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We will be glad to see you among the authors of "Arctic and North"!

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SOCIAL AND ECONOMIC DEVELOPMENT

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Problems and Prospects of Atlantic Salmon Mariculture Development in the Russian Arctic*

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Abstract. The authors present the volume of Atlantic salmon farming in the world and in the Russian Arctic. It shows the reasons that hamper the development of salmonid mariculture in the Russian Arctic: the lack of own planting material adapted to Arctic waters, high-quality fodder, fish diseases and others. Objectives of the article: to show the peculiarities of natural and socio-economic conditions of mariculture development in the Russian Arctic and the impact of Atlantic salmon mariculture on import substitution. Relevance stems from the need to substantiate the sources of import substitution of salmon products. The most important results: the main factors that reduce the economic efficiency of growing and selling products were found; the possible causes of salmon diseases in the Russian Arctic and their impact on production processes were systematized, the possible impact of caged fish farming on the environment and on the population of salmon in the Arctic zone was shown. Practical significance: the article shows the influence of possible escapes of farmed salmon on the socio-economic conditions of the population of the Terskiy coast of the Murmansk region and the White Sea basin. It is proposed to introduce Atlantic GM salmon into the composition of genetically modified products. It is shown that import substitution is fully provided by Atlantic salmon mariculture and the supply of wild salmon from the Far East to the European part of Russia.

Keywords: *Russia, Arctic, Atlantic salmon, commercial farming, import substitution, prospects, problems.*

Introduction

World's population growth, improvements in living standards, primarily in the developing countries of Asia, have become the main factors in increased demand for food of animal origin, including fish. Since lots of natural reserves of fish and seafood were depleted by the end of the XX century and did not allow a significant increase in catches, the governments of many countries and investors turned their attention to aquaculture, which made it possible to use feed resources 4.5 times more efficiently than growing beef and 2.8 times — than pork.

The main production of commercial farming of fish and other objects of aquatic biological resources is concentrated in countries with large population in Southeast Asia¹. These countries have a huge population of 57% (according to 2017), which, given the low level of fisheries devel-

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¹ Ezhegodnik FAO po statistike rybolovstva i akvakul'tury [FAO Fisheries and Aquaculture Statistics Yearbook]. URL: <http://www.fao.org/fishery/statistics/yearbook/en> (accessed 03 January 2021).

opment, needs providing food of animal origin. The share of this region in the total aquaculture production in 2018 is 88.69%, including China — 57.9% (Table 1).

Table 1

*Fish production in aquaculture by major producer
(thousand tons, % of the world volume)²*

Regions / countries	2000	2005	2010	2015	2018
Asia (excluding Cyprus)	28420.6 87.67%	39185.9 88.46%	51228.8 88.72%	64591.8 88.76%	72812.2 88.69%
China (continental)	21522.1 66.39%	28120.7 63.48%	35513.4 61.50%	43748.2 60.12%	47559.1 57.93%
India	1942.5 5.99%	2967.4 6.70%	3785.8 6.56%	5262.0 7.23%	7066.0 8.61%
Indonesia	788.5 2.43%	1197.1 2.70%	2304.8 3.99%	4342.5 5.97%	5426.9 6.61%
Asia, rest of the countries	4167.4 12.86%	6600.8 15.57%	9624.7 16.68%	11241.2 15.45%	12760.1 15.55%
North and South America	1423.4 4.39%	2176.9 4.91%	2514.6 4.35%	3274.7 4.50%	3799.2 4.63%
Chile	391.6 1.21%	723.9 1.63%	701.1 1.21%	1045.8 1.44%	1266.1 1.54%
Latin America and the Caribbean, rest of the countries	447.4 1.38%	784.5 1.77%	1154.5 2.00%	1615.5 2.22%	1873.6 2.28%
North America	584.5 1.80%	668.5 1.51%	659.0 1.14%	613.4 0.84%	659.6 0.80%
Africa	399.6 1.23%	646.4 1.46%	1285.8 2.23%	1777.6 2.44%	2195.9 2.67%
Europe (including Cyprus)	2052.6 6.33%	2137.3 4.82%	2527.0 4.38%	2948.6 4.05%	3082.6 3.75%
Norway	491.3 1.52%	661.9 1.49%	1019.8 1.77%	1380.8 1.90%	1354.9 1.65%
Countries — EU members	1402.5 4.33%	1272.4 2.87%	1263.3 2.19%	1263.7 1.74%	1364.4 1.66%
Europe, rest of the countries	158.7 4.33%	203.1 0.46%	243.9 0.42%	304.0 0.42%	363.2 0.44%
Oceania	121.5 0.37%	151.5 0.34%	187.8 0.33%	178.5 0.25%	205.3 0.25%
The whole world	32417.7	44298.0	57743.9	72771.3	82095.1

Aquaculture in Europe accounts for about 1.2% of world production by volume and about 3% by value. In 2017, the EU grew about 1.4 million tons of fish and seafood worth 4.6 billion euros. This is significantly less than world production. Moreover, production in the EU has declined from a moderate annual growth rate of 3.4% during the period 1990–2000 to negative growth rates of –0.2% in the period 2000–2017³.

