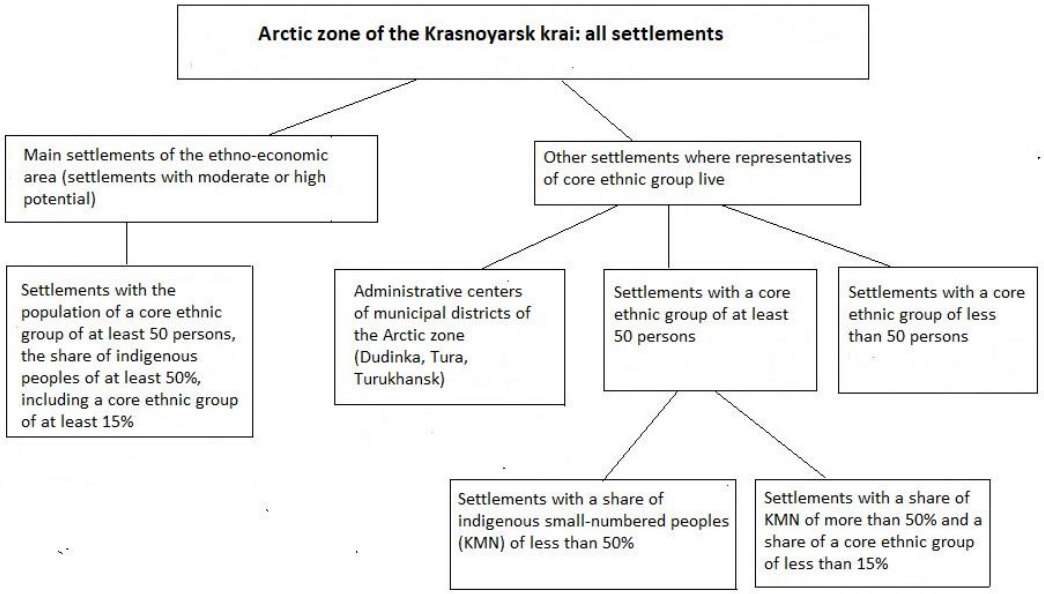

Fig. 3. Scheme for identifying the base settlements of the ethno-economic area (the core ethnic group is a small indigenous people that has a dominant position in the ethno-economic area under consideration).

"The obtained classification groups of settlements and their transformation in the period under review allow us to draw conclusions about the trends in the development and sustainability of TA and TWL in certain areas. For example, an increase in the share and growth in the number of base settlements may indicate positive trends in the preservation of the traditional way of life and traditional activities. Opposite processes — a decrease in the number of base settlements and the dispersion of an ethnic group throughout the territory with the loss of intra-ethnic ties and traditional activities — are signs of its instability and gradual destruction" [12, Koptseva N.P., Shishatskiy N.G., Bryukhanova E.A.].

Prerequisites and prospects for the formation of the Arctic ethno-economic cluster on the basis of the Ilimpi Evenki area

There are more than 100 traditional farms operating on the territory of the Ilimpi Evenki ethno-economic area (Fig. 4).

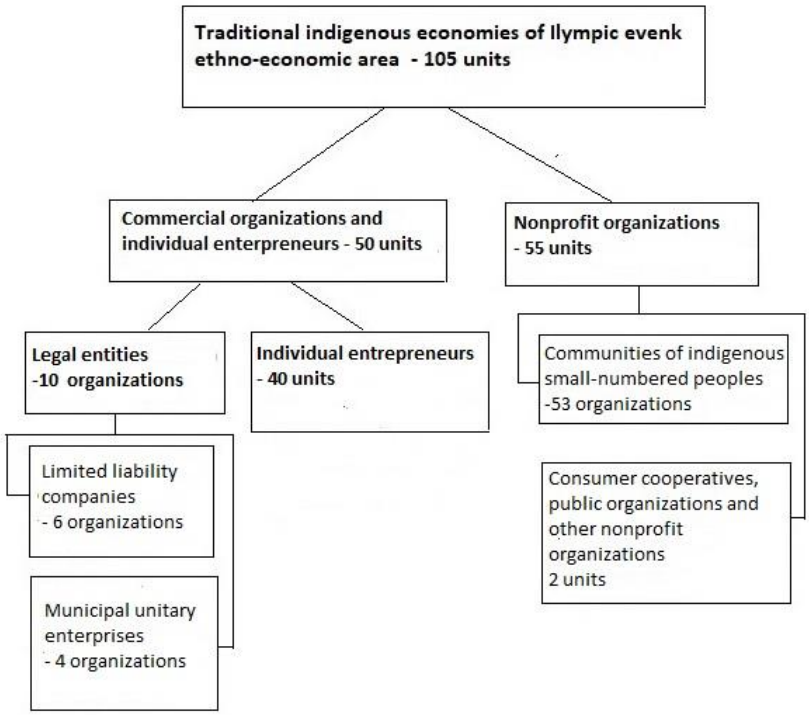

Fig. 4. Organizational and legal structure of traditional economies of the Ilimpi ethno-economic area (at the beginning of 2023).

The resource potential of traditional economies of the Ilimpi area is characterized by the following features:

- the forage base for domestic reindeer husbandry makes it possible to increase the number of reindeer to 7–11 thousand heads (potentially up to 60 thousand heads);
- the area of hunting grounds is more than 40 million hectares. The main hunting resources are: hoofed animals (primarily wild reindeer); fur animals (primarily sable); game birds;
- the unique genotype of the Evenki aboriginal huskies has been preserved, which can serve as a basis for their breeding and distribution for professional hunting;
- fishing potential allows catching more than 300 tons of fish per year;
- the territory of the Ilimpi Evenki ethno-economic cluster is rich in non-timber forest resources, the annual available volume of harvesting mushrooms is over 70 thousand tons, berries — over 60 thousand tons;
- tourist and recreational potential creates opportunities for the development of fishing, hunting, sports (mainly water rafting), ethnographic (creation of ethnographic centers), environmental (part of the Putoranskiy State Nature Reserve is located on the territory) and event (festival “Evenki Dawns”; “Day of the Indigenous Peoples of the World”; “Day of the Aborigines”) tourism.

The availability of a resource base and stable demand for many types of products, including on world markets, create the necessary prerequisites for increasing the marketability and profitability of the traditional economy of indigenous peoples. The following problems hinder the trans-

formation of traditional farming into a full-fledged commercial industry in the Arctic zone of the Krasnoyarsk Krai:

- difficulties with the sale of products due to the remoteness of the zones of traditional environmental management and traditional farming of indigenous peoples from the main markets, high transport costs and the lack of a well-established system of product sales;
- lack of modern slaughterhouses and refrigeration equipment, which prevents the comprehensive use of harvested raw materials and significantly reduces the quality of meat and fish products;
- low degree of product processing and almost complete absence of modern technologies for primary and deep processing.

Increasing the economic importance and strengthening the role of traditional economies of the area is possible through the transition to a cluster model of production organization — a highly organized system of traditional natural resource management entities located on the territory of the Ilimpi Evenki area, connected by effective cooperative relations in the field of procurement, processing and sale of traditional products and services of economic activities of indigenous peoples (Fig. 5).

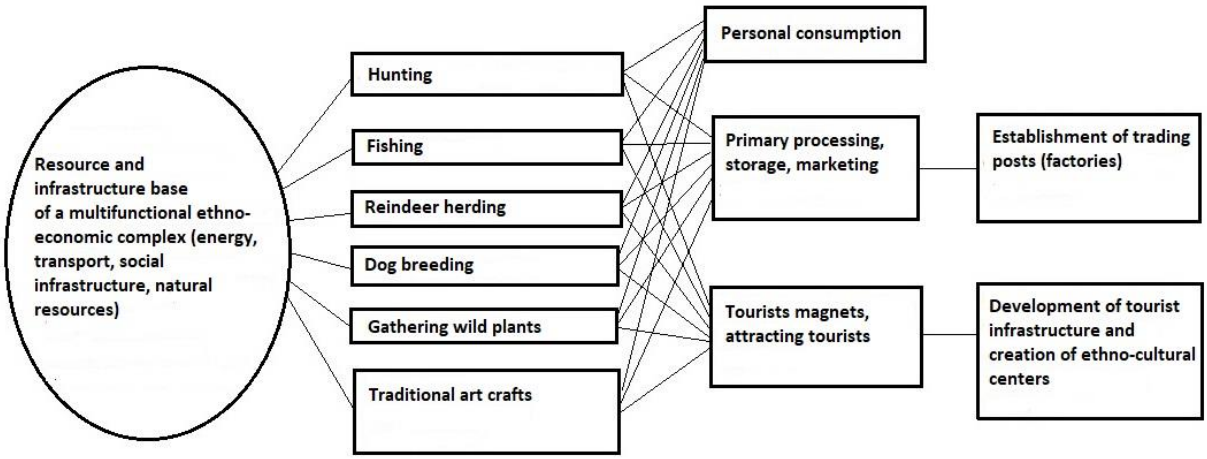

Fig. 5. Structural diagram of the Ilimpi Evenki ethno-economic cluster.

The goal of forming an ethno-economic cluster is the development of traditional activities on a new technological basis, the development of cooperative ties between them and the use of progressive methods of promoting and selling products.

Cluster formation is based on the implementation of a portfolio of investment cluster projects, combining the resources of cluster participants and ensuring synergy effects. The portfolio includes two types of projects:

1) specialized projects focused on the development of the traditional economy of the indigenous peoples:

- increasing the total population size of the herd through the creation of reindeer farms based on the technology of the hedge system of domestic reindeer breeding;
- creation of a three-level system for procurement and processing of products of traditional activities “hunting and fur trade”, “fishing”, “gathering and procurement of wild plants”: 1) a network of procurement points as close as possible to the hunting and procurement sites where sorting and primary processing of products will be carried out; 2) mini-processing facilities for deeper processing of products and logistics centers in large settlements of the Evenki municipal district, which have constant transport links with the regional center; 3) deep processing facilities for the creation of unique products with high added value (Krasnoyarsk)).
- formation of the necessary tourist infrastructure and creation of new tourist routes;

2) cooperation projects aimed at ensuring interaction between participants, creating a common infrastructure of the cluster, a system for promoting and selling products of traditional activities of indigenous minorities.

The main actors of the ethno-economic cluster are:

- state and municipal authorities that provide support for the development of traditional economic activities of indigenous minorities (act as founders of the cluster);
- regional association of indigenous communities, ensuring compliance of the goals and directions of development of the cluster with the interests of the northern ethnic groups of the region (one of the founders of the cluster);
- cluster center that ensures interaction between cluster participants, promotion of the cluster in the domestic and foreign markets, formation and implementation of cluster projects and initiatives; created in the organizational and legal form of an autonomous non-profit organization, the founders of which are the administration of the municipal district, the Ministry of Agriculture and Trade of the Krasnoyarsk Krai , Agency for the Development of Northern Territories and Support of Indigenous Peoples of the Krasnoyarsk Krai, Indigenous Minority Communities of the Krasnoyarsk Krai;
- traditional economies — members of the cluster, performing the main core functions of the cluster as a production and ethnic-preserving complex (they are also part of the supreme governing body of the cluster — the General Meeting of Participants);
- cluster partner organizations that are not part of the cluster, but provide necessary resource and service support for the cluster’s core activities and interact with the cluster on a contractual basis.

The cluster’s partner organizations are educational and scientific institutions, trade and logistics, transport and energy organizations.

The most important financial resource for the implementation of investment cluster projects should be extra-budgetary funds, which will be attracted on the principles of public-private

partnership, ESG and fair interaction of industrial corporations conducting their production activities in the Arctic zone of the Krasnoyarsk Krai with indigenous peoples.

The implementation of a cluster model of organization and sustainable functioning of a traditional economy will improve the well-being of indigenous peoples leading a traditional way of life and make traditional economic activity a full-fledged sector of the economy of the Arctic zone of the Krasnoyarsk Krai.

Conclusion

The traditional economic activity of small indigenous peoples plays an important role in the sustainable development of the Arctic territories, since, on the one hand, it fulfils an ethnic-preserving function and provides the necessary living conditions for settling in the Arctic zone of the Russian Federation, on the other hand, it helps to mitigate the negative socio-economic consequences of single-industry raw material development of the Arctic regions, acting as a branch of diversification of their economy.

The Arctic zone of Krasnoyarsk Krai has a significant resource potential for traditional environmental management, development of Arctic tourism and creative industries. The formation of a sustainable development model on the basis of historically established ethno-economic areas of traditional nature management can provide in the new conditions not only effective employment, high standard of living and quality of life of small indigenous peoples of the Arctic, but also make a significant contribution to the balanced development of the region's economy as a whole [1, Gladun E., Nysten-Haarala S., Tulaeva S.; 16, Sangha K.K., Duvert A., Ricky A., Russell-Smith J.].

In order to increase the economic importance of the traditional economy of indigenous peoples in the Arctic, it is necessary to search for and develop cluster models that combine unique knowledge and experience of traditional activities with modern farming methods and product processing technologies. Such models should use effective state support, relying on a solid scientific base, training and education of the necessary personnel, formation of necessary infrastructure for the development of traditional economic activities, and the use of modern methods of promotion and sale of products of the cluster.

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Olga S. Nagaeva — development of methodology, writing the original text, final conclusions, translation into English;
Elena A. Bryukhanova — processing of statistical information, revision and design of text

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Innovative Potential of the Regions in the Russian Arctic Zone: State and Spatial Differentiation

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Abstract. The article considers the components of the innovation potential of Russian regions that are fully or partially included in the Arctic zone. The purpose of the article is to analyze and evaluate the state and dynamics of innovative development of the regions of the Arctic zone of the Russian Federation. The methodology for calculating the composite index of innovative development is proposed. The calculations are made on the basis of the database formed by the authors, which consists of four blocks; the main conclusions on the blocks are formed. According to the composite index for the period 2015–2021, the leading positions are occupied by the Krasnoyarsk Krai, the Arkhangelsk Oblast and the Komi Republic, and the Republics of Karelia, Sakha (Yakutia) and Komi in terms of the index growth rate. The study of the state, dynamics and level of innovation development in the regions of the AZRF shows that some components of innovation potential are unevenly developed in the regions that are fully or partially included in the AZRF. At the same time, the regions differ in the dynamics of innovative development. Thus, the worst indicators of innovative development in accordance with the proposed methodology are observed in the Arkhangelsk Oblast, Chukotka and Nenets Autonomous okrugs. The high correlation between the composite index of innovative development and indicators of socio-economic development of the regions revealed by the authors characterizes the positive impact of innovation activity on the socio-economic development of the AZRF subjects. In this regard, the key recommendations are the following: improvement of legislative support for the formation of eco-industrial, tourist zones, innovation sites and cluster formations in the Arctic territory within the framework of testing new formats of economic intensification of the Russian Arctic regions; formation of a macro-regional register of suppliers of innovative products for the projects of residents of the AZRF with the distribution of preferential measures of a special economic and administrative regime. The prospects of the research are related to the study of critical vulnerabilities in the production and technological processes of the sectors of specialization of the Arctic regions in import substitution.
Keywords: *region, Arctic, innovative development, indicators, potential, financial support, effectiveness, level of innovative development*

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Introduction

The Arctic macro-region acts as a resource base for the development of many industries of the Russian economy. However, this role, as well as the development of the Arctic space in general, until recently relied heavily on international technological, technical, economic and scientific cooperation in the development of natural resources and minimizing the accompanying anthropogenic impact on fragile natural ecosystems [1, Skufina T.P.]. In many ways, the need for international cooperation was determined by the specifics of the Arctic — its harsh climatic conditions, increased costs and risks of conducting economic activities [2, Vasilyev V.V., Selin V.S.]. It should be noted that none of the circumpolar or interested countries currently has sufficient technological, technical, organizational and financial resources, as well as the legal framework for full-scale independent development of the Arctic spaces and the creation of appropriate infrastructure and icebreaker fleet [3, Gudev P .A.]. However, the extreme tightening of external sanctions pressure against Russia not only threatens the prospects for international economic and scientific cooperation in the macro-region, but also poses a serious challenge to the functioning of existing industries, including those critically important for the domestic economy [4, Skufina T.P., Baranov S.V., Samarina V.P.].

Thus, certain positive results in the field of economic development and job creation are shown by the implementation of a preferential regime for entrepreneurial activity in the Arctic, introduced by a number of regulations in 2020 [5, Volkov A.D., Tishkov S.V., Nikitina A.S.]. At the same time, taking into account the latest challenges, this preferential regime requires improvement in conjunction with other institutions for the development of Arctic territories in order to accelerate the development of innovative production in critical areas of import substitution. In the world practice of developing Arctic territories, there is successful experience in closing macroeconomic chains at the intraregional level, which has a positive effect on the qualitative and quantitative indicators of economic development of the territories [6, Kryukov Ya.V.]. For example, for the Arctic territories of the Republic of Karelia, the development of technologies and the deployment of the high-quality feed production used in aquaculture, as well as the provision of farms with genetic material is of utmost importance [7, Volkov A.D., Tishkov S.V.]. Currently, the most important condition for giving an innovative impetus to these areas is legislative support for the formation of eco-industrial and tourist zones in the Karelian Arctic - special economic zones of a new type with the prospect of spreading the experience of their creation throughout the entire territory of the Russian Arctic. For the Republic of Sakha (Yakutia), the development of small inno-

vative businesses within the framework of high-tech industries is of crucial importance [8, Egorov N.E., Kovrov G.S.].

Modern science has considerable experience in studying the processes of development and management of northern and Arctic territories. The works of Russian and foreign authors propose methodological approaches to the study of the socio-economic development of regions, including the Arctic spaces. The problems of functioning of the northern territories of a number of foreign countries (Norway, Finland, Sweden, etc.) are dealt with by D. Depledge, K. Dodds [9], S. Glomsrod, G. Duhaime, I. Aslaksen [10], J. Jauhiainen, H. Moilanen [11], E. Purkarthofer, A. Humer [12], R.B. Jacobsen, A. E. Delaney [13].

There is currently an increased interest in the creation of regional innovation systems in the Arctic regions in Russia. Particular attention is paid to the conditions of their emergence, stages of development, institutions that contribute to the formation, as well as assessment of the results of their activities [14, Leksin V.N., Porfiryev B.N.; 15, Tishkov S.V.; 16, Zaikov K.S., Kalinina M.R., Kondratov N.A., etc.].

The challenges and limitations of innovative development of the Arctic regions of Russia were analyzed by A.V. Tsukerman [17; 18]. He presented a classification of challenges, including macroeconomic, raw materials, socio-demographic, financial, infrastructural, technological, legal, personnel, information, integration, transport challenges. All these challenges remain relevant during the period of formation of the special economic and legal regime of the Arctic zone of the Russian Federation; the mechanisms of their overcoming or levelling should be taken into account in the legal field and management practice.

In the work [19, Tyukavkin N.M., Anisimova V.Yu.], it is noted that the essence of import substitution should take into account both socio-economic and political factors, which will allow the state to develop steadily in the economic and production spheres. Measures to increase the competitiveness of products manufactured in the domestic market can be modernization of the technological base of an industrial enterprise, an increase in its efficiency indicators and an emphasis on the production of goods that can withstand healthy competition and have increased added value. When implementing an import substitution policy, it is necessary to improve the industrial complex of Russia and transition to an innovative type of economic development model. In the current conditions, it is extremely important for the Russian economy to maintain plans for the development of the Arctic without foreign partners. Therefore, it is necessary to pay special attention to the development of own production capacities, to create an “Arctic division” in terms of priority actions to ensure the development of the Russian economy in the conditions of external sanctions pressure, to combine the efforts of the state and business [20, Kotov A.V.].

Methods

In order to analyse and assess the current state, dynamics and level of innovative development of regions, the authors propose the following methodology (algorithm) for assessing

the level of innovative development of regions on the basis of the study of existing methodological approaches and methods for assessing innovative development of regions [21, Tortsev A.M., Smirennikova E.V., Studenov I.I. et al.; 22, Ryapukhina V.N.; 23, Matvienko I.I.; 24, Egorov N.E., Kovrov G.S.; 25, Kuznetsova M.N., Vasilyeva A.S.; 26, Egorov N.E., Babkin A.V., Babkin I.A. et al.].

At the first stage, the database "*Scientific, educational and innovative-technological potential of Russian regions, fully or partially included in the Arctic zone, for the period 1995–2021*" was formed, consisting of 4 blocks (22 indicators in total):

1. Block A. Main socio-economic indicators (SEP)

A1 — Gross regional product, million rubles (before 1998 — billion rubles);

A2 — Population (at the end of the corresponding year), thousand people;

A3 — Average annual number of employees, thousand people;

A4 — Number of enterprises and organizations, units;

A5 — Fixed assets at the end of the year at full accounting value, million rubles (before 1997 — billion rubles);

A6 — Investments in fixed assets in actual prices, million rubles (before 1998 — billion rubles).

2. Block B. Scientific and innovative potential

B1 — Organizations performing scientific research and development, units;

B2 — Level of innovative activity of organizations, %;

B3 — Number of personnel engaged in research and development, people;

B4 — Share of organizations carrying out technological innovations in the total number of surveyed organizations, %;

B5 — Number of students enrolled in bachelor's, specialist's, and master's programs per 10,000 population (at the beginning of the school year), people;

B6 — Use of broadband Internet access in organizations in the total number of surveyed organizations, %;

B7 — Use of the Internet by the population in the total population, %.

3. Block C. Financial support for scientific and innovative activities

C1 — Internal costs for research and development, million rubles;

C2 — Costs of innovation activities (until 2019 — technological innovations), million rubles;

C3 — Share of regional budget funds in internal research and development costs, %;

C4 — Costs of implementation and use of digital technologies, million rubles.

4. Block D. Result of innovation activity

D1 — Volume of innovative goods, works and services, million rubles;

D2 — Inventive activity coefficient (number of applications filed for patents for inventions and utility models per 10,000 population);

D3 — Issue of patents for inventions and utility models, units;

D4 — Advanced production technologies used, units;

D5 — Ratio of exports to imports of technologies and technical services, thousand USD.

At the second stage, based on the values of the database indicators, calculations and a brief analysis are performed for blocks of regions of the Russian Arctic for the period from 2015 to 2021 and separately for 2021. For this purpose, the method of normalizing the values of each indicator and calculating the average normalized values of all indicators of the block by region of the Russian Arctic are used, based on the results of which the rating of the subjects of the Russian Arctic is carried out.

At the third stage, calculations of the "Composite index of innovative development of regions (CIIDR) of the Russian Arctic" are made as the arithmetic average of blocks (except for block A) according to the following formula:

$$CIIDR = (B*7/16 + C*4/16 + D*5/16)/3 \qquad (1)$$

where B, C, D are the average values of blocks multiplied by weighting coefficients (K_{block}), which are calculated as the ratio of the number of indicators in each block (N_{block}) to the total number of indicators of these blocks (N=16):

$$K_{block} = N_{block}/N \qquad (2)$$

Research results

Block A. Socio-economic potential

The analysis shows that, according to the average normalized value of 6 key indicators, the leading positions among the AZRF subjects for the period from 2015–2021 are occupied by the Krasnoyarsk Krai (1.0), the Yamalo-Nenets Autonomous Okrug (0.78) and the Republic of Sakha (Yakutia) (0.43) with an average value for the Russian Arctic of 0.38, and for 2021, the leaders' ranking remains the same with the results almost unchanged, except for an increase in the average value for the Russian Arctic to 0.46. This comparison shows that the dynamics of the subjects' SEP status over the period under review remains almost stable.

Based on the presented assessments, we can propose the following criteria for assessing the level of SEP (Table 1).

Table 1

Criteria for assessing the level of socio-economic indicators of the region [1]

Criteria	Characteristics of the SEP level
0.67–1.00	High
0.34–0.66	Average
0.00–0.33	Low

According to this table, the AZRF regions can be classified into the following types: regions with a high level of SEP (0.67–1.00) include the Krasnoyarsk Krai (1.0) and the Yamalo-Nenets

[1] Source: compiled by the authors.

Autonomous Okrug (0.78). The average level (0.34–0.66) includes the Republic of Sakha (Yakutia) — 0.44. Other AZRF subjects have a low level (0.00–0.33).

Block B. Scientific and innovative potential

As the calculations show, the level of scientific and innovative potential of the AZRF subjects is comparable to the potential of the Russian Federation. An analysis of block B indicators shows that the top three in terms of scientific and innovative potential are headed by the Krasnoyarsk Krai (1.0), Yakutia (0.842) and the Murmansk Oblast (0.823). In accordance with the criterion for assessing the level of potential proposed above in the SEP assessment, the Komi Republic (0.764) and the Arkhangelsk Oblast (0.697) also have a high level of scientific and innovative potential (SIP) (from 0.67 to 1.00). The remaining 4 subjects have an average level (0.34–0.66): Chukotka Autonomous Okrug (0.649), Yamal-Nenets Autonomous Okrug (0.581), Karelia (0.576) and Nenets Autonomous Okrug (0.428) with an average value for the Russian Arctic (0.707). According to the 2021 rating, the positions of the four leaders did not change, with some variations in values: Krasnoyarsk Krai (1.0), Yakutia (0.974), Murmansk Oblast (0.810) and Komi Republic (0.776). The Republic of Karelia (0.714) and the Arkhangelsk Oblast (0.686) also showed a high level of NIP. The remaining 3 regions show an average level of NIP: Chukotka Autonomous Okrug (0.619), Yamal-Nenets Autonomous Okrug (0.535) and Nenets Autonomous Okrug (0.403). Thus, it can be stated that the subjects of the Russian Arctic have high and average levels of NIP.

One of the key indicators characterizing the scientific and innovative potential of the region is the “Level of innovative activity of organizations, %”, calculations of which for the period from 2015 to 2021 for the Russian Federation and the Russian Arctic, as well as for the AZRF subjects are presented below (Table 2).

Table 2

Level of innovation activity of organizations of the AZRF subjects for the period 2015–2021, % [2]

Region	2015	2016	2017	2018	2019	2020	2021	2021/2015
Russian Federation	**9.3**	**8.4**	**14.6**	**12.8**	**9.1**	**10.8**	**11.9**	1.28
Murmansk Oblast	9.4	7.2	16.2	11.6	9.6	9.4	10.0	1.06
Republic of Karelia	7.2	6.4	5.9	9.2	7.1	7.0	6.4	0.89
Komi Republic	5.2	4.5	8.8	10.6	7.2	8.0	8.9	1.71
Arkhangelsk Oblast	5.9	4.7	4.4	7.5	4.2	4.7	4.6	0.78
Nenets Autonomous Okrug	5.0	6.2	5.7	2.6	2.7	3.1	1.7	0.34
Yamalo-Nenets Autonomous Okrug	7.4	9.0	7.0	8.6	5.4	5.9	6.8	0.92
Krasnoyarsk	8.8	7.1	7.1	11.1	6.9	6.7	7.0	0.80
Republic of Sakha (Yakutia)	7.0	7.6	7.9	8.6	3.9	8.6	14.5	2.07
Chukotka Autonomous Okrug	17.8	7.2	10.7	12.5	7.8	6.7	9.0	0.51
AZRF	**8.19**	**6.66**	**8.20**	**9.15**	**6.09**	**6.67**	**7.65**	0.93

The analysis of Table 2 shows that in the Russian Federation as a whole, a high level of innovative activity of organizations (IAO) was noted in 2017 (14.6%), and in the regions of the

[2] Source: compiled by the authors.

Russian Arctic — in 2018 (9.15%). The analysis of the rate of change of IAO in 2021 compared to 2015 shows that the leaders are Yakutia (2.07 times), Komi (1.71 times) and Murmansk (1.06 times) with an average value for the Russian Federation of 1.28.

Block C. Financial support for scientific and innovative activities

Krasnoyarsk Krai takes the leading position among the regions that are fully or partially included in the AZRF in terms of financial support for research and innovation activities for the period from 2015 to 2021. Leading positions are also occupied by the Yamalo-Nenets Autonomous Okrug and Yakutia. However, it should be noted that in 2021 Yakutia ranked second, and Yamalo-Nenets Autonomous Okrug —third.

One of the key indicators in this block is the static indicator "Internal expenditures on research and development, million rubles" (IE on R&D). In 2021, the absolute value of IE on R&D in AZRF increased by 1.55 times compared to 2015, while the growth in the Russian Federation was 1.4 times. The top three among the subjects of the Russian Arctic are Yamalo-Nenets Autonomous Okrug (1.96 times), Krasnoyarsk (1.73 times) and Yakutia (1.45 times).

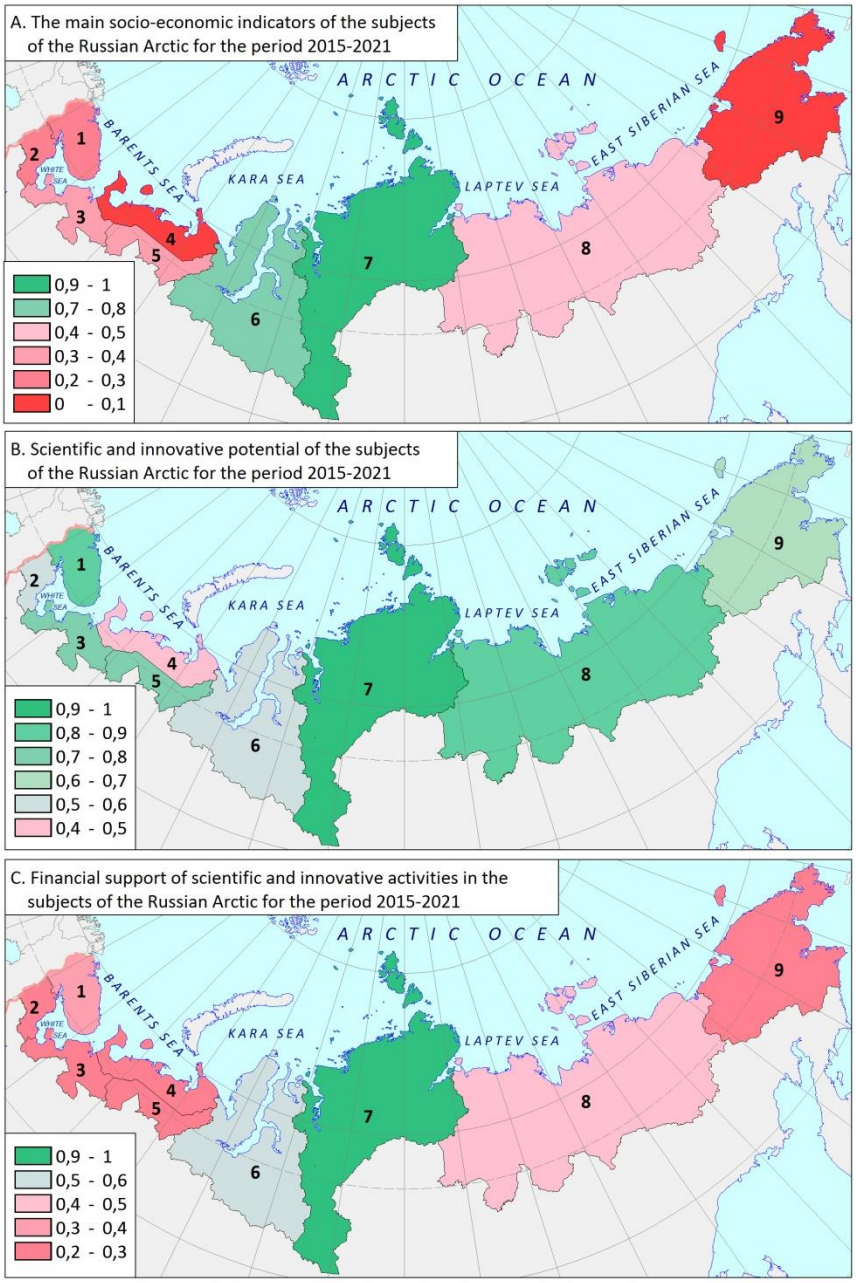
The differentiation of indicator values for blocks A, B and C considered above is presented in Fig. 1.

Block D. Result of innovation activity

The leading positions in terms of the results of innovative activity are occupied by the Krasnoyarsk Krai (1.0), the Murmansk Oblast (0.57) and the Yamalo-Nenets Autonomous Okrug (0.43).

The key indicator in this block is the indicator "Volume of innovative goods, works, services (IGWS), million rubles", which ultimately characterizes the effectiveness of the subject's innovative activities. As follows from the dynamics of IGWS, from 2018 to 2020, there has been a significant increase in the indicator by 2.88 times, with a subsequent decline in its value by 2021.

The assessment of the AZRF subjects by the average values of the IGWS indicator for the period 2015–2021 reflects the leadership of the Murmansk Oblast (1.0), Krasnoyarsk Krai (0.62) and Arkhangelsk Oblast (0.21). The remaining regions follow them with a large lag in the indicator values: the Republic of Karelia (0.09), the Komi Republic (0.03), in the Republic of Sakha (Yakutia) and the Yamal-Nenets Autonomous Okrug the indicator value is 0.02, and in the Chukotka Autonomous Okrug and the Nenets Autonomous Okrug — 0.00.



The numbers on the map indicate the territories of the subjects of the Russian Arctic:
1 - Murmansk Oblast, 2 - Republic of Karelia, 3 - Arkhangelsk Oblast, 4 - Nenets Autonomous Okrug,
5 - Komi Republic, 6 - Yamalo-Nenets Autonomous Okrug, 7 - Krasnoyarsk Krai,
8 - Republic of Sakha (Yakutia), 9 - Chukotka Autonomous Okrug

Fig. 1. Differentiation of indicators of innovation potential of the AZRF regions (blocks A, B, C)[3]

Discussion of results

In accordance with the proposed methodology, the calculation of the composite index of innovative development of regions (CIIDR) of the Russian Arctic and the Russian Federation was carried out on the basis of the values of 16 indicators from 3 blocks (except for block A) for the period from 2015 to 2021. (Table 3).

[3] Source: compiled by Derusova O.V. on the basis of the authors' calculations.

Table 3

Composite index of innovative development of regions (CIIDR) of the AZRF and the Russian Federation, 2015–2021 [4]

Region	2015	2016	2017	2018	2019	2020	2021	CIIDR aver.	CIIDR aver. norm.	Growth rate 2021/2015, %
Russian Federation	**0.276**	**0.268**	**0.285**	**0.292**	**0.290**	**0.312**	**0.331**	**0.293**	**0.989**	19.8%
Murmansk Oblast	0.272	0.240	0.272	0.276	0.261	0.309	0.303	0.276	**0.931**	11.6%
Republic of Karelia	0.233	0.233	0.235	0.270	0.300	0.300	0.317	0.270	**0.909**	35.9%
Komi Republic	0.263	0.245	0.261	0.304	0.318	0.297	0.313	0.286	**0.963**	19.0%
Arkhangelsk Oblast	0.313	0.256	0.304	0.311	0.275	0.308	0.297	0.295	**0.994**	-4.9%
Nenets Autonomous Okrug	0.214	0.333	0.221	0.208	0.209	0.243	0.199	0.232	**0.783**	-6.9%
Yamalo-Nenets Autonomous Okrug	0.272	0.234	0.264	0.274	0.321	0.275	0.277	0.274	**0.923**	1.9%
Krasnoyarsk	0.289	0.274	0.271	0.304	0.315	0.310	0.314	0.297	**1.000**	8.8%
Republic of Sakha (Yakutia)	0.233	0.257	0.260	0.299	0.259	0.292	0.302	0.272	**0.916**	29.2%
Chukotka Autonomous Okrug	0.272	0.262	0.232	0.232	0.215	0.216	0.249	0.240	**0.808**	-8.7%
AZRF	**0.262**	**0.259**	**0.258**	**0.275**	**0.275**	**0.283**	**0.286**	**0.271**	**0.914**	8.9%

The data in Table 3 show that the leading positions among the AZRF regions in terms of the composite CIIDR for the period 2015–2021 are occupied by the Krasnoyarsk Krai (1.00), the Arkhangelsk Oblast (0.99) and the Komi Republic (0.96), and the top three in terms of growth rates of the CIIDR in 2021 compared to 2015 are headed by the Republic of Karelia (35.9%), the Republic of Sakha (Yakutia) in the second place (29.2%) and the Republic of Komi in the third place (19.0%) with average growth rates for the Russian Arctic — 8.9%, and for the Russian Federation — 19.8%.

The comparative diagram of the average values of the CIIDR of the AZRF and the Russian Federation for the period 2015–2021 (Fig. 2) illustrates almost identical regression characteristics of variability for the period under consideration (R = 0.89).

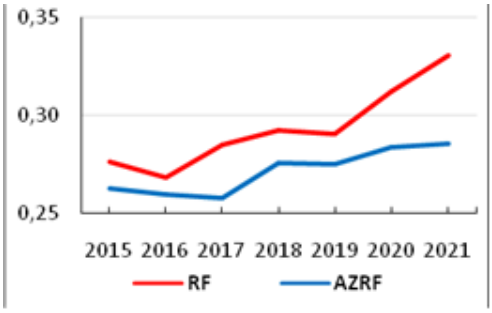


Fig. 2. Comparative diagram of the CIIDR of the AZRF and the Russian Federation for the period 2015–2021 [5].

The considered indicators of block D, as well as the growth rate of the composite index of innovative development of regions are presented in Fig. 3.

[4] Source: compiled by the authors.
[5] Source: compiled by the authors.

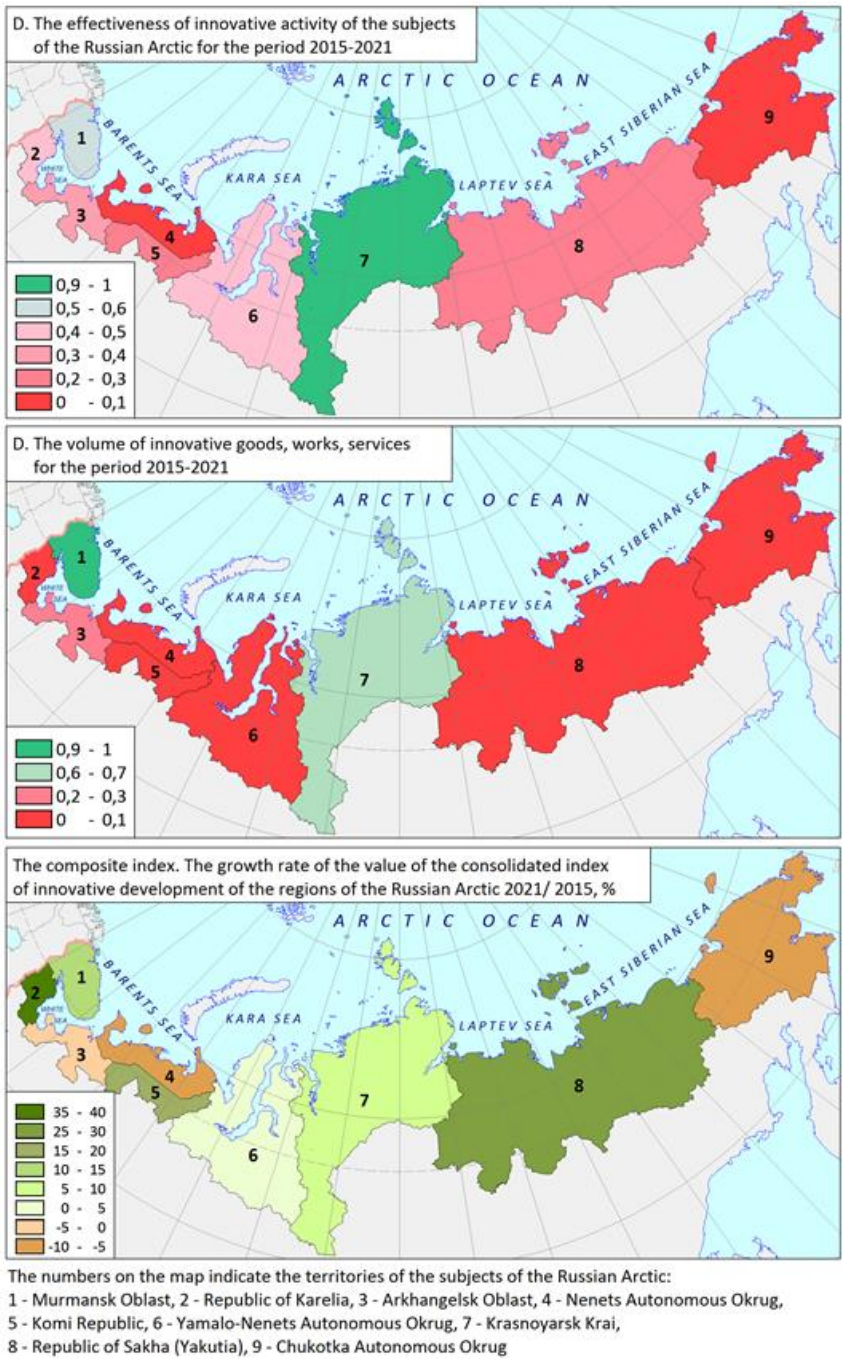


Fig. 3. Differentiation of indicators of the innovative potential of the AZRF regions (block D and composite index) [6].

Further, in order to assess the impact of innovation activity on socio-economic indicators of the AZRF subjects, the correlation between block A “Main socio-economic indicators” and the consolidated CIIDR for the Russian Arctic was calculated (Fig. 4).

[6] Source: compiled by Derusova O.V. on the basis of the authors’ calculations.

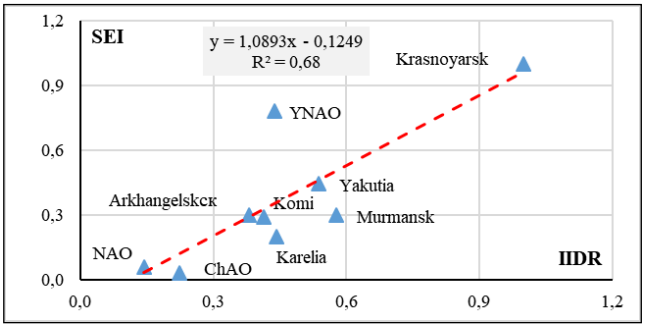


Fig. 4. Correlation between block A "Main socio-economic indicators" and the consolidated CIIDR for the AZRF for 2021 [7].

Illustration of the correlation between block A "Main socio-economic indicators" and the consolidated CIIDR for the Russian Arctic for 2021 (Fig. 6) shows a high closeness of the relationship (R = 0.83), which characterizes the positive impact of innovation activity on socio-economic development of the AZRF subjects.

An important criterion for assessing the effectiveness of innovation activities (IA) is the efficiency indicator, which in quantitative terms can be assessed through the coefficient of efficiency of IA (K_{eff}), calculated using the following formula [26, Egorov N.E., Babkin A.V., Babkin I.A., Martynushkin A.B.]:

$$K_{eff} = Y/\bar{X} \qquad (3)$$

where $\bar{X}$ — average value of normalized input indicators characterizing the innovative potential of the region and assistance in the development of IA;

Y — output parameter that determines the effectiveness of the IA.

In accordance with this methodology, the calculation of the coefficient of efficiency of innovation activity (K_{eff}) of the AZRF subjects for 2021 was carried out according to the data of blocks B, C (X) and block D (Y). Based on the results of calculations, a pie chart of distribution of normalized values of the coefficient of efficiency of IA of the AZRF subjects for 2021 was drawn up (Fig. 5).

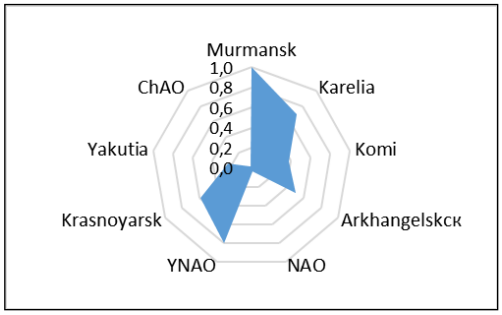


Fig. 5. Pie chart of the distribution of the efficiency coefficient of IA of the AZRF subjects for 2021 [8].

The pie chart of the distribution of the efficiency coefficient of IA of the AZRF subjects for 2021 (Fig. 5) shows that the leaders in terms of the IA efficiency coefficient among the AZRF subjects are the Murmansk Oblast (1.00), the Yamalo-Nenets Autonomous Okrug (0.80) and the

[7] Source: compiled by the authors.
[8] Source: compiled by the authors.

Republic of Karelia (0.70).

Conclusion

The study of the state, dynamics and level of innovative development of the Russian Arctic regions shows that individual components of innovation potential are unevenly developed in the regions, fully or partially included in the AZRF. At the same time, the regions differ in the dynamics of innovative development. Thus, the worst indicators of innovative development in accordance with the proposed methodology are observed in the Chukotka and Nenets Autonomous okrugs. The high correlation between the composite index of innovative development and indicators of socio-economic development of the regions revealed by the authors characterizes the positive impact of innovation activity on the socio-economic development of the AZRF subjects.

In this regard, the key recommendations are:

- improvement of legislative support for the formation of eco-industrial, tourist zones, innovation sites and cluster structures in the Arctic territory within the framework of approbation of new formats of economic intensification of the regions of the Russian Arctic;
- formation of a macro-regional register of suppliers of innovative products for projects of residents of the Russian Arctic with the distribution of preferential measures of a special economic and administrative regime.

The prospects for the research are related to the study of critical vulnerabilities in the production and technological processes of the Arctic industries specializing in import substitution.

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Mining Waste Management of the Arctic Industrial Enterprises: Environmental Protection and Economics of Production

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Abstract. The problems of mining waste management at industrial enterprises and increasing the economy of production are among the most urgent ones, especially for the Arctic ecosystems, characterized by high sensitivity to external factors and the complexity of recovery. The research was conducted on the example of large industrial corporations directly operating in the Arctic, including PJSC PhosAgro, PJSC MMC Norilsk Nickel, Severstal Resource division of PJSC Severstal and PJSC NOVATEK. The key indicators related to waste management for 2018–2022 were analyzed. The trend of increasing volumes of mining waste in the Arctic was revealed, while the level of its utilization remained practically unchanged. It is proposed to intensify scientific research in the field of rational use of mining waste and to develop technologies for their processing, taking into account the impact on the Arctic ecosystems. It is suggested to create research and production centers for each industrial enterprise using the experience of the balanced "triple helix" model. It is recommended to actively participate in the Interdepartmental Scientific Council of the Russian Academy of Sciences on the development of the mineral resource base and its rational use, created in 2023, to develop the scientific foundations for the extraction and processing of minerals and accelerate import substitution.
Keywords: *industrial enterprises, Arctic, ecological indicators, waste management, innovation technologies, economy*

Introduction

The development of mineral resources in the Arctic zone of the Russian Federation (hereinafter referred to as the Arctic) by mining enterprises is accompanied by the formation of waste, which has a negative impact on the natural environment. For the Arctic ecosystems, the problem of waste is particularly important, since the natural environment in this region is extremely sensitive to external influences and is characterized by slow recovery, so the consequences can be irreversible [1, Smirennikova E.V., Ukhanova A.V., Voronina L.V. , p. 73; 2, Tsukerman V.A., Ivanov S.V.]. In this regard, the issues of reducing the formation of mining waste at production enterprises and increasing the efficiency of their use are especially relevant. Mining waste management involves collection, transportation, processing, recycling or disposal.

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The main decisions and legal framework of state policy aimed at reducing waste by industrial enterprises are formulated in laws No. 7-FZ "On environmental protection" and No. 89-FZ "On production and consumption waste", as well as Decrees of the President of the Russian Federation No. 164 "On the fundamentals of the state policy of the Russian Federation in the Arctic for the period until 2035" and No. 204 "On national goals and strategic objectives of the development of the Russian Federation for the period until 2024" and other legislative documents of the Government of the Russian Federation [1, 2, 3, 4]. Mining enterprises need to comply with Russian and international legislation related to industrial waste, develop and implement innovative technologies and take the necessary measures to ensure environmental safety.

Wastes are divided into five hazard classes according to the degree of their impact on the environment [5]. Mining wastes are assessed as practically non-hazardous (hazard class 5), however, they are a source of permanent and significant pollution of territories, including after the completion of field operation [3, Nevskaya M.A., Seleznev S.G., Masloboev V.A. et al., p. 13]. Already at the early stage of storage of such wastes, deterioration of technological qualities and change of properties of mineral masses in dumps begin due to hypergenesis. These wastes pose a serious threat to the atmosphere, soil and water because of dusting and migration of pollutants, which has become persistent in mining regions [4, Derome J., Lindroos A.J.; 5, Csavina J., Field J., Taylor M.P. et al.; 6, Zhang X., Yang L., Li Y. et al.; 7, Liang J., Feng Ch., Zeng G., et al.; 8, Cheng Z., Jiang J., Fajardo O.A. et al.]. Long-term disposal results in widespread and irreversible contamination of the surrounding areas.

Stored mining wastes are used in a limited volume and placed in dumps and tailing ponds, the maintenance of which requires serious economic costs [9, Suvorova O.V., Manakova N.K., p. 1; 10, Tsukerman V. A., Kozlov A. A.; 11, Maslov A.D., Melnikov N.N., Kalashnik A.I. et al.; 12, Kalashnik A.I., Gilyarova A.A., Kalashnik N.A. et al.]. It should be especially noted that wastes are not

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[4] Ukaz Prezidenta RF ot 07.05.2018 N 204 «O natsional'nykh tselyakh i strategicheskikh zadachakh razvitiya Rossiyskoy Federatsii na period do 2024 goda» [Decree of the President of the Russian Federation dated May 7, 2018 N 204 "On national goals and strategic objectives of the development of the Russian Federation for the period until 2024"]. URL: http://static.kremlin.ru/media/acts/files/0001201805070038.pdf (accessed 19 June 2023).

[5] Prikaz Ministerstva prirodnykh resursov i ekologii Rossiyskoy Federatsii ot 04.12.2014 № 536 «Ob utverzhdenii Kriteriev otneseniya otkhodov k I-V klassam opasnosti po stepeni negativnogo vozdeystviya na okruzhayushchuyu sredu» [Order of the Ministry of Natural Resources and Ecology of the Russian Federation dated December 4, 2014 No. 536 "On approval of the Criteria for classifying waste into hazard classes I-V according to the degree of negative impact on the environment"]. URL: http://publication.pravo.gov.ru/Document/View/0001201512310003?index=1 (accessed 19 June 2023).

losses and can be effectively used to obtain marketable products that can be widely used in the national economy. Depletion of the raw material base, decrease in the quality of raw materials, involvement in processing of more difficult to enrich ores and lack of efficiency of the existing enrichment technologies increase the interest in the search for unconventional and alternative sources of raw materials, which forces to consider mining wastes as technogenic deposits with great economic potential, especially in the case of extraction of mainly limited mineral components [13, Ivanova V.A., Mitrofanova G.V., p. 135; 14, Goryachev A.A., Makarov D.V., Svetlov A.V., p. 116]. Increasing the rational use of such technogenic deposits by involving them in economic circulation, for example, to obtain building materials, is cost-effective, since mining wastes are located, as a rule, in close proximity to the processing plants of enterprises, and the cost of their processing is low [15, Churkin O.E., Gilyarova A.A. p. 908; 16, Abaka-Wood G.B., Ehrig K., Addai-Mensah J. et al.]. This makes it possible to strengthen the mineral resource base, providing additional sources of mineral raw materials, to increase the efficiency of its exploitation and reduce the resource intensity of products, as well as to reduce the negative impact on the unique Arctic natural environment [17, Gromov E.V., Opalev A.S., Ivanova V. O.A., Khokhulya M.S.; 18, Tsukerman V.A., Ivanov S.V.]. However, mining enterprises operate over a long period of time, and their high level of energy capacity and resource consumption seriously hinders technical re-equipment and reconstruction [19, Lèbre É., Corder G.D., Golev A.].

Materials and methods

The main objectives of the study include effective management of industrial waste, creation of the necessary conditions and infrastructure for waste processing, increasing the share of waste recycling, creating an environmental regulation system, developing and implementing innovative technologies to protect the environment and improve economic performance.

The purpose of the work is to study the possibility of reducing the environmental impact of Arctic mining enterprises by reducing production waste and their scientifically justified application in order to increase economic performance and stimulate environmentally oriented management of these enterprises.

The study was carried out using the example of large industrial corporations that directly operate in the Arctic and provided data in the public domain, namely: PJSC PhosAgro, PJSC MMC Norilsk Nickel, Severstal Resource division of PJSC Severstal and PJSC NOVATEK.

The methodological basis of the study is the systems approach and the theory of strategic management, which involves research into methods for analyzing various environmental and economic systems and developing strategic directions for their development. The assessment methodology involves consideration of problems of environmental protection and economic development, taking into account international recommendations of the Arctic countries. Various methods of analysis have been used to achieve the set goal, the information basis of which are annual reports of enterprises, annual statistical data of Rosstat, reports of regional divisions of the Minis-

try of Natural Resources, relevant legislative requirements and scientific publications. Methods for specific handling of overburden waste and enrichment and their disposal at each of the presented Arctic industrial enterprises were considered. Key waste management indicators were analyzed, including: waste generation, disposal and neutralization, which reflect the future direction of waste use for product manufacture and application for various purposes, including processing, combustion and disposal.

Based on official indicators of the Federal State Statistics Service, a comparison of the Russian Federation and the Arctic in terms of the volume of generation, recycling and neutralization of production and consumption waste for the period 2018–2021 was made (Table 1).

Table 1

Generation, recycling and neutralization of production and consumption waste in the Russian Federation and the Arctic, million tons [6]

	2018	2019	2020	2021
Waste generation in the Russian Federation	7 226	7 751	6 956	8 449
Waste generation in the Arctic	351.6	410.4	437.3	462.1
Waste management and neutralization in the Russian Federation	3 818	3 882	3 429	3 937
Waste management and neutralization in the Arctic	321.8	244.2	167.4	314.3

It can be noted that in the Arctic, as well as in the Russian Federation, there is a certain upward trend in production and consumption waste generation over the period under review. The share of recycled and neutralized waste in the Russian Federation is increasing, and in the Arctic there is also an increase after a reduction in 2020.

Kirovsk branch of JSC Apatit

An analysis of waste utilization by the Kirovsk branch of JSC Apatit for the period 2018–2022 is presented (Table 2)

Table 2

Landfill disposal and waste utilization at the Kirovsk branch of JSC Apatit, million tons [7]

	2018	2019	2020	2021	2022
Disposal of wastes at the landfill, including:	67.1	81.6	102.4	104	85.2
Overburden rocks	54.9	69.1	89.5	90.5	72.3
Enrichment wastes	12.2	12.6	13	13.5	12.9
Utilization of wastes, including:	21.3	19.7	18.6	15.9	24.3
Overburden rocks	9	7.2	6.6	3.4	11.3
Enrichment wastes	12.3	12.5	12	12.5	13.1
Current environmental	4 587.7	4 351.9	4 825.3	5 510.3	6 534.6

[6] Rosstat. Environmental protection in Russia. 2022: Statistical collection, Moscow 2022, p. 112.
[7] Annual reports of PJSC PhosAgro. URL: https://www.phosagro.ru/investors/reports_and_results/ (accessed 19 June 2023).

protection costs, mln rub.					

Rock, overburden rocks and enrichment wastes from the Kirovsk branch of JSC Apatit make up the bulk of the solid waste generated by PhosAgro (about 63%). An increase in the amount of waste recycled and disposed of at the landfill can be noted. However, the share of recycled rock overburden relative to stockpiled rock has decreased. The volume of recycled rocks varied depending on the company's recycling capabilities. At the same time, the share of recycled enrichment waste remained practically unchanged. These wastes are mainly used to fill mined-out spaces. Depending on the volumes of waste disposal, the volumes of current costs were used, taking into account the change in the cost of activities.

It should be noted that at the Kirovsk branch of JSC Apatit, some waste is recycled and neutralized at special thermal neutralization plants in order to eliminate waste accumulation sites. Dust suppression measures are being implemented at tailing dumps.