The volume of aquaculture in North America is negligible. In 2000, it amounted to 584.5 thousand tons (1.8%), in 2018 — 659.6 thousand tons (0.8%). The countries of this continent — the USA and Canada, — like Russia, have large natural resources of fish and seafood; authorities and society pay great attention to environmental issues and their impact on public health. So, until

² Compiled by the authors. Source: Ezhegodnik FAO po statistike rybolovstva i akvakul'tury [FAO Fisheries and Aquaculture Statistics Yearbook]. URL: <http://www.fao.org/fishery/statistics/yearbook/en> (accessed 03 January 2021).

³ Akvakul'tura v Evrope: ekonomicheskii obzor [Aquaculture in Europe: an economic overview]. URL: <https://fishretail.ru/news/akvakultura-v-evrope-ekonomicheskii-obzor-401293> (accessed 25 December 2020).

recently, the cultivation and consumption of genetically modified fish was prohibited in the United States.

Main section

The Government of the Russian Federation pays great attention to the aquaculture development, planning to increase the participation of fishing industry in the Food Security Doctrine implementation and to reduce the problem of high prices for fish products. The total volume of fish farming production in Russia in 2018 amounted to 238.7 thousand tons, which is only 41 thousand tons (14.6%) less than in 1990. The value of fish farming in the total volume of marketable fish products was 3.7%. At the same time, carp fish accounted for 61.0% of the total growth volume, salmonids — 28.0%⁴. Compared to 2012, the volume of salmon production increased in 2018 by 6.6%, while carp production decreased by 13.0% [1]. The above data show that Russia lags significantly behind the world level of fish farming and that was to be expected, since the country does not develop commercial reserves of wild fish.

In terms of fish farming in 2018 — 78.7 and 37.8 thousand tons (48.8%) — the Southern and Central Federal Districts are in first place. There are good conditions for aquaculture of cyprinids and other non-predatory fish, as well as great demand for them. The territories are far from the main fishing regions — the Far East and the North.

In the Northwestern Federal District, mainly in Karelia and the Murmansk region, 59.5 thousand tons of commercial mariculture products were produced in 2018 (24.9% of the total volume of cultivation). Trout is mainly grown in Karelia. The Murmansk region is the only region in the Russian Arctic where genetically modified Atlantic salmon (genetically modified salmon) is grown for import substitution. The production volumes are shown in table 2.

In the Far Eastern Federal District, mainly in the Primorskiy Krai, there are difficulties with the production and sale of wild salmon. Mariculture has been developed there and 13.0 thousand tons of marketable products were already grown in 2018. Seafood is grown in small quantities and mainly for export. Aqua and mariculture are also developing in other territories of Russia⁵.

Table 2

Mariculture of Atlantic salmon, thousand tons⁶

Country	2013	2014	2015	2016	2017	2018
Norway	1168.3	1258.4	1303.3	1233.6	1236.3	1282.0
Chile	492.3	644.5	608.5	532.2	614.2	661.1

⁴ Karabut T. Osobennosti natsional'noy akvakul'tury. Chto meshaet investoram uvelichivat' proizvodstvo ryby [Peculiarities of National Aquaculture. What Prevents Investors from Increasing Fish Production]. URL: <https://www.agroinvestor.ru/markets/article/31489-osobennosti-natsionalnoy-akvakultury/> (accessed 25 December 2020).

⁵ Dinamika proizvodstva produktsii tovarnoy akvakul'tury v Rossiyskoy Federatsii [Dynamics of Production of Commercial Aquaculture Products in the Russian Federation]. URL: http://fish.gov.ru/files/documents/otraslevaya_deyatelnost/akvakultura/proizvodstvo_akvakultury/statistika/dinamika_proizvodstva_produktsii.pdf (accessed 25 December 2020).

⁶ Compiled by the authors. Source: Ezhegodnik FAO po statistike rybolovstva i akvakul'tury [FAO Fisheries and Aquaculture Statistics Yearbook]. URL: <http://www.fao.org/fishery/statistics/yearbook/en> (accessed 03 January 2021).

Great Britain	163.5	179.4	172.1	163.1	189.7	166.0
Canada	97.6	86.3	121.9	123.5	120.5	123.5
Faroe islands	75.8	86.4	80.6	83.3	86.8	78.9
Australia	42.8	41.6	48.3	56.1	52.6	61.2
Russia	22.5	18.7	10.8	12.9	13.0	20.6
USA	18.9	18.7	18.7	16.2	14.7	16.1
Iceland	3.0	4.0	3.3	8.4	11.3	13.4
Ireland	9.1	9.4	13.1	16.3	18.3	12.0
Other	0.025	0.72	0.73	1.61	1.16	1.09
TOTAL	2093.8	2348.1	2381.3	2247.2	2358.6	2435.9

Table 2 shows that the world's main producer of Atlantic genetically modified salmon is Norway. Its share in the total volume of cultivation in 2018 was 52.6%, and together with Chile — 79.8%. Norway sells genetically modified salmon around the world, using price dumping to capture markets.