At the St. Petersburg International Economic Forum 2023, a cooperation agreement was signed between the Russian Ministry of Science and Higher Education, the Kola Science Centre of the Russian Academy of Sciences and PJSC PhosAgro. The agreement provides for the creation of a research center for the study of apatite-nepheline ores of promising extraction and the implementation of projects in the field of new production technologies. It is planned to conduct comprehensive research on the development and implementation of innovative technologies for ore preparation and enrichment. It is planned to consider the problem of using mining waste from the Kirovsk branch of JSC Apatit. Essentially, the authors of the article consider it advisable to use a balanced model of the triple helix of interaction, based on the interaction of the state, research organizations or universities and industrial enterprises, presented in Fig. 1. This model is effectively used by foreign countries, especially the Arctic ones, which increases the practical significance of improving the efficiency of mining waste management.

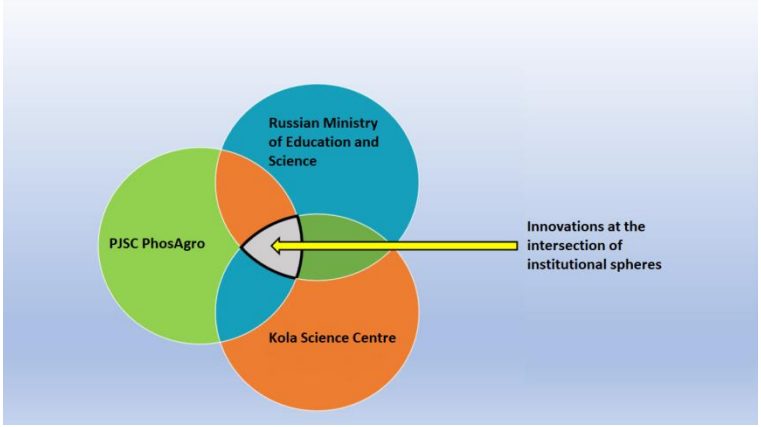

Fig. 1. "Triple helix" interaction [20, Tsukerman V.A., Zharov N.V.].

Polar division and Kola MMC of PJSC MMC Norilsk Nickel

The indicators of the formation and disposal of mining waste at the Polar division and Kola MMC of PJSC MMC Norilsk Nickel for the period 2018–2022 are presented (Table 3)

Table 3

Waste generation and disposal at industrial enterprises of the Polar division and Kola MMC of PJSC MMC Norilsk Nickel, million tons [8]

	2018	2019	2020	2021	2022
Waste generation at the Polar division	16	16	15	14	14
Waste utilization at the Polar division	15.8	14.3	10.6	6.1	8.1
Waste generation at the Kola MMC	8	8	8	8	7
Waste utilization at the Kola MMC	2.5	4.3	6.1	4	4
Current environmental protection costs of MMC Norilsk Nickel, bln rub	19.2	21.6	21.8	18.1	34.4

Almost all wastes generated are overburden and enrichment wastes. The volume of waste generation at the Polar division has a negative trend; the volume of waste disposal is also decreasing. The volume of waste generation at the Kola MMC remains practically unchanged, while the volume of waste disposal has increased, especially in 2020, due to the need to use waste directly by the enterprise: for example, in the preparation of filling mixtures, as flux when melting metal in smelting furnaces, for filling the mined-out spaces, backfilling quarries, roads, leveling sites, embanking railway tracks and strengthening tailings dumps. Most of the generated mining waste is used in own production, the rest is transferred to third-party companies for disposal. Unused waste is disposed of in tailings dumps at the Talnakhskaya concentrating plant, the Nadezhdinskiy metallurgical plant and the concentrating plant in Zapolyarnyy. Environmental protection costs have a positive trend, except for costs in 2021.

Severstal Resources division of PJSC Severstal

Research was conducted on the generation and disposal of waste in the Severstal Resources division of PJSC Severstal for the period 2018–2022. The results are shown in Table 4.

Table 4

Waste generation and utilization in the Severstal Resources division of PJSC Severstal, million tons [9]

	2018	2019	2020	2021	2022
Waste generation, including:	193	202.6	208.7	203.5	179
Overburden rocks	160.1	170.1	175.7	170.5	149
Enrichment wastes	31.6	31.9	32.8	32.9	30
Expenditures on environmental protection measures in the sphere of waste management at PJSC Severstal, mln rub.	634.6	683.8	476.9	740.7	663.3

[8] Reports on the sustainable development of PJSC MMC Norilsk Nickel. URL: https://www.nornickel.ru/investors/reports-and-results/annual-reports/ (accessed 19 June 2023).

[9] Reports on corporate social responsibility and sustainability of PJSC Severstal. URL: https://www.severstal.com/rus/sustainable-development/documents/reports (accessed 19 June 2023).

Overburden ores and enrichment waste make up the bulk of waste generated by the Severstal Resources division. The company operates two tailings dumps at the enterprises of JSC Olkon and JSC Karelskiy Okatysh. Mining industrial waste is largely used directly by the corporation, primarily for construction, road repair, crushed stone production and dam embankment. The volume of overburden and enrichment wastes generated has increased significantly, except for the 2022 figures, mainly due to the withdrawal of the Vorkutaugol enterprise from the PJSC Severstal Corporation. Utilization indicators for the Severstal Resources division are not presented in the reports for the period under review. Expenditures on environmental protection measures in the field of waste management have a positive trend, except for 2020.

PJSC NOVATEK

Quantitative data on waste generation, utilization and neutralization at PJSC NOVATEK for the period 2018–2021 are presented (Table 5).

Table 5

Generation, utilization and neutralization of waste at PJSC NOVATEK, million tons [10]

	2018	2019	2020	2021	2022
Generation	0.071	0.08	0.047	0.054	0.091
Utilization	0.013	0.01	0.023	0.049	0.086
Neutralization	0.003	0.014	0.017	0.007	0.008
Expenditures on environmental protection measures for safe waste management, mln rub.	696	394	320	510	871

The corporation's main activities are related to the exploration, production and processing of natural gas and liquid hydrocarbons. In connection with the main activity, drill cuttings account for about 97% of waste generated. The corporation has developed a unique technology for thermal desorption of waste, which, along with physical and mechanical methods, is used for the disposal of drilling cuttings in developed fields, which allows for the reuse of hydrocarbon-based drilling fluid. In addition, the corporation has a system of separate collection, accumulation and disposal of wastes, some of which are transferred to third-party companies. This makes it possible to get a significant environmental and economic effect. According to the data obtained, the volume of generated, disposed and neutralized waste has increased, with the exception of 2020 and 2021. In order to implement the developed technologies, the corporation increased the volume of expenditure in 2018, 2021 and 2022 after the pandemic.

Results and discussions

The research results allow us to consider the possibilities of increasing the efficiency of mining waste management by large Arctic resource corporations in order to improve the environmental regulation system and increase the efficiency of the production economy. Over the

[10] Reports of PJSC NOVATEK in the field of sustainable development. URL: http://www.novatek.ru/ru/development/ (accessed 19 June 2023).

specified period, the considered Arctic corporations did not demonstrate a significant increase in the efficiency of environmental protection measures in the field of waste management, which is a consequence of insufficient development and implementation of innovative environmental protection technologies. It should be noted that natural and economic conditions make it necessary to identify and overcome institutional barriers to the strategic management of mining enterprises and, in particular, the use of waste. In this regard, Arctic corporations, together with scientific organizations, need to create their own modern base for the innovative development of enterprises, taking into account waste management.

Of particular importance is the stimulation of innovative waste management processes, the formation of environmental laws and the use of natural resources, aimed at maximizing the preservation of environmental balance. This allows us to recommend the development of a strategy for state regulation of waste management of Arctic mining enterprises, taking into account scientific, technological, environmental, socio-economic, and other territorial features. One of the most important goals of the strategy is the creation of an innovative economy in the Arctic territories and the transition from the extensive use of non-renewable natural resources to rational management.

The waste management system of Arctic mining corporations is characterized by low market motivation and the absence of strategic government policy in the sphere of mineral raw materials use. It is more profitable for industrial enterprises to pay for non-compliance with environmental protection requirements than to develop and implement innovative waste processing technologies. Waste management is in fact reduced to compliance with the technological regulations of mineral extraction projects on fulfilment of the main production processes of resource enterprises.

The decline in the quality of the mineral resource base with the continuing trend towards extensive use of subsoil resources allows us to conclude that the mass of waste from enterprises will increase in subsequent years. Wastes with valuable consumer properties and useful minerals contained in them that are not extracted during ore enrichment should be effectively used in economic turnover. In this regard, it should be noted that the organization of waste transfer for the production of valuable products is insufficiently effective. In order to increase the degree of utilization of mineral waste, special projects need to be developed and implemented, which requires the fundamental interest of companies.

Further research should be focused on improving the state environmental policy in the Arctic in the field of waste management and increasing the availability of investments, subsidies or other financial incentives to implement the developed environmental innovations aimed at protecting the environment and increasing the socio-economic development of regions that exploit and process mineral resources.

Conclusion

1. The volumes of mining waste from Arctic enterprises had increased over the period under review, while their disposal had essentially remained at the same level, including the use for the corporations' own purposes.

2. The corporations reviewed do not demonstrate a real increase in waste utilization relative to its generation, except for the Kola MMC of PJSC MMC Norilsk Nickel, which shows positive dynamics.

3. The research has shown that corporations do not sufficiently provide for financial investments in environmental protection: expenditures on the creation of innovative waste management technologies have not practically increased. The developed technology of waste thermodesorption of PJSC NOVATEK can be noted, which made it possible to increase the recycling and neutralization of waste and, accordingly, to increase efficiency, which allowed to obtain a significant environmental and economic effect due to the increase in the cost of measures. As part of improving the environmental and economic condition of mining enterprises, it is proposed to use scientifically justified amounts of financial resources and make appropriate management decisions.

4. To improve the efficiency of waste management, it is advisable to create research and production centers based on the use of a balanced "triple helix" model on the example of a tripartite agreement between the state, research organizations (universities) and industrial enterprises based on the experience of the Arctic countries. Similar agreements between PJSC PhosAgro, the Kola Science Center of the Russian Academy of Sciences and the Ministry of Science and Higher Education of Russia, concluded in 2023, should be supported.

5. Special attention should be paid to the development of innovative technologies and the rational use of mining waste to improve the quality of the Arctic environment and the economics of production.

6. It is recommended to use the capabilities of the Interdepartmental Scientific Council of the Russian Academy of Sciences, created in 2023, for the development of the mineral resource base and its rational use to assist in the development of the scientific foundations for the extraction and processing of minerals and accelerating import substitution.

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Local Transport Systems of the Russian Arctic (On the Example of the Primorskiy District of the Arkhangelsk Oblast)

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Abstract. The article discusses the concept of transport system with a focus on the local transport system, as well as its role in the socio-economic development of the Russian Arctic. The empirical study is based on the materials of expeditions that took place on the Summer and Winter shores of the Onega Peninsula, as well as on the island territories of the Primorskiy district of the Arkhangelsk Oblast. The local transport system was analyzed in terms of its elements: infrastructure, regulatory system, vehicles used, information support, informal institutional system of transport support regulation, etc. The materials obtained during the expedition were supplemented with data on the organization of transport communication, timetables, logistics, and official information on the methods of organizing navigation on the Northern Dvina River and in the White Sea. On the basis of the theory of multiscale and the analysis of empirical data, it is concluded that the local transport system is the main factor determining the scenarios of socio-economic development of municipalities in the Russian Arctic. Transport connectivity of the Arctic zone should start with transformations "from below", from the local transport system, taking into account local knowledge and institutions. Proposals for the development of the local transport network of the Arctic region are presented.
Keywords: *local transport system, infrastructure, transport accessibility, institutional regulation, Russian Arctic*

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Introduction

The transport industry is one of the most important sectors of the economy, connecting all elements of its territorial structure into a single system through the transfer of people, goods, information and energy. Transport plays a key role in the formation of economic and social space [1, Mezhevich N.M., Khaliev A.A., p. 74]. For this reason, the transport factor is an obligatory element of the local and regional paradigm as a condition for the sustainable development of territories.

The importance of transport is recognized in numerous works of foreign researchers [2, Chew J., p. 83; 3, Var T., Gunn C.; 4, Hall C.M.; 5, Inskeep E.; 6, Martin C.A., Witt S.F., p. 255; 7, Page S.J.; 8, Picard M.; 9, Rose H.]. Analysis of the role of transport is more widely considered from

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a spatial or geographical perspective [10, Burton R.; 11, Smith R.A., p. 304], less often — from an economic perspective [12, Prideaux B., p. 53].

In domestic scientific works, despite the recognized importance of the role of transport in socio-economic development, there is still no single concept of transport system. L.I. Vasilevskiy defines the transport system as all modes of transport and all links of the transport process in their interaction [13]. Consistency in volume, time and location of routes is identified by E.B. Alaev as the main characteristic of the transport system [14, p. 237].

In transport geography, the object of study is the territorial transport system, which is characterized by the presence of transport-geographical relations in territories with a similar level of transport development [15, Tarkhov S.A., Shlikhter S.B.]. Foreign researchers emphasize that the functions of the territorial system (among which the quality of life is considered to be primary) depend not only on the movement of goods through transport networks, but also on the characteristics of other technical infrastructure networks to ensure the functioning of material, energy and information flows. Therefore, a unified approach to all these technical networks is necessary for the design and operation of the territorial system [16, Smith S., p. 911]. The creation of sustainable infrastructure is essential [17, Llorca C. et al., p. 95] due to climate change.

The principle of multilevelness is fully applicable to transport systems (TSs): they are divided into country (national), which include all transport routes; regional, representing TS of subjects; local TS of several municipalities [18, Gafarova K.E., Osadchiy E.I., p. 53]. A.N. Privalovskiy, in addition to the above-mentioned TSs, identifies local TS of one administrative district and macroregional ones, uniting TSs of several subjects or federal districts [19, p. 7].

The local approach to the development of transport systems was first considered in Russian science in the dissertation of A.N. Privalovskiy. According to his definition, local transport systems are an integral part of regional transport systems and the general transport system of Russia [19, p. 7]. The researcher proposed his own typology of local transport systems based on the density of the road network: from a very high level of transport development in the central regions of Russia to the lack of land transport in remote areas.

Numerous works by N.Yu. Zamyatina and A.N. Pilyasov are devoted to the local transport system, which is described as “a highly specific, time-evolving combination of various modes of transport and actors in a specific administrative-territorial unit (usually the size of a municipal district), aimed at ensuring the mobility of passengers and goods”. The specificity of the local transport system in their interpretation is determined by the particular combination of transport modes involved. Scientists emphasize the need for constant technological, organizational and institutional renewal, search for solutions to ensure transport connectivity of the territory in the face of such challenges as sparse population, seasonality, lack of roads, using various tools — social networks, lawmaking, contrivance, non-standard ways of using modes of transport, etc. [20, p. 94]. Scientists identify the following elements included in the structure of the local transport system: transport infrastructure; vehicles used in the given territory; business entities; local produc-

tion base for transport development; communication and navigation system; system of information support and innovative development of transport; transport regulatory system; informal institutional system of transport regulation, including local value norms and behavioral attitudes; groups of consumers of local transport system services.

B.V. Nikitin, considering the local transport system (LTS) of the Kamchatka Krai, proposes his own typology, dividing LTS into two main types: with the predominant role of road transport and those located in the off-road zone, which is characterized by combinations of several types of transport: air, all-terrain, sea, river [21, p. 60].

In scientific works [22, Zamyatina N.Yu., Pilyasov A.N.], local transport systems of remote territories are often described as underdeveloped in comparison with the transport systems of central Russia. In this article, we follow the approach "from below", in which the process of transport development takes into account the important features of local transport systems "in their deviation from the average statistical ranking" [23, Pilyasov A.N., Zamyatina N.Yu., p. 58]. The approach "from above" is based on national-scale projects, which are often poorly consistent with the needs of the local population.

The "from below" approach, taking into account the principle of a multi-level transport system, is consistent with the principle of glocality, which means the end-to-end balancing of the approach "from above" and the approach from communities "from below" in the most important issues of territory development. The principle of glocality connects external expert and local knowledge [24, Pilyasov A.N., Zamyatina N.Yu., p. 10].

Scientists emphasize in their works on the local transport system that the territories of the North and the Arctic need a special model of transport arrangement due to their specificity, in which lack of roads is an essential part, and not a negatively perceived phenomenon, as happens in the central regions of Russia, characterized by a fairly high degree of transport development.

To determine the features and significance of the local transport system of Primorskiy district — one of the territories included in the Arctic zone of the Russian Federation — the materials of field research conducted in 2022 were used.

Geography and research methods

The LTS study was carried out using the example of the Primorskiy district of the Arkhangelsk Oblast. The Primorskiy district is located in the northwestern part of the Arkhangelsk Oblast, occupies the lower reaches of the Northern Dvina, its delta, as well as the coast of the White Sea — the Summer and the Winter coasts on an area of 46.1 thousand km^2, on which 215 settlements are located. The permanent population of the district as of January 1, 2023 was 28.7 thousand people, the entire population is rural. The population density is 0.6 people per 1 km^2, which is more than three times lower than the average rural population density in the Russian Federation. The district is part of the Arctic zone of the Russian Federation.

Economic activities in this area are typical for rural areas: fish farming and fishing, agriculture, logging and construction activities, housing and communal services, tourism and trade [1].

The study on the territory of the Primorskiy district of the Arkhangelsk Oblast was carried out in July–August 2022. During trips to the islands of the Northern Dvina River delta and the White Sea coast, data on how the LTS is organized "on the ground" was collected.

The Primorskiy district is characterized by researchers as quite favorable in terms of assessing transport and communication problems and transport discrimination of the population, which is described as the inaccessibility of a socially guaranteed minimum due to the insufficient development of the transport system. The level of transport discrimination is measured by the standard time it takes to reach any point via a single transport network from a given settlement. However, in the Primorskiy district, transport conditions are radically different in regional centers and on the periphery, where both freight and passenger traffic show a significant deterioration in accessibility and quality [25, Tutygin A.G., Chizhova L.A., Lovdin E.N., p. 170].

Some settlements of the Primorskiy district are classified as hard-to-reach. The regulatory acts of the Arkhangelsk Oblast define hard-to-reach areas as areas from which there is no pedestrian accessibility to the administrative center during the working day for all residents of the area [2]. One of the characteristics of a hard-to-reach territory is the underdevelopment of transport infrastructure.

Data collection was carried out taking into account the theory of multiscale, the main feature of which is the consideration of the interaction of scales of different levels. While the overview scale requires the analysis of statistics and literature sources, the medium scale is based on statistical data and surveys of regions, the large scale relies on interviews that take into account local characteristics [26, Goncharov R.V., Pilyasov A.N., Zamyatina N.Yu.]. In accordance with this theory, sociological and anthropological research methods such as expert and in-depth interviews are considered the most relevant, making it possible to identify the full range of standard and unique practices in the use of transport by the population [26]. During field research, over 40 polystructured interviews were conducted with residents of the listed villages in the Primorskiy district. In our research we also rely on the "way from below", which corresponds to the principle of glocality, i.e. we study characteristic areas with all local features as typological samples.

[1] Strategiya sotsial'no-ekonomicheskogo razvitiya munitsipal'nogo obrazovaniya «Primorskiy munitsipal'nyy rayon» do 2030 goda [Strategy for the socio-economic development of the municipal formation "Primorsky Municipal District" until 2030]. URL: https://www.primadm.ru/upload/economy/Strategia_2030.pdf (accessed 17 May 2023).
[2] Zakon Arkhangel'skoy oblasti ot 9.09.2004 g. № 825 «O perechnyakh trudnodostupnykh mestnostey na territorii Arkhangel'skoy Oblasti» [Law of the Arkhangelsk Oblast of September 9, 2004 No. 825 "On the lists of hard-to-reach areas on the territory of the Arkhangelsk Oblast"]. URL: http://docs.cntd.ru/docu (accessed 17 November 2022).

The materials obtained during the expedition were supplemented with data on the organization of transport communications, schedules, logistics, and official information on the methods of organizing navigation on the Northern Dvina River and in the White Sea.

Local transport system of the Primorskiy district

The analysis of the local transport system was carried out on the basis of the theory of importance of the LTS role put forward by N.Yu. Zamyatina and A.N. Pilyasov, taking into account the elements included in the structure of the local transport system [20, p. 94].

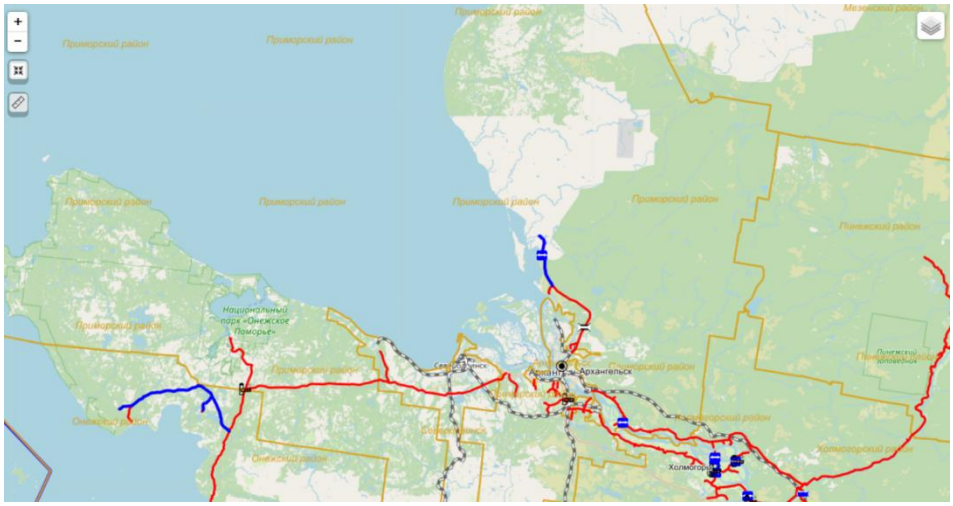

Fig. 1. Map of roads and railways in the Primorskiy district [3]. Red color on the map indicates motor roads, blue color — winter roads.

The transport infrastructure of the Primorskiy district is represented by air, road and sea/river transport. Most of the railway tracks passing through the territory of the Primorskiy district belong to the Arkhangelsk branch of the Northern Railway, but there are also narrow-gauge tracks and timber tracks. The island and coastal territories of the district, which are included in the off-road zone (see Fig. 1), are remote from railway stations of the Arkhangelsk Oblast.

One of the main positive factors influencing the development of the road transport system is the geographical location of the district. The Primorskiy district is directly adjacent to the regional center — Arkhangelsk, and two large cities of the region: Severodvinsk, Novodvinsk, which is characterized by the presence of regional roads and the federal highway M-8 “Arkhangelsk – Kholmogory – Moscow”. Table 1 presents the types of LTS in the Primorskiy district: LTS with a predominant role of road transport and LTS in off-road zones.

Table 1

Types of LTS in the Primorsky district [4]

Type of LTS	Settlements
A. LTS with a predominant role of road transport	
A1. “Entrance Gate”	Arkhangelsk agglomeration (railway, M-8 highway), Talagi/Vaskovo airport
A2. Highway settlements	Izhma, Una, Luda, Rikasikha, Laiskiy Dok, Maloe

[3] Road map of the Road Agency “Arkhangelskavtodor”. URL: https://www.ador.ru/roads.shtml (accessed 17 May 2023).
[4] Source: compiled by the author based on the typology of B.V. Nikitin.

	Toinokurye, etc.
A4. Settlements along departmental roads	Settlements near Severalmaz deposits
A5. Isolated highway settlements (located in close proximity to roads, but separated from them by a river)	Verkhovye, Kushkushara, Gorka, Dom Invalidov, etc.
B. LTS of the off-road zone	
B1. Settlements with seasonal land communication (winter road)	Patrakeevka, etc.
B2-2. Remote settlements on the sea coast	Villages: Pushlakhta, Letnyaya Zolotitsa, Letniy Navolok, Lopshenga, Yarenga, Pertominsk, etc.
B2-3. Remote settlements on rivers	Verkhnyaya Zolotitsa, Nizhnyaya Zolotitsa, Kuya, etc.
B3. Island territories	Villages: Pustosh, Vyselki, Odinochka, Voznesenie, Andrianovo, etc.

The “Strategy for the socio-economic development of the municipal formation “Primorskiy Municipal District” until 2030” [5] notes that the transport system, due to the lack of road communication between some municipalities of the region and the administrative center, cannot fully provide for the population, production and economic development. Figure 2 shows the length of highways in the Primorskiy district with 5-year intervals for 2007, 2012, 2017 and 2022. As the statistical data demonstrate, the length of roads has not increased over 15 years, but roads with hard and improved surfaces (cement concrete, asphalt concrete and asphalt concrete types, crushed stone and gravel, treated with binders) have decreased.

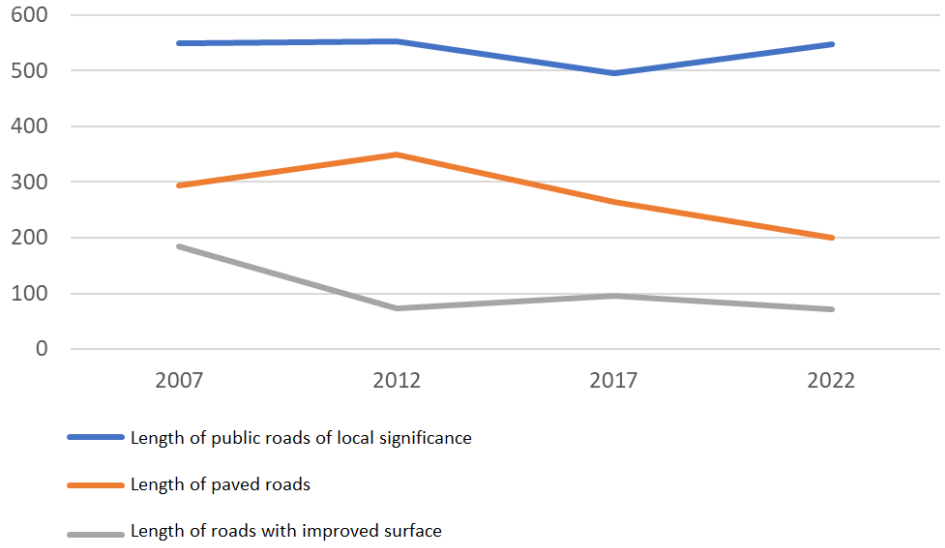

Fig. 2. Length of motor roads in the Primorskiy district, 2007–2022 [6]

There are many island territories in the Primorskiy district, which are connected by water transport during the navigation period [7]. In winter, transport and pedestrian ice crossings are cre-

[5] Reshenie Sobraniya deputatov munitsipal'nogo obrazovaniya «Primorskiy munitsipal'nyy rayon» ot 25 iyunya 2015 g. N 156 «2015 strategiya sotsial'no-ekonomicheskogo razvitiya munitsipal'nogo obrazovaniya "Primorskiy munitsipal'nyy rayon" do 2030 goda» [Decision of the Meeting of Deputies of the municipal formation "Primorsky Municipal District" dated June 25, 2015 N 156 “2015 strategy for the socio-economic development of the municipal formation "Primorsky Municipal District" until 2030”]. URL: http://municipal.garant.ru/#/document/168765844 (accessed 17 May 2023).

[6] Federal State Statistics Service: passport of the municipal district. URL: https://rosstat.gov.ru/scripts/db_inet2/passport/pass.aspx?base=munst11&r=11652000 (accessed 17 September 2023).

ated annually for residents of the island territories. According to information from the Main Directorate of the Ministry of Emergency Situations for the Arkhangelsk Oblast, there were 5 pedestrian and 7 transport ice crossings in the Primorskiy district in 2023.

It is noted that there is practically no infrastructure for water transport in the Arkhangelsk Oblast: 47% of berths do not meet safety requirements [8]. As a result, passengers are often transported in violation of the rules. Thus, in summer, the populated areas of the Summer Coast of the White Sea can be reached through Cape Zayatskiy. There is no berth for small vessels on the cape; a rusty barge pulled ashore is used as a landmark. The local population uses high rubber boots called "brodni" to land on a shore, to which a small-sized vessel cannot approach closely due to insufficient depth. Crews of small vessels carry passengers unprepared for such disembarkation on their backs to the shore.

Transport regulatory system. Regulatory documents emphasize the need for state support for the transport sector: maintaining state regulation of tariffs for passenger and luggage transportation by all types of transport; maintaining the practice of budget financing of lost revenues resulting from state regulation of tariffs for passenger and luggage transportation by all types of transport [9]. From the perspective of LTS development, one can highlight such aspects as repair of roads and bridges, renewal of the vehicle fleet (passenger buses and river boats); development of air and inland water transport in order to provide transport services to remote and hard-to-reach areas of the Arkhangelsk Oblast.

The state program of the Arkhangelsk Oblast "Development of the transport system of the Arkhangelsk Oblast" justifies the provision of subsidies to the budgets of municipal districts of the Arkhangelsk Oblast to co-finance activities for the construction and acquisition of river vessels. In addition, compensation for lost income arising from the transportation of passengers and baggage by air, including to settlements located on the White Sea coast, is subsidized. It should be noted that, in our opinion, these measures are aimed at maintaining the functioning of the LTS, but not at its development.

Vehicles used in the area. The local transport system of the Primorskiy district is characterized by multimodality. The model of transport multimodality in the study areas reflects the uniqueness of remote areas with low population density: it is a combination of locally specific, often seasonal, "small" modes of transport (all-terrain vehicles, snowmobiles, cars) with "long-distance" modes of transport that are neutral in relation to the characteristics of the local space (railroads, airplanes, etc.) [22, Zamyatina N.Yu., Pilyasov A.N.]. In addition, the most important feature of the development of the transport system is the widespread use of seasonal ice crossings; river and sea transport is becoming essential, and the role of air transport is increasing. Sea-

[7] Ibid.
[8] Gosudarstvennaya programma Arkhangel'skoy oblasti «Razvitie transportnoy sistemy Arkhangel'skoy oblasti» [State program of the Arkhangelsk Oblast "Development of the transport system of the Arkhangelsk Oblast"]. URL: https://dvinaland.ru/budget/programs/18 (accessed 17 May 2023).
[9] Ibid.

sonal routes are of critical importance. At the same time, LTS with a predominant role of road transport differs significantly from LTS of off-road zones, which tends to increase: the share of the population living in settlements that do not have regular bus and (or) railway communication with the administrative municipal center or urban district in the total population of the Primorskiy district increased from 17 to 20% in the period of 2012–2022 [10].

Thus, in order to get to the settlements of the Summer Coast of the White Sea in summer, local residents have to change several types of transport: a car to Cape Zayatskiy, a private boat across the Unskaya Bay, a taxi or a private car to Arkhangelsk in Luda village. This method is the most expensive, but at the same time it does not limit the transportation of luggage so much. In winter, when crossing the Unskaya Bay on the ice of the White Sea, residents use their cars, swamp vehicles, karakats, and snowmobiles. Therefore, the delivery of large cargo to coastal villages is mostly done in winter using their own transport. Almost every family has motor boats, snowmobiles, swamp vehicles and other transport equipment. This is confirmed by data from the Main Directorate of the Ministry of emergency situations for the Arkhangelsk Oblast: the number of small vessels in the Primorskiy district increased from 3437 in 2018 to 3528 vessels in 2022.

Sea transportation of passengers on the territory of coastal settlements is carried out on vessels of outdated projects, which have exhausted their service life [11]. For example, the motor ship “Belomorye” carries passengers to the White Sea coast once a fortnight in summer. The ship makes only three stops in settlements located on the White Sea coast, and residents of other villages do not consider the ship as a means of transport to get home from the administrative center of the Arkhangelsk Oblast. One of the reasons is the limited transportation of large cargo (building materials, furniture, etc.). According to local residents, until the early 2000s, a barge of a fishing collective farm was used to transport passengers and cargo from Luda village to Zayatskiy Cape. After the vessel exhausted its resource, a new one did not appear. The population of the island territories located at the mouth of the Northern Dvina River has to hire a private barge for an additional fee. *“Previously, it was convenient with (the motor ships) “Balkhash” or “Kommunar”, because they were quite capacious ships. Besides, its fore body is completely open and one could easily transport a sofa, for example... But now, if it is a sofa or a bed, we realize that it won’t fit through the openings unless it’s in boxes. That’s why you have to order this barge for a certain time. It floats for a very long time.”*

The only year-round mode of transport to the White Sea coast is small aviation. Passenger transportation by air is carried out by OJSC “The Second Arkhangelsk United Aviation Division”. Airports that take small-engine planes and helicopters are located in the villages of Verkhnyaya

[10] Passport of the municipal formation “Primorskiy Municipal District”. URL: https://rosstat.gov.ru/scripts/db_inet2/passport/ (accessed 17 August 2023).
[11] Gosudarstvennaya programma Arkhangel'skoy oblasti «Razvitie transportnoy sistemy Arkhangel'skoy oblasti» [State program of the Arkhangelsk Oblast “Development of the transport system of the Arkhangelsk Oblast”]. URL: https://dvinaland.ru/budget/programs/18 (accessed 17 May 2023).

Zolotitsa, Lopshenga and Pertominsk. Low prices and availability of air travel are due to subsidies from regional authorities. However, the downside of air travel is the strict baggage restrictions.

Settlements on the White Sea coast can be classified as settlements with no alternative land transport, especially during winter and thaw, which lasts from the day when navigation along the river officially stops until the formation of ice crossings, and in the spring it can last from two weeks to two months. Due to snow drifts and the snow removal tractors breaking down, traffic on the only road to the airport on the Summer Coast may be stopped, and traffic through the Unskaya Bay may be cut off in the season of slush spring thaws. At the same time, replacing one type of transport with another may be complicated by difficult weather conditions.

It should be noted that the transport sector is one of the industries most exposed to climate change risks, which are observed both in the Arkhangelsk Oblast and globally. In particular, ice formation occurs at later dates, ice is less durable [27, Grishchenko I.V.]. Extreme climatic phenomena such as fog, heavy rainfall, hazardous snowfall and blizzards, which have become more intense in recent years, can have a wide range of impacts on transport infrastructure and services. In particular, they may cause the cancellation of flights and vessels.

Interview respondents noted the impact of hydrometeorological conditions on their mobility. In conversations with residents, it was often possible to hear similar stories about how regular flights of motor vessels were cancelled due to wind, storm or fog, but people found out about it when they were already at the berth.

Economic entities. Sea transportation of passengers to coastal settlements in the Primorskiy district is carried out by LLC “Shipping Company ‘Arcticraid’”, as well as individual entrepreneurs. The main river transport carrier is JSC Arkhangelsk River Port [12]. Air transportation is carried out by OJSC “The Second Arkhangelsk United Aviation Division”. Thus, LTS unites mainly private companies, as well as divisions of government organizations.

The number of small business entities has a positive trend in the Primorskiy district and a clear upward trend in the municipal region, with 30% accounting for retail trade [13]. However, there is a tendency towards a decrease in the number of retail trade facilities (Fig. 3), the reason for which may be both a general decrease in population and unprofitability.

In order to deliver goods to island villages, shop owners have to use several logistics chains using different types of land transport [28, Kuznetsova S.Yu., Nenasheva M.V.]. The complexity of logistics chains and possible supply interruptions cause a sharp rise in transportation costs. Thus, the cost of transportation on ice crossings requires expenses for their arrangement and maintenance, and in some cases, for the use of adapted transport. Transportation by river is cheaper, but requires transshipment bases, which leads to additional costs and slows down the movement of

[12] Strategiya sotsial'no-ekonomicheskogo razvitiya munitsipal'nogo obrazovaniya «Primorskiy munitsipal'nyy rayon» do 2030 goda [Strategy for the socio-economic development of the municipal formation “Primorsky Municipal District” until 2030]. URL: https://www.primadm.ru/upload/economy/Strategia_2030.pdf (accessed 17 May 2023).
[13] Economy. URL: www.primadm.ru/economy/ (accessed 17 August 2023).

goods [29, Goncharov R.V., Zamyatina N.Yu., Pilyasov A.N.]. Thus, the remoteness and inaccessibility of territories increases the cost of products and goods.

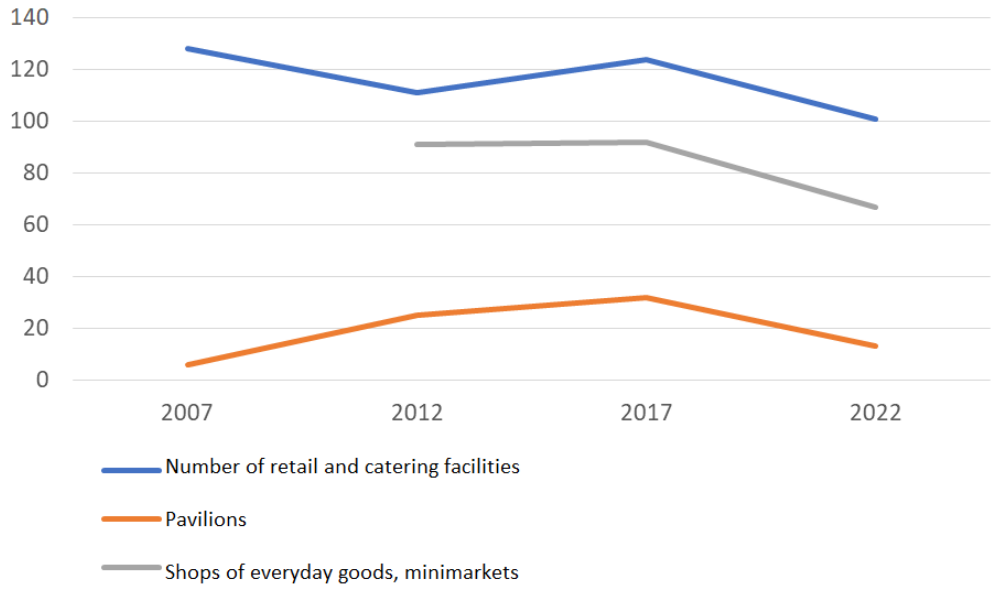

Fig. 3. Number of retail trade facilities in the Primorskiy district, 2007–2022 [14]

Communication and navigation systems are rather limited. In particular, only one mobile operator is available on the White Sea coast. However, if power grids are not functioning due to repair work or cables are broken due to storm winds, the population may be left without mobile communications.

Navigation conditions are provided by the port of Arkhangelsk at the mouth of the Northern Dvina River. However, navigation along the White Sea, for example, in Unskaya Bay, is often ensured by the local population: the channel is marked with high branches with reflective elements to ensure movement in the dark. Movement on sea ice during the freeze-up period, despite the increasing role of government agencies (Ministry of emergency situations and the National Park) in ensuring safety, is started by the local population independently by laying ice roads, taking into account the knowledge and experience of previous generations.

The information support system is based on traditional means of communication. From the respondents' stories, we learned that when planning mobility, local residents receive basic information about hydrometeorological conditions from official sources such as radio, television and the Internet. However, informal leaders and local activists of territorial public self-government can play an important role in it. They often take on the function of informing about flight cancellations and repair work, using social networks and the so-called "word of mouth".

Innovative transport development can also be initiated from below. For example, in Arkhangelsk, small-sized all-terrain vehicles, popularly called "motor dogs", were invented and

[14] Federal State Statistics Service: passport of the municipal district. URL: https://rosstat.gov.ru/scripts/db_inet2/passport/pass.aspx?base=munst11&r=11652000 (accessed 17 September 2023).

are now being produced. A craftsman in the village of Bereznik, Arkhangelsk Oblast, collects "karakats", which are buoyant and are in demand among the population.

The informal institutional system of transport regulation includes local values and behavior, which, according to the results of field research, are characterized by a high level of mutual assistance and willingness to help in the process of ensuring traffic [22, Zamyatina N.Yu., Pilyasov A.N.]: *"You won't be left in trouble, even if they drive by, they'll still pick you up somewhere, drop you off."* The need to survive and overcome disruptions in transport provision determines the possibility of the existence of informal economic relations and the readiness of local communities to quickly become involved in them: *"Our bay was almost frozen. You know, we still have men from Pertominsk going here (to Yarenga) on boats to collect cargo. They were already caught by the ice, but they had to be taken out so that our store wouldn't be left empty."*

Consumer groups of local transport system services include business entities, tourists, as well as local residents who were born and raised in these settlements. Local residents have deep knowledge of local features, natural phenomena and weather. However, their long-term residence has formed their habits of reduced comfort during transportation and an unclear sense of danger. Thus, local residents begin to cross the channel between the islands as soon as some ice cover is formed, risking their lives: *"Those who are not afraid are the first to cross the bay in winter, without a care in the world, well, and then no one cares anymore, that's it, let's go."*

Interpretation of results

During the study, we came to the conclusion that LTS is one of the factors determining the socio-economic development of local communities. In particular, the features of the LTS of the off-road zone listed above may determine the fact that the overall coefficient of natural increase (decrease) of the population in the Primorskiy district decreased from positive indicators of 0.3 ppm in 2017 to negative indicators of -6.4 ppm in 2022. The number of residents of working age and under working age is decreasing, while the percentage of pensioners is increasing[15].

The local transport system should become the basis for the development of strategic documents for the development of regions and federal infrastructure. We have formulated recommendations that can help to consider the components of LTS, taking into account the "bottlenecks" identified during the study, while, from our point of view, the approaches to LTS with a predominant role of road transport and LTS of off-road areas should be different.

Recommendations for LTS with a predominant role of road transport:

- ensuring stable functioning of highways: analysis of Russian and foreign experience for the effective selection of types of road surfaces most suitable for local conditions, construction of bridges;
- maintaining public transport routes, considering opportunities to increase subsidies;

[15] Passport of the municipal formation "Primorskiy Municipal District". URL: https://rosstat.gov.ru/scripts/db_inet2/passport/ (accessed 17 August 2023).

- creation of mini-hubs at points of multimodal change of LTS transport modes, as, for example, occurs at Cape Zayatskiy in Unskaya Bay, where road transport is replaced by small vessels;
- development of infrastructure on the highways (gas stations, mini-hotels/guest houses), including for the expansion of first aid facilities.

Recommendations for LTS of off-road areas:

- launching barges or large vessels on regular routes to ensure the delivery of large cargo to remote settlements on the sea coast, which can also serve as passenger ships;
- development of snowmobile trails: infrastructure, traffic safety, and regulations;
- ensuring affordable air travel: subsidizing routes, improving airport infrastructure;
- development of river transport: use of various models of vessels, taking into account local specifics, including off-season ones: snowmobiles, hovercraft, etc.;
- supporting the use of different modes of transport in different seasons: use of not only all-season land modes of transport, but also a combination of several modes of transport (including off-road ones, invented taking into account local specifics);
- attracting youth and students to invent and use new technologies, simplifying the legalization of off-road vehicles as a result of invention. The introduction of such vehicles will also support small businesses in the territories.

Further mechanisms for LTS development could also include informing the transport community about the importance of innovative approaches and the methods that can be used, reducing management and communication barriers that hinder cooperation between stakeholders, increasing funding for planning and implementation of necessary measures, engaging regional level management to provide clarity on policy direction, developing partnerships at the local level with a focus on the importance of “from below” development. The transport system should be studied locally, including observations about the uniqueness of transport infrastructure in each location.

Climate change should also be taken into account. Key indicators demonstrate that the climate continues to change, and incoming data on socioeconomic impacts emphasize the vulnerability of the population to weather and climate events due to potential damage. The potential impacts of climate change need to be considered when planning the development of local transport systems, modes of transport used and their all-season nature, road surface types and other aspects.

Thus, the transport connectivity of the Arctic zone should begin with transformations “from below”, with a local transport system taking into account local knowledge and institutions.

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New Opportunities and New Risks for Sustainable Development of the Russian Arctic in the Context of Climate Change

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Abstract. The Arctic climate has been changing dramatically in recent years. This external condition, on the one hand, increases the risk of sustainable development of the Arctic; on the other hand, in combination with the management factors of the Russian Federation's Arctic zone, it provides new development opportunities. Based on the authors' methodology, the paper assesses the efficiency of sustainable development management of the Arctic by comparing the costs of environmental protection and the volume of pollutants entering the Arctic ecosystems. The study has shown that, despite the growth of current expenditures on sustainable development management in the Arctic, their use cannot be considered fully effective and efficient: financial investments do not always lead to the reduction in pollution; investments in sustainable development are uneven and depend on the current conjuncture. Changes in the Arctic climate have been assessed by comparing indicators for the period from 1971 to the present, characterizing air temperature, precipitation, snow cover, sea and river ice, permafrost, etc. The analysis has revealed an accelerated growth of Arctic climate change indicators. The impact of climate change on new opportunities and new risks for the sustainable development of the Russian Arctic has been determined on the basis of authors' research and correlated with the opinion of authoritative Arctic researchers. Based on the results of the study, the positive and negative effects of the implementation of new opportunities for the Arctic territories in the context of climate change have been identified.
Keywords: *climate change, risk, new opportunities, sustainable development, Arctic territories*

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Introduction

Historically, most of the Russian Arctic was sparsely populated and had little anthropogenic pressure due to its underdeveloped industrial environment and difficult accessibility. There was a relative balance between the development of local settlements, little social and industrial infrastructure, and Arctic ecosystems subject to little anthropogenic change. Increased interest in the resource potential of the Arctic has led to the development of industry, changes in the traditional

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life of Arctic inhabitants, and the growth of populated areas, including cities. These factors have tended to disrupt the fragile ecological balance of the Arctic territories and increase the risk of sustainable development of the Arctic.

We propose to understand the sustainable development of the Arctic as a set of purposeful actions aimed at balancing the relations between the economy, natural environment, and society to meet the needs of nature users of the Arctic territories at present and in the long term.

The key concept of sustainable development is risk. Risk is a combination of the probability of a dangerous event and the severity of its consequences for the economy, population, and ecosystems of the Arctic. Certain external conditions of natural, technogenic, geopolitical and other origins enhance or weaken the risk of sustainable development of the Arctic. In our study, we will focus on an external natural condition, namely climate change.

The research problem is as follows. The Arctic climate has begun to change dramatically in recent years. This external condition, on the one hand, increases the risk of sustainable development of the Arctic, and on the other hand, in combination with the management factors of the Arctic zone of the Russian Federation, provides new development opportunities.

The aim of this paper is to assess new opportunities and identify new risks of sustainable development of the Russian Arctic under the condition of climate change by analyzing a set of significant factors.

In order to achieve this goal, it is necessary to solve a number of problems:

- assess the efficiency of sustainable development management in the Arctic on the basis of the authors' methodology by comparing the costs of environmental protection and the amount of pollutants entering the Arctic ecosystems;
- analyze the dynamics of Arctic climate change indicators for the period from 1971 to the present;
- assess the impact of climate change on new opportunities and new risks for sustainable development of the Russian Arctic;
- consider environmental pollution as a risk for sustainable development of the Arctic, paying special attention to the content of greenhouse gases in the atmosphere;
- identify positive and negative effects of the implementation of new opportunities for the Arctic territories in the context of climate change.

Literature review

Analysis of numerous scientific works, as well as the authors' own research, made it possible to identify the following conditions that have developed in almost all Arctic territories and negatively affect their sustainable development:

- special natural and climatic conditions caused by the lack of oxygen and solar heat due to high latitudes; long, snowy and low-temperature winters; permafrost; ice sheet on

land and in the Arctic seas [1, Korchak E.A., Serova N.A., Emelyanova E.E., Yakovchuk A.A., pp. 2–5; 2, Skripnuk D.F., Samylovskaya E.A, pp. 2–4];

- slow biological and chemical-biological processes, which reduce the ability of ecosystems to self-clean and make them especially vulnerable to anthropogenic impact [3, Dauvalter V.A., Kashulin N.A., pp. 843–851; 4, Samarina V.P., pp. 22–28];
- short growing season of plants and insufficient ability of vegetation to absorb greenhouse gases [5, Skufina T.P., Samarina V.P., Samarin A.V., pp. 136–138];
- formation of local industrial clusters, significantly dependent on external supplies of material, technical, labor, information, social and other resources [6, Samarina V.P., Subbotina E.V., pp. 136–141; 7, Zaikov K.S., Kondratov N.A., Kudryashova E.V. et al., pp. 12–14; 8, Skufina T.P., Bazhutova E.A., Samarina V.P., p. 56];
- territorial economy, aimed primarily at the extraction of natural resources [9, Suopajärvi L., Poelzer G.A., Ejdemo T. et al., pp. 63–65; 10, Brigt D., Larsen I.B., Skorstad B., pp. 2–4; 11, Baranov S., Skufina T., Samarina V., p. 6337];
- low population of the territory, migration, which has increased in recent years [12, Hamilton L. C., Saito K., Loring P. A., Lammers R. B., Huntington H. P., pp. 113–118; 13, Andrew R., pp. 5–17];
- special significance and special protectionist nature of state management of the socio-economic development of territories [14, Kudryashova E.V., Lipina S.A., Zaikov K.S., Bocharova L.K., pp. 446–447; 15, Samarina V.P., pp. 22–27; 16, pp. 18–21].

Since almost all Arctic territories — both those belonging to Russia and those under the jurisdiction of other Arctic countries — have these characteristics, they can be considered as basic. Basic characteristics hinder the sustainable development of Arctic territories.

Methodology

The methodology of the presented research was developed on the basis of its purpose and scientific objectives. In order to fully identify and study new opportunities and new risks of sustainable development of the Russian Arctic in the context of solving management tasks, methodological tools should be based on the results of a comprehensive study of significant factors that determine the required processes and relationships. In this regard, the orientation of our research not only on theoretical and methodological principles, but also on applied management tasks is of particular importance. Consequently, approaches to research should be based on proven, unquestionable grounds. This determines the focus on the use of government statistics, official reports and forecasts of research organizations recognized in the scientific world. The analytical part of the study was based on the use of reliable methodological assessment tools.

The study was conducted on the basis of information on current (operating) costs for environmental protection and environmental management indicators — volumes of treated and/or recycled waste, wastewater, atmospheric emissions in the Arctic zone of the Russian Federation.

The study involved materials from the State Report "On the state and protection of the environment of the Russian Federation in 2021" for the period from 2017 to 2021 [1]. This time period was chosen because it includes the period of economic stagnation due to the coronavirus pandemic, which peaked in 2020, as well as the years before and after this stagnation. This approach to the research period allows us to indirectly assess the impact of external challenges on the effectiveness of managing the sustainable development of the Russian Arctic.

Quantitative determination of the effectiveness of management of sustainable development of the Arctic includes several stages:

- to identify the directions of environmental protection expenditures in the Russian Arctic zone, the structure of current (operating) costs in monetary and percentage terms were presented;
- to identify the balance of expenditures, correlation coefficients between the amount of current (operating) costs for environmental protection and the volume of treated and/or recycled waste, wastewater, and atmospheric emissions were calculated;
- to identify the dynamics of specific costs for managing sustainable development of the Arctic, the volume of investments per unit of environmental pollution was calculated; the list of proposed indicators is given in Fig. 1.

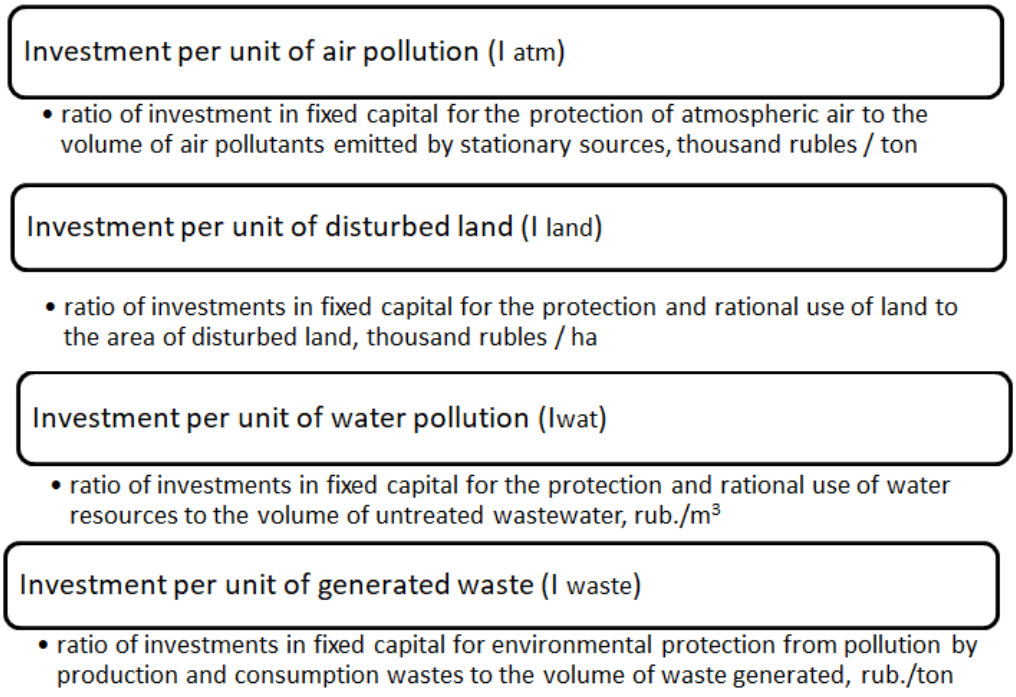

Fig. 1. Indicators of unit costs of sustainable development management in the Arctic [2].

The efficiency of Arctic sustainable development management was assessed by comparing the costs of environmental protection and the amount of pollutants entering Arctic ecosystems. Management of sustainable development of the Arctic can be considered effective if the costs of

[1] State report "On the state and protection of the environment of the Russian Federation in 2021". Moscow, Ministry of Natural Resources and Environment of Russia; Moscow State University named after M.V. Lomonosova, 2022. 684 p.
[2] Compiled by the authors.

environmental protection measures contribute to increasing the environmental compatibility of production and reducing the negative impact on the natural environment.

Changes in the Arctic climate were assessed by comparing indicators characterizing air temperature, precipitation, snow cover, sea and river ice, permafrost, etc. for the period from 1971 to the present day. The study was carried out using materials from AMAP, a Norwegian research organization dealing with climate change in the Arctic [3]. The impact of climate change on new opportunities and new risks for sustainable development of the Russian Arctic was determined on the basis of the author's research and was correlated with the opinion of authoritative Arctic researchers.

Pollution of the Arctic environment was assessed on the basis of data presented in the state report "On the state and protection of the environment of the Russian Federation in 2021" [4]. The concentration of greenhouse gases in the atmosphere (carbon dioxide and methane) was monitored at the Arctic stations of Teriberka and Tiksi, as they are located in conditions close to natural; data is presented for the period from 2012 to 2021.

Results and discussion

1. Efficiency assessment of sustainable development management of the Arctic territories

The problem of ensuring sustainable development of the Arctic territories has been repeatedly discussed by the scientific community. Differing in details, all studies are aimed at developing mechanisms for long-term harmonization of relations between the economic, environmental and social aspects of the functioning of Arctic socio-economic systems.

The problem of ensuring sustainable development is multifaceted. And the results of sustainable development management can be assessed in different ways. In our study we will focus only on some points. The result of managing the sustainable development of the Arctic is proposed to be a reduction in the negative anthropogenic impact on the natural environment. In this study, the negative anthropogenic impact is assessed on the basis of emissions from stationary sources into the atmosphere, wastewater discharges, and waste generated.

An assessment of the dynamics of current (operating) costs for environmental protection in the Arctic zone of Russia showed that they increased from 32,133 million rubles in 2017 to 38,146 million in 2019, but decreased to 36,577 million in 2021. The structure of current (operational) costs for environmental protection in the Arctic zone of Russia in 2019 and in 2021 is shown in Fig. 2.

[3] Climate change in the Arctic. Key Trends and Impacts: Arctic Monitoring and Assessment Program 2021. URL: https://www.amap.no/documents/download/6887/inline#:~:text (accessed 23 July 2023).
[4] On the state and protection of the environment of the Russian Federation in 2021. State report. Moscow, Ministry of Natural Resources and Environment of Russia; Lomonosov Moscow State University, 2022, 684 p.

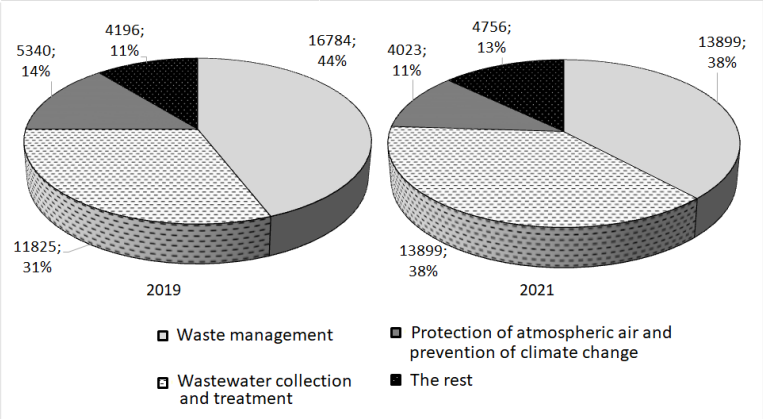

Fig. 2. Structure of current costs for environmental protection in the Arctic zone of Russia, million rubles; % [5].