Two companies are involved in cultivation of genetically modified Atlantic salmon in the Russian Arctic: "Russian Salmon" and "Russian Aquaculture". They increased production until 2015, when the second company suffered a total fish disease and hundreds of tons of salmon were destroyed. The volume of salmon mariculture reached the pre-crisis level only by 2018. The companies import 100% of the fry from Norway, including the Norwegian factory they have already bought. The conditions of the Murmansk region are suitable for the cultivation of Atlantic salmon in the Russian Arctic. There are a significant number of bays, the water temperature there is insignificantly below the optimum. In the Kara Sea and other seas of the Arctic Ocean, the conditions for mariculture of genetically modified salmon, according to experts, are not suitable.

The most important reason for investors' attention to commercial farming of GM salmonids in the world and in Russia is the high level of economic efficiency. Thus, according to the Norwegian Fisheries Administration, the operating profitability of the cage system for growing Atlantic salmon is ~ 40%, the return on investment is ~ 18%, and the payback period is 5.6 years ⁷.

The second stimulating factor for the development of mariculture in Russia, primarily salmon fish, is the policy of import substitution and state assistance. The strategy for the national fishery complex development provides an increase in the volume of aquaculture production by almost three times by 2030 — up to 618 thousand tons. The state provides a set of measures for this. In 2018, the Ministry of Agriculture of Russia and the Federal Agency for Fishery allocated 653 million rubles to support aquaculture. In addition, the issue of reimbursement of capital costs for commercial aquaculture in the amount of 25% to 30% of the estimated cost and a number of other measures are being discussed ⁸.

⁷ Сравнение экономики и экологичности моделей с установкой замкнутого водоснабжения (УЗВ) и садковой системы для выращивания атлантического лосося [Comparison of the Economics and Environmental Friendliness of Models with a Recirculated Water Supply (RWS) and Cage System for Growing Atlantic Salmon]. URL: <https://aquavitro.org/2016/04/23/sravnenie-ekonomiki-i-ekologichnosti-modelej-uzv-i-sadkovoj-sistemy-dlya-vyrashhivaniya-atlanticheskogo-lososya/> (accessed 25 December 2020).

⁸ Стратегия развития рыбного хозяйства на период до 2030 года (утв. Распоряжением Правительством Российской Федерации от 26.11.2020 г. № 2798-р) [Strategy for the Development of the Fishery Sector of the Russian Federation for the Period up to 2030 (approved by the Order of the Government of the

The third factor is high feed efficiency. The feed coefficient for growing genetically modified salmon, depending on the type of feed and a number of other reasons, varies from 0.6 to 1.4. In trout aquaculture, it is 1.5–2.0, in pig farming — 3.0, and in cattle breeding — 6.8⁹.

The period of Atlantic salmon rearing is 16–18 months and is divided into three periods: rearing fry, juveniles and growing up to a certain size or weight, taking into account buyers' preferences. There are feeds with certain qualities for each period: for fry — starting feeds, for juveniles — transitional ones and at the final stage — production feeds.

The feed is based on high quality fish-flour containing about 70% protein, as well as wheat gluten and fish oil. The domestic industry has developed production of various feeds for all age groups. However, quality and prices do not satisfy the fish farmers, and they often prefer to buy foreign feed. This is especially true for predatory fish, such as trout, Atlantic salmon and sturgeon. According to the estimation of "Rosrybkhov" association, the dependence of fish feed on imports is 69% [2].

Considering the economic efficiency of genetically modified salmon farming, it is more profitable to use extruded feed. They have a feed ratio in the range of 0.6-0.8, and granulated ones — 1.2-1.4. In addition, extruded feed is more environmentally friendly — crumbling and sifting is about 1.0%, and granulated feed has the range of 5.0% to 10.0%. Therefore, when using extruded feed, water and bottom are less polluted¹⁰.

Salmon feeding does not stop at low temperatures (1–2° C), and when the temperature rises above 20° C (beyond the optimum), their feeding activity gradually decreases.

Salmonids, including the Atlantic salmon, are quite demanding for an oxygen regime (oxygen content of at least 7 mg/l). With a decrease in oxygen level, fish growth deteriorates, and food consumption decreases. The optimal water temperature for raising salmon fish is 14–18° C. The sea water temperature of the Russian coast of the Western Arctic in certain periods of the year does not correspond to these parameters, which reduces the consumption of feed and the growth of fish adapted to the water temperature of the Norwegian coast¹¹.

It is necessary to adjust the daily ration when the oxygen level in the reservoir or fish tanks fluctuates. At high stocking densities in cages and pools, technological errors and miscalculations in fresh water supply affect oxygen levels. It should also be taken into account that with active feeding, the intensity of oxygen consumption of salmonids increases by 50–200%. Many researchers have proven that even short-term, but frequent reductions in oxygen levels in fish tanks negatively affect the growth of fish¹².

Russian Federation dated November 26, 2020, No. 2798-r)]. URL: <https://www.garant.ru/products/ipo/prime/doc/72972854/> (accessed 25 December 2020).

⁹ Osnovnye strany-proizvoditeli atlanticheskogo lososya [Major Producing Countries of Atlantic Salmon]. URL: <https://uifsa.ua/news/world-news/the-main-producing-countries-of-atlantic-salmon> (accessed 17 December 2020).

¹⁰ Korma dlya ryby: sovremennye resheniya [Fish Feed: Modern Solutions]. URL: https://www.fishnet.ru/news/aquaculture_news/49525.html (accessed 04 January 2021).

¹¹ Ibid.

¹² Ibid.

Consumers are accustomed to the fact that salmon meat has a specific pink tint of varying intensity. In order to achieve the desired color of fish meat, feed suppliers add dyes to their products — natural or artificial. Astaxanthin, which colors fish meat in pink color of varying intensity, is one of them¹³.

As shown above, cost-effective farming of Atlantic salmon is achieved under many conditions, the main of them are high quality fishmeal and oil based feed. In 2019, Russia produced 126.0 thousand tons of fish flour¹⁴, and its production will increase rapidly in the coming years due to the commissioning of about 40 fishing vessels equipped with fishmeal plants. This amount of flour is sufficient for the production of aquaculture feed. But since most of the fishmeal in Russia is produced from wastes from fish cutting, it is not suitable for salmon mariculture due to its low protein content. Whole fish meal is prohibited in Russia.

World fishmeal is produced in the amount of 4.0 to 7.0 million tons¹⁵. There is a shortage of it during periods of poor condition of Peruvian anchovy commercial stocks, which leads to an increase in the cost of aquaculture production and prices for fish products. Other fish suitable for flour production are used, such as herring, menhaden, sardines and others¹⁶.

The cultivation of Atlantic salmon on the Kola Peninsula has potentially serious competitors in the marketing of wild salmon harvested in the Pacific Ocean in the Far East. In future, when the embargo on fish products supply from Norway and Finland is lifted, they will also become competitors.

The annual salmon production in the Far East ranges from 300 to 650 thousand tons. Their massive deliveries to the Russian market are constrained by the unavailability of technical equipment and the underdevelopment of transportation along the Northern Sea Route (NSR). But the Government of the Russian Federation is taking serious measures to organize the transportation of fish along the NSR. A specialized hub “Seroglazka” is being built in Kamchatka, which will be ready in 2021. Test passages with fish in refrigerated containers have been made, including ones assisted by the nuclear-powered lash lighter carrier “Sevmorput”. The issues of return loading of ships are being resolved¹⁷.

Comparison of retail prices for salmon in Murmansk stores shows that they are significantly lower for comparable types of Far Eastern products than for Atlantic salmon of local mariculture production. The main reasons for this are differences in the assortment and cost of products. In addition, salmon from local farms is usually sold fresh and therefore requires a

¹³ Ibid.

¹⁴ V 2019 g. v Rossii vyroslo proizvodstvo rybnoy muki [In 2019, the Production of Fishmeal Increased in Russia]. URL: https://www.fishnet.ru/news/novosti_otrasli/89495.html (accessed 26 December 2020).

¹⁵ Ekspert: rybnaya muka, kak produkt bezotkhodnogo proizvodstva [Expert: Fishmeal as a Waste-Free Product]. URL: https://finance.rambler.ru/economics/35341624-ekspert-rybnaya-muka-kak-produkt-bezotkhodnogo-proizvodstva/?article_index=1 (accessed 04 January 2021).

¹⁶ Ibid.

¹⁷ Rybnaya muka — ugroza rybnym resursam [Fishmeal is a Threat to Fish Resources]. URL: fishnet.ru/news/novosti_otrasli/69565.html (accessed 26 December 2020).

quick sale, forcing producers to lower prices. The seasonality of mariculture salmon production and restricted sales times are also factors limiting sales prices.

Another reason for decline in effectiveness of mariculture in the Russian Arctic, primarily in the European North, is competition with products from Norway and Finland after the resumption of their import to Russia. These countries use the latest technology in salmon farming, and most production processes are automated. Significant progress has been achieved in reducing the feed ratio, preventing and treating fish diseases. They use their own feed and smolt adapted to the sea water temperature. The water temperature off the coast of Norway is slightly higher than in Russia, and therefore the fish grows faster and the return on feed is higher.

Before the import ban, Norway and Finland supplied more than 200 thousand tons of mariculture products to Russia. With its resumption, fish from Norway and Finland will again appear on the Russian market in large volumes and, as evidenced by experience, prices will be lower than of Russian producers. It can have serious consequences, including bankruptcy, which has already occurred in the Russian North and in Finland [3]. Moreover, the Russian competitive factor — low wages — plays an increasingly small role.

Fish diseases, which are usually treated with antibiotics, are a major reason for the decline in the economic efficiency of genetically modified salmon farming. Literary sources claim that, for example, Norway has managed to minimize this damage to mariculture and products are sold with minimal antibiotics in fish meat.

In Russia, the development of cage culture for salmonids is at an early stage, and so far it has not been possible to avoid serious losses. According to Vorob'eva V.V. and Proskura D.Yu., in Russia over the past two decades, mariculture has not received the planned development due to the presence of numerous problems, including the lack of safe feed and fight against diseases of cultivated aquatic organisms [4]. In the Murmansk region, as shown above, hundreds of tons of Atlantic genetically modified salmon were destroyed due to the disease, and a loss of hundreds of millions of rubles was inflicted. During the same period, a salmon disease was observed in the Kola River. Currently, the state of affairs with diseases in this industry is carefully hidden through the secrecy of information.