The largest share of costs was allocated to waste management (44% in 2019; 38% in 2021), collection and treatment of wastewater (31% in 2019; 38% in 2021) and atmospheric air protection and climate change prevention (14% in 2019; 11% in 2021). In 2021, the costs of waste management decreased by 2,885 million rubles, and by 584 million rubles for the protection of atmospheric air and prevention of climate change [17, Samarina V.P., Skufina T.P., Savon D.Y., Shinkevich A.I., p. 3]. At the same time, the costs for wastewater collection and treatment increased by 2,074 million rubles. The total expenditures on environmental protection in the Arctic zone of Russia decreased by 1,569 million rubles or by 4.1% in 2021 compared to 2019.

The assessment of the efficiency of sustainable development management in the Arctic was made on the basis of a comparison of environmental protection costs and the volume of pollutants. Management of sustainable development of the Arctic can be considered effective if the costs of environmental protection measures are balanced and contribute to increasing the environmental compatibility of production and reducing the negative impact on the natural environment [17, Samarina V.P.; Skufina T.P.; Savon D.Y.; Shinkevich A.I., p. 5–7]. To identify the balance of costs, correlation coefficients were calculated between the amount of current (operating) costs for environmental protection and the volume of treated and/or recycled waste, wastewater, and atmospheric emissions. Calculation of correlation coefficients showed a direct correlation between the size of current (operating) costs for environmental protection in the Arctic zone and the volume of treated wastewater (k = 0.68), as well as the volume of reused and recycled waste (k = 0.77). Thus, the effectiveness of managing the sustainable development of the Russian Arctic territory can be seen here. At the same time, a significant negative correlation coefficient between the financial indicators of costs and the indicator characterizing air purification (k = –0.92) indicates ineffective spending of funds.

We further determined the indicators of unit costs of sustainable development management in the Arctic. For this purpose, according to the author's methodology presented above, the volume of investments per unit of environmental pollution was calculated (Fig. 3).

[5] The authors' calculations based on the materials of the State report "On the state and protection of the environment of the Russian Federation in 2021". Moscow, Ministry of Natural Resources and Environment of Russia; Lomonosov Moscow State University, 2022, 684 p.

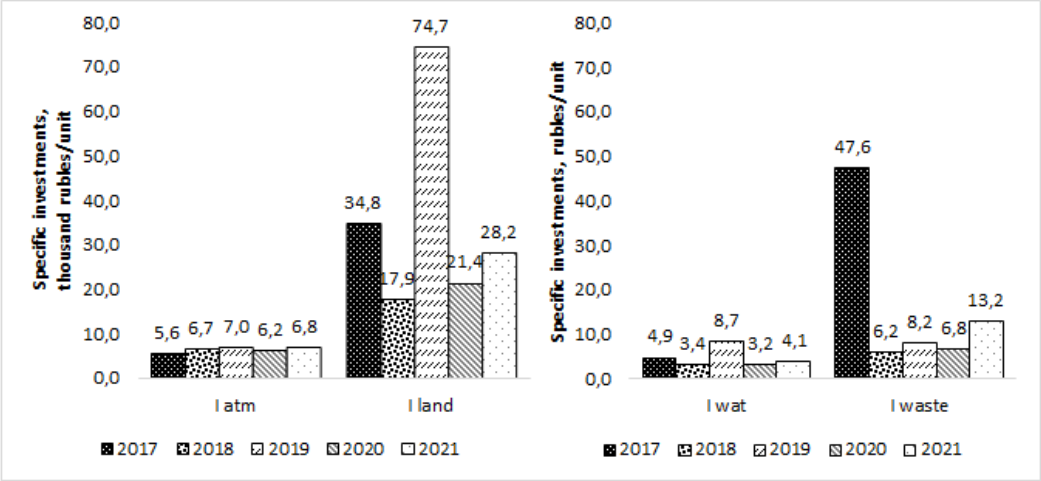

Fig. 3. The volume of investments per unit of environmental pollution in the Russian Arctic [6].

The analysis of specific investments per unit of environmental pollution allows us to state an increase in the funds attracted to ensure sustainable development of the Arctic. In 2019, compared to the previous year, specific investments per unit of water pollution increased by 76.15%, reaching the value I_{wat} = 8.7 rubles per m^3; the increase in specific investments in the protection, rational use and recultivation of land amounted to 114.73%, reaching the value I_{land} = 74.7 thousand rubles per hectare; in measures to protect atmospheric air — 24.76%, reaching the value I_{atm} = 7.0 thousand rubles per t; the increase in specific investments in fixed assets intended for the disposal and recycling of production and consumption waste amounted to 30.9%, reaching the value I_{waste} = 8.2 rubles per t. In 2020, the size of all specific investments per unit of environmental pollution decreased: specific investments per unit of water pollution decreased by 63.22%, reaching the value I_{wat} = 3.2 rubles per m^3; specific investments in protection, rational use and recultivation of land decreased by 71.35%, reaching the value I_{land} = 21.4 thousand rubles per hectare; measures to protect atmospheric air decreased by 11.43%, reaching the value I_{atm} = 6.2 thousand rubles per t; the decrease in specific investments in fixed assets intended for the disposal and recycling of production and consumption waste amounted to 17.07%, reaching the value I_{waste} = 6.2 rubles per t. In 2021, on the contrary, there is an increase in indicators: I_{wat} = 4.1 rub/m^3 (an increase of 28.12%); I_{land} = 28.2 thousand rubles/ha (increase 31.78%); I_{atm} = 6.8 thousand rubles/t (increase 9.68%); I_{waste} = 13.2 rubles/t (increase 112.90%).

Thus, despite the increase in current costs for managing the sustainable development of the Arctic, their use cannot be considered fully effective and efficient: financial investments do not always lead to a reduction in pollution. Investment in sustainable development is uneven and depends on the current situation.

2. *Indicators of Arctic climate change*

In recent years, the Arctic climate has begun to change noticeably. The reason for this is, on the one hand, warming caused by greenhouse gases in the atmosphere, which is largely pro-

[6] Authors' calculations.

duced by anthropogenic activities; on the other hand — natural cyclical processes of temperature fluctuations. While the causes may be different, the result is the same. As long as the Arctic remained one of the most inaccessible places on the planet, scientific theories about its geopolitical and economic importance were perceived as pure abstraction. However, the situation has changed in recent years. Over the past half-century, the Arctic has warmed three times faster than the Earth's surface as a whole. The speed of these changes is increasing. AMAP, a research organization in Norway that studies climate change in the Arctic, has predicted that the average annual surface temperature in the Arctic will increase by 3.3–10°C by 2100 compared to annual averages for 1985–2014 [7]. The melting of permafrost and glaciers is already evident, as well as a larger and earlier clearing of the water surface from ice and land surface from snow cover. According to the AMAP report "Climate change in the Arctic. Main trends and impacts", the Arctic has undergone significant, in many ways critical, climatic changes from 1971 to the present (Fig. 4).

[7] Climate change in the Arctic. Key Trends and Impacts: Arctic Monitoring and Assessment Program 2021. URL: https://www.amap.no/documents/download/6887/inline#:~:text (accessed 23 July 2023).

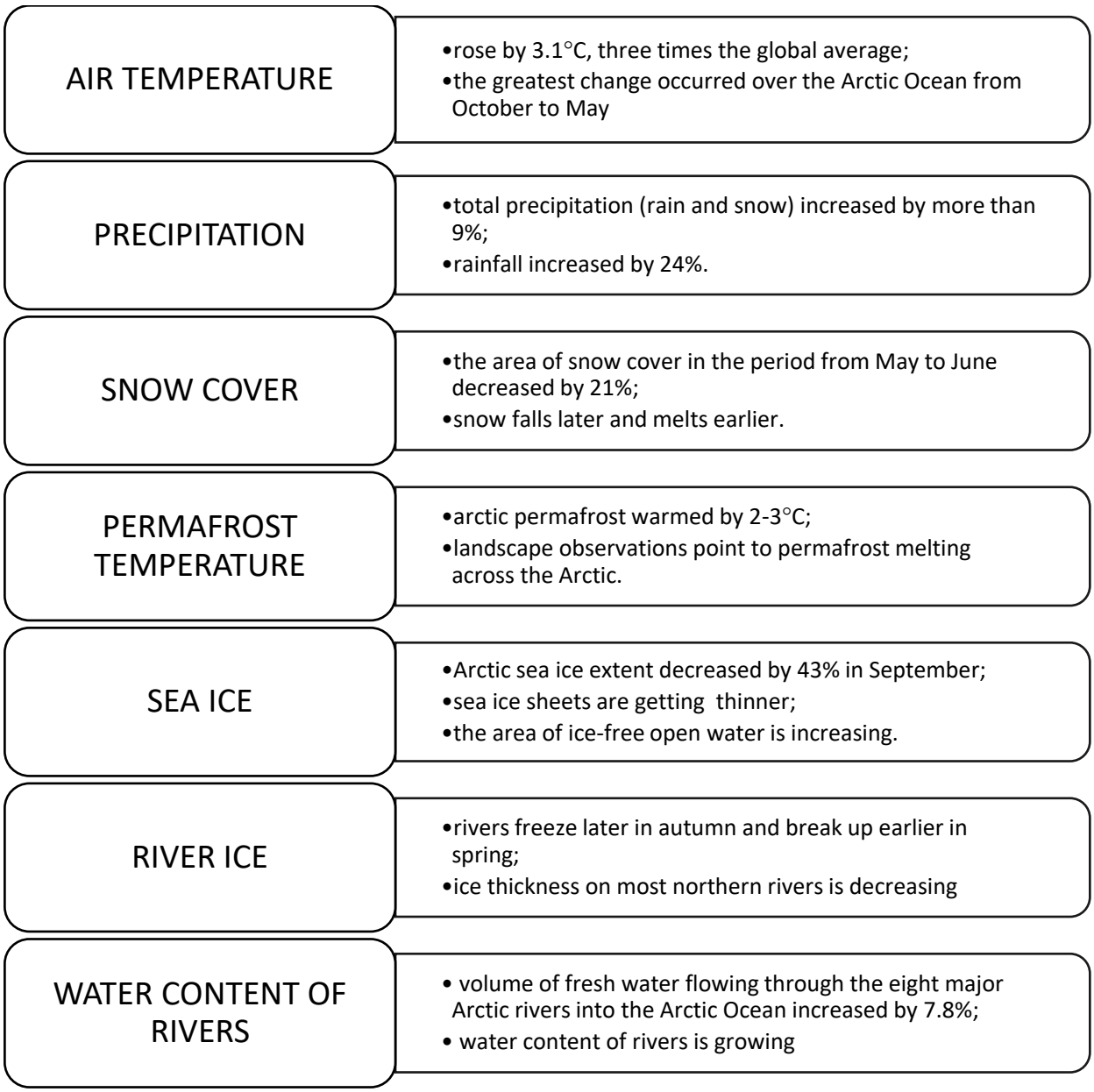

Fig. 4. Climate changes in the Arctic [8].

From 1971 to 2019, the average annual surface air temperature in the Arctic has increased by 3.1°C, which is three times faster than the global average. This conclusion is based on AMAP instrumental data with interpolation applied over the Arctic Ocean, where observations are sparse. The largest change in air temperature over this 49-year period occurred over the Arctic Ocean between October and May, averaging 4.6°C, with a peak warming of 10.6°C in the northeastern Barents Sea.

In the Arctic zone of the Russian Federation the situation was similar. In all sectors of the Russian Arctic, the trend for an increase in average temperature has been evident since the late

[8] Compiled by the authors based on materials from AMAP "Climate Change in the Arctic. Key Trends and Impacts: Arctic Monitoring and Assessment Program 2021". URL: https://www.amap.no/documents/download/6887/inline#:~:text (accessed 23 July 2023).

1970s and has sharply intensified in the 21st century. In 2021, the temperature increased by 1.9°C. The warming for 45 years from 1976 to 2021 for the Russian Arctic as a whole is 0.69°C/10 years [9].

Based on observational and modeling data, total Arctic annual precipitation (rain and snow combined) increased by more than 9% from 1971 to 2019. Rainfall increased by 24% over this period, with no overall trend in Arctic snowfall. The greatest increase in precipitation occurs during the cold season, from October to May. Together with the disruption of glaciological processes in the Arctic, the increasing volume of precipitation leads to an increase in the water content of rivers: the volume of fresh water flowing through the eight main Arctic rivers into the Arctic Ocean increased by 7.8%.

A distinctive feature of the Arctic zone of the Russian Federation is a significant area of permafrost, which is characterized by low temperatures and a small layer of seasonal thawing. The depth of permafrost in some places reaches 1.5 km [18, Skuf'in P., Chuvardinskiy V., p. 191–195]. Since the 1970s, Arctic permafrost has warmed by 2-3°C. In many colder permafrost areas, rates of warming over the past 20 years have been greater than at any time since 1979. The seasonally thawed layer has become deeper in many areas since the 1990s, and landscape observations indicate permafrost melting across the Arctic.

Climate change has had a huge impact on the ice cover of the Arctic seas. Late-summer Arctic sea ice has shrunk by 43% in half a century, becoming thinner. Strong, sustained winds over ice-free sea surfaces generate strong storms and gales.

The combined effects of long-term warming (higher water temperatures, longer ice-free seasons, thawing permafrost) and extreme events (storm waves and ripples) cause increased erosion. Coastal erosion is accelerating in many parts of the Arctic, which have some of the highest erosion rates on Earth.

Climate change is thus a pressing issue in the Arctic, where temperatures are rising much faster than the global average, and widespread changes in precipitation, snow cover, permafrost, sea and continental ice, and extreme events are transforming the Arctic environment, having long-lasting impacts on sustainable development. These changes have long-term consequences for the Arctic.

3. Impact of climate change on new opportunities and new risks for sustainable development of the Russian Arctic

Warming in the Arctic provides new opportunities, but also leads to new risks for sustainable development. New development opportunities were appreciated by experts, politicians, and industrialists around the world. This has intensified the struggle for the Arctic, which is taking place in several directions.

[9] State report “On the state and protection of the environment of the Russian Federation in 2021”. Moscow, Ministry of Natural Resources and Environment of Russia; Lomonosov Moscow State University, 2022, 684 p.

Firstly, and most importantly, these are new opportunities for the exploitation of mineral resources. The Russian Arctic is extremely rich in mineral resources (Fig. 5). However, most of the deposits are located in remote places with harsh climatic conditions, beyond the Arctic Circle.

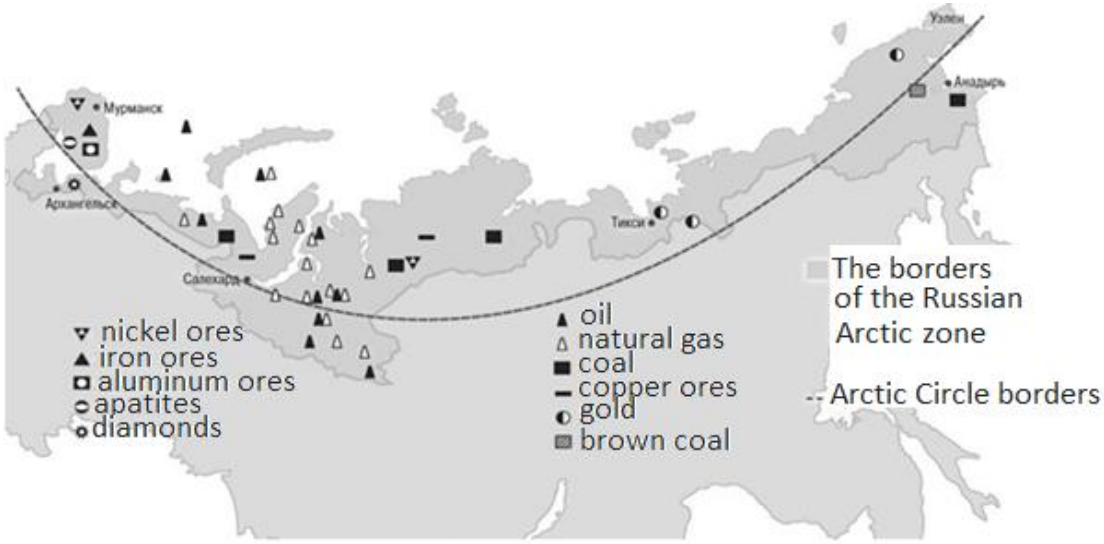

Fig. 5. Mineral deposits in the Russian Arctic [10].

Due to the melting of glaciers, multi-year ice and snow, and a general warming of the climate, extracting and exporting natural resources in the Arctic will become much easier and cheaper. Deposits that were previously impractical to exploit are becoming accessible, moving from the category of off-balance sheet to on-balance one. Warming also opens up new opportunities for geological exploration and the search for new deposits. According to experts, the Arctic contains 13% of the world's undiscovered oil reserves and 30% of gas, rich deposits of uranium and rare earth minerals, as well as gold and diamonds [11]. However, the majority (84%) of particularly significant energy minerals are located in the shelf strata [19, Höök M., Bardi U., Feng L., et al., p. 1999–2001]. Industry representatives from many countries are interested in the Arctic as an area for industrial development of mineral deposits. This is due to the value of the natural resources that are located there.

The importance of the Arctic as a source of resources for Russia is obvious. The Arctic zone of Russia contains (from all-Russian reserves): 40% of gold, 80% of oil, 50-90% of gas, nickel, copper, antimony, cobalt, tin, tungsten, mercury, apatite, phlogopite, 90% of chromium and manganese, 99% of platinum metals, 100% of local diamonds and vermiculite; from the world's reserves: 30% of diamonds and natural gas, 20% of nickel, 50% of apatite, 35% of niobium, 15% of copper, platinum metals and tin, 10% of oil (excluding shelf) and cobalt, 6-8% of tungsten and mercury [20, Petrov V.A., Volkov A.V., p. 191–192]. The Arctic zone of the Russian Federation accounts for about 30 billion barrels of oil and 33 trillion m^3 of gas out of the expected 90 billion barrels of oil and 50 trillion m^3 of gas, respectively. American experts counted 11 billion barrels of oil in the Bar-

[10] Parlamentskaya gazeta [Parliamentary newspaper], dated 02.12.2016. URL: https://www.pnp.ru/politics/arktika-nastoyashhee-i-budushhee.html (accessed 23 July 2023).
[11] World Energy Outlook 2022. URL: https://www.iea.org/reports/world-energy-outlook-2022/ (accessed 23 July 2023).

ents Sea alone, which at current prices is equivalent to 1.25 trillion dollars [12]. As for gas, according to the Annual Energy Outlook (AEO) for 2023, 11 trillion m^3 have been discovered in the Arctic zone of the Russian Federation [13]. The region is also rich in biological resources, including fur-bearing animals (arctic fox, sable, mink, etc.). The number of reindeer amounts to millions. The Arctic and subarctic seas are home to the largest populations of commercial fish. Based on this, we can conclude that the Arctic is an important component of the Russian economy. This territory is of strategic importance for our country, it provides a geo-economic position in the world and influences the internal development of industry related to the use of natural resources extracted in the Arctic.

The total value of Arctic resources could be trillions of dollars. Attention to the Arctic is increasing precisely because of such significant potential income; every country wants to improve its economic condition as a result of sustainable development, including through rational environmental management in the process of mining and processing minerals and the exploitation of other natural resources, and climate change opens up new opportunities for this.

Secondly, new logistics opportunities predetermined the struggle for trade routes. What is the Arctic in this case? The Arctic means billions of dollars, the opening of new zones of influence and, of course, new trade routes. Melting glaciers are opening up previously inaccessible trans-Arctic shipping routes, and this has a huge impact on economic competition in the Northern Hemisphere. The main actors in this rivalry are 3 countries: Russia, China and the USA. Clearing the water surface of ice makes the Northern Sea Route accessible along its entire length and increases navigation time. Climate change will transform the world's logistical routes: transporting sea cargo between the western and eastern hemispheres through the Arctic will be easier, safer, faster, and therefore commercially reasonable. However, the use of the Northern Sea Route leads to new risks. First of all, there are risks of natural genesis: the Arctic waters, free of ice, are exposed to strong winds: as a result, storm waves and ripples arise, significantly complicating navigation. There is also risk associated with the creation and development of infrastructure. The Northern Sea Route requires high-tech ports and cargo hubs capable of receiving, sorting and dispatching cargo. Most of these facilities are under construction. However, under the sanctions imposed on Russia by unfriendly countries, these projects are becoming increasingly difficult to implement. It was planned to use foreign technologies, equipment and machinery in the construction and operation of port and warehouse facilities, but the supply of many of them was suspended or completely cancelled. Warming also leads to the thawing of permafrost, which forces changes in construction technologies in the Arctic and leads to a multiple increase in the cost of infrastructure projects. The expansion of the icebreaker fleet occupies a separate place. Currently, the Russian Federation has relied on the construction of powerful icebreakers — they are necessary for the

[12] World Energy Outlook 2022. URL: https://www.iea.org/reports/world-energy-outlook-2022/ (accessed 23 July 2023).
[13] Annual Energy Outlook 2023. URL: https://www.eia.gov/outlooks/aeo (accessed 23 July 2023).

operation of the Northern Sea Route. Plans for their construction may be disrupted under sanctions. In addition, icebreakers built with great difficulty and significant financial costs may not be in demand both due to political restrictions and due to further warming and accelerated melting of ice.

Thirdly, Arctic development plays a huge role in the development of the mining and processing industries. The Arctic provides about 11% of Russia's national income and 22% of all Russian exports. Russia mines almost all of its diamonds, apatite nepheline and copper ores, phlogopite, vermiculite, 97% of platinum, 90% of nickel, 95% of gas, 60–80% of oil, antimony, rare and rare earth metals in these regions. Warming will increase access to mineral resources. Advances in technology and better accessibility mean that the costs of extracting and processing Arctic natural resources will only fall in the future. At the same time, it is necessary to take into account the requirements of decarbonization of production aimed at reducing greenhouse gas emissions. The Russian Federation has made commitments to sequester CO_2 emissions up to full carbon neutrality. This constrains the potential for expansion of mining and processing industries in the Arctic. It should also be taken into account that due to the high vulnerability and low self-cleaning ability of Arctic eco-systems, the consequences of major man-made disasters and accidents will be especially significant. As a result, Arctic industrial facilities and technologies for the extraction, transportation and processing of minerals should have an increased "safety margin" in the environmental aspect. Besides, materials and technologies used in the construction of industrial buildings and structures should have special characteristics that can withstand extreme natural and climatic conditions [21, Kalinin M.O., Korkishko A.N., p. 98], which leads to an increase in the cost of economic activity of enterprises in the Arctic. The thawing of permafrost negatively affects the development of industrial enterprises in the Arctic, resulting in land subsidence and swamping of territories. This leads to damages of buildings and structures, disruption of production and social infrastructure. Over the past fifty years, the sustainability of buildings and infrastructure built in the permafrost zone has decreased significantly. Particularly negative consequences of climate change are noted on the Taimyr Peninsula, where almost all industrial buildings and structures, transport lines, including pipelines, were damaged [22, Tazayan Yu., p. 67–69]. In addition, as in the case of the construction and operation of port infrastructure, geopolitical factors related to sanctions against Russia increase the risk.

Fourthly, climate change opens up new opportunities in fishing and fish farming. More than a third of Russian commercial fish and seafood is harvested in the Arctic, and about 20% of canned fish is produced. An increase in water temperature and a decrease in the thickness and duration of the sea ice cover lead to the fact that more and more species of subarctic fish and marine mammals are migrating to the Arctic seas, which were previously not suitable for their livelihoods. This increases the possibilities of industrial fishing in the Arctic parts of the Barents, Bering, and Okhotsk seas. Our research shows that the economic benefits of fishing have a significant positive impact on the social development of coastal Arctic settlements [23, Samarina V.P., Skufina

T.P., p. 48–56]. Salmon farming and other forms of aquaculture are also spreading northwards in some parts of the North Atlantic Arctic, creating additional economic opportunities. The social risk of artificial fish farming is possible competition with local fisheries. The ecological risk is the spread of parasites such as salmon lice to local wild fish populations.

Fifthly, there are expanding tourism business opportunities in the Arctic, which creates competition for tourists. Tourism has entered the daily life of almost a third of the population of our planet. Over 9 months in 2022, 10.2 million foreigners visited our country, which cannot but have an impact on the economy of our country. Arctic routes are attracting more and more tourists. Due to the decrease in ice area in the Arctic, new routes are appearing; tourists are ready to pay a lot of money to look at the northern lights and communicate with the local population. Arctic cruise tourism has grown. Here are just a few examples: the number of cruise ship passengers in Iceland increased from 265,935 in 2015 to 402,834 in 2017, an increase of more than 66%; cruise passenger trips in northern Norwegian ports increased by 33% between 2014 and 2019; the number of cruise ship passengers on Svalbard increased from 39,000 in 2008 to 63,000 in 2017; in Greenland, the number of passengers increased from 20,000 to 30,000 over the same period. Overall, the number of visitors to the high Arctic grew from 67,752 in 2008 to 98,238 in 2017, an increase of more than 57% [24, Ren C., James L., Pashkevich A. et al., pp. 5–7; 25, Zhilenko V.Yu., pp. 149–152].

Among Russian residents and foreign visitors, there is a noticeable trend towards increasing interest in Arctic continental, predominantly ecological, natural tourism [26, Abakumova Yu.M., pp. 36–38]. For example, the “Russian Arctic” tourist park: in summer 2019, it was visited by 1306 people from 44 countries [14]. The routes “Chasing the Northern Lights”, “Visiting the Polar Bear” and other programs developed by Russian tour operators are in stable demand among tourists. However, it should be taken into account that natural and climatic features, unique landscapes, inaccessibility, which, among other things, form the attractiveness of the Arctic for tourists, ultimately affect the logistics, infrastructure and economic aspects of organizing tourism activities. Experts also note problems with permitting visits to some Arctic territories and specially protected areas [27, Vasilieva A.V., Volkov A.D., Karginova-Gubinova V.V. et al., pp. 5–8].

Despite this, Arctic tourism is beginning to have a noticeable impact on the Russian economy: the northern territories are developing, new jobs are emerging, new educational and cultural programs that help keep young people in the northern territories are appearing, the economy of the Arctic regions is diversifying, more income is coming to the budgets of various levels. The COVID-19 pandemic disrupted these trends in 2020, with most Arctic tourism trips canceled or postponed. Political reasons led to the fact that Russia and the countries that joined the sanctions, including all circumpolar countries, practically stopped exchanging tourists. Deterioration of relations between the countries and reduction of incomes of the population are the most important risks to the development of Arctic tourism. In addition to political risks, there are socio-cultural

[14] Russian Arctic: official website of the national park. URL: http://www.rus-arc.ru/ (accessed 23 July 2023).

ones associated with the impact of tourism on local communities, as well as the aggravation of environmental and economic risks accompanying the development of tourism infrastructure.

Sixthly, climate change opens up new opportunities for strengthening the military presence in the Arctic and intensifies the struggle for geopolitical influence. The significant military potential of the Arctic cannot be ignored. The state borders of a number of circumpolar countries run along the Arctic Ocean. Defense industry enterprises, land, air and sea military bases, airfields and other military infrastructure facilities of circumpolar states are located in the Arctic. The Cold War ended many years ago and it would seem that relations between Russia and the "collective West", including European countries and the United States, should have normalized. However, the military operation in Ukraine, which began in February 2022, led to a sharp increase in tension between Russia and, primarily, the United States. Thus, the significance of Russia's military presence in such an important region of the Earth as the Arctic has increased. Russia has long been building new military (land and sea) bases on the northern continental territories and on the islands of the Arctic seas, including Kotelnyy Island. Military exercises of the Russian army are actively taking place in Arctic latitudes. At the same time, the armies of other circumpolar countries also regularly conduct their exercises in the Arctic territories. In addition, circumpolar countries are actively working to create military equipment capable of operating in high Arctic latitudes, since material and technical support is extremely important for increasing their military presence in the Arctic. Climate change allows increasing the range of weapons capable of operating in Arctic temperatures, expanding military bases, and making the military personnel's stay there more comfortable.

4. Arctic environmental pollution as a risk for sustainable development

Arctic ecosystems, like no other, are susceptible to environmental pollution. The reason for this is the reduced rate of self-cleaning processes due to low temperatures, chemical and physical characteristics of soils, and degraded vegetation.

The peculiarity of environmental management in the Arctic, which forms the external effects of the industrial development of Arctic territories, is that industrial, logistics and other activities here are carried out, as a rule, by large corporations operating on the basis of the corporate standards and rules they have developed. As our research has shown, the largest Russian corporations with production assets in the Arctic are actively modernizing equipment and developing technologies that reduce the flow of pollutants into natural areas, including the emission of greenhouse gases into the atmosphere [4, Samarina V.P., pp. 45–49; 5, Skufina T.P., Samarina V.P., Samarin A.V., pp. 57–58]. As a result, for the period 2017–2019, there is a reduction in emissions of air pollutants — from 3,356.5 thousand tons to 3,284.6 thousand tons, wastewater discharge — from 638 million m3 to 619 million m3, waste recycling is expanding — from 18.7 million tons to 35.5 million tons. Previously, we noted the effect of decoupling in the economic development of the Murmansk Oblast, when an increase in production volumes was accompanied by a decrease in the load on the natural environment [28, Samarina V.P., pp. 26–29]. The processes of greening

production largely contribute to maintaining this trend. A special place is occupied by the social effects and social significance of decarbonization projects. Greenhouse gas sequestration is part of the project of ensuring sustainable development for the benefit of future generations, which has become the humanitarian basis of modern globalized society.

The dynamics of greenhouse gases are monitored in the Russian Arctic at three stations located in the settlements of Teriberka, Tiksi and Novyy Port. The results of observations at Teriberka and Tiksi stations are of particular interest because they are located in conditions close to natural (Table 1).

Table 1

Concentrations of carbon dioxide and methane in the Russian Arctic [15]

Year	Teriberka				Tiksi			
	CH_4, ppb		CO_2, ppm		CH_4, ppb		CO_2, ppm	
	Value	Annual growth	Value	Annual growth	Value	Annual growth	Value	Annual growth
2012	1910.2	---	396.6	---	1910.2	---	396.1	---
2013	1907.8	-2.4	398.8	2.2	1915.1	4.9	399.1	3.0
2014	1913.5	5.7	400.7	1.9	1930.8	15.7	400.7	1.6
2015	1924.4	10.9	402.2	1.5	1940.1	9.3	403.2	2.5
2016	1946.7	22.3	405.7	3.4	1946.4	6.3	406.1	2.9
2017	1947.1	0.4	409.1	3.5	1956.7	10.3	408.7	2.6
2018	1950.4	3.3	411.4	2.2	1960.4	3.7	411.3	2.6
2019	1961.8	11.4	414.1	2.7	1983.7	23.3	414.3	3.0
2020	1980.4	18.6	415.8	1.8	1993.6	9.9	416.5	2.2
2021	1999.1	18.7	418.5	2.6	2014.1	20.5	419.1	2.6
Growth for 2012–2021								
2012–2021	88.9 ppb 4.65%		21.9 ppm 5.52%		103.9 ppb 5.44%		23.0 ppm 5.81%	

The study for the ten-year period from 2012 to 2021 showed an almost constant increase in the concentrations of carbon dioxide and methane. Over ten years, CO_2 concentration increased by almost 6%, reaching a maximum (418.5 ppm in Teriberka and 419.1 ppm in Tiksi) in 2021; CH_4 concentration increased by 5%, also reaching a maximum (1999.1 ppb in Teriberka and 2014.1 ppb in Tiksi) in 2021. These values are similar to those reported by the Barrow Arctic Research Centre in Alaska [16].

In 2020, the growth rate of CO_2 concentration decreased to 1.8–2.2 ppm per year. The probable reason for this was the reduction in production caused by the COVID-19 pandemic. In 2021, greenhouse gas emissions increased again (an increase of 2.6 ppm per year). In the same year, there was a significant increase in the concentration of CH_4 in the atmosphere (18.7 ppb in Teriberka and 20.5 ppb in Tiksi).

The energy crisis in the circumpolar countries, caused by the rising cost of energy resources against the backdrop of a reduction in their supplies from Russia due to political and economic reasons, leads to an increase in the share of coal, fuel oil, and wood among energy sources.

[15] Compiled by the authors based on materials from the State report "On the state and protection of the environment of the Russian Federation in 2021". Moscow, Ministry of Natural Resources and Environment of Russia; Moscow State University named after M.V. Lomonosova, 2022, 684 p.

[16] Barrow Arctic Research Centre. URL: https://polarpedia.eu/ru/arkticzeskij-issledowatielskij-centr-barrou/ (accessed 23.07.2023).

The use of such energy resources leads to an increase in greenhouse gases and a weakening of the policy of decarbonization of production [29, Shutko L.G., Samorodova L.L., p. 65]. The risks of sustainable development of the Arctic are increasing manifold.

5. Effects arising in the process and as a result of the implementation of new opportunities in the Arctic territories in a warming climate

The effects that arise in the process and as a result of the implementation of new opportunities for the Arctic territories under warming conditions strengthen or weaken the risk of long-term sustainable development of the Arctic. In our understanding, this is a complex of factors caused by climate change, which have a significant impact on the development of the production sector of the Russian Arctic, the livelihoods of the population of these territories, and on the environment. A distinction is made between positive and negative effects. The positive effects of new opportunities in the Arctic territories in a warming climate are weakening, and the negative effects, accordingly, are increasing the risk of sustainable development. Based on scientific research, the effects of new opportunities in the Arctic territories in the context of climate change were systematized [4, Samarina V.P., pp. 56–68; 12, Hamilton L.C., Saito K., Loring P.A., et al., pp. 116–119; 16, Socio-economic development..., pp. 56–80; 30, Volkov A.D., Tishkov S.V., Karginova-Gubinova V.V. et al., pp. 211–219; 31, Lipina S.A., Smirnova O.O., Kudryashova E.V. et al., pp. 128–131; 32, Larchenko L.V., Gladkiy Yu.N., Sukhorukov V.D., pp. 2–7; 33, Skufina T.P., Mitroshina M.N., pp. 88–93; 34, Kryukov V.A., Kryukov Ya.V., pp. 35–42] (Table 2).

Table 2

Effects of implementation of new opportunities of the Arctic territories in the conditions of climate change, determining the risk of sustainable development

Positive effects that reduce risk	Negative effects that increase risk
Ecological	
Collection of pollutants, recycling of production and consumption waste, treatment of discharged wastewater, etc.	Pollution of the atmosphere, water bodies, land destruction, degradation of flora and fauna; increase in population morbidity, etc.
Innovative	
Introduction of research developments and high-tech technologies that meet the interests of numerous stakeholders; inflow of investment.	Increased unemployment of the Arctic population as a consequence of the introduction of innovative and digital technologies that reduce employment.
Investment	
Investing in production — growth in productivity, quality of products; investing in environmental protection measures — reducing the anthropogenic load on the natural environment; investing in the population — growth of human capital.	Corruption, ineffective spending of funds; freezing socio-economic development projects due to outflow of investments caused by the unstable economic situation.
Infrastructure	
Development of transport infrastructure in the interests of business and the population; development of social infrastructure (health care, education, etc.) together with production; development of logistics routes ensures accessibility of goods and services	Destruction of natural ecosystems; significant, often irreversible changes of landscapes, acquisition of land for industrial and residential areas.
Social	
Increasing the attractiveness of the Arctic territories for living due to an increase in the quality of life, wages, and developed social infrastructure.	Unemployment, industrial morbidity among those employed in hazardous enterprises; migration outflow of the working population.

In addition to the positive effects noted above, the possibility of ensuring sustainable development of the Russian Arctic is increasing due to the strengthening of national security at the global level, progressive development of industrial and logistics corporations operating in the Arctic. The risk of accidents of natural and anthropogenic genesis is increasing. The weakening of international cooperation of circumpolar countries, including in the field of environmental protection and environmental management, increases the risk of sustainable development both for the Russian Arctic territories and for the territories under the jurisdiction of other states. Undoubtedly, new risks and new opportunities for sustainable development of the Russian Arctic are related to climate change.

Conclusion

Thus, climate change is a global external factor in the development of the Arctic, which has a long-term impact on people's livelihoods, the Arctic, national and global economies, and environmental management, opening up new opportunities on the one hand, and increasing the risks of sustainable development on the other.

Risk is a key concept of sustainable development and is a combination of the probability of a hazardous event and the severity of its consequences for the balanced development of the Arctic economy, population, and ecosystems. The termination of Russia's international cooperation with other circumpolar countries in the field of environmental protection, rational use of natural resources, and counteraction to global warming contributes to increasing the risk of sustainable development in the Arctic. Currently, all official meetings of the Arctic Council, which Russia chairs until 2023, are suspended until further notice. All other cooperation between circumpolar countries and the Russian Federation on environmental protection, ecosystem conservation, detailed and thorough study of natural, anthropogenic, socio-economic processes in the Arctic, expanded monitoring and documentation of changes, including climate change, development and implementation of mechanisms to limit further warming have been suspended. Cooperation between the Arctic regions of the circumpolar countries and the adjacent Russian Arctic regions has also been terminated. In previous years, such cooperation was the basis of regional strategies.

Under these conditions, it seems advisable to act in three main directions in order to reduce the risk of sustainable development:

- study in detail natural, anthropogenic, socio-economic processes in the Arctic in order to better understand the consequences of climate change;
- expand monitoring and documentation of changes in the Arctic;
- based on new data obtained, develop and implement mechanisms to limit and minimize the negative effects of further warming, including at the international level;
- develop and implement projects that contribute to the discovery of new opportunities for sustainable development of the Arctic and the process of positive changes aimed at

harmonizing relations between the economic, environmental and social spheres to meet the needs of environmental users of the Arctic territories now and in the long term.

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Attitude of the Population to the Industrial Development of the Territories of Traditional Residence of Indigenous Peoples of the North (On the Materials of Ethnological Expertise in the Sadyn Nasleg of the Republic of Sakha (Yakutia))

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Abstract. The article examines the attitude of the population of the Sadyn national Evenk nasleg of the Mirninskiy district of the Republic of Sakha (Yakutia) to industrial development. The source for the study was the author's field material collected as part of the ethnological environmental impact assessment; in particular, a sociological study that included questionnaire survey, expert and group interviews. The results of the study showed that the majority of the population has a negative attitude to the industrial development. Their concerns are related to the deterioration of the environmental situation and the reduction of land suitable for traditional farming and crafts. As a consequence, respondents are confident that the oil and gas exploration project in the territory of the nasleg will either have no effect on their social status and the nature of their work or will worsen their well-being. Positive expectations from the project are primarily related to the organization of new jobs and the improvement of the village. Respondents believe that the compensation of losses provided for by the ethnological expertise should be focused on each resident of the village. First of all, funds should be allocated for the construction of social facilities, training and employment of the youth of the village. Compensation payments should be annual. The research is aimed at solving social issues related to the industrial development of places of traditional residence of indigenous peoples. Recommendations in the search for compromise solutions are given.
Keywords: *indigenous peoples, industrial development, Yakutia, ethnological expertise, field research*

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Introduction

Currently, a new stage of industrial development of the northern territories of Russia is being observed, new fields are being developed and the exploitation of old fields is being resumed. The state and society face the most urgent task of resolving all the contradictions arising between subsoil users and indigenous peoples. In the Republic of Sakha (Yakutia) (hereinafter referred to as RS(Ya)), the tool for resolving these issues is an ethnological expertise, which, according to Republic's legislation, is a scientific study of the impact of changes in the ancestral habitat of small-numbered peoples and the socio-cultural situation on the development of ethnic groups [1].

Problems associated with the procedure of conducting and analyzing the results of ethnological expertise are relevant among the scientific community. The research covers most of the territories traditionally inhabited by indigenous peoples. The authors raise both practical and theoretical issues of implementing ethnological expertise, in which the problem of the relationship between mining companies and indigenous peoples is central [1, Poddubikov V.V.; 2, Sadovaya A.N.; 3, Novozhilov A.G.; 4, Golovnev A.V., Komova E.A.; 5, Basov A.S., Kovalsky S.A., pp. 91–92]. For example, it is emphasized that "the extractive industry, as a disproportionately stronger economic structure, destroys the resource and socio-cultural basis of the traditional nature management of northern peoples and displaces them from their ancestral territories" [6, Martynova E.P., Novikova N.I., p. 111]. Moreover, it is argued that total industrial development will lead to the emergence of areas of social and ethno-national tension [7, Golovnev A.V., p. 151]. The widely presented works devoted to the ethnological expertise in RS(Ya) also support the opinion about the presence of pressure of extractive companies on indigenous communities [8, Baisheva S.M.; 9, Pakhomov A.A., Mostakhova T.S.; 10, Basov A.S.; 11, Romanova E.N., Alekseeva E.K.; 12, Sleptsov A.N.; 13, Sosin P.V.; 14, Shadrin V.I.; 15, Astakhova I.S.].

This article presents the author's research on the attitude of the population to new industrial development projects, expectations and fears of the inhabitants on the example of the Sadyn national Evenk nasleg. This nasleg is the only municipal formation within the Mirninskiy district of the Republic of Sakha (Yakutia), included in the List of places of traditional residence and traditional economic activities of the indigenous minorities of the republic. In addition, the entire nasleg is a territory of traditional natural resource management, the area of which is 12,489.3 km^2, with only one residential settlement. Materials for the study were collected as part of the ethnological environmental impact assessment (hereinafter referred to as EIA) in 2019 and 2022 for the South-Syuldyukar license area in the village of Syuldyukar. The study methodologies in 2019 and 2022 are identical, and the comparative analysis of the materials showed interesting results.

[1] Zakon RS(Ya) «Ob etnologicheskoy ekspertize v mestakh traditsionnogo prozhivaniya i traditsionnoy khozyaystvennoy deyatel'nosti korennykh malochislennykh narodov Severa Respubliki Sakha (Yakutiya)» ot 14 aprelya 2010 g. (redaktsiya ot 23.03.2023 g.) [Law of the Republic of Sakha (Yakutia) "On ethnological examination in places of traditional residence and traditional economic activities of indigenous peoples of the North of the Republic of Sakha (Yakutia)" dated April 14, 2010 (as amended on March 23, 2023)]. Yakutskie vedomosti, 2010, No. 30.

Materials and methods

In December 2022, a sociological study was conducted in the Sadyn national Evenk nasleg of the Mirninskiy district of the RS(Ya), in which qualitative and quantitative methods were used. The questionnaire survey allowed maintaining anonymity, and this is important given the possible pressure of industrial companies on local communities. The questionnaire is divided into thematic blocks containing various aspects and consists of 75 questions, including questions on the attitude of the local community to the development project, identification of conflicts and points of contact between the indigenous community and the extractive company. Semi-formalized face-to-face and group interviews were conducted on issues of traditional management, the socio-economic state of the nasleg, the ethno-cultural development of the indigenous peoples of the North. The main topic of the focus groups was the attitude of the population towards the project, as well as the issues of interaction with mining companies and socio-economic development of the nasleg. As it was shown, in rural areas where collective consciousness is developed, the use of this method has proved to be very effective. Thus, two focus groups were organized with conventional names: “Hunter” (residents of the nasleg, engaged in traditional types of economic activities) and “Villager” (residents not engaged in traditional economy). Both groups included respondents of different ages (over 18 years old) and different genders. There were 5 respondents in each group.

The adult population aged 18 years and older took part in the questionnaire survey. To form the sample population, a quota sample was used, compiled on the basis of current lists of village residents as of December 1, 2022, according to which the adult population was 268 people [2]. The quota population coincides with the structure of the general population by gender and age. The sample population, when adjusting the sample using the formula for a small population and taking into account the actual sampling error of 5%, amounted to 100 people.

The characteristics of the respondents generally reflect the average image of a nasleg resident. Most of the respondents have been living in the village either since birth or for a very long period. The population is predominantly employed in social institutions, energy and agricultural enterprises (Table 1). Almost the entire adult population, regardless of nationality, is members of indigenous communities. However, the Evenks are the national majority. At the time of the study, the author had data on the ethnic composition only for 2010, when representatives of 5 peoples lived in Syuldyukar village: Yakuts (40.5%), Evenks (55.4%), Evens 3.2%, others 0.9% (Kazakhs, Chuvash). Indigenous small-numbered peoples of the North — Evenks and Evens — made up 58.6% [16, Astakhova I.S., p. 114]. Moreover, according to local residents, Evenks women were sometimes mistakenly registered by civil registry office employees as Evens. This is how the Evens appeared in the village. It should be noted that due to the restoration of nationality, the number of Evenks is regularly increasing.

[2] According to the Territorial Body of the Federal State Statistics Service for the Republic of Sakha (Yakutia), as of January 1, 2022, 263 people lived in nasleg.

Table 1

Characteristics of respondents [3]

Indicators	%
Gender	
Male	50
Female	50
Age	
18–34	35
35–49	27
50–64	26
65 and older	12
Nationality	
Evenks	83
Yakuts	16
other	1
Education	
higher and incomplete higher education	29
professional secondary	33
elementary vocational	2
general secondary	33
incomplete secondary	3
Main type of activity	
employee (administration specialist, doctor, teacher, cultural worker, etc.)	36
labourer (housing and utilities, etc.)	20
working pensioner (employed in the budgetary sphere)	9
working pensioner (employed in non-budgetary sphere)	8
non-working pensioner	18
enterprise manager	2
housewife, homemaker (not employed in economic sectors)	4
unemployed, registered as unemployed	1
other	2
Marital status	
married	59
single	22
divorced	5
widower / widow	8
cohabitation (common-law marriage)	6
Number of children living in the family	
did not indicate	33
one	31
two	17
three	12
four	7
Wealth level	
not enough money even for food	7
there is enough money only for food and basic necessities	29
there is enough money to buy consumer goods (clothes and shoes), but not enough to buy durable goods	36
I have enough money to buy large household appliances, but not enough to buy a car or a flat.	26
I do not experience material difficulties	2
Sources of income	
salary	75
pension	34
allowances	9
other compensation payments	1
interest from bank deposits, dividends	3
income from entrepreneurial activity	-
income from private subsidiary farming	1
Time of residence in the locality	
less than 1 year	5
1–2 years	1

[3] Source: author's calculations.

3-5 years	3
6–10 years	3
11 and longer	13
from birth	75
Total number of people interviewed	100

Research results

Awareness of the population about the project was 52%, with the most informed men over 50 years of age, most of whom regularly visit the forest area, hunt and collect wild plants (Fig. 1). Some respondents said that they had seen workers in the areas of planned exploration and works had already started. This is confirmed by the analysis of group interview materials, where participants also noted that they had encountered equipment with the name of the company. It should be noted that works are to be started only after the approval of the ethnological expertise.

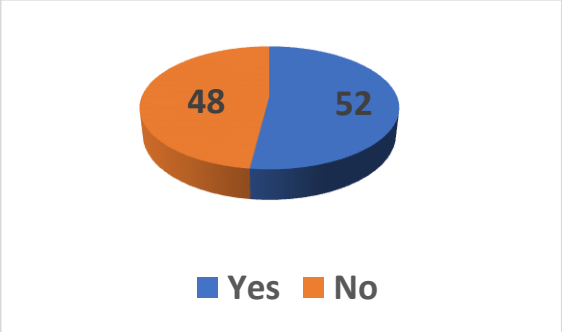

Fig. 1. Distribution of respondents' answers to the question: "Have you heard before about the planned geophysical exploration in the territory of the South-Syuldyukar license area of the Mirninskiy district of the Republic of Sakha (Yakutia) in 2023–2025?" (% of respondents) [4].

Representatives of clan communities and the head of the Sadyn Evenks national nasleg stated that they were not officially informed about the upcoming work and were not familiar with the project; they did not know which specific areas would be affected in the coming season. In general, representatives of the administration and tribal communities served as the main sources of information for the nasleg population about the project (22%). According to focus group participants, a company representative came to the Syuldyukar village in the spring of 2022, and it was reported at a meeting with the population that exploration in the South-Syuldyukar license area will be continued (11%). Analysis of the answer "Other" showed that they were informed about the project from friends or neighbors (6%), or "saw" the work started (2%). The next most popular answer is "Internet"; as young people mainly learnt about the project when communicating in social network chats (6%) (Fig. 2).

[4] Source: author's calculations.

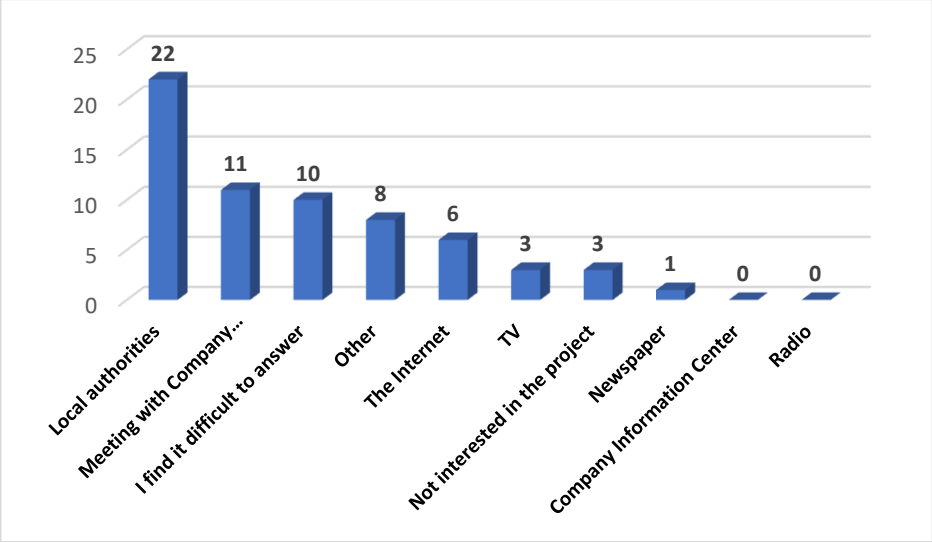

Fig. 2. Distribution of answers to the question: "From what sources did you learn about the project?" (% of respondents) [5].

Analysis of answers to the question "In what form would it be convenient for you to receive information about the project in the future?" showed that the population is still interested in receiving complete and, most importantly, reliable information. Village residents would like to be informed about the project directly from a representative of the Company through the mediation of authorities and public organizations. The most popular answer, regardless of gender and age, was "Meeting with company representatives" (60% of respondents). Despite the pessimistic mood of nasleg residents regarding their future associated with the next round of industrial development, the majority of the population favors an honest and open conversation. 30% of respondents preferred to receive information about the project from local authorities. When analyzing the answers where respondents indicated the media, the distribution is as follows: "Internet" was preferred by 19% of respondents of all age categories except 65 years and older; "television" — 14%, this answer is slightly more common among men, "newspapers" were chosen by 5% of respondents, mostly respondents in the age category of about 50 years and older. 7% of respondents found it difficult to answer, 3% answered "I'm not interested in the project" — these are young men. The answer "other" is 2%; respondents suggest using the village WhatsApp group (Fig. 3). Analysis of data obtained from interviews showed that this messenger is the most popular among the local community; it covers the entire population of the village, regardless of age and gender.

[5] Source: author's calculations.

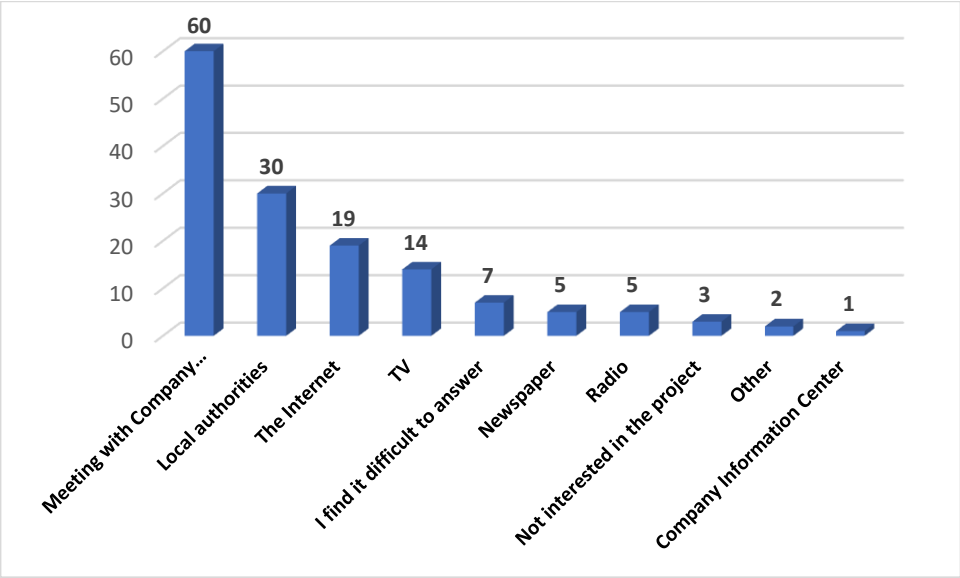

Fig. 3. Distribution of answers to the question: "In what form would it be convenient for you to receive information about the project in the future?" (% of respondents) [6].

The overwhelming majority of the nasleg population, regardless of gender, age and nationality, strongly opposes the project and any interference in nature in general, as this will disrupt their usual way of life. Young people "18–34" are more tolerant: they have a "positive" and "rather positive" attitude towards the project; there are more than 25% of them among this age category. During a comparative analysis of EIA data obtained in 2019, where the research methodology is identical to the present one (N 100), it became noticeable that the situation has slightly changed. Thus, in 2019, the options "negative" and "rather negative" were chosen by 83% of respondents. In 2022, there were only 74% of them. The increase in the number of positively-minded citizens in 2022 can be explained primarily by changes in the socio-economic situation of the region caused by the activities of oil and gas companies (Fig. 4). In particular, in interviews, residents of the village Syuldyukar cited the Botuobuyinskiy nasleg of the same district of the republic as an example, where the local population was able to establish interaction with mining companies: "they were able to defend their right", "I don't know how, but they did it", "we need this too".

[6] Source: author's calculations.

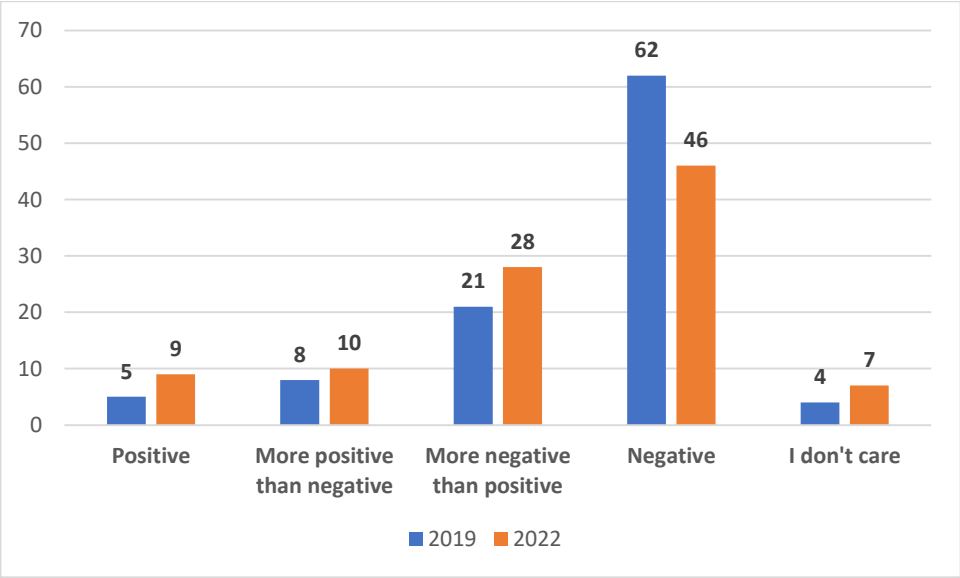

Fig. 4. Distribution of answers to the question: "How do you feel about this project for geophysical exploration of oil and gas in the nasleg territory?" (2019, 2022) (% of respondents) [7].

The population's positive expectations from the project are primarily associated with the emergence of new jobs (41%) and improvement of the village (40%). The creation of new jobs remains an urgent problem, since the branch of the state farm "Novyy" of AC Alrosa (PJSC) was liquidated in the village by 2020. Instead of the state farm, a branch of the Yakutsk Cattle state enterprise of the Republic of Sakha (Yakutia) for farming Yakut breed of cows was established. However, the population believes that this enterprise will probably soon meet the fate of the state farm, and therefore, the male population of the village will remain unemployed. At the same time, to the survey question "Would you personally like to take part in this development project?", only 12% of respondents gave an affirmative answer and 3% found it difficult to answer. These are predominantly men of working age. It is interesting that all of the options presented in the questionnaire about employment were chosen. The most common were: "Labor safety and environmental specialist" and "Mechanic, technician, operator".

The following popular answers coincide with the answer "improvement of the village": "investments in schools, kindergartens, rural health care", "improvement of medical care", "improvement of transport links in the area", "prospects for housing construction, renovation of housing stock" (Table 2).

[7] Source: author's calculations.

Table 2

Distribution of answers to the question: "What positive results do you expect from this project?" (2019, 2022) (% of respondents)

Factor / year	2019	2022
New workplaces	54	41
Investments in schools, kindergartens, rural healthcare	25	24
Village improvement	43	40
Small business development	2	3
Student scholarship program	-	7
Improving transport links in the area (increasing the number of flights, road repairs)	19	16
Improving the quality of mobile communications	9	4
Improving health care	6	19
Development of cable TV, Internet	13	5
Reducing the outflow of young people	7	10
Prospects for housing construction, renovation of housing stock	15	8
I don't expect anything	27	36
Other	3	6

The main problem for residents at present is the construction of a year-round road to the village from Svetlyy settlement. The road passes through the Svetlinskaya hydroelectric power station with a pass entry system, and then crosses a number of streams and small rivers that erode the road, especially in the spring season. Construction of roads and bridges is currently underway. In addition, the construction of a cultural center and reconstruction of the school are planned, but some residents are concerned about the quality of construction: "I wish it would not be like with the gym", since the gym at the village school collapsed after a couple of years. In focus groups, interviewers said that the village needs social facilities: a kindergarten, a school, a club — they require updating, since they were built during the Soviet period; a coal boiler house — it was "brought to the village in 1990 already used" [8]. How could subsoil users help: to participate in the construction of a new sports ground (indoor warm gym) for the entire population of the village, not only for schoolchildren; to help in the reconstruction of the bathhouse.

In 2019, there was public dissatisfaction with the quality of mobile communications and Internet services. In 2022, this issue has been resolved due to the construction and commissioning of fiber-optic communication lines, which ensured constant access to the Internet information and telecommunications network.

Let us note the phenomenon of pessimistic moods in society (both in 2019 and in 2022). This is expressed by a large number of "I don't expect anything" responses, and the number of such responses is growing (in 2019 — 27%, in 2022 — 36%). Many respondents indicated in the open line "I don't expect anything good". In 2022, this attitude is more observed in the age categories "50–64" (46%) and "65 and older" (41%). In the "Hunters" group of interviewees, the

[8] According to the SED of the district, it is planned to convert the boiler house of the village of Syuldyukar to gas fuel.

phrase “they will destroy us” was even heard. Part of society believes that they are under threat of destruction or being forced out of their places of ancestral residence.

In 2022, public concerns are primarily related to environmental degradation (90%) and declining fish and game stocks (71%). Both men and women of all ages are worried about this. The male population of the village is especially concerned; men are more confident that the implementation of this project will lead to the risk of accidents, reduction of pastures and hunting grounds. A number of respondents associate the increased frequency of fires in the nasleg with the exploration of oil and gas fields, including large fires in 2021. Female respondents in the age category “35–49” more often express concerns related to the deterioration of the health of residents. The increase in the number of newcomers is of greater concern to men of pre-retirement and retirement age. When comparing the data of 2019 and 2022, it can be seen that the concerns of respondents remain the same (Table 3).

Table 3

Distribution of answers to the question: “What are your greatest concerns regarding the development of this project?” (2019, 2022) (% of respondents) [9]

Factor / year	2019	2022
Environmental degradation	88	90
Reduction of fish, commercial animals and game stocks	64	71
Poaching by employees of industrial enterprises	15	16
Risk of accidents, emergencies	21	17
Reduction/withdrawal of pastures, fodder/haylands	23	23
Reduction/withdrawal of hunting areas	29	31
Increased crime rate	-	1
Increased level of alcoholism	-	1
Deterioration of public health	26	26
Increase in prices for food and services	3	5
Inflow of newcomers	9	12
No concerns	2	2
Other	5	2

The residents’ concerns are related to the deterioration of the environmental situation and its consequences. The results obtained show how strong the community’s connection to nature is. In the areas of the proposed geophysical exploration, villagers used to collect wild herbs, hunt, and most importantly, some of these areas were hayfields. According to local residents, the forage base in the nasleg is scarce. Tribal communities even considered acquiring deer because they were easier to keep in this ecosystem. However, this area was destroyed by fire in 2021, and reforestation is a long process. Now there is no opportunity to hunt on this territory and “even compensation for these lands will not be given, we will not be allowed to hunt there”, “we believe that it is being deliberately set on fire... such fires have never happened”, “game is leaving due to fires and clearings”. Representatives of the community appealed to the State Assembly of the Republic of Sakha (Yakutia) (Il Tumen) with a request to conduct an investigation, submitted

[9] Source: author’s calculations.

materials, including photos of burnt huts (“seven huts were burnt down”), but there was no response.

The majority of respondents are confident that the oil and gas exploration project in the nasleg territory will not in any way affect their social status and nature of work (everything will remain the same — 45% of respondents) or will worsen their well-being (26%). Only 10% of respondents believe that their well-being will improve, 5% will change their place of residence, 4% hope to get a new job (men “18–34”), 4% found it difficult to answer, 6% chose “other” (“environmental problems will arise”, “this will change our way of life”, “everything will be bad”) (Fig. 5).

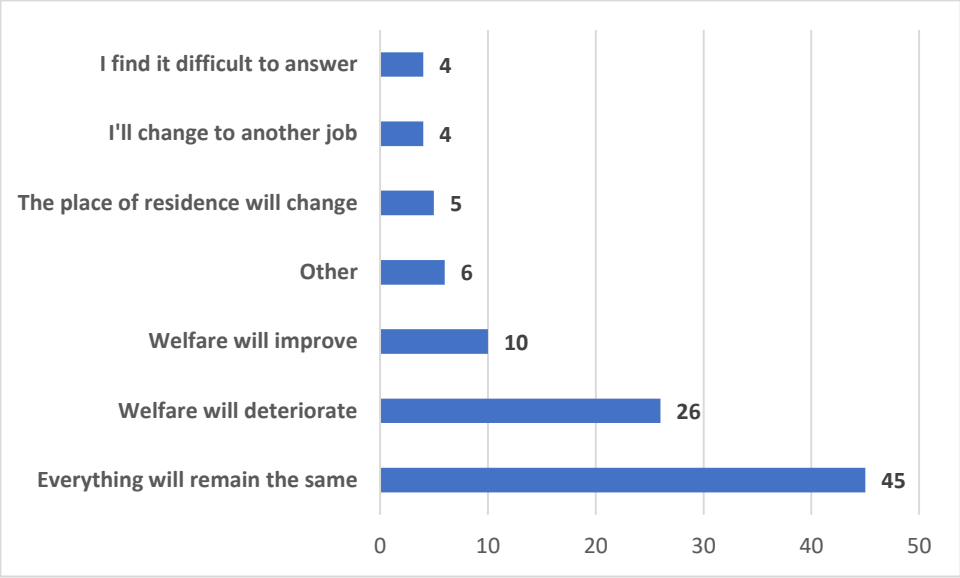

Fig. 5. Distribution of answers to the question: “How will the oil and gas exploration project in the nasleg territory affect your social status and the nature of your work?” (2022) (% of respondents) [10].

To the question “How do you feel about the inflow of population to your nasleg?” the village population predominantly answered that they did not approve of migration — 72%, only 25% approved it, 3% of respondents found it difficult to answer. There are insignificant changes in the answers of respondents of different genders and ages. Men in the age category “18–34” do not approve of the increase in migration flow to nasleg — 28% of surveyed men of this age, and women in the age group “35–49” are more loyal to the arrival of new residents. The majority of those who approve of the arrival of new residents expect the arrival of qualified specialists (42.3%). For example, there is currently a vacancy for a paramedic in nasleg. The prevailing opinion among young people “18–34” is that migration contributes to the rapprochement of peoples. Among those who disapprove, the greatest concern is that migration will cause an overload on the natural environment (about 40%). Regardless of age, male respondents insist that local labor resources should be used (24%) and that the village is unable to provide jobs for all newcomers (32%). Women over 50 years old are wary of an increase in crime in the nasleg with the increase in the number of visitors (more than 50%).

[10] Source: author’s calculations.

The question: “What methods of compensation for losses from the activities of industrial enterprises to hunters, tribal communities and indigenous people do you consider the most appropriate?” caused a lively discussion among the village residents. The most popular answer is “Construction of structures and facilities that improve the quality of life of the local population”, answered by 59% of respondents; this is the most common answer among men in the age category “50–64”. These are the most active residents of the village; everyone listens to their opinion. 24% of respondents chose financial compensation; this answer prevails among the female audience. The allocation of other territories was chosen by 16% of respondents, and there was no gender factor. The allocation of materials and equipment was also chosen by 16% of respondents, here the highest percentage was observed among men — 24%. 21% of respondents found it difficult to answer, mostly young people “18–34”. “Other” — there were different opinions from “don’t need anything from them” to “it is necessary to conclude an agreement” (Table 4).

Table 4

Distribution of answers to the question: “What methods of compensation for losses from the activities of industrial enterprises to hunters, tribal communities and indigenous people do you consider the most appropriate?” (2022) (% of respondents) [11]

Construction of structures and facilities that improve the quality of life of the local population	59
Money	24
Difficult to answer	21
Allocation of materials and equipment	16
Allocation of other territories	16
Other	5

Analysis of group interview materials showed that residents live in one community and “help should be provided to the entire village”. The only precedent for a one-time payment to a tribal community from a mining company (Kuokhaan community received compensation in the amount of 395,466 rubles) is still being discussed in the village, since a significant part of the village residents are members of this tribal community: “they sold their homeland for 300 thousand”, “we feel shame”, “they harmed nature for 1000 years ahead, they left us without berries and game, and they paid us a dab of money”. The money are in the community’s account — “no hand is raised to use it”. Residents propose concluding a tripartite agreement between the tribal community, whose lands are being developed, the municipal organization “Sadyn national Evenks nasleg” and the subsoil user company. The agreement should “specify the construction of social facilities so that benefits for everyone could be seen”, provide jobs for local personnel, train and employ rural youth; compensation payments should be “annual, not one-time, otherwise it’s not fair”. Nasleg residents also ask for advance notification of planned economic works: “we are expecting more than just one person to visit”, “we want them to look at their work”. Residents claimed that they wrote their wishes to the company, but never received a response.

The open question “How do you assess the company’s activities... on the territory of the Sadyn national nasleg?” received 98 responses. The majority of respondents found it difficult to

[11] Source: author’s calculations.

answer, in fact, due to insufficient information about the company (62 people). There were 29 negative answers: from “negative”, “bad”, “they pollute the environment”, “the game is gone” to “they came to us without warning”, “the company is stronger than us”, “they will destroy us”. There were 4 neutral answers “I am not affected”, “the main thing is the development of the village”, “I rather approve... the main thing is that everything should be within the framework of the agreement”. Only three answers were positive.

From the analysis of group interview materials, it can also be found out that nasleg residents study examples of interaction between the indigenous rural population and mining companies. First of all, this is their own experience of interaction with JSC Alrosa: “the Alrosa company signed an agreement for 10 million rubles, they allocate it to nasleg annually for the fact that they got rid of us... they closed a branch of the state farm, we used the entire social package of Alrosa, it’s a shame”. According to respondents, LLC Irkutsk Oil Company carried out land reclamation, in particular, tree planting in the vicinity of the village of Svetlyy. PJSC Surgutneftegas carried out work on land reclamation around the village of Almaznyy. LLC Taas-Yuryakh Neftegazodobycha entered into an agreement with the Botuobuyinskiy nasleg municipal organization and tribal communities: “it improves the village”, “it buys equipment for the community”, and “it employs them”.

Nasleg residents also expect support and help from mining companies that come to work on their lands: “young people are leaving — there is no work, they can give us work, since we can’t hunt”, “they should teach young people to work in industry”, “should develop agriculture”. In addition, respondents expressed doubts about the legality and fairness in relation to themselves: “no one will ask us”, “they will still do what they need”, “how can we demand from private campaigns... notifications, ethnological expertise... we record, signal... we have already learned... but the forestry department and ecologists do not have the equipment to get to the place, they cannot check and record the violation...” Another group of interviewees chose a wait-and-see attitude: “we’ll see”, “we don’t know yet how they will work, while they are only promising to help us, we are watching”. Of course, part of society is more radical: “we will not give up”, “the Motherland is not for sale”, “I don’t want them to work here”.

In each of the two groups, “Hunter” and “Villager”, there are all the presented opinions. We would like to dwell on the differences. Thus, hunters go directly into the forest and see equipment, shift workers, clearings; villagers know about many things only from the words of others, but recently they began to observe equipment on the road to the Svetlyy village, see and hear machinery on the outskirts of the village, helicopters. This worries them. They assume that reconnaissance came close to the village. The population supposes that the village territory is included in the licensed area. The map of the licensed area clearly shows that the fears are not unfounded (Fig. 7).

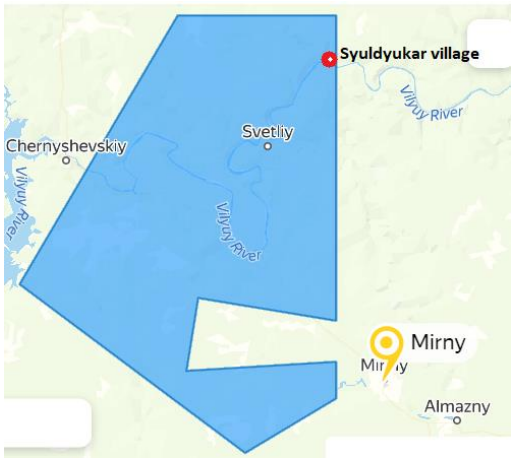

Fig. 7. Map of the South-Syuldyukar subsoil area on the territory of the Mirninskiy district of the RS(Ya) [12].

Discussion

Ethnological expertise is considered by researchers primarily as a mechanism of interaction between government authorities, industrial companies, the scientific community and indigenous peoples. During the expertise, information arrays are accumulated, which are analyzed by specialists in various fields of knowledge, and recommendations are given to industrial companies and the indigenous community, which ensures the development of flexible mechanisms adapted to the conditions of the regions [17, Novikova N.I., pp. 131–132]. The key topic is the attitude of the local population to the development project, their fears and expectations.

Researchers pay attention to the fact that industrial companies have an impact on communities, shaping public opinion [18, Vakhtin N.B.]. However, this study showed that industrial companies do not always make contact with the indigenous population, choosing a wait-and-see approach, distancing themselves from the issues raised by the development project.

The legislation on ethnological expertise provides for the calculation of compensation for damage. Some experts note the potential threat of the indigenous people's interest in receiving damage compensation from corporations rather than long-term sustainable development of the territory of residence [19, Mustafin S.K. et al., p. 11]. Meanwhile, the results of the study demonstrated that the indigenous population insists on the participation of companies in the development of the territory, rather than on one-time compensation. Moreover, compensation in monetary terms causes rejection and a feeling of guilt among the indigenous population.

Scientists from the Yakutsk University, having analyzed investment projects that have undergone ethnological expertise, came to the conclusion that the implementation of large investment projects in the Arctic zone of the Republic of Sakha (Yakutia) for the exploration and extraction of minerals may lead to disruption of the ecosystem, which in turn will lead to the depletion of natural resources for traditional environmental management. As a result, this may cause conflict situations between indigenous peoples and industrial enterprises. At the same time, the authors believe that it is necessary to establish partnerships between all participants of nature use

[12] LLC "SuldyukarNefteGaz". URL: https://suldukar.ru/ (accessed 19 October 2023).

and economic activities under the control of the state and the active position of the indigenous community [20, Burtseva E.I., Sleptsov A.N., Bysyina A.N., p. 58, pp. 68–69]. However, when the goals of industrial and government entities for the development of the territory largely coincide, the opinion of the indigenous peoples, advocating for the preservation of nature, is practically unheard. It is not easy for the state to act as an independent arbiter when it needs to implement projects.

Conclusion

Thus, the population of the Sadyn national Evenks nasleg municipality, including members of tribal communities, feels that the territory of their traditional livelihood is constantly shrinking. They realize that the lands that were taken away from the Sadyn Evenks for industrial development can no longer be returned, but the process continues. During the Soviet and post-Soviet periods, to some extent, the population of the nasleg was protected by Alrosa, but the liquidation of the state farm branch in the Suldyukar village made the population feel themselves deceived and deprived of their native land. For this reason, the village population had a sharply negative attitude towards the project for oil and gas exploration on nasleg lands. They feel anxiety about the possible critical consequences associated with industrial development: environmental pollution, disruption of the ecological system, depletion of biological resources, and land alienation. At the same time, the population realizes that this process cannot be stopped, and it is necessary to establish a dialogue with mining companies. Residents of Syuldyukar are ready to enter into an agreement with the company, but the municipal organization “Sadyn national Evenks nasleg” should become a party to the agreement, and all residents of the nasleg should receive “compensation” through the construction of social facilities. Tribal communities do not refuse assistance and mutually beneficial cooperation with industrial companies. With the start of this project, residents hope to solve a number of social issues in the village, including the creation of new jobs and improvement of the environment.

One of the directions for further research on this issue could be the development of a methodology for identifying potential social conflicts between the indigenous population and industrial companies, forecasting the development of the conflict situation and its resolution.

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Spatial Aspects of Development of the Ethno-Contact Zone in Karelia

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Abstract. The significant diversity of ethnic dynamics in Karelia at the level of its districts is of interest from the standpoint of the concept of ethno-contact zones being developed in the national science. The aim of the study is to classify the districts of Karelia on the basis of the concept of ethno-contact zones according to the peculiarities of the dynamics of the titular population for three periods: from 1933 to 1959, from 1959 to 1989 and from 1989 to 2010. The article carried out approbation of the methodology of identifying the phases of development of ethno-contact zones at the intra-regional level. In total, eight types of ethnic dynamics have been identified, corresponding to positive or negative values in the change in the share of titular population (waves of titularization and detitulization) and four phases of development of ethno-contact zones (initial, growth of contact, beginning of dissolution and complete dissolution). In the period from 1933 to 1959, most districts of the republic entered the initial phase of dissolution of the ethno-contact zone on the wave of detitulization of the population. In the period from 1959 to 1989, in the northern part of the republic, there was a belt of districts, passing to the complete dissolution of the ethno-contact zone. In the period from 1989 to 2010, all eastern districts of Karelia and northern Ladoga were in the phase of complete dissolution of the ethno-contact zone. The districts in the western part of the republic retained the type of ethnic dynamics corresponding to the beginning of dissolution of the ethno-contact zone. Throughout all three periods, Olonetskiy district, located in the south of the republic, demonstrated a type of ethnic dynamics atypical for Karelia. In 2010, it remained the only district of the Republic of Karelia where the share of the titular ethnic group exceeded half of the population.
Keywords: *classification, ethnic dynamics, titularization, detitulization, phases of development, concept of ethno-contact zones*

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Introduction

Karelia is one of the few republics of the Russian Federation where the share of the titular population has only been decreasing since its creation. Moreover, initially, the share of the titular ethnic group was less than half of the republic’s population (34.1% according to the results of the

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1926 census). However, this was not the case on the entire territory of Karelia. In the western part of Karelia, until the Great Patriotic War, the share of representatives of the titular ethnos was more than half of the population, while the eastern part of the republic was traditionally Russian. However, even within the western part of Karelia, noticeable differences in ethnic processes began to be observed. The territories included in Karelia in 1940 made their contribution to the regional diversity of ethnic dynamics.

The identified features of ethnic processes in Karelia at the regional level are of interest from the perspective of the concept of ethno-contact zones being developed in Russian science. This concept is intended to identify spatial patterns of development of ethno-contact zones (ECZ). In this regard, the Republic of Karelia is a unique territorial object for the development and testing of new research methods. This article tested a methodology for identifying the phases of development of ethno-contact zones at the level of municipalities (in Soviet times — urban settlements and rural areas).

The purpose of the study is to classify the districts of Karelia on the basis of the concept of ethno-contact zones according to the peculiarities of the dynamics of the titular ethnic group for three time intervals: from 1933 to 1959, from 1959 to 1989 and from 1989 to 2010.

The information base for the study is ethnic statistics for the Republic of Karelia, including at the level of its urban settlements and rural areas (later — municipalities), based on the results of censuses and current population records from 1897 to 2021, presented in the Ethnodemographic Atlas of the Baltic-Finnish peoples of the Republic of Karelia [1], on the websites of Demoscope Weekly [2] and the Federal State Statistics Service (Database of municipalities according to the results of the 2010 census) [3].

Initial prerequisites

In Russian ethno-demography and ethnic geography, the degree of heterogeneity of the national composition of the population is usually measured using the ethnic mosaic index (EMI), proposed by B.M. Eckel in the 1970s to assess the complexity of the ethnic composition of the republics, territories and regions of the USSR [1, pp. 47–63]. This indicator is calculated by the formula: EMI $=1-\sum(Pi)^2$, where $(Pi)^2$ — proportion of representatives of the *i-th* nationality (i = 1, 2...) in the region of study. But in world science this indicator is better known under a different name. Domestic economists, as well as foreign researchers, call it the index of fractionalization (or ethnolinguistic fractionalization) [2, Bufetova A.N., Khrzhanovskaya A.A., Kolomak E.A., pp. 453–463; 3, Dinku Y., Regasa D., pp. 348–367; 4, Chareyron S., Chung A., Domingues P., pp. 133–143]. More often it is used to assess the relationship between the ethnic heterogeneity of the population and

[1] Ethnodemographic atlas of the Baltic-Finnish peoples of the Republic of Karelia. Petrozavodsk, 1998. URL: http://www.soros.karelia.ru/projects/1998/atlas/index.htm (accessed 12 December 2014).
[2] Demoscope Weekly. Population censuses of the Russian Empire, USSR, 15 new independent states. URL: http://www.demoscope.ru/weekly/ssp/census.php?cy=8 (accessed 10 June 2023).
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various economic characteristics of territories. For example, the influence of ethnic diversity on inequality of population expenditures is being studied [5, Budi M., pp. 8–26], as well as economic diversification [6, Vasilyeva R.I., Rozhina E.A., pp. 663–684], economic growth [7, Dincer O.C., Wang F., pp. 1–10; 8, Suslov N.I., Isupova E.N., Ivanova A.I., pp. 35–47], production efficiency and political stability [9, Repkine A., pp. 315–333].

There are also some works where, using this indicator, the actual ethno-demographic processes in countries and regions are analyzed over a certain time interval. Thus, the work devoted to the dynamics of the index of ethnic fractionalization in 162 countries of the world for the period from 1945 to 2013 should be noted [10, Dražanová L.]. For example, for Latvia, a modified index of ethnolinguistic fractionalization was calculated on the basis of results of all population censuses from 1897 to 2011 [11, Németh Á.], and in this work, mapping of the dynamics of the index at the level of municipalities for the period between the population censuses of 1989 and 2011 was also carried out [11, Németh A., p. 22].

As for the designated research region, we can note a number of publications devoted to the problems of modern ethnic processes in the Republic of Karelia, for example: [12, Nesterova N.A., pp. 365–375; 13, Dzheglav E.A., pp. 305–310; 14, Strogalshchikova Z.I., pp. 17–24; 15, Klementyev E.I., pp. 144–152; 16, Manakov A.G., Terenina N.K., pp. 96–107]. Particular attention should be paid to the work that addresses issues of ethnic self-identification of the local population in the northern part of the Republic of Karelia [17, Dzhioshvili E.A., Krivonozhenko A.F., Litvin Yu.V., Yalovitsyna S.E., pp. 28–43]. The place of the Republic of Karelia in the general trends in the dynamics of the titular peoples of the republics of Russia from 1939 to 2010 is discussed in [18, Manakov A.G., pp. 43–64].

Research methodology

The main indicator that is used to highlight and determine the degree of expression of ethno-contact zones is the ethnic mosaic index (ethnic fractionalization index) discussed above. However, the use of this index in mapping its dynamics faces the difficulty of interpreting changes in its value, which requires additional statistics on the dynamics of the shares of representatives of different nations that make up a certain ethno-contact zone.

To solve this problem, this study proposes to switch to the calculation of the EMI for two-component ethnic systems, which significantly expands the possibilities of using the cartographic method of research in analyzing ethnic dynamics. It is proposed to consider the titular people of the Republic of Karelia, i.e. the Karelians, as two main ethnic components, and the second component is the entire non-titular population living in the republic. It should be noted that the grouping of peoples close to each other on some grounds (e.g., by their status, linguistic or confessional proximity, degree of complementarity, etc.) is not a rare phenomenon in ethno-geography and was highlighted, for example, in the works [19, Safronov S.G., p. 141; 20, Lysenko A.V., Azanov D.S., Vodopyanova D.S., pp. 134–135]. In the proposed version of the EMI calculation, it becomes

possible to display on the growth map the representation of one of the components that make up the ethno-contact zone.

The EMI value for two-component ethnic systems varies from 0 to 0.5. We propose to determine the degree of expression of ethno-contact zones on the basis of the value of the index, distinguishing: 1) strongly manifested ECZ (EMI value over 0.4); 2) moderately manifested ECZ (EMI from 0.2 to 0.4); 3) weakly manifested ECZ (EMI from 0.1 to 0.2); 4) least manifested ECZ (EMI less than 0.1). If the share of representatives of the titular ethnic group or one of the non-titular peoples exceeds 90%, mono-ethnic territories are identified instead of the fourth category of ECZ.

Using this indicator, it was possible to identify and analyze the key phases of the development of two-component ECZ on empirical material. The four main phases of ECZ development were designated as: 1) initial (appearance of representatives of ethnos B in the territory dominated by ethnos A); 2) growth of ethnic contact (increase in the specific weight of ethnos B, decrease in the share of ethnos A); 3) the beginning of dissolution of the ECZ (representatives of ethnos B exceeded half of the population, a continued decrease in the share of ethnos A); 4) dissolution of the ECZ (transition to the dominance of ethnos B in the study area, transformation of the territory into a mono-ethnic one).

When identifying the phases of development of ethno-contact zones, the change in the share of representatives of the titular ethnic group is also taken into account, on the basis of which two types of ethnic dynamics are identified: 1) wave of titularization of the population (increase in the share of the titular ethnic group); 2) wave of detitularization of the population (decrease in the share of the titular ethnic group). It is important to note that our work does not focus on the reasons for the dynamics of the share of the titular ethnic group (natural movement, population migrations, change of ethnic identity, etc.), since the main goal of the study is to identify spatial patterns of ethnic processes.

Thus, taking into account the positive or negative value of the EMI change, indicating the growth or dissolution of the ECZ, eight types of ethnic dynamics have been identified. This article presents the results of the distribution of Karelian districts according to these types of ethnic dynamics for the three time intervals indicated above.

The complexity of the cartographic classification of areas is associated with the instability of the administrative-territorial division of Karelia during the study period. Therefore, it was necessary to recalculate ethnic statistics with their reference to the boundaries of districts for a certain year. In our study, ethnic statistics for different years are linked to two grids of the administrative-territorial division of Karelia: modern (dynamics from 1989 to 2010) and for 1959 (dynamics from 1933 to 1959 and from 1959 to 1989).

Results and discussion

The period in the history of Karelia for which there are official ethnic statistics, i.e. starting from 1897, despite a fairly noticeable increase in the number of Karelians in the pre-war period (Fig. 1), is characterized by their constantly decreasing share in the population of the republic (Table 1).

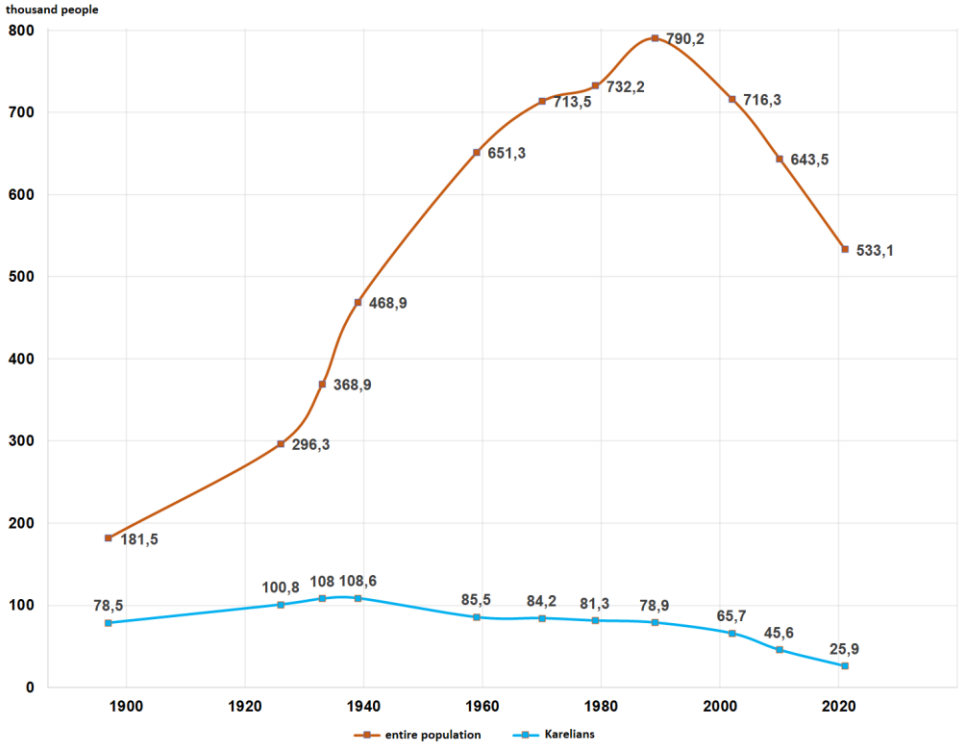

Fig. 1. Dynamics of the number of Karelians and the entire population living within the modern borders of the Republic of Karelia, according to the results of censuses and surveys from 1897 to 2021 [4].

Table 1

Dynamics of the total population, the share of Karelians and the value of the ethnic mosaic index, calculated for a two-component ethnic system (titular and non-titular population), within the modern borders of Karelia for the period from 1897 to 2021 [5]

Years	Population, people	Number of Karelians, people	Share of Karelians in the population, %	Change in the share of Karelians over the period	Value of EMI (titular / non-titular population)	Degree of ECZ manifestation	Change in EMI over the period
1897	181 475	78 517	43.27		0.4909	strong	
1926	296 336	100 781	34.01	-9.26	0.4489	strong	-0.0420
1933	368 892	108 037	29.29	-4.72	0.4142	strong	-0.0347
1939	468 898	108 571	23.15	-6.13	0.3559	moderate	-0.0583
1959	651 346	85 473	13.12	-10.03	0.2280	moderate	-0.1279
1970	713 451	84 180	11.80	-1.32	0.2081	moderate	-0.0199
1979	732 193	81 274	11.10	-0.70	0.1974	weak	-0.0107
1989	790 150	78 928	9.99	-1.11	0.1798	weak	-0.0176
2002	716 281	65 651	9.17	-0.82	0.1665	weak	-0.0133
2010	643 548	45 570	7.08	-2.09	0.1316	weak	-0.0349

[4] Compiled by the authors.
[5] Compiled by the authors.

2021	533 121	25 901	4.85	-2.22	0.0924	least	-0.0392

In accordance with the terminology of the concept of ethno-contact zones, we can talk about the gradual dissolution of the Karelian ECZ throughout the entire period of the study. This dissolution took place in several stages, corresponding to certain phases of development of ethno-contact zones. Crossing the boundaries corresponding to the EMI values noted above (0.4, and then 0.2 and 0.1) meant the transition from the initial phases of ECZ dissolution to its complete dissolution. Before the 1940s, the Karelian ECZ could be designated as strongly manifested, but subsequently the degree of ECZ manifestation decreases to medium, and in the 1970s — to weak. The 2021 population census recorded the crossing of the last boundary in the development of the ethno-contact zone — the share of Karelians in the population of the republic became less than 5%, which meant the beginning of the transition of the ECZ into the phase of complete dissolution.

As early as 1933, a belt of districts with a significant preponderance of representatives of the titular ethnic group stretched across the western part of Karelia. According to the concept of ethno-contact zones, they can be regarded as weakly and moderately manifested ECZ (Fig. 2). The most significant preponderance in favor of the titular ethnic group was found in the Kestengskiy district in the north-west of Karelia, as well as the Pryazhinskiy and Olonetskiy districts in the south of the republic. By 2010, there was only one district with a pronounced ECZ with a slight preponderance of Karelians — Olonetskiy district, located in the eastern Ladoga region.

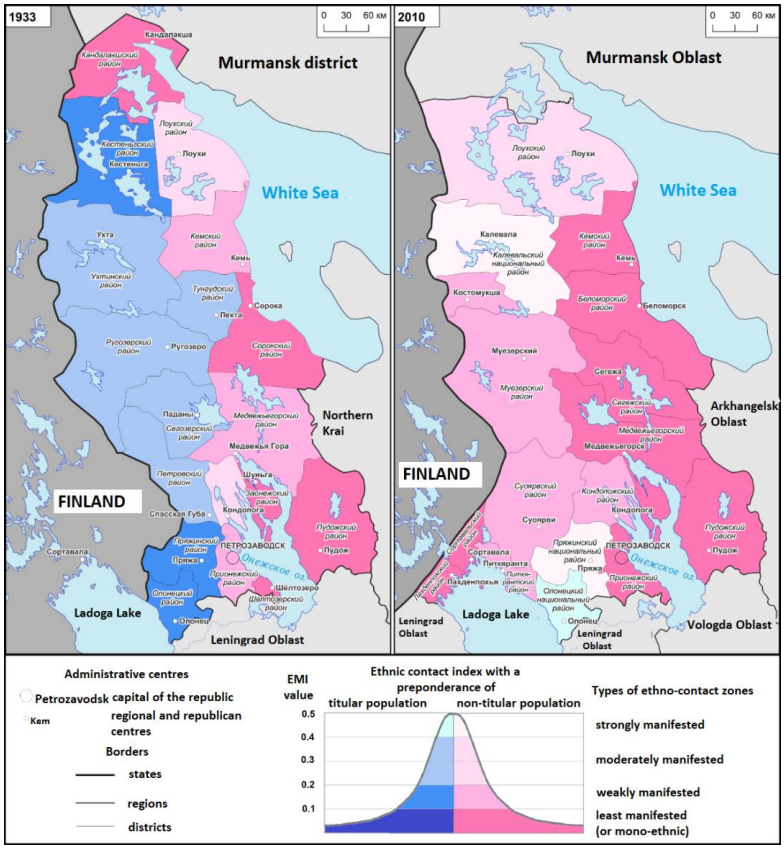

Fig. 2. The value of the ethnic mosaic index, calculated for a two-component ethnic system (titular and non-titular population), at the level of Karelia districts in 1933 and 2010, the degree of manifestation of ethnic contact zones [6].

[6] Compiled by I.A. Ivanov, legend developed by A.G. Manakov and Terenina N.K.

The eastern regions of Karelia in 1933 were characterized by a significant preponderance of the non-titular population. This was due to the peculiarities of the creation of the Karelian Labor Commune (KLC), the predecessor of the Autonomous Karelian SSR (AKSSR), and then the Karelian ASSR. The Karelian Labor Commune, which existed from 1920 to 1923, included territories on the western coast of the White Sea, where the proportion of the Russian population was increased. They were part of the Kemskiy district of the Arkhangelsk province included in the KLC. In 1922, the predominantly Russian Pudozhskiy and Povenetskiy districts from the abolished Olonetskaya province were annexed to the KLC, the territory of which remained part of Karelia when the KLC was transformed into the AKSSR. In 1923, Pomor volosts on the Baltic Sea coast, where the Russian population clearly predominated, were annexed to the territory of the AKSSR [7].

In 1933, the territories with the dominance of the non-titular population of the AKSSR (ECZ with the lowest degree of manifestation) included Kandalaksha (in the north of the KASSR), Sorozhskiy, Pudozhskiy, Zaonezhskiy and Sheltozerskiy districts (in the southeast of the KASSR). Other areas in the eastern part of the republic could be considered as ethnic contact zones of weak and medium manifestation with a preponderance of the non-titular population. Accordingly, the belt of districts in the western part of the republic (except for the three mentioned above) could be classified as an ECZ of medium manifestation with a preponderance of the titular population.

In 2010, the ethno-contact zone with a significant preponderance of the non-titular population covered almost the entire territory of the republic (with the exception of the Olonetskiy district, where the preponderance of the titular ethnic group remained). A pronounced degree of ECZ manifestation (with only a slight predominance of the non-titular population) characterized the Kalevalskiy and Pryazhinskiy districts, which indicated their recent transition to the phase of dissolution of ECZ. Almost all areas of the eastern part of Karelia, as well as the northwestern Ladoga region, could be considered as ECZ of the least manifestation with a dominance of the non-titular population. The regions in the western part of Karelia, where the more obvious features of the ethno-contact zone between the titular and non-titular population (weak degree of ECZ manifestation), and the Loukhskiy district in the northern part of Karelia (medium degree of ECZ manifestation) had transitional features.

Figure 3 presents the classification of Karelia regions according to the dynamics of the ethnic mosaic index, calculated for a two-component ethnic system (titular and non-titular population), and changes in the share of the titular ethnic group from 1933 to 1959, from 1959 to 1989 and from 1989 to 2010. Combining these two characteristics of ethnic dynamics made it possible to determine the phases of development of ethnic contact zones for each region of the republic.

[7] Ethnodemographic atlas of the Baltic-Finnish peoples of the Republic of Karelia. Petrozavodsk, 1998. URL: http://www.soros.karelia.ru/projects/1998/atlas/index.htm (accessed 12 December 2014).

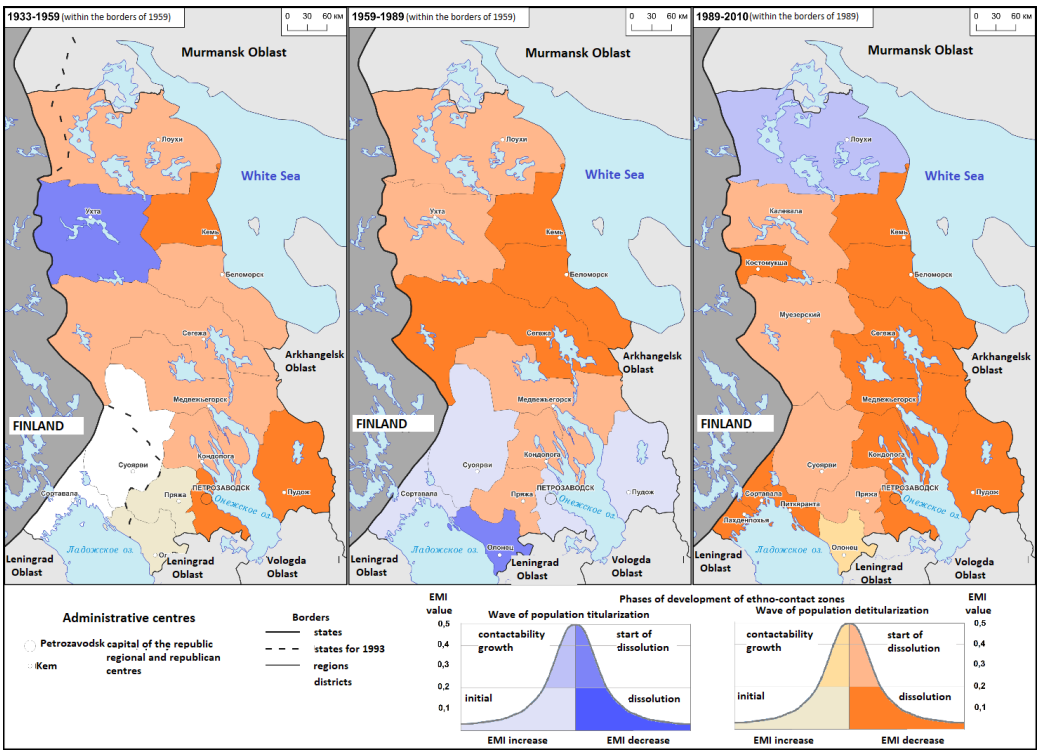

Fig. 3. Dynamics of the ethnic mosaic index, calculated for a two-component ethnic system (titular and non-titular population), by region of Karelia in the periods between 1933 and 1959, 1959 and 1989, 1989–2010 phases of development of ethno-contact zones [8].

Period from 1933 to 1959 primarily reflects the consequences of the Great Patriotic War and mass migration to Karelia for logging and other activities of immigrants from other regions and republics of the USSR (especially from Belarus) in the second half of the 1940s and in the 1950s. Most of the regions of the republic during this period passed to the phase of dissolution of the ECZ in the wave of detitularization of the population, as the share of Karelians in them was already less than 50% and continued to decline rapidly. At the same time, other types of ethnic dynamics could also be found. Firstly, this is a transition to the complete dissolution of the ECZ in the northeast (Kemskiy district) and southeast of the republic (including the city of Petrozavodsk), where the non-titular population was already clearly dominant. Secondly, the direct contrast of these territories was the Ukhta district (later — Kalevalskiy) in the north-west of the republic, where the share of Karelians exceeded 50% and continued to grow. Thus, the dissolution of the ECZ was also indicated here, but in favor of the titular ethnic group. Thirdly, these are the Olonetskiy and Pryazhinskiy districts in the south of Karelia, where the share of Karelians also exceeded half of the population, but they moved to the initial phase of the development of the ECZ on the wave of detitularization of the population (i.e., an increase in the share of non-titular ethnic groups).

In the period from 1959 to 1989, i.e. in late Soviet times, the republic's population continued to grow rapidly (see Fig. 1), mainly due to migration influx. Construction of the Karelian mining and processing plant in Kostomuksha in the 1970s–1980s significantly reduced the share of Karelians in the north-west of the republic, which ceased to differ in its ethnic dynamics from most oth-

[8] Compiled by I.A. Ivanov, legend developed by A.G. Manakov and Terenina N.K.

er territories of Karelia. In the northern part of the republic, the belt of districts has noticeably expanded, moving to the complete dissolution of the ECZ on the wave of detitularization of the population. However, an interesting phenomenon has emerged in the southern part of Karelia — an increase in the share of the titular ethnic group in areas with a clear dominance of the non-titular population. These include areas of the southeast of the republic, including the city of Petrozavodsk, as well as territories transferred to Karelia from Finland in 1940. Thus, the Karelian ECZ began to "spread" across the territory of the republic mainly due to migrations, but, perhaps also due to changes in the self-identification of the local population. It is important to note that this happened at a time when this ethno-contact zone was rapidly approaching the final phase of its development. The only region in Karelia where, between 1959 and 1989, the ECZ was dissolved in favor of the titular ethnic group was the Olonetskiy district in the south of the republic.

In the period from 1989 to 2010, which characterizes the ethnic dynamics of the post-Soviet era, there was a rapid decline in the entire population of the Republic of Karelia. But the rate of decline in the number of the titular ethnic group was even higher, so its share in the population of the republic continued to decrease (see Fig. 1 and Table 1). During this period, only one region of Karelia experienced a slight increase in the share of the titular ethnic group — the Loukhskiy district in the north of the republic. The wave of detitularization of the population covered all other regions of Karelia, including Olonetskiy district, although its population still retained a preponderance of the titular ethnic group. While the regions of the western part of the republic were in the initial phases of the dissolution of the ECZ, almost all the districts of its eastern part, as well as the Kostomuksha urban district in the north-west of the republic and the regions of the northern Ladoga region, moved to the phase of complete dissolution of the ECZ.

Thus, in the course of the research on the basis of specific empirical material at the level of municipalities (urban settlements and rural districts) the methods aimed at studying the spatial and temporal dynamics of ethno-contact zones were tested. In particular, common features of the development of ethno-contact zones were identified, primarily related to the final phases of the development of the ECZ, up to the almost complete dissolution of the ECZ. The Karelian ethno-contact zone has gone the full way from a clearly manifested ECZ to a weakly expressed ECZ with an extremely low share of the titular ethnic group during the 20th and early 21st centuries. But at the level of individual regions of the republic, it was possible to observe all possible diversity of types of dynamics of the titular ethnic group, which also made it possible to trace such phases of the development of ethno-contact zones that characterize the birth and maturity of the ECZ.

Conclusion

The research has resulted in the distribution of Karelian districts by types of ethnic dynamics for the time intervals 1933–1959, 1959–1989 and 1989–2010. In total, eight types of ethnic dynamics have been identified, corresponding to a positive or negative value of changes in the share of the titular population (waves of titularization and detitularization) and four phases of develop-

ment of ethno-contact zones (initial, increasing contact, beginning of dissolution and complete dissolution).

Already in the period from 1933 to 1959, most regions of the republic entered the initial phase of dissolution of the ECZ on the wave of detitularization of the population; the share of Karelians in them amounted to less than half of the population and continued to decline rapidly. In the period from 1959 to 1989, in the northern part of the republic, the belt of districts that passed to the complete dissolution of the ECZ expanded considerably. However, in the southern part of Karelia, in a number of areas with a clear dominance of the non-titular population, there was an increase in the share of the titular ethnic group. Thus, the Karelian ECZ began to "spread" across the territory of the republic. In the period from 1989 to 2010, the entire eastern part of Karelia, as well as the northern Ladoga region, entered the phase of complete dissolution of the ECZ. The western regions of the republic retained the type of ethnic dynamics corresponding to the beginning of the dissolution of the ECZ.

During all three periods, an atypical type of ethnic dynamics for Karelia was demonstrated by the Olonetskiy district, located in the south of the republic, in the eastern Ladoga region. In 2010, it was the only district of the Republic of Karelia where the share of the titular ethnic group exceeded half of the population. In the period from 1959 to 1989, there was even an increase in the proportion of Karelians, although over the entire period of study there was still a reduction in the share of the titular ethnic group. Atypical for Karelia was the positive dynamics of the share of the titular population in the north of the republic (from 1933 to 1959 in the Ukhtinskiy district, from 1989 to 2010 in the Loukhskiy district).

Thus, the study made it possible to identify common features of the dynamics of ethno-contact zones, primarily related to the final phases of the development of ECZ. At the same time, at the level of individual regions of Karelia, it was possible to observe all the diversity of types of dynamics of the titular ethnic group, which also allowed us to trace the phases of development of ethno-contact zones that characterize the birth and maturity of the ECZ.

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Educational Migration from Arctic Regions of Russia That Do Not Have Independent Universities

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Abstract. One of the main reasons for young people to change their place of residence is the desire to get higher education. In the Arctic zone, where there is a lack of or insufficient level of development of the network of higher education organizations, young people are forced to leave for other regions. The relevance of the study is also conditioned by the fact that educational migration is often irrevocable, which strengthens negative migration processes. The study of educational migration with the help of traditional statistical sources is possible at the regional level, but does not reveal the spatial characteristics of migration processes at the level of municipalities. Therefore, the purpose of this study is to approbate the methodology of studying migration from municipalities on the example of regions where there are no independent higher education institutions. The object of the study is the Arctic regions: Nenets, Chukotka, Yamalo-Nemets Autonomous okrugs. The scientific novelty of the study is determined by the use of new data sources and the application of the method of big data analysis to study migration processes at the municipal level. The database for the study was formed on the basis of the results of uploading data from the digital footprint of users of the social network "VKontakte". The study regions included 15,186 users, the vast majority of whom indicated receiving higher education in other constituent entities of the Russian Federation. Based on the obtained data, the trajectories of educational migration at the municipal level were identified, the coefficients of concentration and uniformity of migration flow were calculated, and a typology of municipalities in the Arctic regions of Russia was carried out. The practical significance of the study lies in the possibility of using the results obtained to adjust migration policy in the Arctic regions, including at the municipal level.

Keywords: *educational migration, internal migration, VKontakte, Nenets Autonomous Okrug, Chukotka Autonomous Okrug, Yamalo-Nenets Autonomous Okrug*

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Introduction

In the modern world, higher education is of great importance when seeking employment and achieving success in professional life. The desire to enter a university often becomes the reason for the relocation of school graduates from Arctic regions, characterized by the absence or insufficient development of a network of higher education organizations. As a result, the northern regions lose a part of human potential that is promising in demographic and labor-resource terms, which subsequently leads to additional costs for the authorities and business structures operating in the North [1].

The land part of the Arctic zone of the Russian Federation includes 75 municipalities (municipal districts, urban and municipal okrugs), belonging to 9 regions. In the subjects of the Russian Federation, which fully or partially belong to the Arctic zone, there are both branches of higher education organizations and independent universities (the latter refers to higher education organizations that are not branches). The regions of the Arctic zone of the Russian Federation can be divided into three groups according to the level of development of the network of higher education institutions and, accordingly, the accessibility of higher education in their constituent entities. The municipalities of the Arctic zone of the Murmansk and Arkhangelsk oblasts, as well as the Krasnoyarsk Krai have both independent higher education institutions and branches. The Republics of Sakha, Karelia, and Komi have independent universities located in the parts of the regions that are not included in the Arctic zone. There are also university branches in Vorkuta and Usinsk.

It is difficult to obtain higher education for school graduates in the Nenets (NAO), Chukotka (ChAO) and Yamalo-Nenets (YaNAO) autonomous okrugs, which entirely are part of the Arctic zone. There are no independent universities in these regions. In Chukotka and the Yamalo-Nenets Autonomous Okrug, the “network” of higher education institutions is represented by branches that provide training primarily through correspondence courses: in Noyabrsk, there is a branch of the Tyumen Industrial University, and in Anadyr — of the North-Eastern (Federal) University named after M.K. Ammosov. The number of full-time students is small: in 2022, it was 8 and 42 students, respectively [1].

Thus, the lack of independent universities, the insignificant number of places and the lack of choice of training areas in single branches have necessitated educational migration from these autonomous okrugs. Interregional educational migration from the Arctic regions can be of a return nature, but for full-time students, temporary migration often turns into irrevocable one.

The subject of this study is migration in the Arctic regions where there is no network of higher education institutions: the Nenets, Chukotka, Yamalo-Nenets Autonomous okrugs. The purpose of the research is to test a methodology for studying migration from municipalities without independent higher education institutions. Migration from Arctic territories can be caused not

[1] Characteristics of the higher education system. Monitoring 2022. Information and analytical materials based on the results of monitoring the activities of organizations of higher education. URL: https://monitoring.miccedu.ru/?m=vpo&year=2022 (accessed 11 May 2023).

only by lack of access to education, but also by other factors related to economic development and quality of life. For example, many young people may leave regions with limited career opportunities for more developed regions with a wider range of employment and business opportunities.

Sources of information on educational migration in the Russian Arctic

The study of educational and youth migration, including in the context of the demographic and socio-economic development of the North, is carried out by representatives of various areas of social sciences — demographers, economists, geographers, sociologists, who have different approaches to the object of study and the sources of information. Traditionally, data on population movements are reflected in the materials of population censuses and current statistical records of migration. These sources can be used separately or in combination, reflecting different aspects of population movements in the Arctic regions — migration flows that characterize the resettlement process and the resulting migration stocks [2].

The current accounting of migration since 1997 separately identifies movement in the regions of the Far North and areas equated to them. Currently, Rosstat is compiling tables SPr1_REG "Distribution of migrants aged 14 and older by circumstances that necessitated a change of residence, and regions from which migrants arrived and where they departed to in the Far North and areas equated to them" and SV2_REG "Distribution of migrants by gender, age and regions, where migrants came from and where they are leaving to in the Far North and areas equated to them", which can be used for migration research. Information on the interregional migration of the population aged 14 and older is the basis for the work of I.S. Stepus, V.A. Gurtov, and A.O. Averyanov, who not only estimated the volume of registered interregional migration, but also identified 15 labor surplus regions, from which the largest number of migrants arrive in the Arctic every year [3].

Another administrative source that makes it possible to identify the directions of educational migration is data on the distribution of school graduates provided by regional executive authorities managing education. According to the study by I.S. Stepus and co-authors, conducted on the basis of such information, about 90% of school graduates in the Yamalo-Nenets AO, 75% of the Nenets AO and 71% of the Chukotka AO form their educational trajectory outside their region [1].

Sociological methods are widely used to study youth migration, including educational and postgraduate migration. The main attention is paid to identifying migration attitudes and factors influencing the desire to leave, stay or move to the regions of the Arctic zone of the Russian Federation. Using surveys of northerners, researchers identify the orientation of different groups of young people to move, the reasons for migration, as well as factors of outflow and settling down [4]. The works, the empirical base of which is formed by surveys of students of professional educational institutions of the Arctic regions, analyze the educational plans of young people and their readiness to leave the Arctic regions [5, 6]. Galimullin E.Z. [7] used a survey to identify the atti-

tudes of young people aged 18 to 33 living outside the Arctic region in order to identify facilitating and hindering factors for a possible move to a place of residence in the regions of the Arctic zone.

In the modern information society, methods based on the use of "big data" are becoming increasingly widespread when studying different types of migration. This kind of information includes data about users, which remain in the form of digital traces in social networks or after calls from mobile phones, queries in search systems, information about payments using bank cards, connection to Wi-Fi networks, information from ticket services, etc. [8] "Big data" or "digital footprints" have emerged as new sources of migration measurement, supplementing "traditional" information from censuses and administrative sources.

The value of digital sources is the ability to identify migration trajectories between municipalities and even localities. The first works using data from the most widespread social network in Russia "VKontakte" were carried out by N.V. Zamyatina and A.N. Pilyasov, who analyzed the relationships between the cities of Yamal and the geographic distribution of young migrants from northern cities (Noyabrsk, Magadan , Norilsk) [9]. In development of these studies, based on downloads from the social network carried out at the beginning of 2015, a web atlas "Virtual population of Russia" was prepared, which provides information about universities of study, age, common names, friendships and other characteristics of users of the social network [10]. This project, being a significant research, is also used as a source of information for work devoted to migration routes of the population of the Arctic regions. Thus, V.V. Fauser and A.V. Smirnov analyzed social network data to identify the migration preferences of residents of the Russian Arctic. The study showed that residents of most territories tend to move to their regional capitals, and among the main centers, St. Petersburg is more attractive for residents of the European Arctic, and Moscow — for the Asian Arctic [11]. It is proposed to track digital traces of the movement of the population of the Arctic zone of the Russian Federation by air and rail transport on the basis of the ticket sales service Tutu.ru [12].

Studies using "big data" can probably include those based on the comparison of the information base on the results of the Unified State Exam (USE) and the results of admission to universities [13]. This approach demonstrates the typology of Russian regions according to the peculiarities of youth migration, in which the Arctic subjects of the Russian Federation that do not have their own universities are categorized as donor regions.

Materials and methods

Data from population censuses and current migration records, with confidence in the quality of the information collected, make it possible to estimate the volume of migration at individual ages, but not the directions of movement at the level of municipalities. In addition, Rosstat do not provide detailed information on the geography of migration of representatives of certain age groups (for example, youth), as well as on the number of those who moved to get higher education.

The problem of studying interregional and intermunicipal flows of educational migrants can be solved using “big data”, including profile data of social network users. To identify places of higher education for natives and school graduates of Arctic regions that do not have independent universities, we used the data download of the digital footprint of users of the social network VKontakte, made in the laboratory of applied analysis of big data at Tomsk State University using the platform “SN Lab” (https://lk.opendata.university) in February 2022. This social network is the most popular in Russia and ranks 8th in the world among social networks [2]. All profiles of users with accounts open for uploading were used; the profiles had the filled in fields “hometown” (if not specified, then the field “school”), “city of university” (if more than one university was specified, the last one was taken into account), “date of birth” (users younger than 17 were excluded). Small centers of higher education with less than 300 students were also excluded.