The problem of benefits and harms of eating farmed salmon should also be kept in mind. The founder of the Norwegian Conservation Union, Kurt Oddekalv, claims that fish farmers pour strong pesticides that have neurotoxic effects into the water to fight fish parasites. As a result, various chemicals can be found in fish and it cannot be eaten. French toxicologist Jérôme Rüsken, confirming the results of K. Oddekalv's research, said: "Indeed, the degree of contamination of farmed salmon is very high. It is 5 times more harmful and toxic than any other food.

These toxins must be avoided, and by consuming foods containing them, we run the risk of experiencing their effects.”¹⁸

Fish feed is no less serious concern. Scientists have assessed the level of polychlorinated biphenyls (PCBs) in salmon. Farmed salmon had significantly higher PCB levels than wild salmon. These toxic substances can accumulate in the body over time. It is believed that some of them can disrupt the normal functioning of the nervous, immune and reproductive systems [5].

To give salmon meat a natural color, they are fed with dyes of both natural and synthetic origin (canthaxanthin), which affect human vision [6].

The emergence of genetically modified salmon, one of which is the Atlantic salmon, is also becoming a cause for concern. Typical salmon grows only in the warm season, and its cultivation takes 31–56 months, genetically modified salmon grows all year round due to the implanted growth hormone and reaches the required size in 16–18 months. It significantly reduces its cost. But research suggests that the use of recombinant hormone in living organisms can potentially contribute to cancer. There is also evidence that genetically modified food can cause problems with kidneys, liver and pancreas, cause reproductive problems, and negatively affect blood circulation and immunity¹⁹ [7].

The debate around these issues is complex, and the information available in the media, on the Internet, in scientific publications is highly controversial. However, prices for wild salmon in Russia and in Western countries are currently 1.5–2.0 times higher, which, in our opinion, is one of the factors of poorer quality of farmed fish. It can be argued that with an increase in public awareness, the consumption of farmed genetically modified salmon will decrease. It can also be assumed that the quality of farmed salmon will decrease as a result of changes in the feed formulation due to the lack of high quality fish meal and to reduce costs.

Experts believe that salmon fish farming creates many serious environmental problems. It has been suggested that farming is the main reason for the decline in wild salmon populations. This is mainly due to the spread of diseases and parasites among cultivated fish and contamination of wild populations as a result of fish escaping from cages. According to the official statistics of the Norwegian Directorate of Fisheries, an average of 413 thousand specimens of fish per year escaped from fish farms in 2001–2011²⁰.

A serious environmental problem is the contamination of the bottom with feed residues in places where the cages are located. In the world, it is solved by moving the cages to artificially cre-

¹⁸ Regul'yarnym perevozkam ryby po Sevmorputi pomogut subsidii i zagruzka obratnykh reysov [Regular Transport of Fish along the Northern Sea Route will be Helped by Subsidies and Loading of Return Voyages]. URL: [tass.ru/Экономика и бизнес/8542475](https://tass.ru/Экономика-и-бизнес/8542475) (accessed 26 December 2020).

¹⁹ Norvezhskiy losos' v 5 raz vrednee i toksichnee, chem lyubye drugie produkty, - utverzhdayut ekologi [According to Environmentalists, Norwegian Salmon is 5 Times More Harmful and Toxic than Any Other Food]. URL: <https://roscontrol.com/journal/news/norvegskiy-losos-v-5-raz-vrednee-i-toksichnee-chem-lyubie-drugie-produkti-utverzhdayut-ekologi/> (accessed 26 December 2020).

²⁰ Ryba s zapakhom skandala. Kakuyu pol'zu prinosit i kakoy vred nanosit vyrashchivanie lososya [Fish with the Smell of Scandal. What Benefits and what Harm Does Salmon Farming Do]. URL: <https://www.kommersant.ru/doc/4067642> (accessed 03 January 2021).

ated reservoirs on the shore with closed water supply installations. The second option for solving the problem is the removal of cages into the open sea at great depths and currents. This kind of production is already being developed in Norway.

The above options for solving the problem of sea pollution require significant additional costs and, apparently, will not soon be in demand in the Arctic.

The development of mariculture of Atlantic genetically modified salmon does not contribute to solving the global problem of food shortage, since the production of feed requires catches of other fish, including those suitable for food purposes, exceeding production volumes by 3–4 times. In the European countries of the North-East Atlantic coast, 2/3 of the anchovy catch, half of the catch of capelin, sprat (40%), blue whiting (30%), horse mackerel (20%) are used for fish flour [8].

The main goal of breeding Atlantic genetically modified salmon in the Russian Arctic, from the point of state interests, is to replace ~200 thousand tons of Atlantic salmon imported from Norway before the embargo. PJSC “Russian Salmon” and PJSC “Russian Aquaculture” won all sea areas convenient for breeding on the coast of the Barents Sea and, according to the statement of the head of PJSC “Russian Aquaculture” to the newspaper “Kommersant” dated 09/30/2020, can grow, based on the water area, only 100 thousand tons of Atlantic salmon.

In order to produce feed for such a volume of cultivation, about 40 thousand tons of conditioned fishmeal will be required, which needs about 120 thousand tons of fish. Since such volumes of non-food fish do not exist in the 200-mile economic zone in the Arctic and adjacent waters [9], the construction of own factory for fish feed production is highly improbable.

According to the FAO and WHO report “The State of Food Security and Nutrition in the World 2018”, the number of hungry people in the world is growing, reaching 821 million in 2017²¹. In order to find additional sources of animal protein for nutrition, the world community may limit the use of edible fish for the production of fishmeal for growing relatively small quantities of gourmet fish until more suitable sources of raw materials are found. Moreover, salmon, as follows from the above materials, is harmful to daily nutrition. A decrease in the production of fishmeal or a change in the composition of fish feed substances can have negative consequences for fish farming in the Arctic.

Russia, having huge reserves of salmon fish, is in a special position. There are enough wild salmon to meet the demand for these species in the future. The issues of increasing fish products supply from the Far East to the European part of Russia are being resolved. It is assumed that increase in the volume of fish products transportation by sea will reduce tariffs, which will make it possible to reduce prices for fish products. The planned modernization of the Trans-Siberian railway will also affect the growth of fish supplies from the Far East.

²¹ Global'nyy golod prodolzhaet rasti, govorit'sya v novom doklade OON [Global Hunger Continues to Grow, According to a New UN Report]. URL: ru.wfp.org/news/globalnyy-golod...govorit'sya-v...oon (accessed 26 December 2020).

Conclusion

Despite the risks of the cultivation and consumption of Atlantic genetically modified salmon noted in the article, there is a demand for it in the world and in Russia and there is a slight increase in production (see table 2). At the same time, there is a growing public protest in the world against cage farming of salmonids. So, in the United States in the state of Washington, it was planned to close all farms. In Canada, 17 farms will be closed by 2023²². In Scotland, consumer organization SumOfus has collected 40.000 signatures asking the government to inspect salmon farms²³.

In the Murmansk region, specialists and the population were greatly alarmed by the significant destruction of genetically modified salmon in PJSC "Russian Salmon", which fell ill with lice in 2015. It was burned, buried in the ground, and thrown into the sea. Due to the fact that the cages are located on the west coast, which coincides with the migration routes of salmon, wild fish can become infected with parasites from escaped genetically modified salmon. This will cause irreparable damage to the local population of salmon, which is already in a depressed state [10].

Of particular concern is the traditional lifestyle of the Pomors living on the banks of the rivers of the Terskiy coast and in the basin of the White Sea, having a traditional way of life, as well as those serving wealthy tourists who annually come to salmon fishing from all over the world (this type of tourism is very expensive).

Developing Arctic tourism is a serious competitor for cage culture of Atlantic genetically modified salmon. So, tourism development plans to implement a large project in the Pechenga Bay by 2025, including the construction of berths for mooring cruise ships, as well as eco-hotels and other infrastructure²⁴. At the same time, an enterprise for cage farming of genetically modified salmon with a developed infrastructure is already operating here. There is a high probability that they will not be able to develop together, and priority will be given to tourism, which will lead to a significant reduction in the volume of genetically modified salmon farming.

The study concluded that full import substitution of salmon products previously supplied from Norway can be provided by joint deliveries to the Russian market of salmon fish products grown at Arctic enterprises and delivered from the Far East by water transport via the NSR. The success of selling them to consumers, in our opinion, will mainly depend on price.

²² Kakuyu pol'zu prinosit i kakoy vred nanosit vyrashchivanie lososya [What are the Benefits and the Harms of Salmon Farming]. URL: fishnet.ru/news/aquaculture_news/86112.html (accessed 17 December 2020).

²³ Vovchenko E. Eksperty rashodyatsya v otsenkakh perspektiv stroitel'stva lososevykh ryborazvodnykh zavodov na Sakhaline [Experts Differ in Their Assessments of the Prospects for the Construction of Salmon Hatcheries on Sakhalin]. URL: ecosakh.ru/rashodyatsya...lososevykh-ryborazvodnykh... (accessed 17 December 2020).

²⁴ Nauchnye i prikladnye osnovy ustoychivogo razvitiya i modernizatsii morekhozyaystvennoy deyatel'nosti v zapadnoy chasti arkticheskoy zony Rossiyskoy Federatsii: otchet o NIR (promezhut.) [Scientific and Applied Foundations of Sustainable Development and Modernization of Marine Economic Activities in the Western Part of the Arctic Zone of the Russian Federation: report on research (inter.)]. Apatity, 2020, 128 p.

es, since Russians are not sufficiently informed about the advantages and disadvantages of these types of fish products. Rospotrebnadzor should carefully monitor GM salmon in various positions, including informing buyers that farmed salmon belongs to genetically modified products.