User information about their “native” settlement was linked to specific municipalities based on the ISRD platform data set (infrastructure for scientific research data) “Settlements of Russia: population and geographic coordinates” [3]. The final database for the whole of Russia covered the profiles of 3.656 million unique VKontakte users, of which the users of the municipalities of Nenets, Chukotka and Yamalo-Nenets okrugs, who indicated their hometown or school graduation place, accounted for 806, 1417 and 12963 people, respectively. Analysis of the data obtained showed that in all other regions of the Russian Federation, the majority of natives and school graduates indicate in their VKontakte profiles that they received higher education in the administrative centers or largest cities of their constituent entities of the Russian Federation.

A typology of municipalities in the Nenets, Chukotka and Yamalo-Nenets okrugs was carried out using the database of VKontakte users. We proposed and calculated the coefficients of concentration and uniformity of migration flow distribution. The coefficients correlate with each other, but the first one reflects the dominance of the leading centers, and the second — the degree of uniformity of the migration flow distribution.

The concentration coefficient of the migration flow (CR) shows the degree of limitation of the distribution of the migration flow; it is calculated as a percentage of the amount of migration to the largest recipient municipalities to the total amount of migration in a given subject (1):

$$\mathrm{CR}_n = \sum_{i=1}^{n} S_i,$$

where S_i — share of the recipient municipality in population migration indicators,

n — number of recipient municipalities participating in the coefficient calculations.

The work calculated the concentration coefficient of three leading cities (CR_3), ten leading cities (CR_{10}). By analogy with the analysis of the concentration of market structures, municipalities with a low level of concentration (CR_3 less than 45%), with a moderate level of concentration (CR_3

[2] Similarweb. vk.com. URL: https://www.similarweb.com/website/vk.com/#ranking (accessed 25 February 2023).
[3] Settlements of Russia: population and geographical coordinates. URL: http://data-in.ru/data-catalog/datasets/160/ (accessed 24 June 2022).

from 45 to 70%) and with a high level of concentration (CR_3 more than 70%) of the migration flow were identified.

The coefficient of uniformity of migration flow distribution was calculated as the sum of squares of shares (specific weights) of all municipalities (places) in the total migration flow (2):

$$HHR = \sum_{i=1}^{n} S_i^2,$$

where S_i — share of a municipality in the total value of migration flow.

Depending on the obtained values, all municipalities were distributed into three groups (by analogy with the grouping based on the Herfindahl–Hirschman index). The first group includes municipalities with an index in the range of 1800 <HHI <10,000 (uneven distribution). The second group is municipalities with an index in the range 1000 <HHI <1800 (relatively even distribution). The third group is municipalities with an even distribution of migration flow (HHI <1000).

Municipalities were classified according to the data on the migration flow concentration coefficient for the three leading municipalities (CR_3) and the data on the coefficient of uniformity of migration flow distribution (HHI). A total of 9 types of municipalities were identified.

Results and discussion

Completion of the educational process, which attaches a person to the institution, forms readiness to change one's territorial status. At this age, young people can move to the next stage of education by entering vocational education institutions, enter the labor market, get married, etc. All these events can be accompanied by a change of permanent residence, which is recorded by statistics. Significant migration loss is registered at the age corresponding to school graduation. Age coefficients of interregional migration growth for the regions under consideration are presented in Fig. 1.

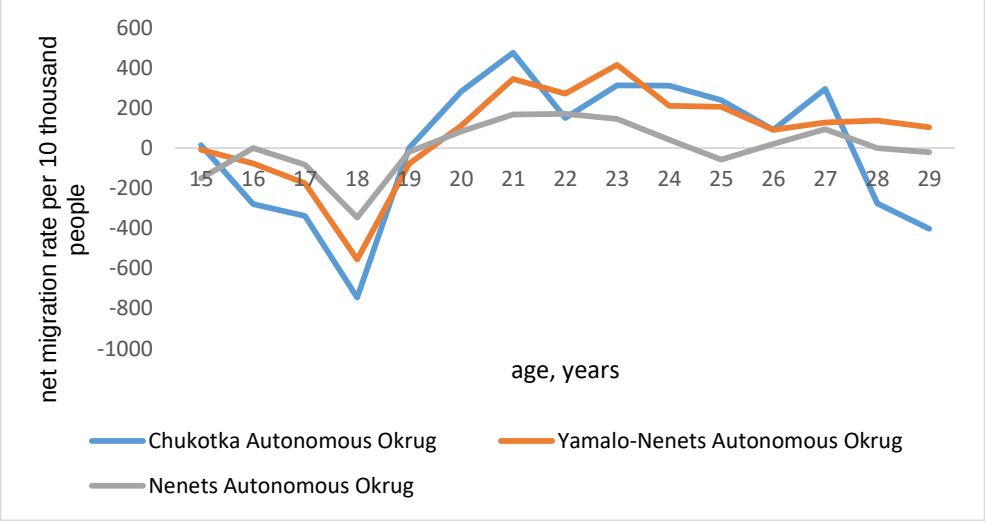

Fig. 1. Age coefficients of interregional migration loss in NAO, ChAO and YaNAO in 2021 [4]

[4] Calculated by: Table MV2 "Distribution of migrants by gender and age groups for 2021. Urban and rural areas. Interregional migration", Database of indicators of municipalities. URL: https://www.gks.ru/dbscripts/munst/ (accessed 24 May 2023).

The absolute values of migration loss or gain are variable and do not exceed tens of people in the sparsely populated Nenets and Chukotka Autonomous Okrug, and hundreds in the Yamalo-Nenets Autonomous Okrug in each of the one-year cohorts. For all regions, the maximum migration decline occurs at the age of 18 — the time when most Russian schoolchildren receive complete secondary education. Unfortunately, traditional statistics do not allow us to judge specific areas of migration either in the context of individual age groups (youth) or in relation to the reasons for migration (higher education).

Census data also indicate a decrease in the number of young people in the autonomous okrugs. Despite the fact that the population of the subjects under consideration decreased insignificantly during the inter-census period, a comparison of population censuses demonstrates a reduction in the cohort of 20–24 years old by 2021 compared to the age group 10–14 years old in 2010 (Table 1). Since mortality losses in these age cohorts do not make a significant contribution to changes in the number of young people, it is obvious that the migration plays a decisive role.

Table 1

Changes in the population of NAO, ChAO and YaNAO during the inter-census period [5]

Area	Census-2010			Census-2020		
	population	10–14 years old		population	20–24 years old [6]	
		people	%		people	%
NAO	42 090	2 720	6.5	41 434	1 969	4.8
ChAO	50 526	3 363	6.7	47 490	2 248	4.7
YaNAO	522 904	33 970	6.5	510 490	25 335	5.0
Russia	142 856 536	6 609 822	4.6	147 182 123	7 750 398	5.3

The educational migration trajectories of natives of Chukotka are characterized by the choice of more remote centers, the low attractiveness of universities in Magadan, which rank only 6th, as well as the higher importance of Moscow than St. Petersburg. The third most important center of higher education for natives and school graduates of the Chukotka Autonomous Okrug is Khabarovsk.

The coefficients of concentration (by CR_3 and CR_{10}) and uniformity of the migration flow of municipal entities were calculated for each municipality (Table 2). The ratio of CR_3 and HHR coefficients was used as a basis for the typology of municipalities in NAO, ChAO and YaNAO.

Table 2

Coefficients of uniformity and concentration of migration flow in municipalities of NAO, ChAO and YaNAO

Municipalities entities	Coefficient of uniformity of migration flow	Coefficient of migration flow concentration by three leading centres, CR_3	Coefficient of migration flow concentration by ten leading regions, CR_{10}

[5] Calculated by: All-Russian Population Census 2020. Volume 2. Age, gender composition and marital status. URL: https://rosstat.gov.ru/vpn_popul; All-Russian Population Census 2010. Vol. 2. Age, gender composition and marital status. URL: https://www.gks.ru/free_doc/new_site/perepis2010/croc/perepis_itogi1612.htm (accessed 24 May 2023).

[6] The age cohorts under consideration do not fully correspond because 11 years have passed between the 2010 and 2020 censuses.

NAO	2113	72	87
Naryan-Mar	2100	73	87
Zapolyarnyy region	2348	69	90
ChAO	***645***	***39***	***59***
Anadyrskiy region	628	38	61
Anadyr	809	44	65
Bilibinskiy region	610	36	62
Egvekinot	562	35	54
Providenskiy	838	44	71
Pevek	663	37	57
Chukotka region	675	34	59
YaNAO	***774***	***38***	***71***
Gubkinskiy	1004	46	74
Krasnoselkupskiy district	1456	55	78
Labytnangi	947	48	73
Muravlenko	827	40	71
Nadymskiy region	1021	50	75
Novyy Urengoy	1364	57	79
Noyabrsk	1441	61	91
Priuralskiy region	686	37	67
Purovskiy region	1027	46	70
Salekhard	1687	64	88
Tazovskiy region	1145	45	69
Shuryshkarskiy region	1964	61	91
Yamal region	1734	55	82
NAO, CHAO, YaNAO on average	***1160***	***38***	***66***

The study of statistical sources has shown a noticeable outflow of young people from the autonomous okrugs of the Arctic zone. Data on the directions of migration flows by region and municipality were obtained as a result of processing the digital traces of 15,186 users of the VKontakte social network. The migration trajectories of natives and school graduates of the regions under consideration, associated with obtaining higher education, are presented in Fig. 2.

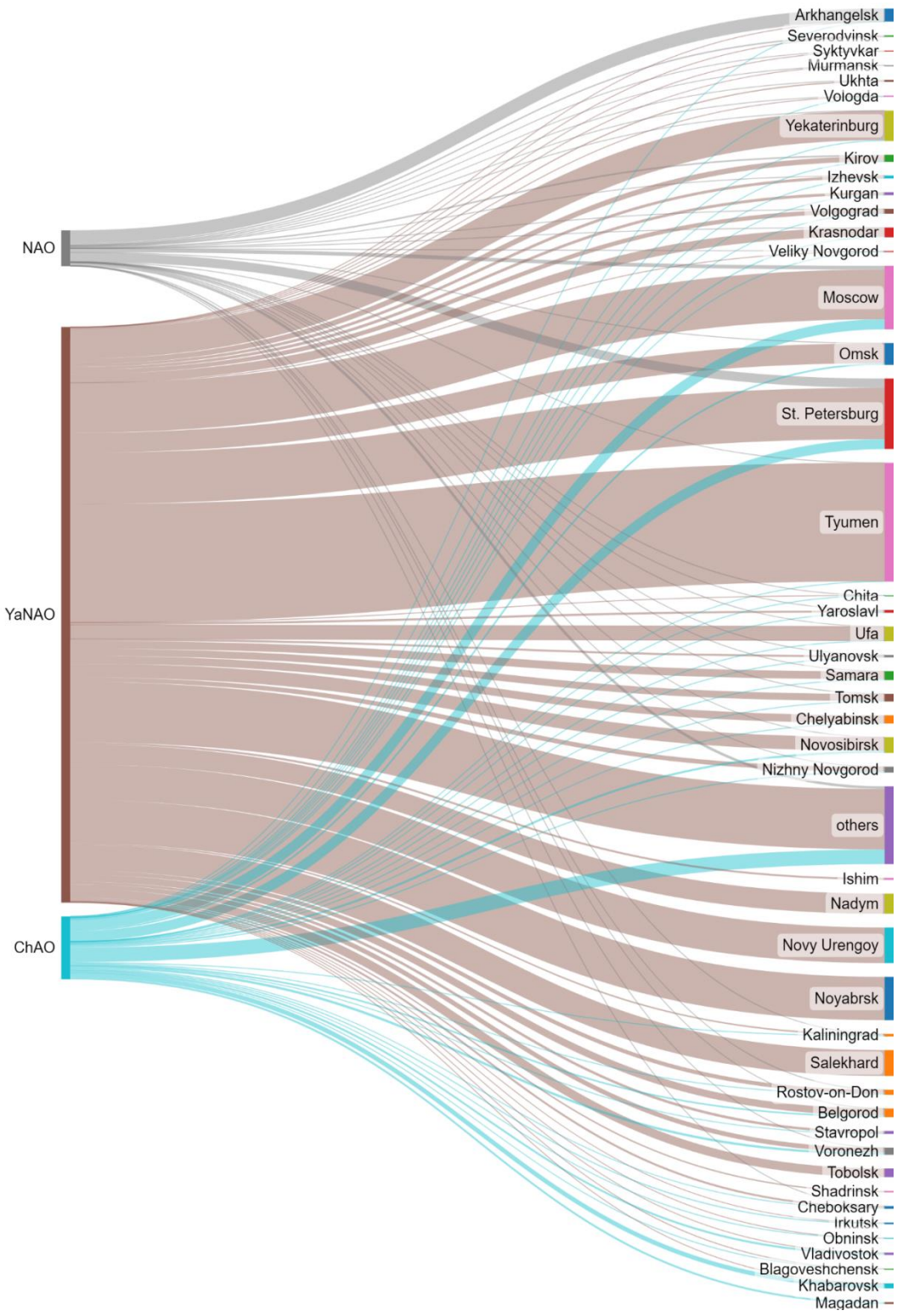

Fig. 2. Distribution of VKontakte users from NAO, ChAO and YaNAO by centers of higher education.

Natives of the districts that are part of the complex constituent entities of the Russian Federation are traditionally move to the regional centers (Arkhangelsk, Tyumen) to receive higher education. About 18% of natives and school graduates of the Yamal-Nenets Autonomous Okrug indicated in their VKontakte profiles that they were studying at university branches in Noyabrsk, Nadym, Novyy Urengoy, and Salekhard, most of which are closed now. It should be noted that social network users who indicated studying at these centers are most often not educational mi-

grants, as they were born or graduated from school there. Among the metropolitan centers, residents of Yamal and the Nenets AO give greater preference to universities in St. Petersburg than in Moscow.

Most municipalities belong to types I and V. Type I is characterized by a low level of concentration and even distribution of the migration flow. Among 9 municipalities of type I, 7 ones belong to the Chukotka Autonomous Okrug. There are no clearly defined points of attraction for residents of municipalities belonging to this type. Migration to Moscow and St. Petersburg, although predominant, does not dominate.

Type V includes 8 municipalities. All of them are part of the Yamalo-Nenets Autonomous Okrug. Municipalities of this type are characterized by average levels of concentration and distribution of migration flow. A feature of migration processes is the low values of metropolitan migration. Most often, residents move to Tyumen or stay in the place of permanent residence (Salekhard, Novyy Urengoy, Noyabrsk).

Two municipalities were included in the VIII type. This type is characterized by a moderate level of concentration and significant unevenness of migration flow distribution. At the same time, there is a clear center of attraction of migration flows. Thus, 42% of residents of the Zapolarnyy region of the Nenets Autonomous Okrug move to Arkhangelsk, and approximately 39% of residents of the Shuryshkarskiy municipal district of the Yamalo-Nenets Autonomous Okrug leave for Tyumen.

Types II, IV and IX include one municipality each. Type II is characterized by an even distribution of the migration flow and a moderate level of its concentration. Labytnangi, which is included in this type, is practically on the upper boundary of the two indicators. Therefore, despite the fact that, according to the HHR indicator, the municipality is classified as having an even distribution of migration flow, almost half of the population leaves for only three cities: Tyumen, Moscow and St. Petersburg. The Tazovskiy municipal district (Yamalo-Nenets Autonomous Okrug), included in type IV, is a recipient for Tyumen (30.3%), while the share of other areas does not exceed 8%. Type IX includes the city of Naryan-Mar (Nenets Autonomous Okrug), which is characterized by both one of the highest values of the concentration coefficient and significant unevenness of the migration flow. There are no municipal formations in types III, VI and VII (Fig. 3).

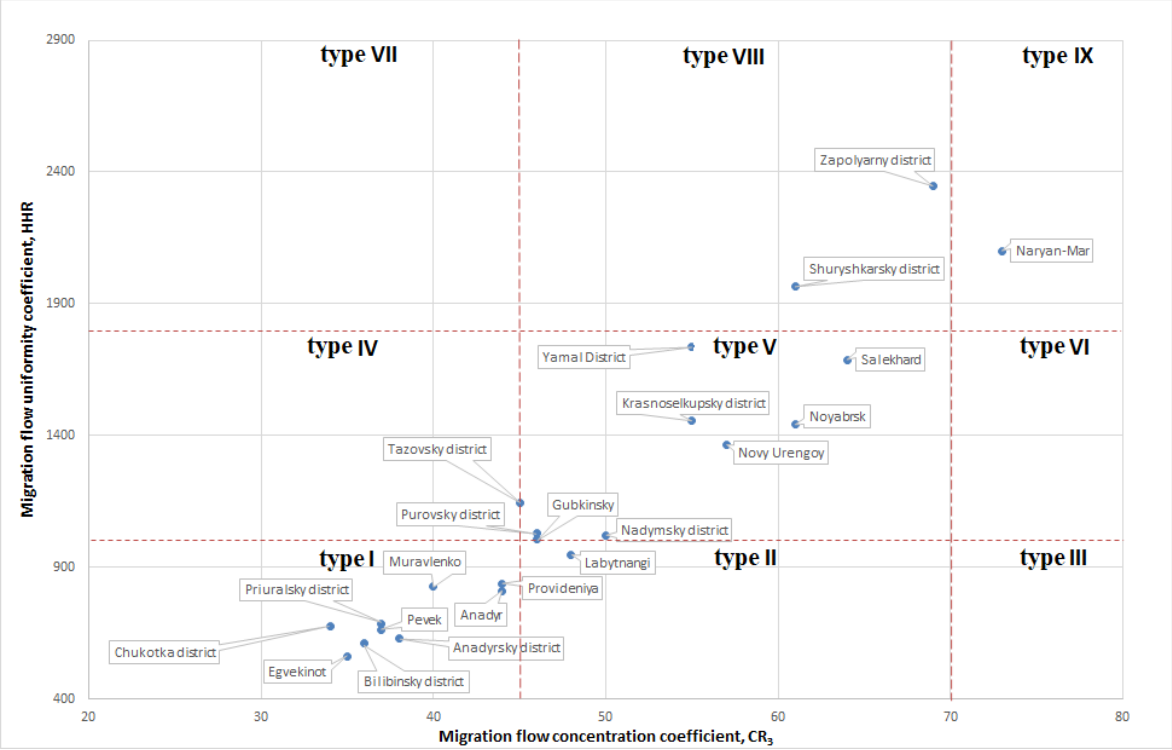

Fig. 3. Typology of municipalities of the NAO, ChAO, YaNAO according to the coefficients of uniformity and concentration of the migration flow.

Conclusion

A study conducted using population census data, current migration records, as well as information from the social network, showed that the autonomous okrugs belonging to the Arctic zone of the Russian Federation are characterized by a significant migration outflow of the young population. A key role is played by the lack of a network of independent higher education institutions. Educational migration is largely irrevocable, as a result of which the Arctic regions lose part of their human potential, spend additional resources to compensate for losses and adapt personnel who have no experience of living in the North. The territorial structure of educational migration of natives and school graduates of different regions and municipalities of the Arctic zone differs markedly in terms of uniformity and concentration coefficients. The main centers of attraction for people from Chukotka are Moscow and St. Petersburg, and those from the Nenets and Yamal-Nenets Autonomous okrugs are Arkhangelsk and Tyumen, respectively, with a high share of St. Petersburg and Moscow. Migration associated with obtaining higher education will not have a negative impact on the economy and social sphere of the Arctic regions if socio-economic conditions facilitate the return of university graduates.

Further research on Arctic migration based on data from the profiles of social network users can be linked to obtaining more detailed information on the educational and career trajectory of northerners. Not only information about the routes of educational migration, but also about the fields of training, faculties and departments of study chosen by students is of interest. Data on the place of residence after graduation would make it possible to estimate the return migration of people from the Arctic regions. The information can be analyzed taking into account the age or

year of graduation of VKontakte users. However, the use of such tools raises the question of the sample volumes necessary to ensure representativeness and clarify the criteria for the reliability of the information obtained.

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Social Polarization and Income Differentiation on the "North-Center" Axis

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Abstract. The article focuses on the problem of social polarization in the global context and on the level of particular countries. The subject of the study is the economic and social parameters of functioning mechanisms of territorial development in the conditions of existing instability and social risk. Income differentiation is considered as a key factor of social distancing of society and as a determinant of social instability. The authors compare data from reports of international economic organizations, statistical bulletins and publications of the scientific community. The proportions of income inequality are analyzed in the cross-country and intra-country contexts; as an example, the regional differentiation of the Russian Arctic territories, as well as the urban and rural population of China, are assessed. Dynamic changes in absolute and relative terms of living standard indicators confirm the hypothesis of increasing social polarization. The development of the Russian Arctic territories demonstrates an imbalance between the living standards of the population and the perceived quality of life, while the main trends of regional inequality in China have clear group characteristics. The identified patterns can be used to adjust social and regional policies, to determine the parameters of development strategies and the content of government programs and projects.
Keywords: *social polarization, income inequality, social justice, standard of living, social risk protection*

Introduction

Issues of social equality and income distribution have been the subject of theoretical concepts and scientific discussions since Plato and Aristotle substantiated the egalitarian approach to social justice. Social risks and social tension in the global community are among the key challenges to sustainable development. Increasing socio-economic differentiation in the global and regional context, significant gap in the main parameters of the level and quality of life in terms of "Center — Periphery", loss of signs of consistency and unity of the economic space cause concern for development institutions.

The World Economic Forum's reports on global risks indicate an obvious shift of emphasis from environmental to social challenges to society. Social inequality in its extreme form — polarization of society, the main segments of which are increasingly diverging in terms of values and wealth — is among the top global risks not only in the current period, but also in the long term.

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Social polarization is a constant concern for the academic community, the public and non-profit sectors, and business structures. Experts have no doubt that social polarization and economic crisis are deeply interrelated in the global risk landscape, and this relationship has the greatest potential and generates numerous risks in various spheres and directions [1]. The economic burden on both people and low- and middle-income countries will increase.

Uneven development against the backdrop of global challenges has revealed new categories of social risks that require deeper and more thorough analysis: social distancing, social vulnerability, loss of social capital. The entire set of modern social risks has a negative impact on well-being, restrains dynamics and reduces opportunities for human development. While the situation with economic risks is more certain, as the world community has already developed regulatory mechanisms, social challenges require transformation of the system of social regulation of society.

Materials and methods

The scientific answer to one of the main economic questions "for whom to produce" after the egalitarian, Rawlsian and utilitarian approaches culminated in the liberal (market) justification of K. Marx, J.S. Mill, M. Weber. One of the modern and widely discussed concepts was proposed by T. Piketty in "Capital in the 21st century", in which he combined the theory of economic growth and the theory of income distribution (factor and individual) [1]. On the basis of correlation analysis, attempts have been made repeatedly to identify the dependence of income inequality on various exogenous and endogenous variables: phases of the economic cycle, demographic characteristics, and socio-political determinants.

Social polarization as an extreme degree of uneven development is considered by modern domestic scientists in different dimensions. The concepts of social polarization, social differentiation and social fragmentation are compared in philosophical works by O.D. Belobrova and Yu.V. Kolin. The sociological studies by A.L. Panishchev [2] and A.V. Sapronov [3] consider the structure, functions and consequences of social polarization. The socio-political mechanism of social polarization in society becomes the subject of study by L.E. Ilyicheva, A.V. Lapin [4]. In the context of spatial development (physical and geographical), this term is studied by V.Yu. Kuzin [5].

Foreign authors also raise the issues of inequality in opportunities depending on age, education, income level, ethnicity, race and political affiliation. Chinese researchers are active in this direction. The works by X. Yan [6], B. Wu [7], Z. Li [8], S.X.B. Zhao [9], Y. Zhao [10] and others consider the causes of regional inequality and its impact on human capital. The authors conduct an in-depth analysis of prospects and trends, comparing the values of individual social indicators in China with similar indicators of the BRICS countries. Over the past three decades, the rate of economic growth has allowed the Chinese economy to become the second largest in the world. However,

[1] World Economic Forum. Global Risks Report 2024, p. 7. URL: https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2024.pdf (accessed 15 February 2024).

this has had a negative impact on social development characteristics, widening the gap in China's national income distribution.

Regarding the northern and Arctic territories of Russia, a significant contribution to measuring the scale and trends of inequality is made by representatives of the Luzin Institute for Economic Studies of the Kola Science Centre of the Russian Academy of Sciences, the Federal Center for Integrated Arctic Research of the Ural Branch of the Russian Academy of Sciences, the Institute of Regional Consulting. They consider systemic factors of inequality as a potential threat to the sustainable development of the Arctic: for example, E.A. Korchak focuses on families with children [11], T.P. Skufina — on people of retirement age and residents of single-industry towns [12], E.N. Bogdanova, L.V. Voronina — on the indigenous and small-numbered peoples of the North [13].

The main trends in income distribution and the scale of social polarization in the global context are considered by the United Nations Development Program (UNDP) and the World Economic Fund (WEF) in the space of "challenges-threats-risks". Inequalities in human development received particular attention in the UNDP Human Development Report 2019 [2], and the following report examines the causes of inequality and, in particular, the dangerous planetary changes in the Anthropocene [3]. The Human Development Report 2021/2022 is entitled "Uncertain Times, Unsettled Lives: Shaping Our Future in a Changing World", it attempts to unify and broaden the debate on uncertainty and future development [4]. The emergence and manifestation of new forms of insecurity are analyzed in the Special Report on Human Security for 2022. The Human Development Report 2023–2024, entitled "Overcoming Deadlock: Rethinking Cooperation in a Polarized World" [5], opens a trilogy of reports on different levels of uncertainty, their identification and the formation of strategies for advancing human development. In this report, the centerpiece is an analysis of the recovery of the human development index (HDI) by country, and experts conclude that this process will be extremely uneven: the gap between countries in terms of HDI value is growing.

The annual WEF Global Risk Reports (GRR) are of particular interest to analysts, as they identify risks in the short and long term and assess them in terms of "probability – possible impact".

Social inequality and social instability in the context of global risks

A dynamic analysis of the results of WEF reports over the past dozen years reveals fundamental differences in assessments of global threats belonging to different categories. While eco-

[2] UN Development Programme. Human Development Report 2019: Beyond income, beyond averages, beyond today: inequalities in human development in the 21st century. URL: https://hdr.undp.org/system/files/documents/hdr2019ru.pdf (accessed 17 February 2024).
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nomic risks prevailed in 2009 and 2010, since 2017 they are no longer in the top five in terms of both probability and consequences, as the global community has already accumulated experience in managing such uncertainties. In the context of discussion on social risks, three stages of perception of their significance on the global agenda can be distinguished (Fig. 1).

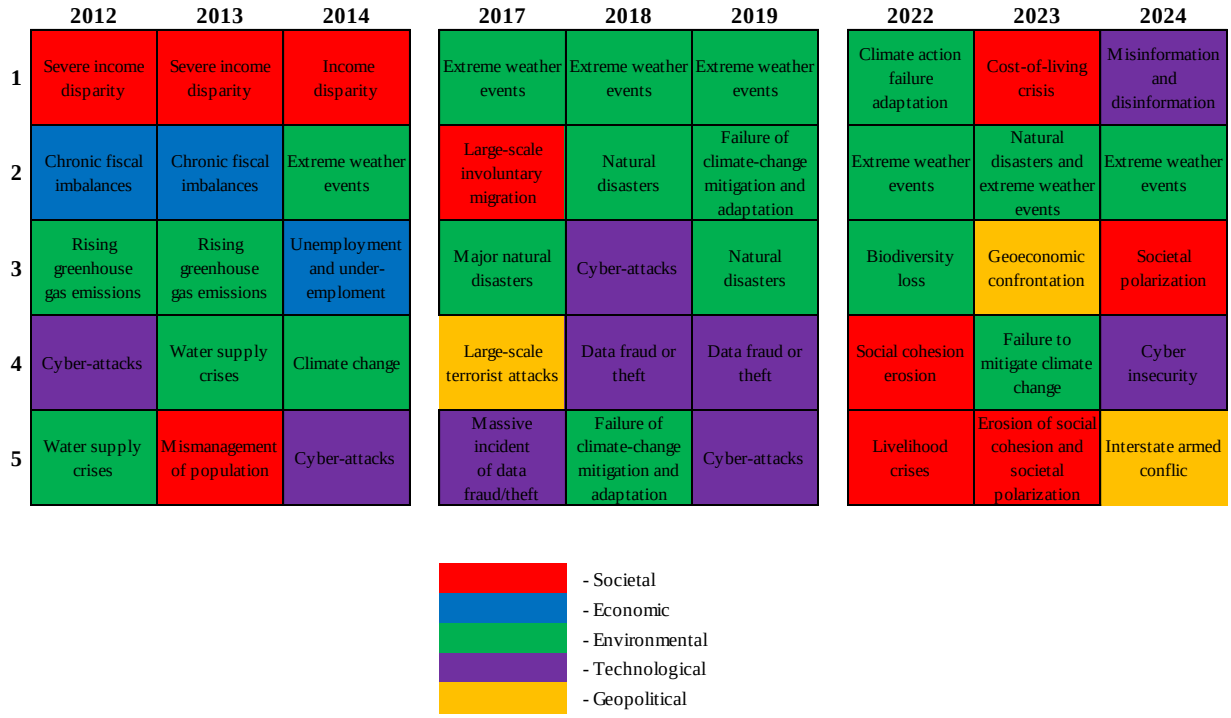

Fig. 1. Map of risks [6].

At the first stage (2012–2014), social risks occupied the first position, determining experts' concern about serious income inequality. In addition, in 2013, the risk of ineffective governance in the context of social policy implementation, which may deepen social instability in general, ranked fifth. The second stage (2017–2020) is the stage of leadership of environmental risks, which were located in 2–3 positions out of five not only in terms of probability, but also in terms of impact on development prospects. The third stage (2022–2024) — attention shifts again to social risks, while environmental risks do not lose their importance. At the third stage, the cost of living crisis remains a serious problem and a new concept appears — social polarization, which is interpreted as ideological and cultural differences within and between communities, leading to a decrease in social stability, deadlocks in decision-making, economic disruption and increased political polarization. In the 2024 report, WEF experts classify income inequality as an economic risk. Despite the

[6] Compiled by: World Economic Forum. Global Risks Report 2024. URL: https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2024.pdf (accessed 15 February 2024); World Economic Forum. Global Risks Report 2023. URL: https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2023.pdf (accessed 15 February 2024); World Economic Forum. Global Risks Report 2022. URL: https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2022.pdf (accessed 15 February 2024); World Economic Forum. Global Risks Report 2021. URL: https://www.weforum.org/publications/global-risks-report-2021/ (accessed 15 February 2024); World Economic Forum. Global Risks Report 2021. URL: https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2021.pdf (accessed 15 February 2024).

fact that this risk is not included in the consolidated top five, a number of countries, including 3 BRICS countries — Brazil, India and Iran — mention it in a detailed national report.

Classification of countries by income level allows analyzing the proportions of intercountry inequality by individual countries and by groups of countries (Table 1).

Table 1

Parameters of cross-country inequality, 2022 [7]

Ratio	GNI per capita (Atlas methodology), times	GNI per capita (PPP), times
GNI of the highest income country to GNI of the lowest income country	521.7	141.0
Average GNI value for a group of high-income countries compared to the average GNI value for a group of low-income countries	71.2	27.9
Average GNI of North America to average GNI of Sub-Saharan Africa	45.1	17.6

Differentiation of countries by income level is determined by the difference in the value of the main quantitative indicator — gross national income per capita. In terms of GNI per capita for 2022, calculated using the Atlas methodology, Bermuda leads with an income of $125,210, more than 520 times higher than Burundi with income of $240, which is the lowest in the list of countries. Looking at the GNI ratio of the groups of countries recognized by the World Bank as high- and low-income countries, the wealth gap is more than 7000%. It is worth noting that the differences in the level of GNI calculated using PPP are not so dramatic. Using this methodology, Norway has the highest GNI per capita ($118,470), which is 141 times higher than the income of Burundi.

The World Bank, in order to fulfil its primary objective of fighting poverty, compiles a databank of key inequality indicators through comparative assessments. Extreme poverty has been declining for nearly a quarter of a century, but the challenges of the past five years with the pandemic, geopolitical controversies and the climate agenda have worsened the situation, especially for countries with a large proportion of poor people. A slight decline in median income is also observed in the BRICS countries (Fig. 2).

[7] Calculated by: World Development Indicators database, World Bank, 1 July 2023. URL: https://databankfiles.worldbank.org/public/ddpext_download/GNIPC.pdf (accessed 10 February 2024).

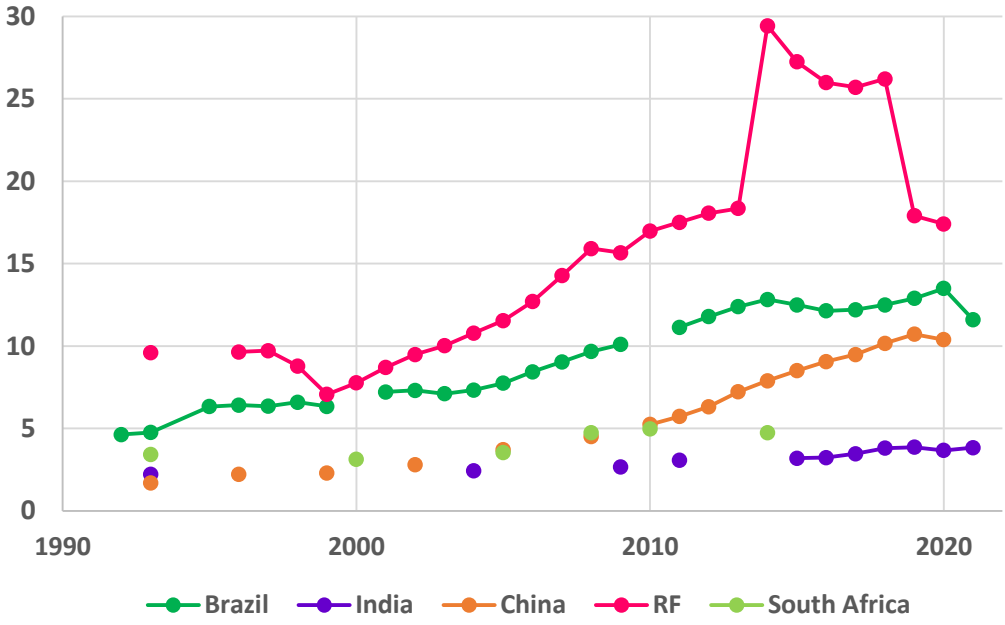

Fig. 2. Median income of the BRICS countries (composition of 2021) [8].

In the analyzed period, it is possible to observe changes in median income across the BRICS countries, with the trajectory proportional to the GDP growth rates of these countries. Differences in the cross-country values of the indicators remain significant.

Differences in income distribution between countries in the context of discussion on social polarization should be transferred to the analysis of differentiation of intra-country indicators. Changes in the Gini index as one of the key indicators characterizing the degree of income inequality in society are insignificant in most countries of the world, as well as in the BRICS countries (Fig. 3).

[8] Compiled using data from the World Bank's Poverty and Inequality Platform. URL: https://pip.worldbank.org/key-inequality-indicators (accessed 20 February 2024).

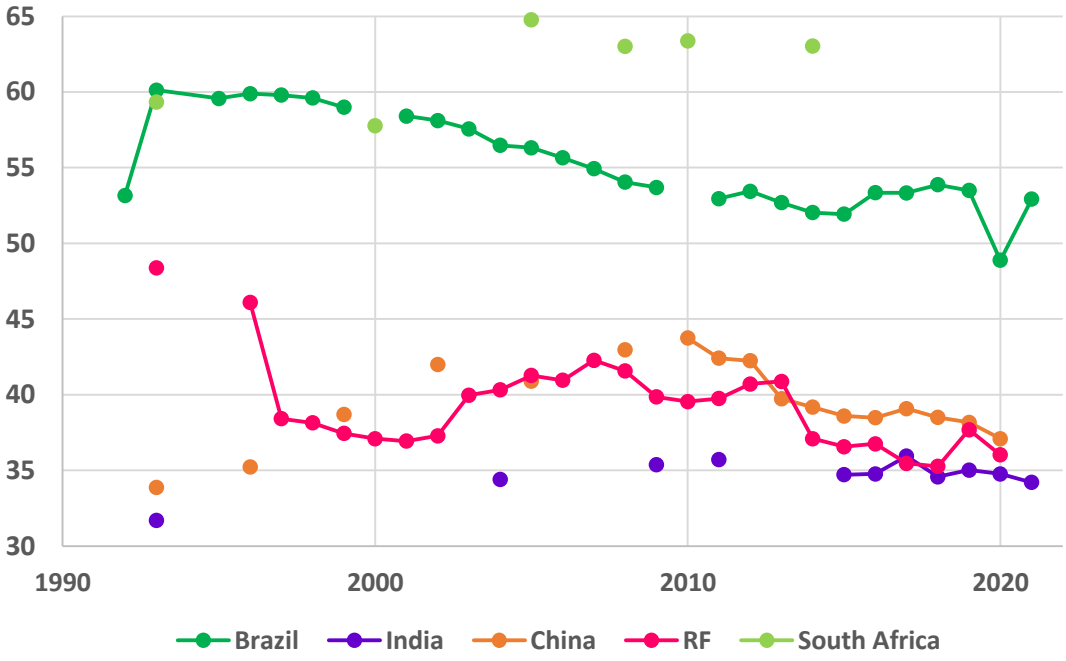

Fig. 3. The value of the Gini index of the BRICS countries (composition of 2021) [9].

It is worth noting that the Gini index values of Brazil and South Africa exceed the accepted optimal value (0.3–0.4), which indicates serious income inequality in these countries.

Differentiation of incomes of the population of the constituent entities of the Russian Federation with the Arctic territories

The parameters of income inequality in Russia vary significantly by individual territories. The presence of regional differentiation is demonstrated by published ratings on individual and aggregate indicators of socio-economic development of the constituent entities of the Russian Federation. For example, the potential cash balance of an average family with two children after minimum expenses varies from -7,298 to 118,310 rubles/month [10], and the quality of life rating score ranges from 26.506 to 83.640 [11]. Wages with percentage bonuses in the Soviet period of development of the northern territories compensated for the uncomfortable living and working conditions. In modern Russian economic conditions, the motivational function of the wage structure has ceased to work; despite this, the stereotype about the high level of income of the population of the northern and Arctic territories still exists.

A comparison of the positions of the Arctic subjects of the Russian Federation in terms of the level and quality of life does not confirm the hypothesis that there is a direct relationship between these indicators (Table 2). While the Arctic territories are in the top 20 in terms of wages (with the exception of the Republic of Karelia), and the Chukotka and Yamalo-Nenets Autonomous

[9] Compiled using data from the World Bank's Poverty and Inequality Platform. URL: https://pip.worldbank.org/key-inequality-indicators (accessed 20 February 2024).
[10] Rating of regions by level of family well-being — 2023. URL: https://riarating.ru/infografika/20230529/630242444.html (accessed 01 March 2024).
[11] Rating of regions by quality of life — 2023. URL: https://riarating.ru/infografika/20240212/630257500.html (accessed 01 March 2024).

okrugs occupy the first two positions, then in terms of quality of life, 6 out of 9 subjects are in the top 20 outsiders. The Chukotka Autonomous Okrug disproves the hypothesis “high incomes — high quality of life” most vividly: it is the first in terms of wages and 75th in terms of quality of life.

Table 2

Subjects of the Arctic zone in all-Russian ratings [12]

	Rating of regions by salaries	Rating of regions by family wealth	Rating of regions by quality of life
Yamalo-Nenets Autonomous Okrug	2	1	21
Murmansk Oblast	10	14	36
Krasnoyarsk Krai	12	10	40
Republic of Sakha (Yakutia)	8	8	70
Komi Republic	13	18	71
Nenets Autonomous Okrug	4	9	73
Republic of Karelia	26	55	74
Chukotka Autonomous Okrug	1	7	75
Arkhangelsk Oblast	17	21	78

Analyzing the statistical value of the income concentration index allows understanding how great the income inequality is within the Arctic subjects.

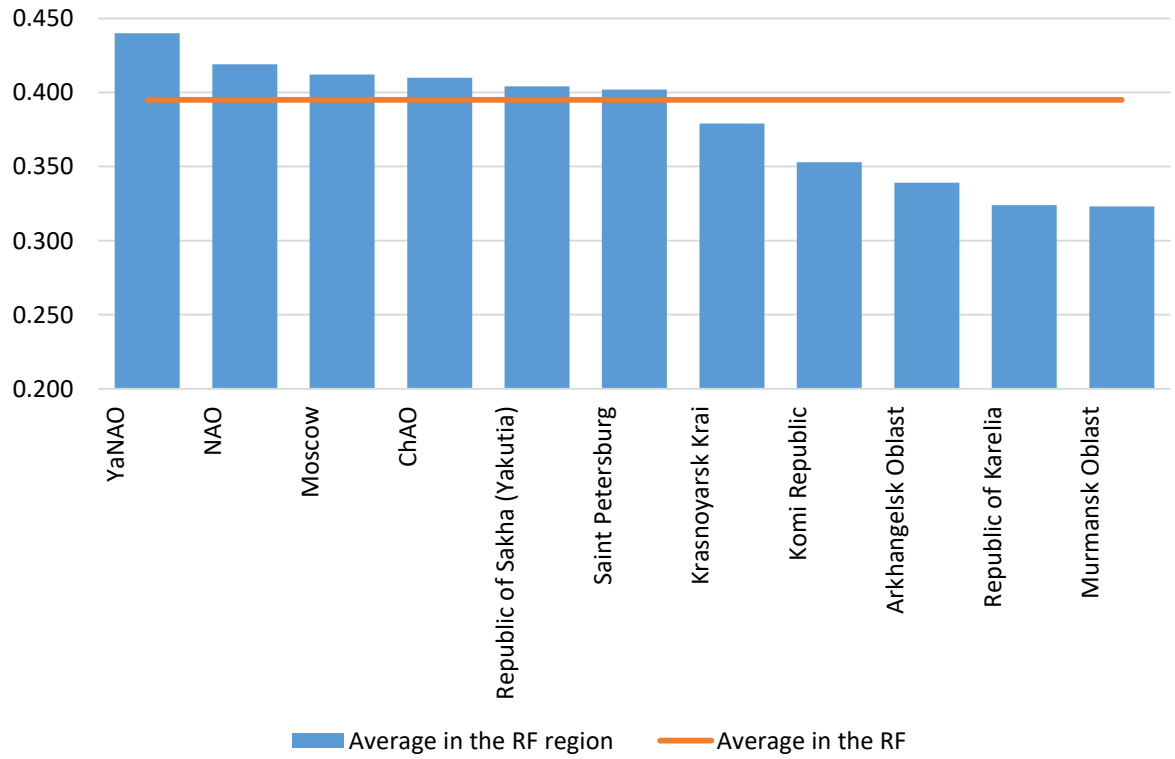

Fig. 4. Income concentration index, 2022 [13].

[12] Compiled using data from the Rating of Regions. URL: https://riarating.ru/infografika/20231120/630252682.html; https://riarating.ru/infografika/20230529/630242444.html; https://riarating.ru/infografika/20240212/630257500.html (accessed 01 March 2024).

Figure 4 demonstrates the differences in the Gini coefficient value from the Russian average and from capital cities. Of all the Arctic subjects, only the autonomous okrugs and the Republic of Sakha (Yakutia) have Gini index values that exceed the Russian average and at the same time go beyond the optimal value of 0.4, albeit insignificantly. It is worth noting that over the 10-year period, the average Russian value of the income concentration index has decreased, as well as in the majority of the subjects of the Arctic zone of the Russian Federation, with the exception of the Chukotka and Yamalo-Nenets Autonomous okrugs and the Republic of Sakha (Yakutia).

The effectiveness of the social policy of the Russian Federation in relation to income redistribution can be demonstrated by the dynamics of changes in the poverty rate (Fig. 4).

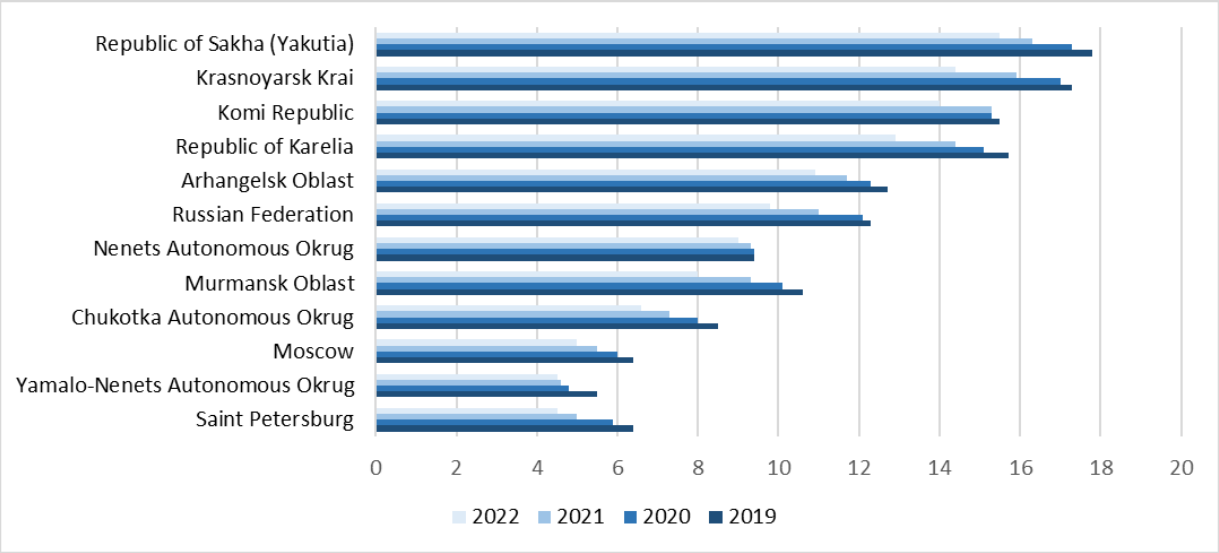

Fig. 4. Poverty rate, as a percentage of the total population [14].

Over the period 2019–2022, there is a decrease in the value of this indicator in Russia and in its constituent entities, but only in 3 constituent entities of the Arctic zone the poverty level is lower than in the country as a whole, which should be reflected in the adjustment of regional policy.

It is worth noting that since 2021, the approach to determining the value of the subsistence rate has changed, which allowed bringing its value closer to its basic content. One of the options for assessing the quality of life of the working-age population is to estimate the ratio of wages and the subsistence rate (Table 3).

Table 3

Ratio of average wages and per capita income to the subsistence rate of the constituent entities of the Russian Federation [15]

	Ratio of the average monthly nominal gross wage to the subsistence rate		Ratio of median average per capita income to the subsistence rate	
	2021	2022	2021	2022

[13] Compiled on the basis of data of the Federal State Statistics Service. Gini coefficient (income concentration index) by constituent entities of the Russian Federation. URL: https://rosstat.gov.ru/folder/13723 (accessed 01 March 2024).
[14] Ibid.
[15] Ibid.

Russian Federation	4.9	4.7	2.6	2.5
Moscow	6.2	6.1	3.6	3.6
Saint Petersburg	6.4	6.0	3.6	3.5
Yamalo-Nenets Autonomous Okrug	6.8	6.6	4.0	3.9
Chukotka Autonomous Okrug	5.4	4.4	3.1	2.6
Nenets Autonomous Okrug	4.3	4.2	2.8	2.8
Republic of Sakha (Yakutia)	4.6	4.6	2.1	2.1
Krasnoyarsk Krai	4.5	4.6	2.1	2.1
Komi Republic	4.2	4.1	2.1	2.0
Arhangelsk Oblast	4.2	4.0	2.2	2.1
Murmansk Oblast	4.1	4.1	2.3	2.2
Republic of Karelia	3.4	3.4	2.0	2.0

In world practice, the excess of wages over the subsistence rate is interpreted as follows: if this ratio is from 3 to 5 times, then the quality of life of the working-age population can be considered average, if it is above 5 — high [14, p. 19]. The analysis of Rosstat data demonstrates that only capital cities, the Yamalo-Nenets Autonomous Okrug and the Chukotka Autonomous Okrug (only in 2021) can meet a high quality of life, while the Republic of Karelia is at the lowest level of all Arctic subjects by this indicator. If we take the median average per capita income rather than wages as a basis for comparison, the ratio in most of the subjects of the Arctic zone of the Russian Federation is barely more than twice as high. This analysis once again confirms the thesis about the presence of regional income differentiation and at the same time refutes the assumption about the high level of income of the population of the Arctic territories.

Trends in regional income inequality in China

The problem of income inequality in China has become one of the central issues over the past two decades, especially against the backdrop of statistical indicators of the Gini coefficient, which rose from 0.317 in 1978 to 0.465 in 2019. According to the results of the National Bureau of Statistics in 2022, the per capita disposable income of the 20% of households with the highest incomes is 10.5 times higher than that of the 20% of households with the lowest incomes [16]. The identified trends in regional inequality in China show clear group characteristics reflected in urban and rural populations, individual sectors of the manufacturing and non-manufacturing industries, as well as regional differentiation.

There is an increasing attention of experts comparing the growth rate of real income with the increasing income differentiation of the population in the Eastern, Central and Northeastern regions. Figure 5 and Table 4 present the distribution and growth rates of household disposable income by PRC regions. The largest developing economy demonstrates an increase in the disposable income of the population throughout the entire study period.

[16] China Statistical Yearbook 2023. URL: https://www.stats.gov.cn/sj/ndsj/2023/indexeh.htm (accessed 02 March 2024).

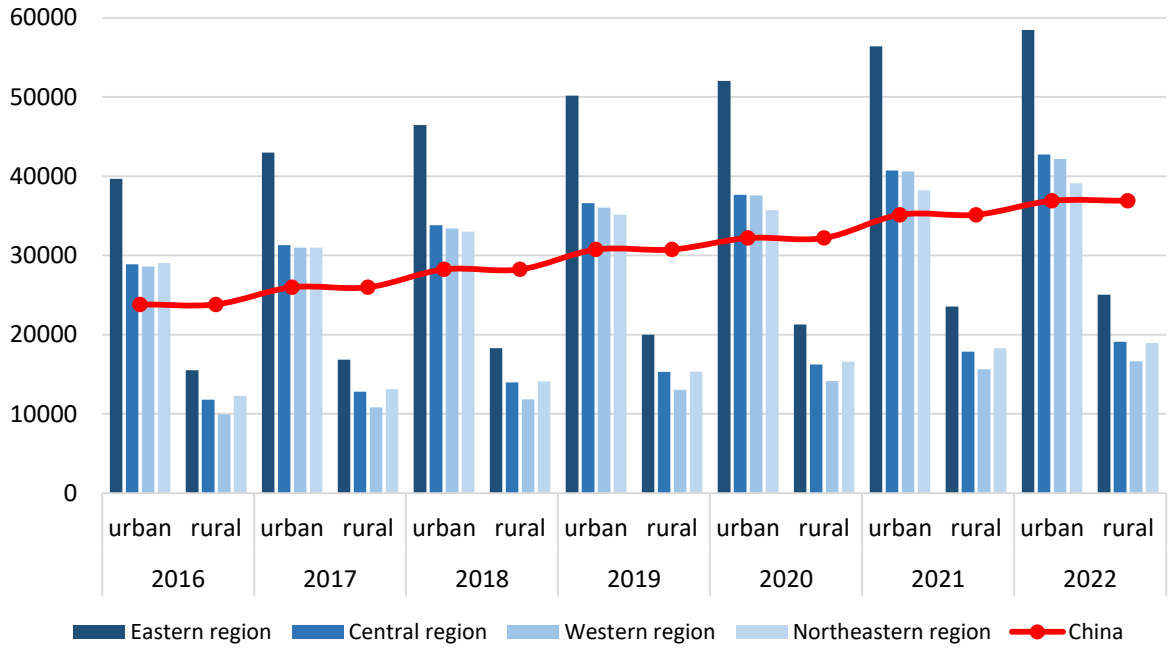

Fig. 5. Disposable income of urban and rural households per capita in the Eastern, Central, Western and Northeastern regions of China, RMB [17].

The following characteristics of inequality can be identified:

- the highest level of disposable income per capita is achieved in Eastern China, and the lowest — in the Northeastern China (urban population) and Western China (rural population);
- the disposable income level of the urban population in all areas exceeds the national average, while that of the rural population lags far behind;
- the gap in the income level of the urban population at a regional level increases from 1.36 in 2016 to 1.50 in 2022, and the gap in the rural population decreases from 1.56 in 2016 to 1.50 in 2022;
- low growth rates are observed in 2020 and 2022, except for the rural population in Northeast China;
- the growth rate of rural disposable income exceeds the growth rate of urban disposable income over 2016–2022;
- the highest growth rates are demonstrated by the income of the rural population in 2021 in all regions of China (10.1–10.7).

[17] Compiled on the basis of China Statistical Yearbook 2023. URL: https://www.stats.gov.cn/sj/ndsj/2023/indexeh.htm (accessed 02 March 2024).

Table 4

Growth rate of disposable income of rural and urban population in some regions of the PRC, percentage [18]

Group	2017 to 2016	2018 to 2017	2019 to 2018	2020 to 2019	2021 to 2020	2022 to 2021
Eastern region						
urban	8.4	8.0	8.0	3.8	8.4	3.7
rural	8.5	8.7	9.3	6.5	10.7	6.3
Central region						
urban	8.4	8.0	8.3	2.9	8.1	5.0
rural	8.6	9.0	9.6	6.0	10.1	6.8
Western region						
urban	8.3	7.8	7.9	4.2	8.1	3.9
rural	9.2	9.3	10.2	8.3	10.6	6.6
Northeastern region						
urban	6.6	6.6	6.5	1.6	7.1	2.3
rural	6.8	7.3	9.1	8.0	10.2	3.5

The reasons for increasing income inequality in different regions of China are explained by a number of factors [8, p. 158]:

- Resource:
  - uneven settlement along the “north-south” axis due to internal migration;
  - differences in the provision of natural resources;
  - differences in experience of attracting and using foreign capital.
- Institutional:
  - low minimum wages;
  - loyal tax policy towards people with high incomes;
  - restrictions on labor migration.
- Industry:
  - immaturity of mechanisms for regulating the activities and pricing of natural monopolies;
  - high monopoly profits in the fields of electricity, telecommunications and finance.

Institutional and industry factors can be eliminated or partially compensated by competent regional policy of the PRC.

Conclusion

The analysis allows identifying only one characteristic of social polarization — the stratification of society by income, and therefore requires further research. At the same time, it can be argued with a high degree of probability that sustainable rates of economic growth may be accompanied by increased social imbalance, which in turn becomes a barrier to further development.

[18] Compiled on the basis of China Statistical Yearbook 2023. URL: https://www.stats.gov.cn/sj/ndsj/2023/indexeh.htm accessed 02 March 2024).

Analysis of the effectiveness of using territorial development tools should include an assessment of the degree of influence of social risks. There is no absolute equality between successful economic development and social stability of society. Issues of interconnectedness and interdependence of regional and social policies are subject to more serious study, especially for those regions that have specific characteristics and internal imbalances. Examples of such regions are the Arctic zone of the Russian Federation and Northeast China, where the analytical comparison of living standards leads to the need for continuous monitoring of changes in social processes. Monitoring of social risk protection of the territory as a feature of preserving its ability to continue to develop in the presence of external and internal negative impacts should become an obligatory element of regional policy. The more risk protection a socio-economic regional system possesses, the more viable it is. The main condition for sustainable regional development is not intensive rates of economic growth, but a high quality of life. Issues of reducing social polarization, social stratification, and social instability are a priority topic for the socially regulated development of territories in the global and regional dimensions.

The development of the social sphere in the ideology of a socially oriented economy should be carried out in the setting of simultaneous achievement of two goals:

- On the one hand, the elimination of income inequality and the development of the social potential of the territory, which is expressed in an increase in the degree of satisfaction of needs and real disposable (median) income of the population, as well as an increase in the value of the components of the human development index (healthy life expectancy and education).
- On the other hand, the elimination of inequality in opportunities, which is determined by the level and access to social benefits and services, as well as the provision of modern social infrastructure.