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Infrastructure Projects — General Resource for Increasing the Economic Potential of the Arctic *

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Abstract. The study examines modern challenges affecting the development of the Arctic marine transport system and the economic situation of the Arctic zone of the Russian Federation (AZRF). The basic normative legal acts that determine the activities of economic organizations in the Arctic are presented. It was determined that in the context of the world economy regression caused by geopolitical, economic, natural and other reasons, increasing the AZRF economic potential is a priority goal, and the implementation of tasks for the Arctic zone development and ensuring national security corresponds to the implementation of the Fundamentals of State Policy of Russia. The tendency of competitive struggle by the Arctic countries on the issues of economics and geopolitics is noted. The Northern Sea Route (NSR) is presented as the basis of the Arctic sea transport system, its economic potential, international importance, international integration with the People's Republic of China is shown. The main infrastructural projects of the Arctic for the development of the oil and gas complex, the construction of an icebreaker fleet, the construction of new and modernization of the existing ports of the NSR, etc. are presented to solve the problems of increasing cargo traffic along the Northern Sea Corridor. New projects for modernization of port infrastructure, transport development, etc. are considered. The purpose of the study is to assess the ongoing and planned infrastructure projects carried out by the state and business to increase the economic potential of the Arctic. Many of them are unique, which expresses firm confidence in the modern development of the Arctic zone, in ensuring the national security of the Russian Federation.

Keywords: *economy, Russian Arctic zone, infrastructure project, Northern Sea Route, icebreaker fleet, logistics, natural resources.*

Introduction

The economy of the Arctic zone of the Russian Federation (AZRF) is currently undergoing a course aimed at

- preservation / retention of the outlined strategic goals of economic development;
- reboot of the processes contributing to the Arctic economic potential growth.

In the context of the global economic downturn caused by the COVID-19 coronavirus pandemic, these goals can be considered optimistic, ambitious or extreme. This is indicated by numerous factors, one of which is "long money", that is, a situation in which all projects have a strategic level. They postpone the horizon for achieving goals, and most importantly, are subject to a high level of risks. At the current stage of the implementation of infrastructure projects in the Russian Arctic, this factor has a key feature, which provides for state participation to increase the country's economic potential and reduce the risks of innovative projects. It is incredibly difficult to support, create and increase all infrastructure facilities — social, transport, innovation, engineer-

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ing, production, information, national security — in the Far North without a high-tech economy. The implementation of unique projects in the Russian Arctic, which will be discussed below, is a powerful paradigm confirming the country's technological breakthrough, the rise of scientific and technological progress, strengthening of the community life, expansion of the human environment, etc.

The active development of the Arctic and the increasing of AZRF economic potential have become urgent topics for modern Russia. The Decree of the President of the Russian Federation of October 26, 2020 No. 645 approved the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2035¹.

Main section

The Arctic is commonly referred to as the zone around the North Pole, including the Arctic Ocean and some land areas. There are five basic theories that define the Arctic frontiers:

- astronomical;
- discomfort of living;
- climatic;
- CAFF (Conservation of Arctic Flora and Fauna)²;
- administrative — if the Arctic zone is legally defined.

The Arctic zone of the Russian Federation has been recognized as an emergency object of state policy and management³.

The Arctic zone of the Russian Federation includes all districts of the Murmansk region, the Nenets, Chukotka and Yamalo-Nenets Autonomous Okrugs, 6 municipalities of the Republic of Ka-

¹ Ukaz Prezidenta RF ot 26 oktyabrya 2020 g. № 645 "O Strategii razvitiya Arkticheskoy zony Rossiyskoy Federatsii i obespecheniya natsional'noy bezopasnosti na period do 2035 goda" [Decree of the President of the Russian Federation of October 26, 2020, No. 645 "On the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2035"]. URL: <https://www.garant.ru/products/ipo/prime/doc/74710556/> (accessed 28 October 2020).

² Vasilyev A. Zachem Rossii razvivat' Arktiku? Istoriya osvoeniya i sovremennye proekty na Severe [Why should Russia Develop the Arctic? The History of Development and Modern Projects in the North]. URL: <https://bankstoday.net/last-articles/zachem-rossii-razvivat-arktiku-istoriya-osvoeniya-i-sovremennye-proekty-na-severe> (accessed 18 October 2020).

³ Ukaz Prezidenta Rossiyskoy Federatsii № 296 ot 02.05.2014 g. «O sukhoputnykh territoriyakh Arkticheskoy zony Rossiyskoy Federatsii» (v red. ukazov Prezidenta Rossiyskoy Federatsii ot 27.06.2017 № 287, ot 13.05.2019 № 220) [Decree of the President of the Russian Federation No. 296 of May 02, 2014 "On the Land Territories of the Arctic Zone of the Russian Federation" (as Amended by the Decrees of the President of the Russian Federation of June 27, 2017 No. 287, of May 13, 2019, No. 220)]. URL: <http://www.kremlin.ru/acts/bank/38377> (accessed 17 October 2020). Gosudarstvennaya Programma Rossiyskoy Federatsii «Sotsial'no-ekonomicheskoe razvitie Arkticheskoy zony Rossiyskoy Federatsii» (s izmeneniyami na 31 marta 2020 goda). Utverzhdena postanovleniem Pravitel'stva ot 21 aprelya 2014 goda № 366, ot 31 avgusta 2017 goda № 1064 [State Program of the Russian Federation "Socio-economic Development of the Arctic Zone of the Russian Federation" (as Amended on March 31, 2020). Approved by the Government Decree of April 21, 2014, No. 366, of August 31, 2017, No. 1064]. URL: <http://docs.cntd.ru/document/499091750> (accessed 17 October 2020).

relia, the municipality of the Komi Republic, 13 municipalities of the Republic of Sakha (Yakutia), 4 municipalities of the Krasnoyarsk Territory, 9 municipalities of the Arkhangelsk region ⁴.