This goal-setting system, which forms the basis of strategic national and regional documents, can become an effective tool for motivating people to permanently reside and work in the northern territories.

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Population Health in the Russian Arctic: Problems, Challenges, Solutions

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Abstract. Significant lagging of the Arctic regions of Russia from the all-Russian values of life expectancy and mortality rates of people of working age is noted at the highest state level as one of the main threats to the socio-economic development of the Russian Arctic and ensuring its national security. This lag is largely due to the negative impact of extreme natural and climatic environmental conditions on the health of the population working and living in the Arctic. The presented article is aimed at systematizing the problems and challenges associated with the impact of the harsh natural and climatic conditions of the Arctic on the health of the population living there, as well as finding ways to adapt the public administration system to these challenges. Based on a critical analysis of scientific literature and official statistical information, the paper identifies the health features and the process of adaptation to the natural and climatic conditions of the Arctic for different groups of the Arctic population: indigenous, old-timers and newcomers. The authors have substantiated that the most vulnerable group of the population, whose health is most negatively affected by the extreme natural and climatic conditions of the Arctic, are migrants. On the basis of generalization of problems and peculiarities of public health of the Arctic population and systematization of the experience of previous scientific research, the directions of adaptation of the public administration system of the Arctic regions to the existing challenges have been developed. These directions are based on a differentiated approach to various groups of the Arctic population: indigenous, old-timers and newcomers. According to the authors, the implementation of the directions presented in the article, as well as the creation of the most favorable socio-economic living conditions, can compensate for physiological losses and improve the health indicators of Arctic residents.
Keywords: *population health, Russian Arctic, natural and climatic conditions, public administration*

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Introduction

The Arctic is a strategically important macro-region for the Russian Federation. Significant reserves of energy, biological, water and other resources necessary to ensure the overall security

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system of the country are concentrated here. However, it is important to realize that, along with natural and physical capital, the population makes a significant contribution to the national wealth and security of Russia. According to the Strategy for the Development of the Arctic Zone of the Russian Federation until 2035, one of the main threats that creates risks for the development of the Russian Arctic and ensuring its national security is the lagging in the values of indicators characterizing the quality of life in the Arctic zone from the all-Russian ones, including in terms of life expectancy at birth and mortality of people of working age. This lag is largely caused by the negative impact of the extreme natural conditions of the Arctic on the human body and health. Today, science has accumulated a vast amount of knowledge and information concerning public health issues of the population of the Arctic territories. Therefore, the purpose of this article is to systematize the problems and challenges associated with the impact of the harsh natural and climatic conditions of the Arctic on the health of the population living there, as well as to find ways to adapt the public administration system to these challenges.

Impact of the Arctic's natural and climatic conditions on the health of population

The impact of the severity of Arctic climatic conditions on the human body is dualistic. On the one hand, numerous studies have proven the negative impact on human health of such unfavorable natural and climatic factors in the Arctic as a lack of heat and light, a sharp change in photoperiodicity, increased geomagnetic activity, changes in atmospheric pressure, etc. [1, 2]. A large number of domestic scientific works are devoted to specific reactions of body arising in response to the impact of harsh Arctic climatic conditions: “polar stress syndrome” [3], immunodeficiencies [4], hypovitaminosis [5], arterial hypertension [6], etc. Taken together, the unfavorable natural and climatic factors of the Arctic negatively affect the functional state of the human body, reducing its performance and life expectancy, increasing morbidity and mortality [2].

This is confirmed by official statistical information obtained at the population level. According to Rosstat, in 2021, the level of morbidity of the population in all regions of the Russian Arctic, with the exception of Krasnoyarsk Krai, was higher than the average Russian value (Table 1). In some regions of the Russian Arctic, such as, for example, the Republic of Karelia, Nenets, Yamalo-Nenets and Chukotka Autonomous okrugs, the excess was 40–50% of the Russian average. The sustainable nature of this phenomenon is confirmed by the persistence of the negative trend in hyper morbidity among the population of the Russian Arctic throughout the entire period under review (from 2005 to 2021). It should be noted that even the leader among the Arctic regions — the Krasnoyarsk Krai — was able to demonstrate lower morbidity values in comparison with the Russian average, not due to its decrease in the region, but due to a significant increase in the values of the analyzed indicator in the Russian Federation.

Table 1

Morbidity rate of the population of the Russian Arctic regions (per 1000 people, registered diseases among patients diagnosed for the first time in their lives) [1]

	Republic of Karelia	Komi Republic	Arkhangelsk Oblast	Nenets Autonomous Okrug	Murmansk Oblast	Yamalo-Nenets Autonomous Okrug	Krasnoyarsk Krai	Republic of Sakha (Yakutia)	Chukotka Autonomous Okrug	Russian Federation
2005	1 027.1	960.4	903	1 632.4	799.3	1 178	752.7	881.7	1 189.1	743.7
2006	1 046.7	966.3	967.9	1 765.1	844.2	1 171	773	951.8	1 149	760.9
2007	1027.7	989.1	952.2	1 752	852.4	1 155.8	806.7	933.1	1 117.9	767.3
2008	1 055.2	986.4	983.8	1 746.7	853.1	1 179.7	801.6	978.9	1 110.9	767.7
2009	1 108.3	1 023.1	1 006.4	1 886.8	894.3	1 167.4	835	1 006.7	1 142.9	797.5
2010	1 078.8	1 035.2	1 021.4	1 813.8	891.9	1 151.5	813.3	1 023.4	1 213.5	780
2011	1 100.9	1 047.2	1 036.3	1 750.4	851.2	1 180.7	831.3	1 047.4	1 246.8	796.9
2012	1 076.1	1 053.5	1 042.3	1 752	853.3	1 122.1	825.8	1 066.5	1 172.5	793.9
2013	1 115.4	1 047.4	1 008.6	1 573.1	896.7	1 191.9	807.9	1 107	1 122.8	799.4
2014	1 113.8	1 054.8	991.3	1 436.8	850.3	1 132.1	804.8	1 098.1	1 025.2	787.1
2015	1 114.3	1 072	1 015.9	1 421.4	835.5	1 096.9	784.9	1 026.6	1 076.3	778.2
2016	1 126.2	1 121.2	1 002.2	1 380.7	875.8	1 180.4	783.1	1 043.8	1 289.4	785.3
2017	1 175.1	1 158.5	998.5	1 361	825.3	1 224.4	795.6	1 021.1	1 342.9	778.9
2018	1 173	1 119.8	1 004.9	1 369.8	831.9	1 272	790.6	1 015.3	1 278.3	782.1
2019	1 165.7	1 082	980.2	1 386.1	823.1	1 291.9	773.3	1 032.9	1 149.2	780.2
2020	1 067.7	924.3	945.6	1 179	783.1	1 249.4	776.6	899.6	1 182.2	759.9
2021	1 246.9	1 043.8	1 028	1 188	920.2	1 308.4	852.4	1 053.8	1 189.2	857.1

Another key indicator of public health is life expectancy (LE). As can be seen from Table 2, life expectancy in almost all regions of the Russian Arctic (with the exception of the Yamalo-Nenets Autonomous Okrug) throughout the entire analyzed period from 2005 to 2021 was lower than the Russian average.

Table 2

Life expectancy at birth, years [2]

	Republic of Karelia	Komi Republic	Arkhangelsk Oblast	Nenets Autonomous Okrug	Murmansk Oblast	Yamalo-Nenets Autonomous Okrug	Krasnoyarsk Krai	Republic of Sakha (Yakutia)	Chukotka Autonomous Okrug	Russian Federation
2005	61.8	62.1	63	63	63.8	67.6	63	64.7	58.5	65.4
2006	63.5	64	64.9	62.3	65.2	68	65.5	65.5	59.6	66.7
2007	64.8	65.6	66.3	61.9	66.8	69.1	66.4	66.1	59.4	67.6
2008	65.1	65.9	67	63.2	66.7	69.1	66.8	65.8	60.3	68
2009	66.2	66.3	67.7	65	67.2	69.8	67.5	66.4	58.8	68.8

[1] Compiled by: Regions of Russia. Social and economic indicators. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed 08 June 2023).
[2] Ibid.

2010	66.4	66.9	67.9	64.9	68.4	70.1	67.6	66.8	57.5	68.9
2011	67.95	67.95	68.84	66.71	68.93	70.16	68.27	67.67	61.58	69.83
2012	68	68.33	69.71	68.21	69.81	70.66	68.42	67.93	60.79	70.24
2013	69.19	69.27	70.27	65.76	70.46	71.23	69.06	69.13	62.11	70.76
2014	69.36	69.05	70.2	70.65	69.97	71.92	69.23	69.81	62.32	70.93
2015	69.16	69.4	70.7	71	70.24	71.7	69.69	70.29	64.16	71.39
2016	69.78	69.45	70.8	71.08	70.94	72.13	70.01	70.84	64.42	71.87
2017	70.65	71.05	71.96	71.52	71.67	73.53	70.61	71.68	66.1	72.7
2018	70.56	71.06	72.09	71.85	71.68	74.07	70.71	72.72	63.58	72.91
2019	71.46	71.3	72.3	73.19	71.75	74.18	71.16	73	68.09	73.34
2020	69.63	70.3	71.39	70.4	69.81	71.91	69.82	71.1	65.82	71.54
2021	67.31	68.32	69.6	69.39	68.29	71.7	68.34	69.98	64.87	70.06

A retrospective analysis of the life expectancy indicator allows concluding that there is a widespread positive trend in the growth of its values in the period from 2005 to 2019. However, in 2020–2021, LE showed a serious decline both in the Arctic regions and in the country as a whole, which is directly related to the COVID-19 pandemic. Losses in life expectancy were highest in some regions of the European Arctic. Thus, life expectancy in the Republic of Karelia in 2021 decreased by more than 4 years relative to 2019, in the Nenets Autonomous Okrug — by 3.8 years, in the Murmansk Oblast — by 3.5 years. In other Arctic regions, life expectancy losses were comparable to or lower than the Russian average. However, the overall reduction in life expectancy in the Russian Federation and its Arctic regions was more than 3 years, which "threw them back" to the values of ten years ago. Thus, in 2021, life expectancy in Russia was 70 years, and in the regions of the Russian Arctic on average it barely exceeded 68.5 years.

Relatively low life expectancy values in the regions of the Russian Arctic are directly related to another feature of the public health: excess mortality in working age. As can be seen from the information presented in Table 3, the working-age mortality rate exceeded the Russian average throughout the entire period under consideration in the vast majority of the regions of the Russian Arctic. The greatest scale of this problem is typical for the Republic of Karelia, where the mortality rate of the population of working age in 2021 was 40% higher than in Russia, as well as for the Komi Republic and the Murmansk Oblast, where the excess ranged from 19 to 24%.

Table 3

Mortality rate at working age, per 100,000 people of working age [3]

	Republic of Karelia	Komi Republic	Arkhangelsk Oblast	Nenets Autonomous Okrug	Murmansk Oblast	Yamalo-Nenets Autonomous Okrug	Krasnoyarsk Krai	Republic of Sakha (Yakutia)	Chukotka Autonomous Okrug	Russian Federation
2005	1154.2	1046.3	899.3	1043.1	896.5	546.5	956.2	776.2	1070.2	826.5

[3] Compiled by: UISIS. State statistics. URL: https://www.fedstat.ru/indicator/59267?ysclid=lioitbhcpw415069823 (accessed 08 June 2023).

2006	1028.3	902.7	955.6	904.8	812.1	495.3	778.5	723.3	1135.3	746.1
2007	926.2	771.3	955.8	793.2	705	494.8	722.7	680.6	1141.1	695.4
2008	907.1	782	972.3	781.5	739.8	475.7	703.4	722.2	1 207.9	685.7
2009	863	794.1	915.8	737.2	710.1	478.8	664.9	725.6	1 227.2	641.7
2010	908	796.6	908.1	766.8	689.6	461.7	700	726	1 328.4	634
2011	789.4	741.2	824.9	709.9	657.7	458.2	668	679	1 010.6	600.9
2012	793.1	721.8	833.2	649.7	602.4	443.1	642.4	649.4	1053.2	575.7
2013	722.9	682.4	739.2	622.9	570.3	420.6	634.9	590.6	987.6	560.9
2014	722.7	700.1	570.6	636	617.6	437.1	631.4	571.2	953.4	565.6
2015	749.7	701.1	590	642.3	635.4	427.7	621.6	552.8	865.8	546.7
2016	684	691.1	576.6	637.5	582.6	424.6	611.6	532.2	827	525.3
2017	638	602.4	604.5	566.9	520.2	381.2	573.5	516.7	822.7	484.5
2018	677.8	607.7	528.9	570.9	547.8	359.9	583.4	468.8	954.6	482.2
2019	618.7	608.3	578.3	560.7	556.2	336	550.8	465.2	801.3	470
2020	744.2	658.3	629.2	630.1	664.1	441	624.4	538.4	853.2	548.2
2021	853.1	748.6	565.4	694.3	719	443.8	686.4	554.8	453.7	604.6

It should be noted that the analysis of official statistical information of the Arctic regions does not allow forming a completely objective picture. Thus, the statistics do not take into account that a significant part of the population, having completed their labor activity in the Arctic, leaves it for permanent residence in the middle and southern latitudes. As a result, diseases accumulated over the years of work in the Arctic manifest themselves in other regions, negatively affecting their statistical indicators. Thus, we can talk not only about the “export of mortality” from the Arctic regions noted by some scientists [7], but also about the “export of morbidity”.

On the other hand, the impact of the harsh natural and climatic conditions of the Arctic on human body triggers the process of adaptation. The representatives of the indigenous population (indigenous small-numbered peoples of the North, as well as indigenous peoples who do not have the status of small-numbered people, for example, Yakuts, Komi, etc.) are the most adapted to living in the Arctic. For them, the extreme conditions of the Arctic can be considered adequate and result in a number of morphological and physiological features, such as:

- increase in heat production due to the increase in the intensity of lipid metabolism and fatty acid content in blood and cell membranes, as well as activation of lipid peroxidation processes;
- intensification of energy processes and intensity of basic metabolism;
- significant development of the thorax, increase in the alveolar surface area and volume of the microcirculatory channel of the lungs;
- shortened inhalation phase and extended exhalation phase;
- hypotonic type of hemodynamics;
- nutritional adaptations: very high protein and fat content and low carbohydrate content in the diet;
- increased content of total protein in blood serum;

- high activity of lipolytic enzymes, increased levels of triglycerides, fatty acids and cholesterol;
- interhemispheric asymmetry, in which there is an increased activity of the right hemisphere with normal function of the left hemisphere of the brain, etc. [8, 9, 10].

These morpho-physiological characteristics of the indigenous population of the Arctic indicate evolutionary adaptation to extreme environmental conditions developed over many generations. At the same time, public health problems are also observed in this group of the Arctic population. Depending on their genesis, they can be subdivided into:

- health problems of the indigenous population of the Arctic associated with the traditional way of life: high level of traumatism (falls from sleds, snowmobiles, etc.); spread of various infectious and parasitic diseases (insufficient compliance with personal hygiene rules due to a nomadic lifestyle; low level of awareness about the ways of spreading diseases; eating raw, unprocessed meat and fish, etc.); high level of infant and child mortality (due to difficult access to medical care);
- health problems of the indigenous population of the Arctic, caused by the "westernization" of their way of life: high prevalence of alcoholism (due to a decrease in population tolerance to alcohol associated with enzyme deficiency [11]) and, as a consequence, high rates of alcohol-related mortality (among for the indigenous population, it is almost twice as high as among the immigrant population [12]); spread of sexually transmitted infections and tuberculosis [13]. The problem of transforming the nutrition of the indigenous population deserves special attention. Traditional nutrition for indigenous peoples involves high consumption of proteins and fats and ensures the maintenance of energy balance in harsh climatic conditions [14]. The change in nutrition from the use of local raw materials of animal and plant origin (venison, meat of wild animals and birds, fatty varieties of fish, various types of berries) to the consumption of fast carbohydrates, which are not typical for the indigenous population, has had an extremely negative impact on their health. Together with the general transformation of lifestyle, this factor provokes the emergence of various diseases that were previously considered uncharacteristic of indigenous peoples, in particular diseases of the circulatory system and diabetes mellitus [12, 15].

Some researchers note a high level of adaptation to the uncomfortable natural and climatic conditions of the Arctic not only among indigenous peoples, but also among the European population living there for four or more generations (old-timers) [16]. There is an extensive series of studies by physiological scientists reflecting the compensatory and adaptive mechanisms of various systems of the human body in the North, in particular the metabolic system [17], autonomic nervous system [18], endocrine [19] and immune systems [20]. However, the adaptive capabilities of the body of the old-time population of the North should not be overestimated. The overwhelming

majority of their compensatory reactions has their limited validity period and over time, as a rule, still turns into pathology.

However, the most vulnerable groups of the population, whose health is most negatively affected by the extreme natural and climatic conditions of the Arctic, are migrants. Data of numerous studies show the high complexity of adaptation processes among the immigrant population in the North [21].

The migrants' bodies are adapted to the complex of environmental factors in which they lived. Moving to unfavorable natural and climatic conditions of the Arctic leads to stress of regulatory systems, disruption of the internal environment constancy and even disruption of adaptation processes; this leads to aggravation of chronic diseases and emergence of new ones. This is a "biosocial payment" for achieving a state of adaptation with great stress, in overload mode, against the background of a restructuring of metabolic processes in the body [22].

The work of L.N. Maslova and co-authors notes that the main cause of mortality from cardiovascular accidents is dyslipidemia, which is developed much more often in the immigrant population living in the Far North for a long time. Among the indigenous population leading a traditional lifestyle, this pathology is much less common, which is apparently explained by the peculiarities of nutrition (frequent consumption of fatty fish) [23]. A number of scientific studies have noted lower morbidity and mortality rates from malignant neoplasms [24], diseases of the circulatory system (coronary heart disease, myocardial infarction, atherosclerosis of the coronary arteries) [25], as well as a lower prevalence of obesity and diabetes mellitus [26] among representatives indigenous nationalities of the North in comparison with the immigrant population.

The process of adaptation of the immigrant population to the extreme conditions of the Arctic is uneven. In certain periods (especially in the first months of life in the Arctic), there is a radical restructuring of the functioning of the physiological systems of the body, which is in a state of severe stress. In addition, researchers identify so-called critical periods of adaptation depending on the length of residence in the North, when, due to biorhythmological patterns, a decrease in the adaptive stability of the human body occurs over a period of about three years, which leads to maladaptive and subsequent pathological disorders [27].

In most cases, after a 10-year period of residence of the immigrant population in the North, the period of organism exhaustion begins, as it no longer has sufficient reserve capacities to function normally in these conditions [28]. This period is critical in making a decision to change a permanent place of residence. Later, remigration and the associated readaptation may have more negative consequences for the body than the decision to stay. Some of the migrants choose the Arctic as their permanent place of residence, which not only significantly increases the risk of premature aging and the development of various pathologies (primarily the cardiovascular and respiratory systems), but can also negatively affect future generations. Thus, according to V.S. Solovyov and co-authors, full adaptation of the newcomer population to the new hypocomforta-

ble, uncomfortable and extreme conditions of the Arctic may not happen even in the fourth generation of immigrants [29].

In recent years, the issue of human body adaptation to the natural and climatic conditions of the Arctic has been complicated by the problem of global climate change. WHO experts note that climate change is currently the main threat to human health. It increases mortality and morbidity due to the growing frequency of extreme weather events, leads to an increase in the number of zoonoses, injuries, intestinal infectious diseases, mental disorders, etc. [4] In the Arctic, where the rate of climate change is much higher than the global average, the issue of physiological adaptation to these rapid changes is of great importance. The problematic aspect is that the body of the indigenous peoples of the North and the old-time population, who have already adapted to the harsh natural conditions of the Arctic, is forced to spend resources on adaptation again.

Directions for adapting the public administration system to problems and challenges related to the impact of extreme Arctic conditions on public health

Thus, the above-mentioned challenges pose an extremely difficult task for the public health system of the Arctic regions of the Russian Federation to develop a set of adequate management responses and solutions. Having summarized the problems and peculiarities of public health of the Arctic population and systematized the experience of previous scientific research, the team of authors has developed the following most important directions for adapting the public administration system of the Arctic regions to the existing challenges:

1. Formation of a differentiated approach to the implementation of preventive measures and the provision of medical care in relation to various categories of the population of the Arctic regions.

Thus, V.I. Khasnulin and co-authors note that the lack of understanding of the difference in the mechanisms of formation of various diseases in the indigenous and non-indigenous populations of the Arctic, the lack of separation of morbidity and mortality statistics for indigenous and non-indigenous residents and the simple copying of “advanced” Western medical and preventive technologies without their adaptation to the Arctic specifics lead to low effectiveness of medical measures [27].

In our opinion, treatment and preventive measures should be developed separately for each group of the Arctic population: indigenous, old-timers and newcomers.

The most relevant for the indigenous population of the Arctic are:

2. Maximum preservation and maintenance of the traditional way of life of indigenous peoples. Many scientific studies of various directions confirm the higher level of health of the indigenous people leading a traditional way of life, which implies high physical activity and traditional nutrition. In turn, the indigenous population, which has abandoned the traditional way of life, is experiencing processes of maladaptation [30]. The rejection of the traditional type of eco-

[4] Climate change and health. World Health Organization. URL: https://www.who.int/ru/news-room/fact-sheets/detail/climate-change-and-health (accessed 05 June 2023).

nomic activity entails a mismatch of the body's regulatory systems, as a result of which the conditioned adaptation mechanisms can no longer fully act as protective ones, preventing the formation of diseases [10]. Thus, the preservation of the traditional way of life of indigenous peoples of the North is a guarantee of their health and well-being in the future.

3. Effective organization of medical care for the indigenous peoples of the Arctic in hard-to-reach areas, including:

- development of a system of regular medical examination of the indigenous population living in traditional tundra conditions;
- organization of medical and educational activities among the indigenous peoples of the Arctic. Many diseases among Arctic indigenous people leading a traditional way of life are caused by ignorance and non-compliance with the rules of personal hygiene, sanitary requirements for food processing, and rules for the care and feeding of infants. As a result, helminthic diseases, dental diseases (for example, dental caries was detected in more than 90% of the nomadic population), chronic nutritional disorders, dystrophy and intestinal dysfunction among children are widespread in this group of the Arctic population. Almost a quarter of children die in the first year of life from accidents: mechanical asphyxia, general hypothermia, foreign bodies in the respiratory tract [31]. All these cases of death and morbidity can be prevented by implementing special information and educational activities for the targeted distribution of information related to health problems. As noted by experts, it is most appropriate to conduct dispensary and health-education activities during the celebration of major national holidays (for example, Reindeer Day), when the tundra population gathers in one place. Mobile medical teams, travelling paramedics, as well as the introduction of the position of a sanitary assistant into the staff of reindeer herding brigades have proven to be the best way to implement these activities [31].

The most important issues for the old-timers of the Arctic are:

4. Development of intra-regional and intra-Arctic rotations.

From the point of view of saving financial resources, the use of a rotational method of territory development has a significant advantage. However, the social and cultural aspects, as well as the consequences for the health of employees working on a rotational basis are assessed extremely negatively [32]. According to Ya.A. Korneeva and co-authors, "climatic-geographical, industrial and social factors place impose requirements on the body of a rotational worker that exceed its reserves, which excludes the possibility of full adaptation of the body to these conditions and determines the presence of occupational health risks" [33]. Among these risks, it following should be noted: the negative impact on the body of shift workers of constant acclimatization and re-acclimatization, resulting in an increased level of morbidity and a temporary decrease in working capacity, as well as psychological stress associated with isolation from family, group isolation, inability to have privacy, etc. [33]. Obviously, it is impossible and impractical to completely aban-

don the shift as a method of organizing work. However, it is possible to minimize certain negative impacts on the human body through the development of intra-regional or intra-Arctic rotations. Such types of rotations imply the maximum preservation and optimal use of the labor potential already formed in the Arctic region and / or macro-region (the Russian Arctic), adapted to extreme natural and climatic conditions.

The most pressing issues for the Arctic immigrant population are:

5. Organization of selection of applicants for work in the Arctic conditions.

It is not enough to select healthy (without chronic diseases) people of young age to work in the harsh natural and climatic conditions of the Arctic. Thus, Academician V.P. Kaznacheev noted that in order to successfully adapt to the conditions of the Far North, a person should belong to a certain constitutional type of stayer, i.e. have the ability to withstand workloads for a long time [9]. Another constitutional type is the sprinter; on the contrary, it can withstand very heavy loads, but only for a short period of time. People of this type, according to V.P. Kaznacheev, will not be able to adapt to Arctic conditions even at a young age and in perfect health [9].

6. Continuous medical observation and consultation of the newcomer population.

As noted above, the process of adaptation of the newcomer population to the extreme conditions of the Arctic is uneven. In certain periods, there is a decrease in the adaptive stability of the human body. Therefore, it is important that during these periods a person should be under medical supervision and undergo unscheduled preventive examinations. According to the research of L.V. Anpilogova, the effectiveness of vaccine prophylaxis decreases during these periods [34]. Thus, the immigrant population should have its own schedule of preventive vaccinations.

During the first three years of life in the Arctic, when significant changes occur in the body, doctors do not recommend women to plan a pregnancy, as this may negatively affect baby's healthy development [5].

In addition, the problem of the return of migrant populations from the Arctic should be addressed in a timely manner, i.e. before the phase of depletion of the body's adaptation reserves. After 10 years of work in the extreme conditions of the Arctic, medical professionals should inform the newcomer population of the importance of timely return. Consultation should also be given to pensioners who wish to leave the North, since moving to even the most favorable natural and climatic conditions may carry a greater risk for them than a decision to stay in the North. Thus, there is data that the mortality rate among pensioners who left the Far North for the middle zone is several times higher than the Russian average [6].

[5] Vasilyeva A., Konkieva N.A. Adaptatsiya cheloveka k usloviyam Kraynego Severa [Human adaptation to the conditions of the Far North]. In: Materialy VII Mezhdunarodnoy studencheskoy nauchnoy konferentsii «Studencheskiy nauchnyy forum» [Materials of the 7th International Student Scientific Conference "Student Scientific Forum"]. URL: https://scienceforum.ru/2015/article/2015015574?ysclid=lguwdyden4834186012%22%3Ehttps://scienceforum.ru/2015/article/2015015574?ysclid=lguwdyden4834186012%3C/a%3E (accessed 08 June 2023).

[6] Ibid.

It is also important that people who have lived in the Arctic for a long period of time and returned to other regions should be under closer medical attention, since the diseases accumulated during their work in the Arctic will manifest themselves in a new place of residence.

7. Organization of proper nutrition for the newcomer population.

Scientists note the significant role of proper "northern nutrition" based on protein-lipid diets and the use of locally produced products, primarily fatty fish, deer meat, and northern berries, in successful adaptation to the harsh natural conditions of the Arctic. It is very important to reduce the consumption of sugar, salt and carbohydrates [7]. This recommendation is also relevant for the old-timer population.

The relevant issues for both the old-timers and the newcomers are:

8. Organization of opportunities for regular physical education. Scientists note that systematic physical education is one of the most effective means of increasing the body's resistance to disease and the influence of unfavorable environmental factors [35]. This explains better adaptation to the harsh natural and climatic conditions of the Arctic among manual workers compared to intellectual workers, as well as the fact that regular physical training and vigorous forms of activity make the initial period of adaptation much easier [36]. The relatively low incidence of circulatory system diseases and diabetes mellitus among indigenous minorities is associated not only with dietary habits, but also with a high level of physical activity [26]. Thus, the authorities should pay particular attention to the creation and development of opportunities for physical education and sports for the population of the Arctic.

9. Organization of the educational process taking into account the natural and climatic specifics of the Arctic. Long-term studies by scientists have proven that it is unacceptable to organize the educational process in the North and the Arctic in two shifts. In addition, the training program should include twice as many physical education lessons as in educational institutions of the middle zone [8].

10. Development of a system of recreation and sanatorium treatment within the Arctic regions. According to experts, moving of Arctic residents for short-term holidays to the middle zone and to the south and equally rapid return may not only have no positive effect on health, but even harm it. Long-term studies of the effectiveness of treatment of northerners at southern resorts show that such treatment is ineffective and often leads to deterioration in health indicators due to a sharp change in climatic conditions and the high body's adaptation costs. Treatment is most effective in those natural and climatic conditions to which the body has adapted and therefore adjusted its work in an optimal mode [9]. That is why developed intra-regional systems of sanatorium-

[7] Jos Y.S. Vliyanie usloviy Severa na zdorov'e shkol'nikov [Influence of northern conditions on the health of schoolchildren]. URL: https://narfu.ru/upload/medialibrary/b6e/vliyanie-usloviy-severa-na-zdorove-shkolnikov_dzhos-yu.pdf (accessed 08 June 2023).
[8] Ibid.
[9] Vasilyeva A., Konkieva N.A. Adaptatsiya cheloveka k usloviyam Kraynego Severa [Human adaptation to the conditions of the Far North]. In: Materialy VII Mezhdunarodnoy studencheskoy nauchnoy konferentsii «Studencheskiy nauchnyy forum» [Materials of the 7th International Student Scientific Conference "Student Scientific Forum"]. URL:

resort institutions (sanatoriums, sanatorium-preventoriums, balneomudtherapeutic clinics, boarding houses with treatment, sanatorium-type children's camps) and recreation organizations (recreation resorts, rest houses, camping sites, children's health camps) should be created for residents of the Arctic.

11. Active development of telemedicine.

The low population density and the large number of sparsely populated areas, as well as their remoteness and inaccessibility, which are characteristic of the entire territory of the Russian Arctic, cause problems in ensuring the right of the Arctic population to receive affordable and high-quality medical care. The use of telecommunication and electronic information technologies is of particular importance in eliminating this problem. According to A.L. Tsaregorodtsev [37], in the Arctic, when the factor of geographical distance becomes critical, the use of telemedicine can solve the following main problems:

- providing high-quality specialized medical care to remote sparsely populated areas;
- minimizing the cost of providing medical services in remote sparsely populated areas;
- solving the problem of the lack of highly qualified medical personnel in remote sparsely populated areas;
- providing an opportunity for medical workers in sparsely populated areas to quickly consult with colleagues from medical centers in large regional and district cities, which eliminates the problem of professional isolation and minimizes the likelihood of medical error.

In addition, there are studies proving that the introduction of telemedicine technologies can reduce the mortality rate of patients with cardiovascular diseases, reduce the frequency of hospitalizations and requests for emergency medical care, and increase patient satisfaction with the quality of medical services [38].

12. Development of a system for informing the population of the Arctic about existing health risks and opportunities to minimize them. As noted by scientists [22], an extensive set of scientific research and recommendations has been accumulated regarding issues of human adaptation to the extreme conditions of the Arctic. However, there is a huge gap between these recommendations and the awareness of the population of the Arctic regions about them. It is necessary to create an appropriate system of informing and educating the health culture of the population of the Arctic, including the dissemination of knowledge about regional health risk factors and the specific features of a healthy lifestyle in harsh natural and climatic conditions. The implementation of activities within this system involves the participation of both medical professionals, education specialists and the media.

13. Development of northern (Arctic) medicine. As noted above, the organization of treatment and preventive work in the Arctic is carried out according to Western standards without suf-

https://scienceforum.ru/2015/article/2015015574?ysclid=lguwdyden4834186012%22%3Ehttps://scienceforum.ru/2015/article/2015015574?ysclid=lguwdyden4834186012%3C/a%3E (accessed 08 June 2023).

ficient consideration of adaptive morpho-functional changes in the human body to the extreme natural conditions of this macro-region. According to Yu.P. Nikitin and co-authors [39], the extensive achievements of science in the field of polar medicine have been perceived by practical public health care in a very limited version. Meanwhile, the results of the study by D.S. Timofeeva [40] showed that the introduction of relevant regional approaches in therapeutic and preventive work in the Arctic reduces the morbidity of the population by more than one third.

It should be emphasized that the training of medical specialists in programs with an extensive regional module that forms understanding of the characteristics of adaptive processes and diseases of the body of both the indigenous inhabitants of the Arctic and the immigrant population is of exceptional importance for the development of Arctic medicine.

Conclusion

Thus, based on a critical analysis of scientific literature and official statistical information, the authors systematized the main problems and challenges associated with the impact of harsh natural and climatic conditions on the health of the population of the Russian Arctic. The dualistic nature of this impact has been determined, which consists, on the one hand, in a decrease in life expectancy, an increase in morbidity and mortality of the Arctic population, and on the other hand, in launching the process of adaptation to the extreme conditions of the Arctic.

The features of the health and process of adaptation to the natural and climatic conditions of the Arctic of various groups of the Arctic population — indigenous, old-timers and newcomers — are highlighted. Thus, the specificity of the public health of the indigenous population includes the presence of morphophysiological characteristics, indicating evolutionary adaptation to extreme environmental conditions over many generations, as well as lower morbidity rates of diseases of the cardiovascular, respiratory and endocrine systems (under the condition of traditional way of life). At the same time, there is a high level of traumatism, infant and child mortality, as well as morbidity from parasitic and some types of infectious diseases among the indigenous population of the Arctic.

The authors have substantiated that the most vulnerable group of the population, whose health is most affected by the extreme natural and climatic conditions of the Arctic, are migrants. This group of the Arctic population is characterized by a higher level of morbidity due to the process of adaptation with a greater stress on the body's regulatory systems.

On the basis of the generalization of problems and peculiarities of public health of the Arctic population and systematization of the experience of previous scientific research, the author's team has developed directions of adaptation of the system of public administration of the Arctic regions to the existing challenges. These directions were based on a differentiated approach to the represented groups of the Arctic population: indigenous, old-timers and newcomers. The main directions include:

- maximum preservation and maintenance of the traditional way of life of indigenous peoples;
- effective organization of medical care for indigenous peoples of the Arctic in hard-to-reach areas;
- development of intra-regional and intra-Arctic rotations;
- organization of the selection of applicants for work in the Arctic;
- continuous medical observation and consultation of the immigrant population;
- organization of the educational process taking into account the natural and climatic specifics of the Arctic;
- development of a system of recreation and sanatorium treatment within the Arctic regions;
- development of telemedicine and northern (Arctic) medicine, etc.

In conclusion, it should be noted that the most important factor in compensating for physiological losses and improving health indicators of Arctic residents is the creation of the most favorable socio-economic living conditions (comfortable housing, high income, opportunities for rest and recreation, a variety of leisure activities, etc.). To compensate for the negative impact of extreme conditions on human health, the level and quality of life in the Arctic regions should be not just higher, but significantly higher than the Russian average. This, along with the implementation of the recommendations proposed by the authors, will make it possible to maximally protect the health of the population working and living in the extreme natural conditions of the Arctic.

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Outcomes of the Russian-Chinese Expert Seminar "Science Diplomacy in the Arctic under Global Challenges"

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Abstract. The review summarizes the results of the Russian-Chinese expert seminar "Development of Science Diplomacy in the Arctic under the Global Challenges", which was organized in December 2023 in Arkhangelsk, Russia. The aim of the seminar is described: accumulation of intellectual resources of universities and scientific institutes of Russia and China. The need to unite the scientific potential of the two countries is determined by the current geopolitical context, in which the development of relevant functional solutions to international humanitarian issues becomes extremely important. The seminar was organized by the Northern (Arctic) Federal University named after M.V. Lomonosov together with the project partners — Beijing Institute of Technology (PRC) and the Association "National Arctic Scientific and Educational Consortium" within the framework of the project of the Alexander Gorchakov Public Diplomacy Fund. The event resulted in a final document (recommendations) on further development of Russian-Chinese cooperation in the Arctic.
Keywords: *Arctic, Russian-Chinese cooperation, science diplomacy, international projects*

Introduction

The Arctic remains one of the most dynamically developing regions with vast resources in the 21st century. According to researchers, in the near future, the Arctic may experience an acute confrontation between the Arctic countries and extra-regional states for dominance and use of

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the natural, military-strategic and transport potential of the region. Since spring 2022, due to geopolitical events, the activities of the Arctic Council and Russia's presence in international organizations have been suspended, sanctions have been imposed and participation of Russian organizations in international scientific and educational projects has been ceased.

The current breakdown of international scientific cooperation with Western countries has shown that one of the important conditions for the effectiveness of scientific diplomacy is knowledge of the sociocultural specifics of communication with foreign researchers in conditions of global crises. Lack of understanding of the communicative perspective of partners, national cultural patterns and social traditions will not allow for productive interaction in the professional field. Studying the sociocultural foundations of cooperation is all the more important in relation to the eastern states, with which Russia is reaching a new level of relations.

Since the beginning of the 21st century, Russia is carrying out fruitful work on building multi-vector international cooperation with China as one of its strategic partners, including in the development of polar research. China has the status of an observer country of the Arctic Council and has a large-scale polar research program, positioning itself as a responsible state and partner in the Arctic. At the same time, the number of projects dedicated to Russian-Chinese intercultural and social-humanitarian cooperation in the Arctic remains insignificant. An extensive expert discussion on issues of Russian-Chinese scientific diplomacy could significantly contribute to improving knowledge on the implementation of the national Arctic strategies of the two countries, identifying sociocultural features of Russian-Chinese scientific diplomacy, and searching for tools for constructive international partnership in the professional field of Arctic research.

The Russian-Chinese expert seminar "Science diplomacy in the Arctic under global challenges", initiated by the Northern (Arctic) Federal University named after M.V. Lomonosov on the Russian side, became a platform for such a discussion The seminar was organized jointly with the project partners — the Beijing Institute of Technology (PRC), which has many years of successful cooperation experience in joint initiatives on Arctic issues and network partnerships, and the Association "National Arctic Research and Educational Consortium" with the support of the Alexander Gorchakov Public Diplomacy Fund at the Northern (Arctic) Federal University named after M.V. Lomonosov (NArFU) on December 11–13, 2023

More than 80 experts, diplomats, young scientists and business representatives from Russia and China came to Arkhangelsk to participate in the seminar. The main goal of the events is to accumulate intellectual resources of universities and scientific institutes of Russia and China. The importance of combining the scientific potential of the two countries is determined by the current global geopolitical context, in which the development of relevant solutions to emerging humanitarian problems becomes extremely important. Representatives of the two states came together to determine the most favorable and mutually beneficial formats of interaction, taking into account the modern world agenda and the needs of the countries participating in the seminar.

The high expert level and scale of the seminar was ensured by the participation of leading specialists from 10 Chinese universities, including Beijing Institute of Technology, China Ocean University, Nankai University, Dalian Maritime University, China Polar Research Center, China Petroleum University (East China), Xiamen University, Xiamen University of Technology , Harbin Engineering University, as well as the Chinese Academy of Sciences and the Consulate General of the People's Republic of China in St. Petersburg. On the Russian side, the seminar was attended by representatives of the Ministry of Foreign Affairs of the Russian Federation, the Russian International Affairs Council, the Association of Polar Explorers of Russia, IMEMO RAS, Federal Research Center KSC RAS, Federal State Unitary Enterprise "State Trust 'Arktikugol'" of the Ministry of the Russian Federation for the Development of the Far East and the Arctic, St. Petersburg State University, North-Eastern Federal University, South Ural State University, Admiral Makarov State University of Maritime and Inland Shipping, Yugra State University, Tomsk State University, Moscow Automobile and Road Construction State Technical University, Murmansk Arctic University, Syktyvkar State University, Northern (Arctic) Federal University named after M.V. Lomonosov, Association of Oil and Gas Industry Suppliers "Sozvezdye", etc.

Fig. 1. Participants of the plenary session, 11 December 2023, Northern (Arctic) Federal University.

Outcomes

The three-day seminar program started with a plenary session with the leading Russian and Chinese experts on international multilateral relations in the Arctic. Reputable scientists, officials, diplomats, youth leaders and media representatives took part in the plenary session. Welcoming the participants, the speakers noted the significance of the events for the development of mutually beneficial cooperation between Russia and China. It was stated that relations between the two states are reaching a new qualitative level of development.

For the Chinese side, the seminar is important due to the launch of the International Science and Technology Cooperation Initiative adopted in 2023 [1], which plans to expand open, fair and equitable international scientific and technological cooperation for the benefit of all countries and to form a global scientific community.

The welcome address on behalf of the Consulate General of the People's Republic of China in St. Petersburg to the participants of the Russian-Chinese seminar states that:

"Science, technology and innovation (STI) are an important driving force for the development of human society and an important means to address global challenges. Currently, the world is undergoing profound changes, which pose more and more serious challenges for humanity.

Today, more than ever before, human society needs international cooperation, openness and exchange of experience. Interaction within the framework of research activities to find solutions to global problems, jointly confront the challenges of the time and promote peaceful development is relevant.

Understanding the need to develop open, fair and equitable international scientific and technological cooperation for the benefit of all, regardless of borders, and with the goal of jointly forming a global scientific and technological community, the Ministry of Science and Technology of the People's Republic of China adopted the International Science and Technology Cooperation Initiative on November 6, 2023.

The main principles of the Initiative are:

- *Maintain a commitment to scientific activity, support scientific ethics, and develop technology for the benefit of humanity.*
- *Strive for innovative development, promote the diffusion of new technologies, work together to develop connectivity in the digital age, and accelerate the global transition to low-carbon development.*
- *Adhere to the principle of open cooperation, be committed to open science regardless of borders, and promote an open international ecosystem of scientific and technological cooperation.*
- *Adhere to the principles of equity and inclusiveness, mutual respect, fairness, and encourage all countries and research organizations to participate in international scientific and technological cooperation on equal terms.*
- *Strengthen solidarity and coordination. In the face of urgent global challenges in areas such as climate change, health, environmental protection, energy and food security, countries should work together to advance the implementation of major international*

[1] Kitay vydvinul initsiativu po mezhdunarodnomu nauchno-tekhnicheskomu sotrudnichestvu [China has put forward an initiative for international scientific and technological cooperation]. URL: http://russian.china.org.cn/china/txt/2023-11/07/content_116800795.htm (accessed 02 April 2024).

scientific programs and projects and achieve breakthroughs in major scientific and technological challenges concerning the future of mankind.

- *Strive for win-win outcomes for all, uphold genuine multilateralism, explore a new model of win-win global cooperation on STI, and ensure that the STI achievements are shared by all.*

The presented International Science and Technology Cooperation Initiative perfectly demonstrates China's commitment to promoting science diplomacy and maintaining an open, mutually beneficial dialogue in the world in general and in the Arctic in particular. This makes today's expert seminar on the development of scientific cooperation between China and Russia extremely relevant."

The plenary session was opened by a report "Cooperation Zone? Transformation of the world order and global governance in the Arctic" by Yulia Yuryevna Melnikova, program manager at the Russian International Affairs Council, which presented the current vision of the transformation of the world order and global governance in the Arctic, proposed initiatives to establish norms for cooperation, develop common standards, coordinate between the national strategies of the countries involved, and promote environmentally friendly solutions for the Arctic.

The issues of Chinese-Russian cooperation in the field of scientific diplomacy in the Arctic were raised in the plenary report by Alexander Sergunin, professor of the Department of Theory and History of International Relations of St. Petersburg State University. He mentioned several potential and existing platforms for the development of scientific diplomacy between the two countries, which include joint research projects, scientific publications, conferences, development of scientific infrastructure, and organization of expeditions in high latitudes. The professor noted that Chinese-Russian relations in the field of scientific diplomacy are developing quite dynamically and have good prospects for the future.

Professor Liu Hao, executive director of the School of Global Governance at the Beijing Institute of Technology (PRC), shared his vision of better Arctic governance. He noted that, according to the approach adopted in China, challenges and opportunities are interconnected. "Identifying challenges and opportunities in the Arctic is a complex issue and cannot be addressed in one meeting or conference. However, seminar participants have the opportunity to develop their own vision and present it to decision-makers, engaging in collaboration and formulating joint projects," stated Professor Liu Hao in his speech. The outcomes of the discussions could significantly impact the future environmental landscape, security dynamics, energy supply routes and Arctic shipping.

A scientific and educational center on Spitsbergen in the Pyramida village was presented as another platform for the possible development of international cooperation. According to Dmitriy Negrutsa, Advisor to the General Director of the FSUE "State Trust 'Arktikugol'" of the Ministry of the Russian Federation for the Development of the Far East and Arctic, such countries as China, Brazil, India, Turkey and Thailand have already expressed interest in this project. It is planned to

conduct research on climatic, environmental, biological, geological and many other scientific aspects on the basis of the centre.

The directions of Russian-Chinese scientific cooperation in the development of logistics of the Northern Sea Transport Corridor were analyzed by Mikhail Grigoryev, leading researcher at the Primakov National Research Institute of World Economy and International Relations of the Russian Academy of Sciences, director of the consulting company “Gekon”. In his opinion, the successful NSR transportations to China this year are likely to be continued.

The researchers discussed in detail the directions set at the plenary session within the framework of three parallel thematic platforms on the most pressing issues of the development of international scientific diplomacy in the Arctic: Section 1: “Science diplomacy in the context of geopolitical challenges”; Section 2: “Science diplomacy in the context of transport and logistics development”; Section 3: “Science diplomacy in the context of environmental and climate risks”.

The section “Science diplomacy in the context of geopolitical challenges” highlighted not only the challenges of science diplomacy in the Arctic, but also emerging opportunities and mechanisms for their use. It is important that understanding of how Arctic diplomacy, governance and cooperation are interconnected with and contribute to the broader security, foreign policy, economic and social interests of countries in the Arctic region and beyond is developed.

Fig. 2. Participants of the section “Science diplomacy in the context of geopolitical challenges”, December 12, 2023, Arkhangelsk.

The section “Science diplomacy in the context of transport and logistics development” focused on the most important topic: the development of the Northern Sea Route. Experts shared the latest data and analytical conclusions on the future of maritime logistics and transport communications in the Arctic. The resolution of this section includes the conclusions of the seminar participants, which will allow working out specific steps towards further development of cooperation between Russia and China in this area.

Fig. 3. Participants of the section “Science diplomacy in the context of transport and logistics development”, December 12, 2023, Arkhangelsk.

The speakers of the section “Science diplomacy in the context of environmental and climate risks” discussed the relevance of productive dialogue with all participants of the Arctic space and interested partners. In addition, they addressed the task of creating a mechanism to increase the motivation of researchers and teachers participating in international initiatives. Thematic research project competitions are still important. They should be organized at the interstate level.

Fig. 4. Participants of the section “Science diplomacy in the context of environmental and climate risks”, December 12, 2023, Arkhangelsk.

The cross-cutting theme of the seminar was the discussion of issues related to the language of scientific communication and preparation of joint scientific publications of international format, organized within the framework of the international school “Communication in a global context”. Two sessions brought together speakers with experience in publishing scientific works. The focus was on written scientific communication as a tool for exchanging ideas within the scientific and professional community.

Fig. 4. Participants of the international school “Communication in a global context”, December 12, 2023, Arkhangelsk.

The results of the work of the sections were presented on the final day of the Russian-Chinese seminar on December 13, 2023 in the format of recommendations for constructive bilateral partnership in the professional field of Arctic research, including for presentation through the activities of the Permanent Russian-Chinese Intergovernmental Working Group on Cooperation in the Arctic.

Liu Hao, Professor and Executive Director of the School of Global Governance at the Beijing Institute of Technology, highlighted the following emphases of the results of the sections.

Fig. 5. Professor Liu Hao, December 13, 2023, Arkhangelsk.

One of the challenges, according to Professor Liu Hao, is the suspension of the Arctic Council and the blocking of initiatives and cooperation with Russia, the lack of a platform for dialogue in the Arctic region. This position not only hinders the work of bilateral, regional and global platforms, but also disrupts the harmonious interaction of science, diplomacy and governance, data and information sharing in the Arctic region. This obstacle not only complicates scientific activities, but also increases the cost of Arctic research.

However, along with the challenges, there are opportunities as well — diversification of cooperation in the Arctic, expansion of Russia's dialogue with the countries of the Pacific region, Latin American countries, and BRICS.

According to experts, BRICS, the Shanghai Cooperation Organization, the Association of Technical Universities of Russia and China, the Northern Forum for Sustainable Development and a number of other organizations can contribute to the development of scientific diplomacy in the Arctic. The creation of new platforms for the development of youth cooperation in the fields of science, diplomacy and management is welcomed. Research initiatives such as the "Arctic Floating University", the school "Russia in the Arctic Dialogue: Global and Local Context" and others can work as a basis for expanding multilateral ties. Scientific seminars, forums, international schools and research expeditions are well-established forms of organizing international dialogue and should be used for the benefit of Arctic development.

The leading role of universities in science communication is of paramount importance to closing existing gaps. Universities are becoming agents of change in their efforts to promote innovative knowledge, fresh perspectives and public policy. The new role of universities makes them indispensable agents of international public policy and expert guides in new global contexts.

Professor Liu Hao noted the following as proposals to the governments of the Russian Federation and China:

1. Invest more in activities organized by universities to develop Arctic science diplomacy and governance.

2. Establish a special research grant in the area of science diplomacy and governance in the Arctic within the framework of the programs of national science foundations.

3. Develop funding opportunities for educational programs and Arctic academic mobility (exchange) programs for teachers and students.

4. Delegate greater opportunities to representatives of the Chinese government and scientific community to speak on behalf of Russia at various multilateral, regional and bilateral platforms to promote information and strengthen the "voice of Russia".

Anton Vsevolodovich Vasilyev, Vice-President of the Association of the Polar Explorers of the Russian Federation, Advisor to the Rector for International Activities of Northern (Arctic) Federal University, makes the following conclusions based on the results of the seminar.

1. The principle of open science proclaimed by China implies its readiness to cooperate with all Arctic states or, in other words, to collect information from everywhere. Its current perception of the Arctic is largely shaped by contacts with Western Arctic states and the Arctic Council. At the same time, expanding scientific ties with Russia objectively show China that the main and most valuable knowledge about the Arctic is concentrated in Russia. Taking into account the ongoing transformation of China into the world's leading economic, scientific and technical power, many Western Arctic states are actively developing scientific ties with China on Arctic

issues. Russia has opportunities to win a kind of competition for China, but this requires systematic and active work.

2. In relation to the PRC, Russia will act as a supplier of knowledge on Arctic topics. In the course of subsequent interaction, it is necessary to define more clearly Russia's own interest — in addition to the political one — in scientific cooperation with China on the Arctic. It is also important to outline practical steps to support Russia's policy in the region. It is necessary for Chinese partners to understand the specifics of investment, applying technologies in the Arctic, transit along the Northern Sea Route and its development.

3. Promoting scientific interaction in the Arctic with China will help to attract other BRICS states to cooperation in this area and will serve to strengthen BRICS as one of the system-forming international organizations. In addition, the Russian experience of cooperation with China may be valuable for establishing interaction on Arctic issues with other interested non-Arctic states.

4. The discussion revealed three main areas of mutual interest for continuing and expanding Russian-Chinese scientific Arctic cooperation. The first direction, political, concerns the protection and promotion of the national interests of the two countries in the context of the ongoing restructuring of the world order, the emergence of new security threats in the Far North, and the objective increase of the Arctic role in world affairs. The interaction of scientists and universities will contribute to the understanding and predictability of ongoing processes, the expansion of practical policy tools, the timely neutralization of emerging threats, and the strengthening of the stabilizing and constructive influence of Russian-Chinese relations in world and regional affairs. The second direction, socio-economic, is associated with new opportunities for the development and use of Arctic natural resources and transport routes while observing the principles of sustainable development. It is important to apply the achievements of the technological revolution and to develop professional personnel. The third direction is climatic and environmental. It is related to the study of the role of the Arctic in the processes of transformation of the Earth's climate. It is necessary to use the opportunities to influence ongoing natural processes and overcome new challenges.

Chinese experts assess the Arctic region as no less sensitive than the Antarctica and the South China Sea, which they are accustomed to analyzing. The importance of equal and mutually beneficial multilateral cooperation within the Arctic Council is recognized. The prospect of splitting the Arctic into a "NATO zone" and a "Russian zone" is perceived by the Chinese side as a dangerous situation. Russia's turn towards non-Arctic states in the study and development of the Arctic is beneficial for China. The role of scientific exchanges in international cooperation in the Arctic and regarding the Arctic is defined as extremely significant. In this context, science diplomacy is of particular importance. A precise selection of competent partners is necessary. Chinese colleagues note NArFU, as well as RAARC, as valuable partners for scientific cooperation in the Arctic.

Both sides of the seminar focused on the development and use of Arctic logistics routes, especially the Northern Sea Route, as well as the development of hydrocarbon production in the Arctic, with an emphasis on the use of modern technologies, including artificial intelligence. The development trends and problems of the Northern Sea Route were discussed in detail, including issues of safety and ice forecasting, possible new directions and projects of Russian-Chinese interaction in this area. The prospects for digitalization of production in the oil and gas industry and the economy of big geodata were addressed.

The participants considered both general fundamental issues of solving environmental challenges in the process of Arctic development, and specific successful projects for studying the state and preservation of the Arctic environment. Chinese scientists, in particular, discovered an increase of polycyclic aromatic hydrocarbons in Arctic waters of Pacific origin. Russian scientists shared their experience of operating a carbon test site, features of the development, operation and disposal of electronic devices in the Arctic, and the results of research of microplastic removal into the White and Barents Seas. The issues of sustainable aquaculture as a condition for ensuring food security were discussed. A great potential for expanding interaction between Russian and Chinese experts on climate and environmental issues was revealed.

Conclusion

The Russian-Chinese expert seminar “Science diplomacy in the Arctic under global challenges” became a meaningful event, which the participants recognized as an event significant for the development of Russian-Chinese scientific cooperation and the search for solutions to global problems in the Arctic.

Fig. 6. Final session, December 13, 2023, Arkhangelsk.

The results of the seminar indicate that it is expedient to build scientific cooperation with China in the Arctic for the long term. There is obvious great mutual interest in such cooperation, complementarity of scientific potentials, understanding that cooperation between the two countries is an important part of Russian-Chinese global interaction. The sectoral priorities of

international scientific and technical cooperation recently announced by China — climate change, healthcare, environmental protection, energy and food security — are to a large extent consonant with Russian ones and have a global dimension. A long-term perspective will make it possible to understand China's strategy and intentions better, as well as to neutralize Chinese fears of the short-term opportunism of a new round of development of bilateral cooperation in the Arctic, involvement as a bargaining chip in some larger-scale geopolitical game. China's better understanding of the Arctic should help to improve the "quality" of cooperation with it in this region.

The results of the seminar indicate that establishing long-term working contacts between scientists, universities and research centers will play a key role in expanding scientific cooperation between Russia and China in the Arctic. This is especially important given the complexity of the Chinese language and the peculiarities of Chinese psychology and worldview, which sometimes create obstacles to adequately understanding the Chinese and assessing their actions and ideas. Long-term stable cooperation programs and regular contacts between scientists are a prerequisite for overcoming such cultural barriers, avoiding errors in assessing the intentions of partners, and achieving maximum efficiency and mutual benefit in Russia-China cooperation.

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Arctic Agenda of the St. Petersburg International Economic Forum (SPIEF-2023)

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Abstract. The article summarizes the general results of the 26th St. Petersburg International Economic Forum (SPIEF-2023), which took place in St. Petersburg from 14 to 17 June 2023. The author, as a participant of the forum, attended all 15 events of the business program "The Arctic: Territory of Dialogue", organized by the Ministry for the Development of the Far East and the Arctic. The article focuses on the problems of international cooperation, including with Asian countries, and the development of the Northern Sea Route.
Keywords: *Russia, Arctic, Roscongress Foundation, international cooperation, Asian countries, Northern Sea Route*

Introduction

According to Roscongress, more than 17 thousand people from 130 countries took part in the work of the 16th St. Petersburg International Economic Forum (SPIEF-2023) in live and virtual formats.

The main event of the Forum was the plenary session with the participation of the President of the Russian Federation Vladimir Vladimirovich Putin and the President of the People's Democratic Republic of Algeria Abdelmadjid Tebboune.

The United Arab Emirates, whose delegation was headed by President Mohammed bin Zayed Al Nahyan, was an honored guest country this year. The forum was also attended by the President of the Republic of Armenia, the President of South Ossetia, the Prime Minister of the Republic of Cuba, and more than 150 high-ranking officials — heads of international organizations and associations, foreign ministers, heads of diplomatic missions.

The largest delegations were from the UAE, China, India, Myanmar, Kazakhstan, Cuba and the USA. More than 6,000 representatives of Russian and foreign business from more than 3,000 companies from 75 countries and territories, including 150 companies from 25 unfriendly countries, took part in the Forum.

Business program

SPIEF-2023 was held under the slogan "Sovereign development is the foundation of a just world. Let's join forces for the sake of future generations." Numerous discussions were held within the framework of five thematic blocks: "World economy at a global turning point", "Russian econ-

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omy: from adaptation to growth", "Building technological sovereignty", "Protecting the population and quality of life as the main priority", "Labor market: a response to the new challenges".

The experts stated that the new world order and the new world economy open new strategic opportunities for Russia for business partnership rather than competition. At the final press conference of SPIEF-2023, Anton Kobyakov, Advisor to the President of Russia, noted: "Russia has become the center of the new world order, forming it with its partners in the SCO, BRICS, and EAEU. Partnership with ASEAN countries is developing. Thirty new countries have expressed their desire to join BRICS, and the same number of countries wants to become partners in the SCO. The number of EAEU observer countries is constantly growing. African states are seriously interested in cooperation. Cooperation with Arab countries is expanding." [1]

The Forum focused on the development of business relations and expansion of contacts with trade partners from the CIS countries, the Arab world, India, China, EAEU–ASEAN, Latin America, which allow Russia to demonstrate economic stability under the pressure of huge sanctions. SPIEF-2023 participants started to form a new space of trust based on the principles of equal trading partnership. The Forum clearly showed that a new bloc of countries striving for sovereignty has been formed, ready to build bridges of understanding and cooperation around the world. The main expectation from SPIEF-2023 was the identification of the vector of international, state, economic and social tasks for the future.

More than 100 organizations and companies acted as Forum partners. More than 4,000 media representatives from Russia and foreign countries covered the international event. Representatives of 200 Russian higher education institutions took part in the Forum's Youth Day events. As part of the business program, over 200 events took place at industry and thematic venues. Over the four days, more than 1,500 moderators, experts and speakers, including foreign ones, discussed socio-economic development, ecology, healthcare, transport, culture and tourism, education and science [2].

The "Soul of Russia" International Festival of the Peoples of the North was a highlight of SPIEF-2023. Its discussion and cultural programs were included in the plan for Russia's chairmanship of the Arctic Council in 2021–2023. The festival demonstrated the diversity of the cultural heritage of the northern peoples of the Russian Federation.

The cultural and sports programs were rich and varied. More than 50 events were organized for Forum guests: the St. Petersburg Seasons cultural festival, St. Petersburg Art Fair 1703, classical music concerts, the Sails of Kronstadt festival, and the exhibition "Terracotta Army. Immortal warriors of China". SPIEF sports games were held in two cities in 18 sports. The Roscongress Foundation was the traditional organizer of the Forum.

[1] Results of SPIEF-2023. URL: https://www.vedomosti.ru/press_releases/2023/06/19/itogi-raboti-pmef-2023 (accessed 20 June 2023).
[2] Results of SPIEF-2023. URL: https://roscongress.org/news/itogi-raboty-pmef-2023/?ysclid=ljg54s1ouf44892634 (accessed 20 June 2023).

In addition to the main business program, the Russian Small and Medium-Sized Enterprises Forum, the International Youth Economic Forum, the Drug Safety Forum, and the Creative Business Forum were held.

Arctic agenda of the Forum

The Arctic issues took a special place in the work of the Forum. Over the course of 4 days, 15 events were held within the framework of the business program "The Arctic: Territory of Dialogue" (the exhibition of which was designed in the form of an iceberg and the northern lights).

At SPIEF-2023, the prospects and opportunities for international cooperation, including with Asian countries, issues of Arctic biodiversity, specially protected natural areas, development of the Northern Sea Route, human capital, Arctic cities, scientific and educational potential of the Arctic, and digitalization of the northern territories were widely discussed. Leaders of the Arctic regions of the Russian Federation presented new investment projects of their regions. Events devoted to tourism development, branding, promotion of the Arctic theme in the media and film production were also significant.

Speakers at these events were the Minister of the Russian Federation for the Development of the Far East and the Arctic A.O. Chekunkov, heads of subjects of the Arctic zone of the Russian Federation: Governor of the Murmansk Oblast A.V. Chibis, Governor of the Arkhangelsk Oblast A.V. Tsybulskiy, Governor of the Nenets Autonomous Okrug Yu.V. Bezdudnyy, Head of the Yamalo-Nenets Autonomous Okrug D.A. Artyukhov, Head of the Republic of Sakha (Yakutia) A.S. Nikolaev, Head of the Komi Republic V.V. Uiba, Head of the Republic of Karelia A.O. Parfenchikov, Acting Governor of the Chukotka Autonomous Okrug V.G. Kuznetsov, as well as high officials of the Ministry of Eastern Development of the Russian Federation (G.G. Guseinov, E.R. Nurgalieva, M.A. Dankin), the Ministry of Natural Resources of the Russian Federation, the Ministry of Transport of the Russian Federation, the Ministry of Education and Science of the Russian Federation, the Russian Academy of Sciences, the State Atomic Energy Corporation Rosatom, heads of large industrial enterprises, business structures, scientific and educational organizations, the Association of Indigenous Peoples of the North, Siberia and the Far East.

The speakers emphasized the increasing role of the Arctic in the socio-economic development of the Russian Federation and its regions and noted the negative consequences of limiting the activities of the Arctic Council.

At the session "The Arctic as a special area of international cooperation: prospects and opportunities" [3], prepared within the framework of the Think Arctic — Think Global project, implemented jointly by the Roscongress Foundation and the Center for Comprehensive European and International Studies of the National Research University Higher School of Economics in the context of the program of Russia's chairmanship of the Arctic Council in 2021–2023, the current state

[3] SPIEF-2023: The Arctic: Territory of Dialogue. URL: https://forumspb.com/programme/arctic/111143/ (accessed 28 June 2023).

and prospects for cooperation in the Arctic towards achieving the UN Sustainable Development Goals in the light of Russia's AC chairmanship were discussed.

The online session was opened by Ambassador-at-Large of the Russian Ministry of Foreign Affairs, senior official of the Russian Federation in the Arctic Council N.V. Korchunov, noting that the Arctic is becoming increasingly prominent on the global agenda and more and more countries are showing interest in this region. Particular attention was paid to the BRICS countries, taking into account the upcoming Russian chairmanship in the association. Opportunities for cooperation with the countries of the Persian Gulf and Latin America were also noted. Director of the Department for the Development of the Arctic Zone of the Russian Federation and the Implementation of Infrastructure Projects of the Ministry for the Development of the Russian Far East M.A. Dankin added that the Asia-Pacific countries have shown interest in cooperation [4].

All the presentations at the session discussed the processes and changes that have recently occurred in the Arctic region and the Arctic Council in particular [1, Lukin Yu.F.; 2, Zhuravel V.P.].

Some of the major European and Asian transnational companies, despite significant financial and image losses, have withdrawn from Arctic projects or revised their plans to invest in them. The European Commission imposed sanctions on the Kolarctic program, members of the Barents/Euro-Arctic Council and the Nordic Council of Ministers suspended cooperation with the Russian Federation. Arctic scientific cooperation was frozen [3, Zhuravel V.P., Timoshenko D.S.].

In March 2022, seven countries of the Arctic Council (Denmark, Iceland, Canada, Norway, USA, Finland and Sweden) refused to participate in all meetings chaired by the Russian Federation and held on its territory as a sign of protest against Russia's special military operation in Ukraine. Later, on June 8, these states decided to resume AC activities on a limited basis, but without Russia's participation. All this ultimately resulted in a large-scale boycott ("freezing") of the Russian Federation's presidency of the Council.

Analyzing the speeches made at the session by representatives of Norway, China, India, and the United States, it is possible to identify their concerns. Glenn Diesen, Professor of the Department of Business, History and Social Sciences at the University of South-Eastern Norway, noted that the main areas of cooperation in the Arctic could be infrastructure development, energy and combating climate change. Guo Peiqing, Professor at the School of International Relations at China Ocean University, supported closer cooperation with the BRICS countries [5]. Suresh Gopalan, Professor, Doctor of Economics at Indian Jawaharlal Nehru University, drew attention to the importance of de-

[4] Na PMEF obsudili perspektivnye napravleniya sotrudnichestva v vysokikh shirotakh v ramkakh sessii proekta "Think Arctic — Think Global" [At SPIEF, promising areas of cooperation in high latitudes were discussed as part of a session of the "Think Arctic — Think Global" project]. URL: https://arctic-council-russia.ru/news/oficial/na_pmef_obsudili_perspektivnye_napravleniya_sotrudnichestva_v_vysokikh_shirotakh_v_ramkakh_sessii/ (accessed 28 June 2023).

[5] Ekspert: Rossii vazhno razvivat' mezhdunarodnoe sotrudnichestvo so stranami BRIKS v Arktike [Expert: It is important for Russia to develop international cooperation with the BRICS countries in the Arctic]. URL: https://tass.ru/ekonomika/18012037 (accessed 28 June 2023).

veloping science in the Arctic, studying the processes affecting climate, since people in India largely depend on agriculture. In his opinion, the Arctic is the future of large economic projects. Paul Foose, President of the Alaska Marine Exchange, stated that fisheries research, the Northern Sea Route, search and rescue, and Arctic cooperation have been stalled due to sanctions [6].

Noting the existing difficulties, foreign speakers were unanimous in their readiness for full cooperation as soon as the situation in the world allows. Undoubtedly, in modern conditions it is necessary to develop and implement new forms and mechanisms of interaction with all Arctic countries and their regions, public associations, mass media, and organizations of indigenous peoples, especially youth. Such work experience has been successfully demonstrated by the Northern (Arctic) Federal University named after M.V. Lomonosov during the events within the framework of the Russian Federation's chairmanship of the Arctic Council.

In this regard, the speech of M.L. Lagutina, Doctor of Political Science, Professor of St. Petersburg State University, was noteworthy. She noted the end of Arctic exceptionalism and stated the advent of a new era characterized by the globalization of the region, where in the new geopolitical situation the Arctic is moving from a regional to a global agenda. This is manifested in the new balance of power between Russia and NATO countries; Finland's entry into the alliance strengthens the Arctic potential of the military bloc and creates real threats to Russia in the northern direction. If previously there were two trends in the Arctic — economics and environmental protection, now politics dominates, as a result of which cooperation has suffered greatly, which is now limited and manifested only through private ties, mainly among representatives of the scientific community.

The participants of the international session were interested in the speech of the Executive Director of the Northern Forum Secretariat V.N. Vasilyev, who spoke about the plans of the organization. It was formed in 1991 at the conference "Cooperation in a Changing World", held in Anchorage (Alaska, USA). The following year, the organization received UN accreditation as a non-governmental organization and observer status in the Arctic Council. Since 2013, its Secretariat was transferred to the Republic of Sakha (Yakutia) in the city of Yakutsk, where it still operates. Changes in the international situation led to the fact that the Northern Forum de facto turned into an organization of Russian regions at the end of February 2022, although in the initial period foreign member regions did not apply to leave the organization, but stopped any interaction, ceasing to participate in organization events even in online format. According to V.N. Vasilyev, in March 2022, a new Concept for the development of the Northern Forum was developed for the short and medium term, aimed at turning in an eastern direction and actively reaching the global level. The main focus of the organization remains to improve the quality of life in the North, support the sustainable development of tourism and implement initiatives in the field of socio-economic cooper-

[6] Pochetnyy prezident «Morskoy birzhi Alyaski» o segodnyashnikh otnosheniyakh s RF: «Slozhnee, chem ran'she» [Honorary President of the Alaska Marine Exchange on today's relations with the Russian Federation: "More difficult than before"]. URL: https://fedpress.ru/news/78/policy/3248716 (accessed 28 June 2023).

ation between the northern regions. The Regional Coordinators Committee approved the Concept at a meeting on June 6–7 in Khanty-Mansiysk, and the III Governors' Summit, held in Yakutsk as part of the IV Northern Forum on Sustainable Development, approved it on November 28. His speech positively assessed the activities of the Goodwill Ambassadors, including those from foreign countries, who carry out significant work aimed at popularizing, preserving the historical and cultural heritage of the Arctic and northern regions, stimulating environmental, educational, research and other activities, and attracting widespread attention to the problems of the North and Arctic regions. Khanty-Mansiysk Autonomous Okrug – Yugra became the chairman of the international organization for the period 2023–2025. As the analysis shows, the 30-year experience of this organization is an instructive example of how, under favorable circumstances, it is possible to quickly establish constructive cooperation between the regions of the global North and the Arctic, exchange best practices, accumulated experience and competencies [4, Vasilyev V.N., Krasnopolskiy B.Kh., Pilyasov A.N.]. In our opinion, after the "freezing" of the Arctic Council in 2022, Russia needs to rely more on the Northern Forum in the development of international cooperation in the Arctic, but the basis should be contacts and relations in a bilateral format.

Director of the Arctic and Antarctic Research Institute A.S. Makarov dedicated his speech to discussing the global climate agenda. In his opinion, common problems for the activities of scientists from different countries could be the study of the North Pole, permafrost monitoring, joint use of ships, and year-round expeditionary work on the Spitsbergen archipelago as part of the work of the Russian Science Center. He also noted that Indonesia is interested in cooperation with Russia in the Arctic on climate studies in the Arctic, because climate change in this region greatly affects the monsoons and rains in Asia, which create risks for agriculture and threaten severe floods.

Taking into account the results of the Russian Federation's chairmanship of the AC, the incipient Norwegian chairmanship and the emerging Arctic situation should be analyzed more deeply. It is necessary to clarify the tactics of actions in the Arctic direction, realizing the importance of the Arctic Council in the exploration and development of the Arctic.

A.B. Likhacheva, Dean of the Faculty of World Economy and International Affairs at the National Research University Higher School of Economics, moderated this session with a deep knowledge of Arctic issues.

The session "Russia — Asia. U-turn based on trust" continued the discussion on the prospects of cooperation and the format of Russia's interaction with Asian countries, establishment of research and economic ties between leading scientific, educational and industrial organizations in bilateral and multilateral formats. The discussion was attended by representatives of government authorities, relevant ministries and agencies, scientific and business communities of Russia and Asian countries — Brazil, China and India. The Russian-Asian Consortium for Arctic Research, established at the end of 2022, laid a good foundation for this cooperation. The speakers suggested pos-

sible ways to achieve mutually beneficial and trusting relations between the Russian Federation and Asian countries.

Attention is drawn to the non-functioning of existing regional cooperation institutions against the backdrop of progress towards multipolarity. Much attention was paid to China and India as important partners for Russia in the economic development of the Arctic region. Unfortunately, the speeches did not include an analysis of possible risks and prospects for cooperation in the Asian direction. Indeed, Russia's geo-economic and geopolitical interests are gradually being reoriented towards further strengthening interaction with friendly countries, including countries in the Asia-Pacific region, where China is considered as one of the promising strategic partners [5, Akimov R.H.]. This creates new opportunities to increase the level of cooperation between the Russian Federation and China in the Arctic, primarily in the field of development of oil and gas fields and transportation of hydrocarbons.

For a deeper understanding of the current situation, we would like to draw attention to a number of provisions of an article by A.V. Torkunov and D.V. Streltsov "Russian policy of turning to East: problems and risks" recently published in the journal "World Economy and International Relations" [6]. The authors note: "From the historical and civilisational points of view, Russia remains a "distant neighbour" for the countries of the region, i.e. the country with a Western mentality and Western national traditions. Another problem is Russia's lack of experience and no significant achievements in Asian economic integration structures, as well as the lack of a solid niche in Asian markets." They further write: "Russia's policy-specific risk of pivoting to the East creates an obvious bias towards China in both economic and diplomatic spheres. It is particularly noticeable in the energy sector. In 2021, China imported almost USD3 billion worth of natural gas from the Russian Federation (a 16-fold increase since 2017). Since the start of the SMO, China has become a major alternative to European export markets for Russia. At the same time, Russia is not a monopoly supplier of energy to China. Russia's share in Chinese natural gas imports in 2021 was just over 6% — less than the supplies from "unfriendly" Japan. This gives rise to a risk of the "buyer's dictate" on the part of Beijing, which objectively weakens the negotiating position of Russian suppliers."

Taking into account these warning factors, Russia needs to think through long-term plans for developing relations with the main Asian partners on bilateral tracks. Given the current international situation, Russia also needs strong ties with India, DPRK, and the countries of Southeast Asia (Vietnam, Myanmar, Thailand, Indonesia, Malaysia, etc.). A strategy should be carefully developed, based on an understanding of the importance of each of these states for Russian national interests. In this regard, it is proposed to continue the development of the Russian Federation's policy strategy in the Eastern (Asian) direction at a new organizational level with the involvement of scientists from the Russian Academy of Sciences and institutions of the Ministry of Education and Science of the Russian Federation in this work.

The session "Northern Sea Route. Results and plans" [7] discussed the development of the Northern Sea Route in the context of the task set by the President of the Russian Federation to ensure year-round use of the Northern Sea Route as a transport corridor on a global scale and the implementation of the NSR Development Plan until 2035, adopted in 2022 [7, Zhuravel V.P.] .

In his introductory remarks, session moderator M.E. Kuznetsov (director of the Eastern State Planning Centre), speaking about the Northern Sea Route, noted that we are at the beginning of year-round navigation and are actually talking about laying a new route, which are not so numerous on the planet. This was quite a long and intensive course, as a result of which Russia has advanced knowledge and technologies for effective and safe Arctic shipping in ice conditions.

We would like to draw attention to the report of the special representative for Arctic development of the State Atomic Energy Corporation Rosatom V. Panov, which outlined new approaches to the development of the NSR. Firstly, it is required to train personnel. Taking into account the construction of icebreaker-class vessels, it is necessary to have 7500 specialists by 2030, whose training will take 5.5 years. One nuclear icebreaker will require 431 people. In this regard, the Ministry of Transport, Rosatom, shippers, and shipping companies need to develop a specialist training program as soon as possible. Secondly, it is necessary to complete the development of a financial and economic model for the development of the NSR.

Top managers of leading mining, transport companies and scientific organizations attended the session. They discussed a large list of issues related to: ensuring the safety of navigation; effectiveness of government support measures for projects; mechanisms for increasing the efficiency of interaction between shippers, shipowners, authorities and infrastructure operators; competencies and experience of Russian industry in the construction of a civil fleet for work in the Arctic; creation of special vessels (hydrographic, auxiliary ice support vessels, maintenance of icebreakers); possibilities of existing and prospects for the construction of new shipyards.

The session was addressed by G.G. Huseynov, First Deputy Minister of the Russian Federation for the Development of the Far East and the Arctic (the development of the NSR is an urgent change in global logistics); I.V. Tonkovidov, General Director, Chairman of the Board of PJSC Sovcomflot (shipbuilders play a large role in the development of the Northern Sea Route); E.V. Gudkov, Deputy Chairman of the Board of PJSC NOVATEK (the NOVATEK company has begun implementing the Arctic LNG 2 project; for this purpose, a Center for the construction of large-capacity offshore structures, "a plant for the production of plants (LNG)", is being built in the Kola Bay, in the Belokamenka area); A.M. Grachev, Vice President for Federal and Regional Programs of PJSC MMC Norilsk Nickel (the Northern Sea Route is a factor in the development of industry, shipbuilding, tourism, it connects the most remote territories of the country); G.V. Fotin, General Director, LLC "GDK Baimskaya" (the Baimsk project will not only strengthen Russia's position in the international market, but will also radically transform the country's Arctic territories); A.S. Makarov,

[7] SPIEF-2023: The Arctic: Territory of Dialogue. URL: https://forumspb.com/programme/arctic/111143/ (accessed 28 June 2023).

director of the Arctic and Antarctic Research Institute of Roshydromet (an increase in cargo traffic will require more data), etc.

The task of year-round use of the NSR is complex, since severe ice conditions are predicted until 2050, icebreakers are a key solution to this problem, and by 2030 a group of 14 icebreakers will be operating on the NSR [8]. It is also noted that one of the most important tasks is the provision of personnel, construction and development of new infrastructure for the development of the territory of Siberia and the Far East [9]. There were also discussions about the newly formed institution "Main Directorate of the Northern Sea Route" (FSBI "Glavsevmorput") [10], created to ensure navigation in the waters of the Northern Sea Route, and its role in increasing security on the Northern Sea Route.

The NSR is the sea route to the East. The SMO has only reinforced the strategic importance of accelerating the development of this path. In 2014, 4 million tons of cargo was transported along it, and since 2020 — more than 30 million tons. There has been a serious growth in 6 years. The Northern Sea Route will continue to develop as new facilities are commissioned.

Conclusion

For more than a quarter of a century, the Forum has become a sought-after global platform for establishing cooperative ties, an authoritative and representative event of the world level. The event took place against the backdrop of a special operation in Ukraine, large-scale sanctions and the departure of a significant number of foreign companies from Russia. The sessions made a significant contribution to a comprehensive understanding of the real situation in the Arctic and made it possible to develop specific steps and effective solutions to fulfill the tasks set by the Russian leadership to ensure balanced sustainable development of the Arctic region and improve the well-being of its inhabitants, including the indigenous peoples of the North. The leadership of the country and the heads of the constituent entities of the Russian Arctic understand that this region is an important and promising territory of Russia. In the foreseeable future, according to experts, economic projects, including those with Asian countries, will become the main ones [8].

As a result of the forum, more than 900 agreements were signed for a total amount of 3 trillion 860 billion rubles (including 43 agreements with representatives of foreign companies, including two with Italy and Spain). Agreements the amount of which is not a commercial secret are taken into account. The top three regions of Russia in terms of the amount of concluded agreements included the Leningrad Oblast (30 agreements, more than 900 billion rubles), St. Petersburg

[8] K 2030 godu na Severnom morskom puti dolzhny rabotat' 14 ledokolov [By 2030, 14 icebreakers should be operating on the Northern Sea Route]. URL: https://rg.ru/2023/06/16/reg-szfo/k-2030-godu-na-severnom-morskom-puti-dolzhny-rabotat-14-ledokolov.html (accessed 28 June 2023).

[9] Perspektivy razvitiya Severnogo morskogo puti obsudili v ramkakh PMEF-2023 [Prospects for the development of the Northern Sea Route were discussed at SPIEF-2023]. URL: https://roscongress.org/news/perspektivy-razvitija-severnogo-morskogo-puti-obsudiliv-ramkah-pmef-2023/ (accessed 28 June 2023).

[10] V «Rosatome» schitayut, chto sozdanie «Glavsevmorputi» povysilo bezopasnost' navigatsii na SMP [Rosatom believes that the creation of the Glavsevmorput increased the safety of navigation on the NSR]. URL: https://tass.ru/ekonomika/18025587 (accessed 28 June 2023).

(more than 50 agreements, 414 billion rubles) and the Krasnodar Krai (24 agreements, 331 billion rubles). The largest number of agreements was signed in the field of industry and construction (206), socio-economic development of regions (185) and international and interregional cooperation (85) [11].

The Forum was organized by the Roscongress Foundation, a socially oriented non-financial development institution, the largest organizer of all-Russian, international, congress, exhibition, business, social, youth, sports and cultural events. It was created in accordance with the decision of the President of the Russian Federation in 2007 with the aim of promoting the development of economic potential, national interests and strengthening the image of Russia [8].

A delegation of the teaching staff of the Northern (Arctic) Federal University named after M.V. Lomonosov took an active part in the work of the 16th St. Petersburg International Economic Forum. The University Rector Professor E.V. Kudryashova made presentations that discussed issues of training personnel for the Arctic regions, the development of science and education, and improving the human factor.

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[11] Results of SPIEF-2023. URL: https://roscongress.org/news/itogi-raboty-pmef-2023/?ysclid=ljg54s1ouf44892634 (accessed 20 June 2023).

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Arctic Agenda of SPIEF 2023 — Digital, Economic, Environmental, and Socio-Cultural Aspects

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Abstract. The article summarizes the results of the 26th St. Petersburg International Economic Forum (SPIEF-2023), which took place in St. Petersburg from June 14 to 17, 2022. V. P. Zhuravel, Head of the Centre for Arctic Studies of the Institute of Europe RAS, is a permanent member of the Forum. In 2023, he attended the meetings of all 15 events of the "Arctic: Territory of Dialogue" program. The article deals with issues that were widely discussed at SPIEF-2023, related to the prospects and opportunities for international cooperation, social, economic and investment development of the Arctic regions, Arctic biodiversity, development of specially protected natural areas, northern cities, human resources, scientific and educational potential of the Arctic, branding of the northern regions, digitalization of the northern territories. All these topics are widely covered by the CAS IE RAS scientific group on a regular basis. The author also analyses the development of the tourism, culture, and film industries in the Arctic with a focus on the promotion of Arctic topics in the media. Speakers of the thematic sections emphasized the increasing role of the Arctic in the social and economic development of the Russian Federation, noted the negative consequences of limiting the activities of the Arctic Council. The forum was held under the slogan "Sovereign development is the basis of a just world. Let's join forces for the sake of future generations".
Keywords: *Russia, Arctic, economy, international cooperation, regional development, digitalization, science, investment projects, tourism, ecology, protected areas, professional personnel, CAS IE RAS*

Introduction

This article is part of the anthology of scientific articles by the Centre for Arctic Studies of the Institute of Europe RAS and represents a logical continuation of the annual analytical review of the results of the Arctic segment of the St. Petersburg International Economic Forum. The annual review is conducted by the Centre for Arctic Studies of the Institute of Europe of the Russian Academy of Sciences under the charge of leading researcher V.P. Zhuravel [1]. This work reflects the digital, economic, environmental and socio-cultural aspects of the Arctic agenda of the St. Petersburg International Economic Forum 2023. The CAS IE RAS team continues its scientific work on researching aspects of security, socio-economic development and international cooperation in the Arctic in tandem with leading contemporary scientists who study Arctic issues [2, Lukin Yu.F.; 3].

Arctic agenda of the Forum

Arctic topics occupied a significant place in the work of the Forum. V. P. Zhuravel, head of

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the CAS IE RAS research group, is a permanent member of the Forum. In 2023, he attended all 15 events of the "Arctic: Territory of Dialogue" program for 4 days. At SPIEF 2023, the prospects and opportunities for international cooperation with Asian countries, issues of Arctic biodiversity, specially protected natural areas, development of the Northern Sea Route, human capital, Arctic cities, scientific and educational potential of the Arctic, and digitalization of the northern territories were widely discussed. Leaders of the Arctic regions of the Russian Federation presented new investment projects of their regions. Events dedicated to the development of tourism, branding, and promotion of Arctic themes in the media and film production have become significant.

The speakers at these events were the Minister of the Russian Federation for the Development of the Far East and the Arctic A.O. Chekunkov, heads of subjects of the Arctic zone of the Russian Federation: Governor of the Murmansk Oblast A.V. Chibis, Governor of the Arkhangelsk Oblast A.V. Tsybulskiy, Governor of the Nenets Autonomous Okrug Yu.V. Bezdudnyy, head of the Yamalo-Nenets Autonomous Okrug D.A. Artyukhov, Head of the Republic of Sakha (Yakutia) A.S. Nikolaev, head of the Komi Republic V.V. Uiba, Head of the Republic of Karelia A.O. Parfenchikov, Acting Governor of the Chukotka Autonomous Okrug V.G. Kuznetsov, as well as officials of the Ministry of Natural Resources, the Ministry of Transport, the Ministry of Education and Science of Russia, the Russian Academy of Sciences, the State Atomic Energy Corporation Rosatom, heads of large industrial enterprises, business structures, the Association of Indigenous Peoples of the North, Siberia and the Far East.

The speakers emphasized the increasing role of the Arctic in the socio-economic development of the Russian Federation and its regions and noted the negative consequences of limiting the activities of the Arctic Council.

Digital, economic, environmental and socio-cultural aspects

The session "Conservation and Monitoring of Arctic Biodiversity", which took place within the framework of Russia's chairmanship of the Arctic Council (AC), discussed the impact of climate change, thawing of permafrost, the formation and development of integrated monitoring of ecosystems in the Arctic, the use of modern technologies, aspects of public-private partnerships, and the initiation of special climate norms in the legal field. Considerable attention was paid to the preservation of Lake Baikal.

The moderator of the session was I.Yu. Makanova, Director of the Department of State Policy and Regulation in the Development of Specially Protected Natural Areas of the Russian Ministry of Natural Resources. Discussion participants were: N.Yu. Belyakova, Director of the Department of Expedition Activities and Tourism Development of the Russian Geographical Society (RGS), E.I. Kompasenko, Head of the Department for Labor Protection, Industrial Safety and Environmental Protection of JSC Zarubezhneft, O.N. Krever, Deputy Director of the FSBI "Roszapovedtsentr" of the Ministry of Natural Resources of the Russian Federation, E.V. Matveeva, Coordinator of the subcommittee on the protection of Lake Baikal of the State Duma of the Federal Assembly of the

Russian Federation, E.A. Perfilyev, acting Minister of Ecology, Nature Management and Forestry of the Republic of Sakha (Yakutia), R.L. Romanenkov, Deputy General Director – State Secretary of the ANO Center "Arctic Initiatives", S.S. Seleznev, Vice President for Ecology and Industrial Safety of PJSC MMC Norilsk Nickel, Paul Foose, Honorary President of the Alaska Marine Exchange and N.V. Shabalin, Executive Director of the Marine Research Center, Moscow State University named after M.V. Lomonosov.

The species diversity of the Arctic amounts to 20 thousand organisms, most of which are listed in the Red Book of Russia. The Russian Arctic currently has 40 specially protected natural areas (SPNA), the most significant of which are 14 nature reserves, 10 national parks and 8 wildlife sanctuaries. "And they are entrusted with the task of preserving biodiversity... SPNA are managed by 19 institutions under the jurisdiction of the Russian Ministry of Natural Resources, and they employ almost 1,300 specialists," stated O.N. Krever, Deputy Director of the FSBI "Roszapovedtsentr" of the Ministry of Natural Resources of the Russian Federation. Olga Nikolaevna Krever also highlighted the "know-how" of the USSR — the scientific report of the nature reserves "Chronicle of Nature", the first of which in the Arctic began to be compiled in the Kandalaksha Nature Reserve in 1932. When it came to polar bears on Wrangel Island, the moderator noted that "the country should have such a methodology that the same bear is not counted twice, that is, we need to see the processes occurring in nature." It concerns an integrated monitoring system, and UAVs can help with this.

S.S. Seleznev drew the attention of his colleagues to the cooperation of PJSC MMC Norilsk Nickel with 15 institutes of the Russian Academy of Sciences to study the processes of industrial production and transport damaging the Arctic nature.

US Representative Paul Foose noted that the planned increase in ship traffic in the Bering Strait will disrupt the ecology in the area and the habitual way of life of fur seals. It is necessary to achieve a balance between economy and nature.

The active development of SPNA was facilitated by the implementation of the federal project "Preservation of biological diversity and development of ecological tourism" of the national project "Ecology" since 2018, as well as the competitive program launched in tandem with it for the creation of tourist and recreational clusters and the development of ecotourism in Russia. The program, initiated in 2020 by the Agency for Strategic Initiatives with the support of the Ministry of Natural Resources of the Russian Federation, the Ministry of Economic Development of the Russian Federation, the Ministry of Eastern Development of the Russian Federation and the Federal Agency for Tourism, provided for an all-Russian competition for the creation of tourist and recreational clusters (TRC) and the development of ecotourism in Russia [4, Timoshenko D.S.]. At the Forum session, it was proposed to amend the law "On Environmental Protection" and consider SPNA as unique model sites for environmental monitoring. Problems of climate and ecology in the Arctic are discussed in the monograph of the CAS IE RAS, which emphasizes the importance of en-

vironmental engineering and biodiversity conservation in the North from the perspective of national security [3].

One of the sessions at the Arctic stand was dedicated to filmmaking — "Film Production in the Arctic: A Dialogue between Nature and Technology". Participants reported that over the past few years, film production has brought about 9 billion rubles to the region. Filmmaking contributes to the inflow of tourists and investment, the construction of infrastructure, and the conservation of species and culture. At the same time, film production processes can become a threat to the ecology of the Arctic. Currently, large-scale filming of the series "Chelyuskin" about the development of the Northern Sea Route is underway in the Arctic. The section discussed issues of sustainable film production in the Arctic and balance with nature conservation, measures to reduce and compensate for damage caused during filming, environmental requirements and standards necessary to preserve the vulnerable nature of the North, formats of practical cooperation with NPOs and indigenous peoples in film production.

The session was moderated by D.V. Pristanskov, State Secretary — Vice President for Relations with Government and Management Bodies of PJSC MMC Norilsk Nickel. The participants included B.Yu. Bulychev, blogger, Head of the ANO "Center for Support and Development of Expedition Activities and Tourist Attractiveness of Regions 'RGO Expo'"; E.V. Dyagileva, Deputy Governor of the Murmansk Oblast; S.A. Korshunov, director; A.A. Melnik, producer of the film "Territory"; I.A. Neverov, acting General Director of the FSUE "State Trust 'Arktikugol'"; A.S. Nikolaev, Head of the Republic of Sakha (Yakutia); N.V. Novikov, Secretary of the Presidium of the Council of Heads of Representative Offices of Russian Regions under the President of the Russian Federation and the Government of the Russian Federation; member of the board of the Regional Cinema Support Fund of the Union of Cinematographers of Russia; S.Yu. Soldatova, director, producer of the ANO "Production Center 'Northern Character'"; D.A. Tabarchuk, General Director of LLC "NMG Studio"; D.M. Yakunin, Russian producer, executive director of the youth center of the Union of Cinematographers of Russia; Deputy Executive Director of the Regional Cinema Support Fund.

A.S. Nikolaev expressed the opinion that Yakutia's experience and potential as a center for preservation and development of traditional culture and crafts of the peoples of the North is important for Russia's cultural dominance in the world Arctic and promotion of Russia's cultural code in the circumpolar space. The head of the Republic of Sakha (Yakutia) also said that the multifunctional film pavilion would be the only full-cycle film technology center in the Far East, and its core would be Russia's largest virtual film pavilion [1]. N.V. Novikov put forward the idea that it is necessary to film in the regions, considering regional cinema as a cultural support for business projects, as well as the great role of working with young screenwriters and directors locally. It is important to be able to write scripts and make films about the Arctic and tourist attractions in the northern regions.

[1] V Yakutii postroyat mnogofunktsional'nyy kinopavil'on [A multifunctional film pavilion will be built in Yakutia]. URL: https://www.sakha.gov.ru/news/front/view/id/3359734 (accessed 20 June 2023).

The session “New Opportunities for the Development of Arctic Cities” [2] was attended by representatives of federal and regional authorities, development institutes, and large companies. The session was moderated by A.V. Finogenov, Director for Urban Development of JSC DOM.RF. The participants included E.A. Akhmeeva, First Deputy Chairman of the Government of the Komi Republic, A.M. Grachev, Vice President for Federal and Regional Programs of PJSC MMC Norilsk Nickel; A.S. Dovlatov, Deputy Chairman of VEB.RF; P.A. Kudryavtsev, founder of Citymakers; E.R. Nurgalieva, Deputy Minister of the Russian Federation for the Development of the Far East and the Arctic; R.V. Trotsenko, founder, chairman of the board of directors of AEON Corporation; A.V. Chibis, Governor of the Murmansk Oblast.

E.R. Nurgalieva, Deputy Minister of the Russian Federation for the Development of the Far East and the Arctic, opened the session by announcing the allocation of about 8 billion rubles for the next three years to develop master strategies for the development of cities in the Arctic zone of the Russian Federation [3].

New opportunities for the development of Arctic cities in the Russian Arctic were considered as a driver for the formation of a supporting framework for the development of the Arctic. Key approaches to the development of master plans and strategic projects, balances between city-forming enterprises and the development of a modern service urban economy, processes for launching sustainable mechanisms for interaction between “Arctic business captains” and authorities were discussed. In this regard, the audience was interested in the speech of the Director of the Department for the Development of the Arctic Zone of the Russian Federation and the Implementation of Infrastructure Projects of the Ministry of Eastern Development of Russia M.A. Dankin, who shared his accumulated experience in this area.

A.V. Chibis, Governor of the Murmansk Oblast, emphasized the importance of implementing the mechanism for creating master development plans, identifying anchor cities in the Arctic and multiplying federal support, such as the “Unified Subsidy” in order to accelerate the dynamics of urban development and attract people [4]. The head of Norilsk D.V. Karasev announced the approval of a comprehensive development plan for Norilsk until 2035 [5], noting that Murmansk and Norilsk are the largest Arctic cities in the world.

[2] SPIEF-2023: The Arctic: Territory of Dialogue. URL: https://forumspb.com/programme/arctic/111143/ (accessed 28 June 2023).
[3] Gorodam Arkticheskoy zony Rossii na blizhayshie tri goda vydelili okolo 8 mlrd rubley [About 8 billion rubles have been allocated to the cities of the Arctic zone of Russia for the next three years]. URL: https://tass.ru/ekonomika/18013965 (accessed 28 June 2023).
[4] Na PMEF obsudili «Novye vozmozhnosti arkticheskikh gorodov» [“New opportunities for Arctic cities” were discussed at SPIEF]. URL: https://invest.nashsever51.ru/list_item/news/na-pmef-obsudili-novye-vozmozhnosti-arkticheskikh-gorodov (accessed 30 June 2023).
[5] Dmitriy Karasev: «Gorod menyaetsya, i bukval'no cherez 20 let eto budet novyy Noril'sk» [“The city is changing, and literally in 20 years it will be a new Norilsk”]. URL: https://24rus.ru/news/power/206742.html?%20utm_source=yxnews&utm_medium=desktop&utm_referrer=https%3A%2F%2Fdzen.ru%2Fnews%2Fsearch%3Ftext%3D (accessed 28 June 2023).

In order to conduct a detailed and objective analysis of the problem, it is worth taking into account the developed methods for assessing critical factors that limit the development of single-industry towns in the Russian Arctic [5, Korchak E.A.].

On June 15, 2023, the second day of the SPIEF-2023 “Arctic-Territory of Dialogue” stand program, the session “Development of the Scientific and Educational Potential of the Arctic” was opened. The participants discussed the issues of ensuring access to quality education in the Arctic zone of the Russian Federation in the new geopolitical conditions and the situation of suspension of membership of Russian universities in the Association of Arctic Universities “UArctic”, as well as further development of international scientific and educational cooperation in modern realities. The speakers analyzed the most popular and necessary professions and specialties in the near future in the Russian Arctic, raised issues of the relationship between the implementation of strategic projects and the development of science and education, considered the best practices and forms of interaction between educational and scientific organizations with stakeholders (state level, regional needs, investors). In order to preserve and increase the scientific and educational potential, the activity of the Association “National Arctic Scientific and Educational Consortium” was presented, which is aimed at monitoring the accessibility of the education sector of the Russian Arctic and international cooperation with partners from friendly countries.

The session was moderated by G.D. Hasanbalaev, Executive Director for Social Development of JSC Far East and Arctic Development Corporation. The participants included A.I. Bondar, Director of the Department of Educational, Scientific and Technical Activities of the Ministry of the Russian Federation for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters; E.V. Dyagileva, Deputy Governor of the Murmansk Oblast; D.A. Kryachkova, Vice President for Personnel Policy of PJSC MMC Norilsk Nickel; Yu.F. Sychev, Deputy General Director for work with scientific organizations “Arktikugol”; M.V. Gordin, Rector of Moscow State Technical University named after N.E. Bauman; I.V. Vorotyntsev, acting Rector of the Russian Chemical-Technological University named after D.I. Mendeleev; E.V. Kudryashova, Rector of the Northern (Arctic) Federal University named after M.V. Lomonosov; A.N. Nikolaev, Rector of the North-Eastern Federal University named after M.K. Ammosov. Mr. Gao Tianming, Professor, Director of the Arctic Blue Economy Research Center at Harbin Engineering University of China and Ms. Li Xin, General Director of Beijing Jining Technology Company / Joinyea education & technology Co.ltd participated online.

E.V. Dyagileva presented the scientific and educational potential in the development of infrastructure of universities in the Murmansk Oblast. Professor E.V. Kudryashova, speaking about the Arctic cooperation of universities on the basis of the conducted research, said that, according to the Ministry of Eastern Development, about 28 thousand specialists are required for the existing Arctic projects today. At the same time, about 6 thousand are highly productive jobs. Until 2035, according to the development strategy of the Russian Arctic, up to 180 thousand specialists will be required to be employed in the Arctic, including professionals in the field of new economy,

artificial intelligence, robotization, etc. She also noted that "today, there are 19 universities and their branches and about 96 vocational education institutions, which, in terms of budget places, covers only 59% of school graduates in the Russian Arctic. Therefore, the tasks that the Russian Arctic faces today cannot be fulfilled under the existing infrastructure. In this regard, it is possible to focus on cooperation." Rector of NArFU E.V. Kudryashova also made a presentation of the scientific and educational consortium of Arctic universities NAREC — "National Arctic Research and Educational Consortium", formed within the framework of the conference "The Arctic — a national megaproject: staffing and scientific support", which was held on June 5–7, 2016 on the basis of the Northern (Arctic) Federal University named after M.V. Lomonosov (NArFU). She also reported on the possibility of developing a scientific and technological map of the Russian Arctic on the basis of NAREC to help employers, on joint network educational programs, student mobility programs, educational programs for indigenous minorities, motivation and stimulation of scientific research on Arctic topics. Professor E.V. Kudryashova confirmed the readiness of NArFU to become the flagship of scientific and technical developments for the entire region.

D.A. Kryachkova noted that currently there are two vacancies per one good CV. At the same time, the Norilsk Nickel corporate educational university has about 900 educational programs that help employees master new competencies in the process of work, career guidance for children and their parents is carried out, cooperation with universities is developed, the possibility of providing professional corridors, production case championships "Conquerors of the North", the "Professional Start" program, attracting more residents to Norilsk. Yu.F. Sychev announced the initiative to organize a scientific and educational center (a research complex and an Arctic educational center) on the Spitsbergen archipelago in the Russian village of Pyramida, the main goal of which will be to create opportunities for international scientific cooperation between the BRICS countries, the SCO and other countries friendly to Russia.

It was also noted at the session that Ammosov University (NEFU) initiated a new model of international cooperation "Arctic – Asia" with the aim of creating research ties between leading scientific and educational organizations of Russia, China, India, as well as, together with the international organization of northern regions "Northern Forum", creating the Russian-Asian Consortium for Arctic Research (RACAR). The agreement on the establishment of the consortium was signed on November 28, 2022 [6].

CAS IE RAS researches personnel problems in the Arctic on a regular basis and publishes the results obtained, including in foreign publications. Thus, the staff of the CAS IE RAS is conducting scientific work to improve the proposed mechanism for managing the personnel policy of the Arctic in modern geopolitical conditions and in accordance with the strategic objectives of the state [7, Timoshenko D.S.].

[6] Razvitie nauchno-obrazovatel'nogo potentsiala Arktiki [Development of scientific and educational potential of the Arctic]. URL: https://roscongress.org/sessions/spief-arctic-2023-razvitie-nauchno-obrazovatelnogo-potentsiala-arktiki/about/# (accessed 20 June 2023).

During the session “Investment Potential of the Russian Arctic”, the heads of the Russian Arctic presented the main projects of their regions.

Governor of the Murmansk Oblast A.V. Chibis focused on the construction of the Murmansk transport hub, the gas agreement with Gazprom, and emphasized that 900 billion investments have been made over four years: “the region ranks second in the Northwestern Federal District in terms of investment growth, third in GRP growth, and is the leader in the number of residents of the Russian Arctic”.

Within the framework of SPIEF, the Governor of the Nenets Autonomous Okrug Yu.V. Bezdudny held a working meeting with A. Molskiy, member of the board, deputy for investments and capital construction of PJSC Rosseti, during which they discussed the pre-design stage of justification for the construction of high-voltage overhead power lines from the Komi Republic to Naryan-Mar. Agreements were signed between the Administration of the Nenets Autonomous Okrug, the Far East and Arctic Development Corporation and LLC NORD-GROUP on the reproduction of wild salmon, as well as on the joint development of unmanned aircraft between the State Transport Leasing Company and the Administration of the Nenets Autonomous Okrug.

Head of the Chukotka Autonomous Okrug V.G. Kuznetsov said that eight agreements on infrastructure projects with a total investment volume of 25 billion rubles (the largest is the Chukotskiy greenhouse complex) are being signed within the framework of the forum.

Head of the Republic of Karelia A.O. Parfenchikov signed an agreement with the general director of PC Geoplast on the production of polymer pipes for utility networks on the premises of the former Nadvoitskiy aluminum plant, located in the Arctic zone of Karelia. The project involves investing 900 million rubles and creating 120 new jobs.

Head of the Komi Republic V.V. Uiba reported on successful negotiations with the Republic of Tatarstan on the use of experience in organizing the work of a management team, construction and creation of new residential complexes and infrastructure. An agreement was reached with the Republic of Dagestan on a joint project for the construction of a children’s recreation camp.

Head of the Republic of Sakha (Yakutia) A.S. Nikolaev reported that within the framework of the Forum, the regional delegation signed 12 major agreements in strategically important areas related to the development of the region’s transport system, the introduction of new IT technologies, and reducing the cost of northern deliveries. One of the most important results of SPIEF for the republic’s economy is the agreement with PJSC Tupolev on the purchase of new passenger aircraft. By 2030, the company will build and supply 12 Tu-214 midrange narrow-body airliners for Yakutia Airlines. An agreement was signed with JSC GLONASS on the development of a satellite system in the region. An agreement was reached with the Chairman of the Board of Sberbank Herman Gref to open in Yakutsk the country’s fifth campus of School 21 to train IT specialists. The head of the republic drew attention to the further development of the “Children of Asia” project.

Governor of the Arkhangelsk Oblast A.V. Tsybulskiy and General Director of Rosseti North-West A.Yu. Pidnik signed an agreement on cooperation to develop electricity supply and improve

energy efficiency. By the end of 2023, the company will conduct an energy audit of 20 hospitals, educational institutions and kindergartens in the Arkhangelsk Oblast and will modernize the lighting system of socially significant institutions in the region. Rosseti North-West plans to invest 1.6 billion rubles in the power grid infrastructure of the Arkhangelsk Oblast in 2023 as part of the investment and repair program.

On June 16, 2023, the session "Russian Arctic — The Center of Gravity. SPNA of the 21st Century" was held. The moderator was Yu.E. Bekhtereva, journalist, TV presenter and social and political figure. The participants included I.Yu. Makanova, Director of the Department of State Policy and Regulation in the Development of Specially Protected Natural Areas of the Russian Ministry of Natural Resources; D.A. Artyukhov, Governor of the Yamalo-Nenets Autonomous Okrug; O.A. Kuznetsova, Deputy Governor of the Murmansk Oblast, V.A. Fetisov, Goodwill Ambassador of the United Nations Environment Program (UNEP); N.V. Korchunov, Ambassador at Large of the Russian Foreign Ministry; A.M. Grachev, Vice President for Federal and Regional Programs of PJSC MMC Norilsk Nickel; A.G. Kirilov, Director of the FSBI "Russian Arctic National Park"; Glenn Diesen, Professor of the Department of Business, History and Social Sciences, University of South-Eastern Norway; B.Yu. Bulychev, blogger [7].

Glenn Diesen noted that in the era of "economic globalization" there is a problem of environmental protection opposing economic interests, which also contributes to understanding and implementation of business and territory sustainability strategies. I.Yu. Makanova cited statistics on the increase in the number of tourists and noted that the tourist flow in 2021 amounted to 103 thousand tourists in Arctic SPNA, in 2022 — 111 thousand visitors, as of June 1, 2023, 50 thousand visits were recorded in the Russian Arctic. According to her assessment, "...it should not be about ecological tourism, when we talk on a national scale, probably the goal of the Arctic is popular science and expedition tourism". According to N.V. Korchunov, the Arctic is experiencing serious climatic changes, it is opening up to economic activity, and all this exacerbates this pressure on nature. He also noted the importance of developing a comprehensive line of action integrating economic operators and regions.

In the context of promoting northern regions and SPNA for visiting and economic development, the session also discussed a mechanism for calculating the anthropogenic load of each protected area and the use of artificial intelligence for analytical activities. The successful practice of finding a balance between economic development and conservation of biodiversity in the Murmansk Oblast in the context of its expansion to neighboring regions was analyzed. Deputy of the State Duma of the Federal Assembly of the Russian Federation, UN Goodwill Ambassador V.A. Fetisov noted that it is necessary to correctly calculate the maximum recreational capacity and

[7] Russkaya Arktika — tsentr prityazheniya. OOPT XXI veka [The Russian Arctic is the center of gravity. SPNA of the 21st century]. URL: https://roscongress.org/sessions/spief-arctic-2023-russkaya-arktika-tsentr-prityazheniya-oopt-xxi-veka/translation/# (accessed 20 June 2023).

permissible recreational load for the territory, and paid special attention to preserving the quality of life of the indigenous peoples of the North.

Since 2009, the author has repeatedly initiated research on these issues and proposed existing schemes for reasonable, balanced and comprehensive economic promotion and staffing of Russian regions, including within the framework of the implementation of northern strategies and in the context of the tense geopolitical and economic situation [10, Timoshenko D. S.; 11, Timoshenko D.S.].

During the session "Digital North: The Potential for Developing a DPC Network in the Northern Regions of Russia" [8], strategic issues of developing digital foundations in the Arctic were discussed. The issues of creating data processing centers, connecting sparsely populated and remote areas, and satellite coverage of the Arctic were discussed in detail. Internet connectivity and digitalization are now considered as important for the economic development of the region, for the future of the Russian Arctic and the development of the NSR, as electrification. The participants included Deputy Minister of Digital Development and Mass Communications of the Russian Federation Maxim Parshin, Minister of Innovation, Digital Development and Infocommunication Technologies of the Republic of Sakha (Yakutia) Anatoliy Semyonov, Director of the Center for Global IT Cooperation Vadim Glushchenko, Director of the Department for Development of the Arctic Zone of the Russian Federation and Implementation of Infrastructure Projects Maxim Dankin, Deputy General Director of Gazprom SCAIT Facility Sergey Masalov, Technical Director of Rostelecom-DPC Alexey Zabrodin and program manager of the Russian International Affairs Council Natalya Vyakhireva. The moderator of the session was the Deputy General Director for ICT projects in the Arctic zone of the Russian Federation of the ATOMDATA group of companies (part of the Electric Power Division of Rosatom), head of the interdepartmental working group of Rosatom for preparing the concept of the project for creating a trans-Arctic telecom operator, Roman Yakovlev.

Deputy General Director of Gazprom SCAIT S.A. Masalov made a report "Advanced space systems and services", in which he spoke about the area of interest of PJSC Gazprom in space. Sergey Anatolyevich Masalov said that the company's priorities are: 1) satellite communications and broadcasting through updating and expanding the Yamal constellation with Yamal-501 and Yamal-502 satellites (included in the Sphere project); 2) industrial safety and ecology through the development of geotechnical and environmental monitoring technology, the creation of the SMOTR-V remote sensing satellite constellation (included in the Sphere project), creation of the SMOTR-R radar constellation of satellites; 3) development and integration of space systems through the creation of an assembly plant for spacecraft and the development of a universal space platform. At the moment, given the current situation, maintaining the operation of the orbital constellation is becoming one of the highest priority tasks. In order to service the Arctic shelf and the Northern

[8] SPIEF-2023: The Arctic: Territory of Dialogue. URL: https://forumspb.com/programme/arctic/105491/ (accessed 11 July 2023).

Sea Route, it is planned to replace the Yamal-402 satellite, which will run out of fuel and will be decommissioned by 2025. Another important task is the creation of an assembly production facility for spacecraft, the commissioning of which is scheduled for the end of 2023. At the same time, the SCAIT design bureau is working on the creation of remote sensing satellites "SMOTR-V" weighing up to 800 kg and "SMOTR-R" weighing up to 600 kg, as well as the creation of a universal space platform with a mass of up to 350 kg and a service life of 7–10 years.

Technical Director of Rostelecom-DPC A.I. Zabrodin made a presentation "Effective methods for constructing data centers in cold climates", reporting on the main methods of cooling data centers (DPCs): 1) Cooling traditional data centers by switching off compressor equipment in winter (universal method). 2) Adiabatic method — effective in regions with a dry climate (Central Asia, most of the USA, etc.). 3) Thermal method — effective in regions with large volumes of fresh or salt water (most of Russia, Canada, Scandinavian countries). The speaker noted that limited communications do not allow the northern regions to use remote large data centers. The needs of the northern regions are not concentrated in one area, which limits the capabilities of commercial operators. Small data centers, in his opinion, are not profitable to build. Rostelecom's proposals are to create a technological base using mobile data centers with a pre-installed secure cloud infrastructure and thermal cooling; to work out the deployment of the IT infrastructure of cloud operators based on mobile data centers, taking into account the needs of the northern regions, including for the development of public services; to synchronize the development of data centers in the northern regions with the state program for the socio-economic development of the Arctic.

A.A. Semyonov, Minister of Innovation, Digital Development and Infocommunication Technologies, presented a report "Digital Development of the Republic of Sakha (Yakutia)". Anatoliy Askalonovich Semyonov presented a detailed plan for the digitalization of remote areas of Siberia, in particular, he announced the extension of up to 7000 kilometers of fiber-optic communication lines, through which over 72 thousand people in 86 settlements would receive Internet access. The implementation of these plans will make it possible to increase the growth of tourism by 2 times, online banking by 3 times, and Internet commerce by up to 4 times.

A number of works by modern scientists involved in the study of the Arctic are devoted to the problems of digitalization. For example, Kuratova L.A. proposed an index method of ranking the Arctic regions of Russia by the level of digitalization according to four sub-indexes: activities of households, population, authorities, and organizations. This made it possible to track the dynamics of indicators and evaluate the effectiveness of measures to develop the digital space of the regions [6, Kuratova L.A.]. This scientific work should be continued in order to objectively assess the dynamics of digitalization of the Russian Arctic in the modern period.

The session "Human Capital for the Conquest of the Arctic" discussed the possibilities of Russian universities in ensuring the implementation of the state strategy for the development of the Arctic, the features of education in high latitudes, the definition of key "supraprofessional" competencies for the Arctic, as well as the role of interuniversity associations in career guidance

for future and current specialists. The session was moderated by D.Yu. Guzhelya, Deputy General Director of the Autonomous Non-Profit Organization "Russia – Land of Opportunities". The key speakers were E.V. Kudryashova, Rector of the Northern (Arctic) Federal University named after M.V. Lomonosov; A.N. Nikolaev, Rector of the North-Eastern Federal University named after M.K. Ammosov; A.N. Nagibin, Head of the project office of the ANO Clean Arctic; R.V. Churaevskiy, Rector of Norilsk Nickel Corporate University; G.D. Hasanbalaev, Executive Director for Social Development of JSC Far East and Arctic Development Corporation.

Professor E.V. Kudryashova emphasized the importance of organizing systematic career guidance work starting from kindergarten, and the unity of career guidance with employers in the North, as well as its role in solving the problems of technological sovereignty. A unified system of continuous education and improvement of competencies, starting from the earliest preschool age and continuing throughout the life of a specialist, was developed and proposed by senior researcher of CAS IE RAS D.S. Timoshenko in 2021 and has been successfully implemented in whole or in part in many Arctic regions [7].

Over the past years, the Government of the Russian Federation has created favorable conditions for the development of the tourism sector in the Arctic regions of Russia. We have repeatedly emphasized that tourism should be considered as a factor of civilizational development, unity and cooperation [8, Timoshenko D.S.; 4, Timoshenko D.S.]. Issues of development of the tourism industry in the Arctic were discussed at several venues of the Forum in 2023. The session "Tourism in the Arctic: Points of Attraction, Prospects, People Creating Tourism Products" included a presentation by the Deputy Minister of the Russian Federation for the Development of the Far East and the Arctic E.R. Nurgalieva. As E.R. Nurgalieva reported at the Forum, residents are implementing 116 investment projects worth 38.6 billion rubles in order to boost the tourism sector, and "every fourth of the 4.8 thousand recipients of "hectares" opens a tourist or recreational project on their land" [9]. According to her report, about 1.5 million people visited the territory in 2022, but there is no data in value terms about these visits and about the profit for the Arctic regions from tourism activities, as well as no information about the damage suffered by the territories from the organization of tours. The Head of the Republic of Sakha (Yakutia) A.S. Nikolaev noted the important role of subsidizing regional air routes and launching special programs for tourists, equalizing the load on tourism infrastructure during the season. A clear example of the synergy of tourism, ethno-cultural heritage, modern design, musical culture and cinema was the "Soul of Russia" festival, which demonstrated the best projects and achievements of the creative economy of the northern territories of the Russian Federation [10]. The festival program included film screen-

[9] Razvitie turizma v Arktike obsudili na panel'noy diskussii v ramkakh PMEF [The development of tourism in the Arctic was discussed at a panel discussion at SPIEF]. URL: https://gtrksakha.ru/news/2023/06/18/razvitie-turizma-v-arktike-obsudili-na-panelnoj-diskussii-v-ramkah-pmef/ (accessed 20 June 2023).

[10] Festival "Soul of Russia". URL: https://forumspb.com/programme/soul-of-russia/; Full Festival program: URL: https://forumspb.content.rcmedia.ru/upload/uf/bcb/bcbe82b76d37dd18cbacc7cab52e1d62.pdf (accessed 20 June 2023).

ings, exhibitions, concerts, master classes and project presentations; the life and traditions of indigenous peoples of the North were demonstrated. Exhibition events of the “Soul of Russia” festival were held simultaneously in all Arctic regions of Russia (Fig. 1).

Having analyzed the “Soul of Russia” program, we can summarize that the organizers of the event focused on the Arctic orientation of the ethno-cultural, exhibition and tourism programs. Special attention should be paid to the Northern Cinema Festival, which included historical and premiere screenings of Arctic-themed films. Thirteen films were shown: “Women’s Voice of the Arctic”, “Don’t Bury Me Without Ivan” (Republic of Sakha (Yakutia), Krasnoyarsk Krai, St. Petersburg), “How to Fix a Bicycle” (Republic of Sakha (Yakutia), “Diary of a ‘White Crow’” (Arkhangelsk Oblast), “Ugra Novels” (Khanty-Mansi Autonomous Okrug — Yugra), “Territory” (Krasnoyarsk Krai, Chukotka Autonomous Okrug), “White Nights of Postman Alexey Tryapitsyn” (Arkhangelsk Oblast), “...Nerkagi...” (Yamalo-Nenets Autonomous Okrug), “Book of the Sea”, “Exit”, “Whaler” (Chukotka Autonomous Okrug), “Chief of Chukotka” (special screening from the Lenfilm Film Studio), “History of Kamchatka Snowboarding” (Kamchatka Krai).

The concert musical program took place during all days of the “Place of Power” Forum and was full of authentic and national works in a modern interpretation.

14 June 2023	1	Exhibition "People's Beauty. Russia – a deep image"
	2	“Forgotten Craft”, Lidia Kostareva, Komi Republic
	3	“The Magic of Kamchatka” photo exhibition, Maxim Balakhovsky, Kamchatka Krai
	4	Exhibition of art works by the IkkiTaba creative alliance, Norilsk, Krasnoyarsk Krai
	5	“Yugra: a collection of unforgettable experiences” book exhibition, State Library, Yugra State Library, Khanty-Mansi Autonomous Okrug – Yugra
	6	Beads in the Peoples of Siberia culture, Museum of Nature and Man, Khanty-Mansi Autonomous Okrug – Yugra
	7	“Ancient traditions of the Siberian North” exhibition of sculpture, Galina Wiesel, Khanty-Mansi Autonomous Okrug – Yugra
	8	"Man. Earth. Space" Exhibition by Gennady Raishev, Khanty-Mansi Autonomous Okrug – Yugra
	9	“Sacral North” exhibition of folk craftsmen, Republic of Sakha (Yakutia)
	#	Photo exhibition "Yamal Attraction", Yamalo-Nenets Autonomous Okrug
15 June 2023	1	Exhibition of art works by the IkkiTaba creative alliance, Norilsk, Krasnoyarsk Krai
	2	“Coloured threads of Kantele”, Republic of Karelia
	3	Photo exhibition "Yamal Attraction", Yamalo-Nenets Autonomous Okrug
	4	“Sacral North” exhibition of folk craftsmen, Republic of Sakha (Yakutia)
	5	"Man. Earth. Space" Exhibition by Gennady Raishev, Khanty-Mansi Autonomous Okrug – Yugra
	6	Exhibition "People's Beauty. Russia – a deep image"
	7	Beads in the Peoples of Siberia culture, Museum of Nature and Man, Khanty-Mansi Autonomous Okrug – Yugra
	8	“The Magic of Kamchatka” photo exhibition, Maxim Balakhovsky, Kamchatka Krai
	9	Media exhibition – Artists of the North, Khanty-Mansi Autonomous Okrug – Yugra
16 June 2023	1	Exhibition of art works by the IkkiTaba creative alliance, Norilsk, Krasnoyarsk Krai
	2	Beads in the Peoples of Siberia culture, Museum of Nature and Man, Khanty-Mansi Autonomous Okrug – Yugra
	3	“Coloured threads of Kantele”, Republic of Karelia
	4	Photo exhibition "Yamal Attraction", Yamalo-Nenets Autonomous Okrug
	5	“Sacral North” exhibition of folk craftsmen, Republic of Sakha (Yakutia)
	6	Man. Earth. Space Exhibition by Gennady Raishev, Khanty-Mansi Autonomous Okrug – Yugra
	7	Exhibition "People's Beauty. Russia – a deep image"
	8	“The Magic of Kamchatka” photo exhibition, Maxim Balakhovsky, Kamchatka Krai
17 June 2023	1	Exhibition of art works by the IkkiTaba creative alliance, Norilsk, Krasnoyarsk Krai
	2	“Coloured threads of Kantele”, Republic of Karelia
	3	Photo exhibition "Yamal Attraction", Yamalo-Nenets Autonomous Okrug
	4	“Sacral North” exhibition of folk craftsmen, Republic of Sakha (Yakutia)
	5	Man. Earth. Space Exhibition by Gennady Raishev, Khanty-Mansi Autonomous Okrug – Yugra
	6	“The Magic of Kamchatka” photo exhibition, Maxim Balakhovsky, Kamchatka Krai
	7	Exhibition "People's Beauty. Russia – a deep image"
	8	Beads in the Peoples of Siberia culture, Museum of Nature and Man, Khanty-Mansi Autonomous Okrug – Yugra

Fig. 1 Exhibitions within the official program of SPIEF-2023.

Excursions to national dwellings included visits to Yakut, Kalmyk, Buryat yurts, an Ob Ugrian chum, and a Chukchi yaranga. During the Forum, there were master classes of folk crafts of the Komi Republic, Yamalo-Nenets Autonomous Okrug, Kamchatka Krai, "Colored threads 'Kantele'" (Republic of Karelia), a master class on making a traditional Ob Ugrians doll from fabric (Khanty-Mansi Autonomous Okrug —Ugra), master classes on creating amulets and bead embroidery (Republic of Buryatia), master class on creating a traditional doll of the Chukotka Autonomous Okrug, master class on creating animation from the animation studio "Mechtalet" (Khabarovsk Krai), master class on creating media content for meta-universe Zov Zemli Cyber and the development of character prototypes to transfer the cultural code of peoples into virtual space. A separate series of master classes was organized by the Museum of Geology, Oil and Gas (Khanty-Mansi Autonomous Okrug —Ugra) and the School of Creative Industries (Ministry of Culture of the Russian Federation).

In order to promote and brand the Arctic tourist regions, VR tours "Meet the Ob Ugrians" (Khanty-Mansi Autonomous Okrug —Ugra), a VR video on the Manpupuner plateau (Komi Republic), "Meet Yamal!" (representative office of the Yamalo-Nenets Autonomous Okrug), VR trip through the polar Urals (Yamalo-Nenets Autonomous Okrug), "Eco Komi Republic: presentation of the cultural and tourist potential of the region" (Komi Republic), VR tour "Meet the Ob Ugrians" (Khanty-Mansi Autonomous Okrug —Ugra) were organized.

There were presentations of creative industries projects "Art collaboration as a driver for the development of creative industries" (State Academic Capella of St. Petersburg), presentation of the project "Creative industries as a new strategy for cultural institutions" (St. Petersburg SBIC "Petersburg Concert"). Lectures and performances were held: "Experience, practices, innovations" (St. Petersburg State Institution "St. Petersburg House of Nationalities"), "Zakhozhskoe lace. Interweaving of times" Traditions in modern creativity, "Traditional practices of the peoples of the North in the modern world: from risks to new opportunities" (Institute of the Peoples of the North of the Russian State Pedagogical University named after A.I. Herzen), "The image of the Arctic in the works of artists of the Komi Republic" (Komi Republic), presentation of the project Freeride Community (Kamchatka Krai).

Within the framework of SPIEF-2023, there were presentations of cinema from the Murmansk Oblast and the Komi Republic, a two-part animation program "The Soul of Russia in Animation. Echo of Suzdalfest", a film about the Youth National Ensemble "Koritev" (Kamchatka Krai) was shown.

During the Forum, there were presentations on tourist attractiveness, promotion of culture, customs and traditions of the Republic of Kalmykia, Kamchatka, events "The ritual of the Gorki holiday — the visiting card of the Komi region (Ust-Tsilma)" (representative office of the Komi Republic), a lecture "Prohibitions, superstitions, taboos and magic in the traditional cultures of the peoples of the North" (Institute of the Peoples of the North of the Russian State Pedagogical University named after A.I. Herzen), "Reserve volunteers "Heart of the Taiga": tourism with care

for nature" (Komi Republic), a lecture on working as a guide and volunteering in Kamchatka, a presentation of the project "Heritage of the Russian Great Silk and Tea Roads: problems and prospects" (Republic of Sakha (Yakutia), the board game "Monopoly — Ugra" (Khanty-Mansi Autonomous Okrug —Ugra), the project "Preservation of the traditional culture of peoples Arctic in the projects of the National Museum of the Komi Republic" (Komi Republic), presentation of a newspaper in the Nenets language (Yamalo-Nenets Autonomous Okrug). Among socially significant projects, it is worth mentioning the project about the support of the role of women of the North "Komi. Women in the Arctic. Yesterday, today, tomorrow" (representative office of the Komi Republic).

A number of modern scientists address the issues of studying the image and place of the Russian Arctic [9, Simakova A.V., Stepus I.S.; 2, Lukin Yu.F.]. Many of the author's works are devoted to tourism in the Arctic; guidelines for the formation, management and promotion of the tourism industry in the domestic regional and international markets are proposed. Most of the proposed methods, including those on the problems of forming a personnel reserve for the Arctic, have been successfully implemented by the tourist regions of Russia [10, Timoshenko D.S.; 11, Timoshenko D.S.].

Conclusion

The St. Petersburg International Economic Forum once again demonstrates the unity of key economic players of Russia and its foreign partners in the desire to strengthen and develop the Russian and global economy. Despite the special operation in Ukraine, comprehensive sanctions from the countries of the collective West [12, Zhuravel V.P., Timoshenko D.S., 13, Zhiltsov S.S.], the Forum summed up the results of systematic and precise work of the Russian Federation and its regions to strengthen their political, economic and socio-cultural positions within the framework of the tasks set by the President of the Russian Federation V.V. Putin. The stand "The Arctic — Territory of Dialogue" demonstrated the unity of the subjects of the Russian Arctic in understanding the strategically important role of the dynamic development of the Arctic region of the country. In the foreseeable future, according to experts, the main priorities will be economic projects, including those with Asian countries, as well as the development of scientific, educational and cultural cooperation between the Arctic regions and non-Arctic subjects, a balanced increase in domestic and international tourist flows, global digitalization of the North, promotion and branding of the Russian Arctic.

The scientific team of the CAS IE RAS continues to work on researching aspects of security, international cooperation in the Arctic, problems of social and economic development, digitalization, personnel policy, promotion of the Russian Arctic, as well as international relations in the Arctic [12, Zhuravel V.P., Timoshenko D.S.; 14, Zhuravel V.P.]

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Studies of Social and Economic Development of the Russian Arctic at the Regional and Local Levels: Review of Some Relevant Works by Russian Researchers

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Abstract. This review is an analytical presentation of the content of scientific articles and monographs published in the last few years and devoted to the problems of socio-economic development of the territories of the Arctic zone of the Russian Federation (AZRF). Since the legal recognition of the AZRF, many empirical studies have been devoted to the issues of its socio-economic development. However, the literature review in them is limited to the selected narrow subject of research. This circumstance creates an urgent need for a comprehensive analysis of currently relevant directions in the study of socio-economic processes in the AZRF. The purpose of this article is to demonstrate the diversity of vectors of scientific search in contemporary Russian studies of social and economic processes in the Arctic. The limitation of the study is the significant growth of publications on the topics of interest to us, caused by the variety of specific issues covered in the latest Arctic research. Therefore, we have selected only a few representative works that reflect the multi-vector nature of Arctic research in contemporary Russia. As a result of analyzing the works, we have found that Arctic research is characterized by both thematic and geographical diversity. The authors conditionally divide contemporary Arctic studies in Russia into three directions: interregional comparative studies within the boundaries of the entire AZRF, regional case studies, and local studies (at the level of municipalities). It is important to note that within the framework of the last two directions of research the key contribution to the multiplication of empirical material and its conceptual understanding is primarily made by scientists from regional scientific and university centers. Another peculiarity of Russian Arctic research is the shift of interest towards the study of the urban environment, industrial centers, and urbanism, while economists and sociologists pay insufficient attention to the study of the rural periphery. The observed deficit of local studies of social and economic processes in the rural Arctic in the future may lead to the rapid development of this direction in contemporary Russian science.

Keywords: *Russian Arctic, social and economic development, region, municipality, local studies, Russian science*

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Introduction

In the middle of next year, it will be 10 years since the signing of the presidential decree "On the land territories of the Arctic zone of the Russian Federation", which marked a new stage of state policy towards the Arctic macro-region. As its strategic importance became actualized, which became a consequence of intensive discussions about the prospects of the Northern Sea Route, the development of natural resources available in the Arctic, threats to the stability of Arctic ecosystems, global economic competition, military and political security in the Arctic, etc., the interest of Russian researchers has increased in the issues of managing the socio-economic development of individual Arctic territories and the Russian Arctic as a whole, in the conceptual rethinking of the principles of Arctic policy, in the search for effective strategies and technologies for simultaneously achieving the goals of economic growth, social well-being and ecosystem sustainability. This interest stimulated the development of a number of research projects, the results of which were reflected in publications of the last decade.

The complexity and multidimensionality of the processes studied by social researchers of the Russian Arctic have determined the inevitable subject-thematic specialization of some of them — from demography to sustainable development, from municipal reform to garage economy, from Arctic urbanism to the situation of small indigenous peoples. At the same time, in the long term, the task of interdisciplinary synthesis of conceptual developments made by domestic researchers in the period from the creation of the AZRF (accompanied by the intensification of its scientific study) to the present day. It is worth noting that most of the articles published in recent years on the topics stated above have an empirical focus, and the literature review presented in them is aimed at highlighting the state of affairs in a highly specialized subject area.

At the same time, there is already an opportunity to carry out some revision of the work done, including the identification of "bottlenecks" in the subject field of current scientific research in the Arctic territories. As will be shown in our review, such research is carried out at several levels (regional and local) and in several main thematic areas. At the same time, certain significant issues of development of the Arctic territories still remain outside the active attention of Russian economists, demographers and sociologists. This review is intended, among other things, to highlight these gaps in scientific knowledge about the Russian Arctic in its current state.

The focus will be on the territories within the European part of the Russian Arctic (Murmansk Oblast, Nenets Autonomous Okrug, Arctic municipalities of the Arkhangelsk Oblast, Republic of Karelia and Republic of Komi), due to the greater attention from business and the number of projects implemented over the last decade. Some of the works concerning the Siberian and Far Eastern territories of the AZRF are considered in the text of the review only insofar as their content is an interregional comparative analysis within the boundaries of the entire AZRF.

Regional cases and interregional comparative studies

The research works devoted to the socio-economic development of the Arctic territories of Russia, in which the analysis on the scale of a region of the Russian Federation is carried out, can be divided into studies of individual regional cases that reveal the specifics and uniqueness of the selected region, and comparative studies, covering a sample of several Arctic regions or all regions of the Russian Arctic at once.

Such topics as infrastructural development in the Arctic, economic policy of the state and the dynamics of regional economies, social well-being in the Arctic regions, natural and migratory movement of their population, rational use of natural resources, and other related issues are most studied, predictably, in monographic surveys.

Among the most recent monographs summarizing the results of comparative interregional analysis of social and economic processes, one can highlight a collective work published on the basis of the Kola Science Center in 2019 [1, Bazhutova E.A., Biev A.A., Emelyanova E.E.]. This monograph aggregates data for all regions (individual territories of regions) included in the AZRF at the time of publication for a very extensive period of time, reaching several decades for some indicators. The latter allows us to analyze changes in the general trends of socio-economic development of the Arctic macro-region of Russia at certain stages of its historical development over long time series. However, the work under review is not primarily retrospective: the focus of the authors' research interest is the latest period of the post-Soviet development of the country (2001–2018). The central issues of the monograph are the settlement structure of the Arctic territories, demographic processes, investment activities and experience of public-private partnerships, development of the transport system, and sectoral structure of regional economies. The Arctic macro-region is described not only in its internal diversity, but also in comparison with all-Russian trends, as well as similar processes and phenomena in the Scandinavian countries. This monograph represents a detailed analytical review of the totality of the processes of socio-economic development of the Russian Arctic in the 20th and especially the 21st centuries.

The monograph, prepared by the staff of the N. Laverov Federal Center for Integrated Arctic Research of the Ural Branch of the Russian Academy of Sciences [2, Chizhova L.A., Tutygin A.G. et al.], is another collective work that covers the entire Arctic macro-region, and the issues range from methodological problems of studying socio-economic processes in the Russian Arctic to more specific, but in practical terms extremely important issues, such as problems and prospects for the development of transport and logistics infrastructure of Arctic sea and land communications. In terms of content, the monograph covers, along with the above-mentioned topics, the study of trends in various forms of economic behavior of the population of the Arctic territories, including entrepreneurial behavior, the influence of various components of social well-being on the realization of the economic potential of the Russian Arctic, the substantiation of valid and reliable indicators for the purposes of constructing both descriptive and numerical (where the nature of the data allows this) models of socio-economic dynamics within the boundaries of the macro-region under

study. The monograph pays attention to the main directions of state policy for the development of the Arctic and proposes standardized approaches (algorithms) to the development of management decisions within the framework of this policy.

Despite the fact that the book was published in 2022, it underestimates the radical changes generated by the recent coronavirus pandemic and the new geopolitical reality. It is all the more interesting to assess in what aspects the conceptual developments of the authors are able to explain the processes observed in changed conditions, and what requires adjustment and even significant revision.

Several other monographs of recent years touch upon a much less wide range of topics, focusing on a certain class of phenomena. Thus, the monograph "Human capital of the Arctic regions: systemic problems and technologies for solving them", published in 2020 [3, Barbakov O.M., Belonozhko M.L. et al.], written with the involvement of authors from scientific organizations of several Arctic and northern regions of the country (from Arkhangelsk to Tyumen oblasts), focuses on the problems of reproduction of labor resources and human capital in the Russian Arctic at the current stage of its economic, socio-political and technological development. The authors do not limit themselves to traditional questions about the contribution of educational institutions to the growth of human capital and the reform of the system of personnel training for the Arctic economy, but also explore the role of attitudes, values, and identities of Arctic residents on their motivation to work, continuous learning, and settling in the territory of residence, which, in turn, affects the dynamics of human capital.

A recent work of 2022 edition, prepared by economists and economy-geographers from the previously mentioned FRC of the UB of the RAS, "Realization of the demographic potential of the Russian Arctic territories in the context of innovative development: mechanism, factors, regulation tools" [4, Smirennikova E.V., Gubina O.V. et al.], combines the problems of demographic processes in the Russian Arctic and innovations in the economy (technological, managerial, etc.). In the monograph by the Arkhangelsk researchers, the analysis is carried out on the scale of the entire AZRF. It presents the "demographic portrait" of the macro-region, the mechanism for realizing the demographic potential of the Arctic territories in the context of innovative development, and practical aspects of regulating demographic processes. In addition, the monograph contains a methodological section that reveals the research background of the team of authors [4, Smirennikova E.V., Gubina O.V. et al., pp. 113–146].

The book by the specialists from the Kola Scientific Centre of the Russian Academy of Sciences "Dynamics of social development of the territories of the Russian Arctic in the estimates of the population: Murmansk Oblast" [5, Gushchina I.A., Kondratovich D.L. et al.] refers to examples of research cases: this work summarizes the results of many years of sociological research conducted in the Murmansk Oblast, which is entirely included in the Russian Arctic and is its northwestern border region. The peculiarity of this monograph is that its authors analyze not the objectified parameters of the development of the socio-economic system of the region, but the percep-

tion and assessment of socio-economic processes and government policy in this area directly by residents of the Murmansk Oblast, which act as predictors of their economic behavior, migration decisions, political participation, and, consequently, factors in the development of the Oblast's territories. In this regard, researchers consider the conditions and potential of self-development of local communities [5, pp. 80–115].

Among the general journal publications on the socio-economic development of the Arctic regions, one should mention the article by a team of authors from the Northern State Medical University (Arkhangelsk), which shows the dynamics of the socio-economic situation of the AZRF regions for a wide range of indicators in two time intervals — 2000 and 2020 [6, Malinina E.S., Ushakova T.N. et al.]. The article presents changes in the following indicators for 9 constituent entities of the Russian Federation, fully or partially included in the Arctic zone: population and life expectancy, real cash income and Gini coefficient, industrial production index and employment. The authors conclude that the socio-economic situation in almost all regions of the Russian Arctic is steadily deteriorating (over a horizon of 20 years) in most of the analyzed indicators [6, p. 145].

Young Arkhangelsk researchers L.V. Voronina, A.V. Grigorishchin and co-authors reveal the importance of the institutional environment for the development of social infrastructure on the example of two subjects of the Russian Federation (the Arkhangelsk Oblast and the Komi Republic) [7]. The authors of the article see the main flaw in institutional design in the inconsistency of strategic planning documents of different levels of government (municipal, regional, interregional), and the solution to the problem —in the development of "harmonized regional programs for the development of social infrastructure in the Arctic zone of the Northern macro-region" [7, p. 152].

The joint article by scientists from Yekaterinburg and Arkhangelsk [8, Voronina L.V., Shelomentsev A.G. et al.] once again raises the well-known question in the context of the topic of socio-economic development about the influence of the migration movement of the population on it. Based on the results of correlation and regression analysis, the authors established a connection between the migration balance and the level of employment, the availability of places in kindergartens, the number of schoolchildren, the average wage, the volume of goods shipped, investments and taxes. Regions of the Russian Arctic are differentiated depending on the intensity of migration processes and the degree of their impact on the regional economy into extractive regions, where the effects of migration due to the significant role of the rotational method of labor force formation are most pronounced, and regions with a diversified economy (such as the Arkhangelsk and Murmansk oblasts), where such effects are minimal.

Along with the demographic and institutional factors of the socio-economic development of the Arctic territories, some articles are devoted to the impact of the specifics of social relations and cultural determinants of Arctic communities. Thus, the article by A.M. Maksimov and A.V. Ukhanova [9] made an attempt to discover the connection between the value orientations of the population of the Arctic regions (the article compares the Yamalo-Nenets Autonomous Okrug and the Arctic municipalities of the Arkhangelsk Oblast) and their propensity for entrepreneurial be-

havior. In this work, the direct connection between these parameters is weakly traced; however, the indirect influence of values (through their participation in the formation of positive attitudes and motivation for entrepreneurship) on entrepreneurial activity is logically justified. Another article by A.M. Maksimov and his colleagues [10] examines the dependence of entrepreneurial activity on social capital and the level of trust on the materials of a single region (the Arkhangelsk Oblast). The article shows how the lack of social capital and trust in institutions increases the transaction costs of market agents, negatively affects the realization of the region's entrepreneurial potential and contributes to maintaining its low investment rating.

The efforts of regional researchers develop and offer for discussion structural models of integrated socio-economic development of the AZRF, taking into account the role and interrelationships of components related to the factors of production, social infrastructure, institutional order and socio-cultural specifics of the population of the Arctic territories [11, Regeta A .I., Malinina K.O., Maksimov A.M., p. 167].

Regional (including comparative) studies of typologically different territories of the AZRF — economically diversified cities, single-industry towns and rural areas — are particularly worth highlighting. In a comparative perspective, these types of settlements are actively studied by A.N. Pilyasov and his colleagues [12], these studies will be discussed below in the section devoted to local socio-economic research. Here we would like to note the article by V.V. Dyadik, an economist from the Kola Scientific Centre of the Russian Academy of Sciences, which is a meta-analysis of studies of Arctic single-industry towns [13]. The author carried out a thorough review of domestic and foreign publications on the socio-economic situation in Arctic single-industry towns, which allowed generalizing on the main research issues regarding the problems and trends in the development of Arctic single-industry towns. The author shows that the central topics in Russian scientific discourse are the environmental situation in single-industry towns, their inherent demographic problems and issues of their strategic development as a type of settlement characteristic of the Russian Arctic. The interest of foreign (European and North American) researchers is focused more on the prospects and difficulties of organizing local self-government and local civil initiatives in Arctic single-industry towns, which reflects the decentralized and subsidized approach to territorial (in particular, urban) development in the Arctic inherent in these countries.

In turn, the specifics of northern and Arctic rural territories are consistently studied by Doctor of Economic Sciences, Professor V.A. Ivanov from the Komi Scientific Center of the Ural Branch of the Russian Academy of Sciences. His latest works include the articles devoted to the role of the northern/Arctic regions in ensuring the country's food security [14] and the peculiarities of the economic development of rural areas of the Arctic and North (based on the case of the Komi Republic) [15]. Despite the general assessment of the agricultural sector of the economy of the northern and Arctic regions (territories) of the Russian Federation as deeply depressed and peripheral in their sectoral structure, V.A. Ivanov believes that rural settlements and rural communities have prospects and they lie in the diversification of the production sector, as well as in the

transition of state policy from a tactical response to current rural problems to strategic management [15, pp. 52–53].

Local studies and comparative researches at the municipal level

In recent years, studies of socio-economic development have been developed and actively conducted at lower territorial level — municipalities of various types. The analysis of works has shown that researchers often turn to the study of a separate municipal district, urban district, typologically close cities of a particular region (for example, single-industry towns), several interconnected settlements. The local nature of the research is compensated by a greater depth of immersion in empirical material, greater detail in the texture and complexity of the analysis. At the same time, the general picture of social and economic life in the Russian Arctic at the local level, despite all the common features inherent in the territories of this macro-region, is distinguished by diversity and variety.

This is largely due to the historically developed heterogeneity of the distribution of the population, production facilities and infrastructure, the difference in approaches to the development of Arctic territories in the Northwestern, Siberian and Far Eastern parts of the Russian Arctic, and the typological differentiation of Arctic settlements and communities, which form the "Arctic facade of Russia". This issue is currently being developed by A.N. Pilyasov. Thus, in his article of 2021, he provides the author's classification of types of settlements, describing the economic, social, cultural and everyday differences between them. In particular, seven types are distinguished (2 for urban districts and 5 for municipal districts): "genuine" city (all Arctic regional centers and large industrial centers), areal "quasi-urban" district (Pevek, Novaya Zemlya), urban municipal district, agro-industrial rural district, rural "national" district with a large urban center, national municipal district with underdeveloped urban centers, classic rural municipal district (in which there are no permanent urban settlements, only rotational ones) [12, pp. 743–751]. Moreover, within the same type, the local socio-economic situation may vary depending on the context, which is set by the general characteristics of the subject of the Russian Federation, the border nature of the location of the municipality, etc. The above circumstances determine the importance of empirical study at the local level of individual research cases, on the basis of which it is possible to form the most complete and dynamic picture of the socio-economic "landscape" in the Russian Arctic.

Many specialists from regional research centers and universities are currently engaged in such local studies. A comparative overview of the demographic, social, economic characteristics of municipalities within the boundaries of one region can be found in the works of researchers from the Arkhangelsk and Murmansk oblasts, the Komi Republic (similar studies are conducted in the Tyumen Oblast/Yamalo-Nenets Autonomous Okrug, the Sakha Republic, but their systematic review requires a separate bibliographic article).

Thus, the article by scientists from the FCIAR of the Ural Branch of the Russian Academy of Sciences (Arkhangelsk) tests formalized methods of expert assessment of the socio-economic situ-

ation in five Arctic municipalities of the Arkhangelsk Oblast (in the context of both individual settlements and regions as a whole) by 9 factors — from transport accessibility to the availability of industrial infrastructure [16, Tutygin A.G., Chizhova L.A., Lovdin E.N., pp. 177–183]. Although the result obtained by the authors, indicating the determining role of the state of transport communications for successful socio-economic development, is a posteriori justified only for the areas mentioned above, the methodology used is basically applicable regardless of the geography of the study (at least within the Arctic macro-region) .

Arkhangelsk researchers also pay close attention to the medical and social situation in the Arctic territories and its interrelation with economic, social and environmental conditions of the population. In particular, recent study carried out by a group of scientists from the Northern Medical State University [17, Konovalova L.V., Ushakova T.N., et al.] analyzed the dynamics of recent years (before and during the pandemic of coronavirus infection) by 15 indicators in four groups of factors: economic, social, medical-ecological, and living conditions. The study covered 9 municipalities (3 city districts, 5 districts and the special administrative-territorial unit “Novaya Zemlya”). A comparative analysis of the short-term dynamics of public health factors in the surveyed territories showed a significant dispersion among individual municipalities, in particular between urban districts and rural areas, peripheral territories and territories adjacent to the agglomeration around the regional center. In this regard, it is stated that “it is necessary to take an individual approach to solving problems that have become much more contrasting against the backdrop of restrictive measures and other consequences of the pandemic” [17, Konovalova L.V., Ushakova T.N. et al., p. 3018].

It is worth noting that Moscow researchers are also interested in the medical and social problems of the Russian Arctic at the local level. In 2021, scientists from the National Research University Higher School of Economics and the Institute of National Economic Forecasting of the Russian Academy of Sciences published the results of a study on premature mortality of residents of the Arctic municipalities of the Arkhangelsk Oblast according to the main classes of causes of death [18, Fattakhov T.A., Mironova A.A.]. The 2010–2019 timeframe shows a decrease in premature mortality (obviously, the COVID-19 pandemic had to make adjustments to this dynamics). But what is more important is the authors’ pointing out the differentiated nature of this dynamics within the region: in the cities, its positive character was expressed to a clearly greater extent than in the peripheral areas. The latter are also distinguished by higher mortality from external causes in working age. In general, the conclusions of Moscow authors are consistent with the results of the research work of Arkhangelsk colleagues.

In their latest works, regional researchers also pay attention to the traditional topic of mutual influence of human economic activity and the state of the environment. In the 2021 article, economist from the Komi Scientific Center of the Ural Branch of the Russian Academy of Sciences T.V. Tikhonova develops the important topic of ecological function and provided ecosystem services at the municipal level [19]. Using the example of Vorkuta, Unta, Ust-Tsilemskiy and Izhemskiy

municipal districts, the contribution of local ecosystems to neutralizing the negative effects of the activities of industrial enterprises and agricultural firms is shown — absorbing pollution from the atmosphere, maintaining the level of river flow due to taiga vegetation, purification of surface water runoff by bogs. The article substantiates the idea that the economic policy of regional and municipal authorities, aimed at the optimal use of ecosystem services, will significantly reduce the costs of environmental conservation and compensation for environmental damage.

Unique in its kind is a two-volume monograph by a team of authors from the Kola Scientific Center of the Russian Academy of Sciences, dedicated to the ecological state of Lake Imandra (Murmansk Oblast, the territory of the cities of Apatity and Monchegorsk, the settlements of Imandra, Khibiny, Tik-Guba, Afrikanda, Zasheek). In the context of our review, the 4th chapter of the 1st volume is interesting, which deals with the anthropogenic load on the ecosystem of the lake and lakeside areas [20, Moiseenko T.I., Dauwalter V.A., Sandimirov S.S., pp. 42–50]. This chapter analyzes in detail the impact of local industry and transport infrastructure on the ecological state of Lake Imandra. It is shown how the development of apatite concentrate production since 1930 and the increasing volume of wastewater from 1976 to 2020 from nearby enterprises led to significant pollution of water with heavy metals, and the work of power plants led to the draining of part of the lake, changes in water temperature, which affected the decline in fish population, changes in flora and fauna. It is obvious from the research materials that serious ecological threats from the activities of extractive industry and energy enterprises have been preserved up to the present time. Further sustainable development of these territories requires increased budget expenditures on environmental protection measures and investments in eco-oriented modernization of local production facilities.

Another important and relevant monograph by scientists from the Kola Scientific Center of the Russian Academy of Sciences (specifically, the staff of the G.P. Luzin Institute of Economic Problems) covers a more extensive geography of the study beyond the Murmansk Oblast (in addition to the Komi Republic, Yamalo-Nenets, Nenets and Chukotka Autonomous okrugs, Krasnoyarsk Krai, Arkhangelsk Oblast), but the analysis is carried out in the relations of municipal statistics and expert assessments of the socio-economic situation at the local level of government. It is entirely devoted to the economic consequences of the coronavirus pandemic of the early 2020s [21, Kobylinskaya G.V., Fedoseev S.V. et al.]. The authors assessed the impact of the pandemic on the economic development of municipalities in the Russian Arctic and identified the most significant problems. The monograph describes and substantiates the methodological principles in detail; statistical analysis and expert survey were used as research methods. The authors clearly showed the views of the administrative apparatus on the existing problems of territorial development in accordance with the approved federal and regional guidelines. The identified list of current problems at the municipal level affects practically all aspects of the territory's development: from social issues to innovation. The paper presents a profile of municipalities by economic specialization based on a general list of indicators. Moreover, the analysis was carried out for the period from 2017 to

2020, which made it possible to compare the economic dynamics at the territorial level before the pandemic and at the end of its first year. The advantage of the work is an overview of leading enterprises, as well as an assessment of the number of small businesses, where the leader (among the surveyed municipalities) is the city of Naryan-Mar.

At the end of our review, we would like to mention another interregional study (Arkhangelsk and Murmansk Oblasts, the Republic of Karelia), where the object is not regions as a whole, but individual municipalities — an article by a group of economists from the Karelian Scientific Centre of the Russian Academy of Sciences on the development of territories and settlements on the White Sea coast [22, Druzhinin P.V., Kurilo A.E., Moroshkina M.V.]. The analysis used the indicators that characterize both social phenomena (population size) and economic ones (structure of enterprise turnover, investments in fixed capital, employment, wages, volume of shipped goods of own production). Most of them are analyzed for the time period 2010–2019. Negative trends in development are observed for most of the coastal municipal districts. At the same time, within the framework of the forecast presented in the article, the authors point to a more successful development of coastal municipalities of the Arkhangelsk Oblast — mainly due to the location of the regional center (Arkhangelsk) and the large industrial city of Severodvinsk in the waters of the White Sea [22, Druzhinin P.V., Kurilo A.E., Moroshkina M.V., p. 14, pp. 17–18].

Conclusion

The analysis of scientific works in the field of socio-economic development of the Russian Arctic showed that research of the last few years mainly demonstrates a reflection on the trends that existed before global stress for Russian society in the “face” of the COVID-19 pandemic and the radically reformatted international political context of the country. Serious scientific works documenting the economic effects of the pandemic in relation to the Arctic territories so far exist in the form of exceptions (unlike similar studies on a nationwide scale). Obviously, thorough, well-funded research on this topic is a matter of the future, albeit the immediate one.

At the same time, the authors found that studies of the Russian Arctic in its social and economic dimensions are distinguished by pronounced thematic diversity: the focus of research attention is on the issues of economic growth drivers, social well-being, environmental security, cultural determinants of economic behavior, demographic processes, medical and social situation, strategic management of territorial development and the role of local community activity. Such thematic diversity creates the prerequisites for the formation of a complex, holistic and detailed vision of the Russian Arctic as a dynamic social system.

The rapid growth rate of the number of newly published studies devoted to the socio-economic development of the Russian Arctic inevitably imposed restrictions on the completeness of our literature review. At the same time, it reflects the diversity of scientific research vectors in the latest socio-economic studies of the Arctic macro-region. As our review shows, this diversity is

not limited to thematic breadth, but is also expressed in the interest of researchers in the analysis of socio-economic processes at different levels of territorial organization.

Thus, the work of researchers in the Arctic and northern Russia is divided into three "flows": interregional comparative studies within the borders of the entire Russian Arctic, regional case studies, local studies (of one, a group or a large number of municipalities). It should be noted that, outside of large-scale comparative studies of Arctic territories, the most important contribution to the multiplication of empirical material and its conceptual understanding is made primarily by researchers from regional scientific and university centers.

If we turn to the diversity of local research, the attention is drawn to the fact that research into urban economics, urbanism, and urban communities is developing much more actively, while specialized research into Arctic rural areas remains rather on the periphery of scientific work. An initial search in the RSCI database for articles with the word "Arctic" in their titles or keywords for the period from 2018 to 2023 gives a result of 29 articles specifically devoted to the study of urban issues, while the number of articles on rural territories in the Russian Arctic for the same period is only 15 (excluding ethnography, history, and medicine) — in fact half as many, with almost a third of they account for one author (Professor V.A. Ivanov from the Komi Scientific Center mentioned in the text above). On the one hand, this is quite explainable by the high level of urbanization of the Russian Arctic: in this macro-region, nine out of ten residents live in cities [23, Fauzer V.V., Smirnov A.V. et al., p. 31]. On the other hand, the study of the rural periphery in the Arctic is associated with difficulties in field work generated by its notorious transport inaccessibility. At the same time, rural communities are an integral part of the Arctic "social landscape", so, given the current shortage of socio-economic research on the rural periphery of the Russian Arctic, their quantitative and qualitative growth can be expected in the future.

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Electronic Dictionary of Arkhangelsk Dialects

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Abstract. The research group of the Northern (Arctic) Federal University is implementing the project "Thematic dictionary of Arkhangelsk dialects with electronic support" supported by the Russian Science Foundation. The project aims to publish three issues of the dictionary, which will include the vocabulary reflecting the traditional world picture of the Arkhangelsk peasant: the first issue contains the vocabulary related to the names of clothes, shoes, hats; the second issue contains the names of residential and non-residential buildings; the third issue contains the vocabulary naming the food and drinks of the Arkhangelsk inhabitant. The second task of the project is to create an electronic dialect corpus devoted to the Arkhangelsk dialects, which is currently not available in universities of the North-West region. The article presents the experience of the project, which is at the intersection of dialectology, ethnography, cultural studies and corpus linguistics. The results of this research and the electronic database can be used in dialectological, folklore and ethnographic expeditions, in teaching Russian literature at universities and schools, in organization of local history work, in educational projects aimed at promoting northern spiritual culture, in preparation of cultural and scientific events devoted to the language and culture of the Russian North.
Keywords: *Arkhangelsk dialects, corpus linguistics, dialect dictionary*

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Introduction

The Department of Russian Language and Speech Culture of the Higher School of Social Sciences, Humanities and International Communication of the Northern (Arctic) Federal University named after M.V. Lomonosov keeps a card index of Arkhangelsk dialects recorded during dialectological expeditions in the Arkhangelsk Oblast, starting from 1960s. This interesting, extensive material is a great source for studying the living northern vocabulary. Currently, it is necessary to systematize this rich material and make it accessible to researchers and specialists dealing with issues of dialectology, folklore, ethnography, and culture of the Russian North.

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Along with the National Corpus of the Russian Language [1], where a collection of texts in Russian is presented, there is a subcorpus of historical and dialect texts. In recent years, scientists from various universities have been creating electronic dialectal corpuses, which are posted on university web pages. Such electronic databases are available at the Volgograd State Socio-Pedagogical University, Dostoevsky Omsk State University, Tomsk State University, etc.

Currently, the collected dialect materials of the card index of the Department of Russian Language and Speech Culture are kept in handwritten form on paper media, and access to them is difficult for researchers and specialists. Therefore, there is a need to create an electronic corpus and information system in order to duplicate the traditional method of storage and provide convenient work with data. The Department of Russian Language and Speech Culture of NArFU named after M.V. Lomonosov is developing a web application and a mobile application to provide convenient access to dialectal materials. The mobile application will also allow working with the materials in the field and will facilitate systematization and classification of the collected materials on site.

Main part

In 1980s, A.S. Gerd proposed to compile a digital fund of historical and dialect texts. His idea was supported by V.E. Goldin [1]. Today there is a wide range of corpuses, both foreign and Russian, that store dialect texts and demonstrate elements of dialect speech, for example, foreign corpuses — The Nordic Dialect Corpus [2], The Freiburg English Dialect Corpus [3], Helsinki Corpus of British English Dialects [4]), Russian ones — dialect subcorpus within the National Corpus of the Russian Language (NCRL) [5], Saratov dialect corpus [6], Tomsk dialect corpus [7], Kuban dialect corpus [8], Dialect corpus of linguistic culture of the Northern Angara region [9], Corpus of folk speech of the Middle Irtysh region [10], Volgograd lexical atlas [11].

The dialects of the Russian North, in particular the Arkhangelsk dialects, have attracted the attention of linguists, philologists, and ethnographers for decades due to their remoteness from

[1] National Corpus of the Russian Language. URL: https://ruscorpora.ru (accessed 25 July 2023).
[2] Nordic Dialect Corpus. URL: http://www.tekstlab.uio.no/nota/scandiasyn/ (accessed 14 July 2023).
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[8] Kuban dialect corpus. URL: https://ethnolex.ru/kubdk/ (accessed 20 July 2023).
[9] Electronic text corpus of linguistic culture of the Northern Angara region. URL: http://angara.sfu-kras.ru (accessed 20 July 2023).
[10] Dictionary of constants of folk speech of the Middle Irtysh region. URL: http://dict.univer.omsk.su/ (accessed 20 July 2023).
[11] Word on the map. Volgograd lexical atlas. URL: http://dialekt.vspu.ru/?q=node/2 (accessed 20 July 2023).

the center and archaic nature. In recent decades, domestic scientists have been seriously mastering the vocabulary of the Russian North; research has resulted in the publication of such dictionaries as the "Arkhangelsk Regional Dictionary", published by Moscow State University named after M.V. Lomonosov, edited by O.G. Getsova and E.A. Nefedova, "Dictionary of dialects of the Russian North", edited by A.K. Matveev, published by Ural University, "Dictionary of Russian dialects of Karelia and adjacent regions", edited by A.S. Gerd, published by St. Petersburg State University, "Dictionary of Pinega dialects" by A.N. Levichkin and S.A. Myznikov (the first issue of the dictionary with sample articles was published in 2014).

Currently, the work on creating thematic dictionaries has also intensified, such as, for example, "Thematic Dictionary of dialects of the Tver Oblast" (2002–2006) [2], "Lovetskoe slovo: Dictionary of Volga-Caspian fishermen" by E.V. Kopylova (1984) [3], dictionary by Kostroma local historian A.V. Gromov "Vocabulary of flax growing, spinning and weaving in Kostroma dialects along the Unzha River" (1992) [4], "Dictionary of geographical terminology in Russian speech of the Perm Krai" by E.N. Polyakova (2007) [5].

The rich dialect material stored at the Department of Russian Language and Speech Culture makes it possible to create a thematic dictionary in which words are grouped according to a thematic principle. The dictionary contains vocabulary for one or another sphere of people's life (clothing, food, buildings, nature, flora and fauna, etc.) within the Arkhangelsk Oblast. The dictionary materials can serve as a good source for reconstructing the traditional picture of the world of the Arkhangelsk peasant. Due to the development of computer technology, there is a need to create an electronic version of the "Thematic Dictionary of Arkhangelsk Dialects".

Within the framework of the grant by the Russian Science Foundation, it is planned to prepare three issues of a thematic dictionary of Arkhangelsk dialects, including vocabulary associated with the names of clothing, residential and non-residential buildings, food and drinks, i.e. vocabulary reflecting the traditional picture of the world of the Arkhangelsk peasant.

The first issue of the thematic dictionary "Clothes, shoes, headwear, accessories, fabrics" includes such subgroups as "general name of clothing", "qualitative name of clothing", "women's outerwear", "men's outerwear", "sundresses, dresses, women's sweaters, shirts, skirts", "men's shirts, trousers", "materials used to make clothes", "mittens, gloves", "hats, female and male", "shoes, female and male", "socks, stockings", "children's clothing", "vocabulary of wearing clothes and shoes", "vocabulary of manufacturing and repairing clothes and shoes", "accessories".

At the moment, the dialectal material recorded by teachers and students of the Pedagogical Institute (now — Northern Arctic Federal University) during dialectological expeditions is stored in the form of field recordings on paper (in notebooks and on cards) and on tape cassettes. This material is very valuable because it preserves the original, unique, drawling, melodious northern speech. The dialect material in notebooks indicates personal data of informants: last name, first name, patronymic; year of birth (age); education; it is also noted whether the informant is an indigenous person — this information is especially important as the authentic northern speech is

preserved among indigenous people. Dialect words in notebooks are underlined and accented. The word is written in context, based on which the meaning can be formulated. One can also find drawings of everyday objects in notebooks, which illustrate how the spoken object looks like. Fig. 1, 2 show samples of field notes recorded during dialectological expeditions in the village of Ukhta, Kargopol region, in June–July 1991 (Fig. 1) and in Oshevensk, Kargopol region, in June–July 1993 (Fig. 2).

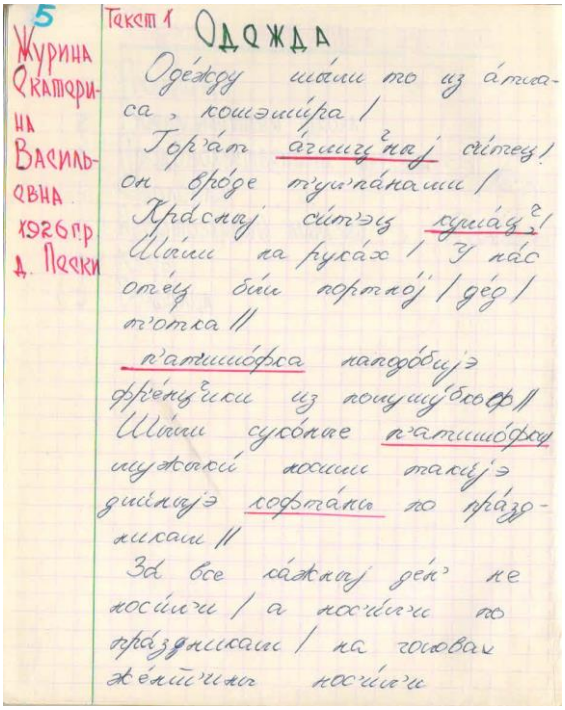

Fig. 1. Dialect record.

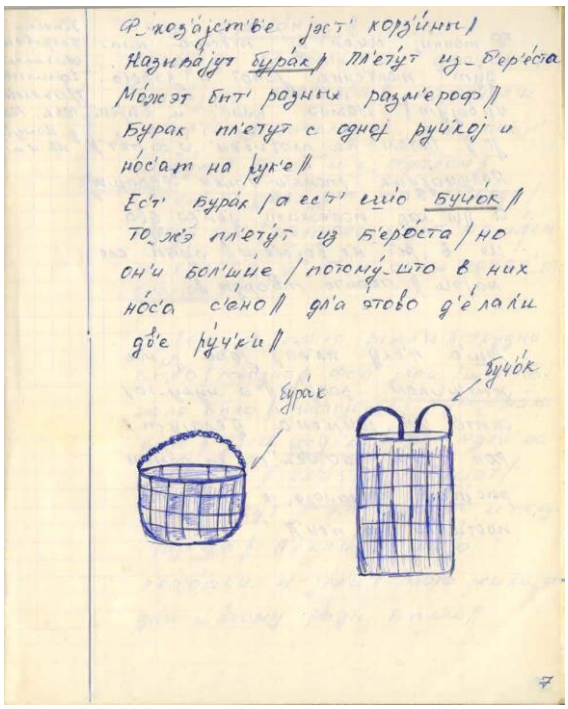

Fig. 2. Dialect record with illustrations.

From the collected records, dialect words were written down on cards in their original form: noun — in the nominative case, singular or plural; adjective — in the nominative case, mas-

culine, singular; verb —in the infinitive. The interpretation of the word (definition of the meaning of the word) was formulated, and the context revealing the meaning of the word (illustrative material) was recorded on the card. The locality and district of the Arkhangelsk Oblast where the word was recorded, as well as the initials of the informant, were also noted down.

Fig. 3. The word “Kazachina” [long fur coat].

At the moment, the first issue of the thematic dictionary “Clothes, shoes, headwear, accessories, fabrics” has been prepared for publication. The same material has been loaded into the electronic dialect corpus. The formed cards are entered into the database of dialect words with the help of a specially developed application “Word Box”.

“Word Box” allows forming lists of dialect words. For this purpose, information about each word is entered into a special electronic card. Entries can be edited or deleted if necessary. The resulting list of words can be exported in .docx format as a set of dictionary entries or in .csv format as a dataset suitable for analysis.

The interface of the application is shown in Fig. 4.

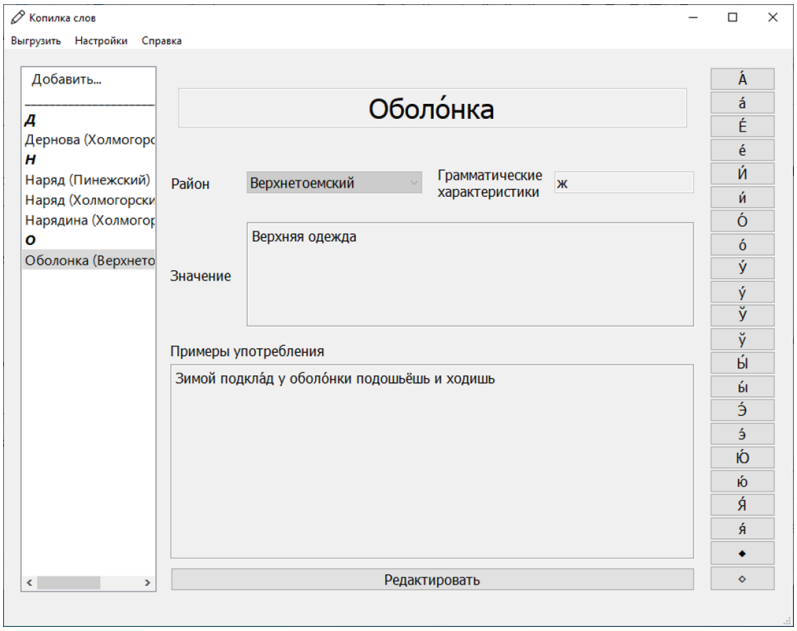

Fig. 4. Application interface.

The menu bar allows accessing the program's features. In the "Download" submenu there are two lines: 1) "csv", which allows downloading the collected vocabulary cards in .csv format for machine analysis, and 2) "word", which allows downloading the collected vocabulary cards in .docx format as an alphabetically sorted dictionary. The "Settings" submenu contains the line "Change font size", by clicking on which the dialog box for setting the font of text elements is called up. The "Help" submenu contains a corresponding line that opens a window with brief information about the application and its functionality and with the developer's contacts.

In the center there is a vocabulary card, in the fields of which the relevant information from paper cards is entered.

To the left of the vocabulary card, there is a word organizer. Words are displayed without accents to avoid unnecessary visual noise, but with an indication of the areas in which these words are used. The words in the organizer are sorted alphabetically and divided into sections according to the first letter; each section is preceded by an initial — the corresponding capital letter.

Clicking on the "Add…" allows switching to the mode of adding a new word. By clicking on the selected word, the corresponding vocabulary card is shown. Clicking on the "Edit" allows switching the vocabulary card to editing mode. In order to continue working with the list of words, it is necessary to save or cancel changes in the current card, and at least the first field of the card must be filled in.

To the right of the vocabulary card area, there is a panel of additional symbols. They are used to place accents (Á), indicate brevity (Ў), and add other necessary information (◆, ◇). You can use them by placing the mouse cursor in the "word", "word meaning" or "examples of use" field and then click on the desired symbol with the left mouse button. The symbol will be inserted at the cursor position. You can also use apostrophes to set accents: after editing the field, all vowel letters with apostrophes will be replaced with vowel letters with accents.

As part of testing, the application was offered to a group of eight students of the Philology department as one of the tasks for practical training. As a result of testing, it was found that the application works correctly and performs the stated functions. The files generated as a result of processing in .csv format (datasets) are suitable for analysis.

A dataset was collected and analyzed on the basis of the materials included in the first issue of the thematic dictionary "Clothes, shoes, headwear, accessories, fabrics". Thus, Fig. 5 shows a word cloud that reflects the most frequent words. The more often a word is used, the larger it appears in the picture.

Fig. 5. Word cloud.

Figure 6 shows a bar graph showing the distribution of the most frequent words in this dataset by region. The figure shows the relative frequencies — the shares occupied by each of the frequency words in each specific area. The diagram demonstrates the uneven use of words: for example, the word “ранний” [“early”] is found in the Vinogradovskiy district more often than other frequency words and occupies a leading position among other districts, and the words “сарафан” [“sundress”] or “шить” [“sew”] are not reflected in the dictionary for this region at all. The diagram also shows that the word “носить” [“wear”] is the absolute leader both among all frequency words and among all regions.

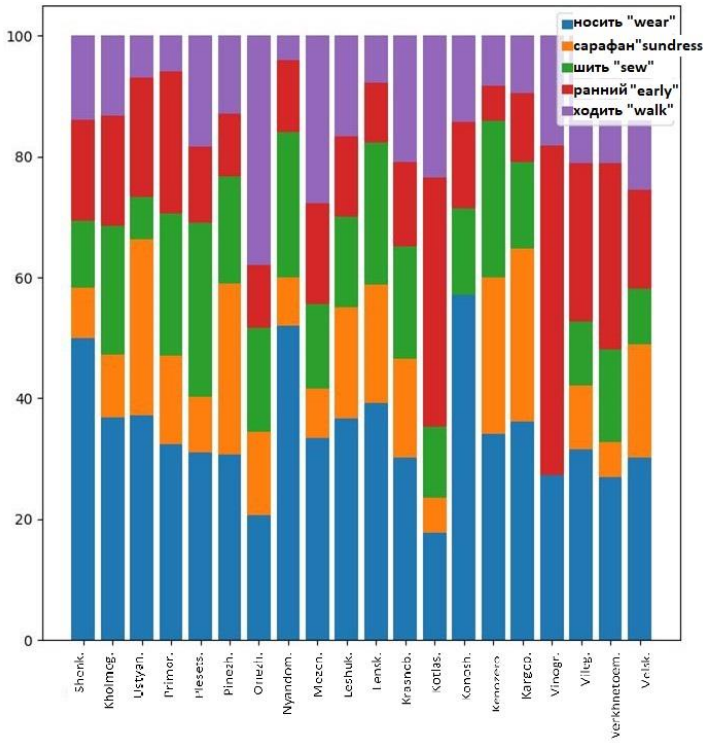

Fig. 6. Distribution of the most frequent words by region

Conclusion

Thus, on the basis of the Northern (Arctic) Federal University named after M.V. Lomonosov, a multi-volume thematic dictionary of dialects of the Arkhangelsk Oblast is being prepared for publication, and for the first time, an independent corpus dedicated to Arkhangelsk dialects is being created. The materials of the thematic dictionary of Arkhangelsk dialects will become available to a wide range of readers, to all who love living words, and the dialect corpus filled with these materials will help specialists in researching Russian folklore, in works on ethnography, social history, folk costume and life, as well as in organizing museum and ethnographic activities. The results of this study can be used in teaching Russian literature at universities and schools; in organizing local history work; in educational projects aimed at popularizing northern spiritual culture; in preparation of cultural events dedicated to the language of the Russian North; in organizing museum and ethnographic activities.

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