At the present stage, the Russian Federation, the United States and Norway claim part of the territory, or rather, part of the Arctic water area: these countries have access to the Arctic Ocean. Denmark and Canada also put forward their territorial claims. They can be joined by Iceland, which plans to expand its policy in the region. Ownership of the Arctic opens up exceptional prospects for countries.

Russia's interests in the Arctic are generally represented by natural resources, the Northern Sea Route, defense issues, geopolitics, etc. [1, Zaikov K.S., p. 10–12].

The main economic base of our country, including the Russian Arctic, is natural resources. In the foreseeable future, Arctic deposits will significantly strengthen the financial situation, ensure sustained economic growth, therefore, new jobs will be created, and the demographic and social situation will be improved.

It is estimated that the Arctic has nearly 90 billion barrels of oil reserves. Gas production on the Arctic shelf of three deposits — Shtokman, Rusanovskoe and Leningradskoe — is measured at 10 trillion cubic meters of gas ⁵. Thus, the Arctic can be considered to contain 1/4 of oil reserves and 1/2 of gas reserves. Rare earth metals, gold, platinum, nickel, copper, cobalt, diamonds and many other minerals have been found on the Arctic mainland. The Arctic — 20% of the world's fresh water reserves — is one of the major factors in the global economic system life.

Northern Sea Route / Northern Sea Corridor / Chinese “Ice Silk Road” passes through the seas of the Arctic and Pacific Ocean [2, Silber G.K., p. 3]. It has a length of about 5600 km and is the shortest route between the European part of Russia and the Far East. The distance along it from St. Petersburg to Vladivostok is over 14 thousand km (through the Mediterranean Sea, the Suez Canal, the Indian Ocean — over 23 thousand km) [3, Verny J., p. 110].

Forty-three hydrocarbon deposits (61 in total) have been discovered on the Arctic shelf in Russian territorial waters; the development of maritime navigation will increase the extraction of minerals and their processing in the coastal regions, and therefore will lead to the development of the transport infrastructure of the northern territories of Russia.

At the first stage of plans for the NSR infrastructure development (until 2024), there is an urgent need to increase the volume of cargo transportation, which is the basis for receipt of funds and confirmation of the intended goals fulfillment ⁶. In accordance with the May Decree of the

⁴ Federal'nyy zakon ot 13.07.2020 N 193-FZ "O gosudarstvennoy podderzhke predprinimatel'skoy deyatel'nosti v Arkticheskoy zone Rossiyskoy Federatsii" [Federal Law of 13.07.2020 N 193-FZ "On State Support for Entrepreneurial Activity in the Arctic Zone of the Russian Federation"]. URL: http://www.consultant.ru/document/cons_doc_LAW_357078/ (accessed 17 October 2020).

⁵ Zachem Rossii razvivat' Arktiku? Istoriya osvoeniya i sovremennye proekty na Severe [Why does Russia Need to Develop the Arctic? The History of Development and Modern Projects in the North]. URL: <https://bankstoday.net/last-articles/zachem-rossii-razvivat-arktiku-istoriya-osvoeniya-i-sovremennye-proekty-na-severe> (accessed 17 October 2020).

⁶ Ukaz Prezidenta Rossiyskoy Federatsii ot 7 maya 2018 g. № 204 «O natsional'nykh tselyakh i strategicheskikh zadachakh razvitiya Rossiyskoy Federatsii na period do 2024 goda» [Decree of the President of the Russian Federation

President of the Russian Federation, the plan provides the growth of cargo transportation up to 80 million tons by 2024.

To solve this problem, against the background of ongoing exploration and construction of the icebreaker fleet, several complex engineering projects have been implemented in the Far North, which have proven the ability of domestic business to effectively develop hard-to-reach regions. The most significant projects are the following:

- NOVATEK has put into operation a complex for the production, liquefaction and supply of natural gas: YAMAL LNG produces up to 17.4 million tons of liquefied gas per year;
- GAZPROM has launched the first offshore ice-resistant stationary platform Prirazlomnaya in the Arctic (a unique project);
- PJSC Lukoil has increased the capacity of the Varandey Terminal ⁷.

According to experts, the share of liquefied natural gas (LNG) sales in the world market will amount to 52% by 2035, Russia will produce more than 68 million tons of LNG per year by 2025, and in the future, the country's share in the global LNG market may reach a quarter of the world total. Russian LNG producers have high potential in the world market due to the world's largest resource base (20% of world reserves), geographic proximity to both Europe and Asia, and also because of the prospects associated with the Northern Sea Route ⁸.

In addition to mining, the projects also address on-site processing. This principle has been implemented within the framework of the Yamal LNG project, which converts natural gas from nearby deposits into LNG. Then it is poured into gas carriers at the Sabetta terminal and enters the international market.

The Arctic port of Sabetta ⁹ was built to transship hydrocarbons from the South Tambayskoe gas condensate deposit as part of the Yamal LNG project and to ensure year-round navigation of gas carriers and their passage along the Northern Sea Route. The port and airport were built with state funds, and the Yamal LNG plant was built by PJSC NOVATEK ¹⁰ and partners with private investment. The project includes the French company Total, the Chinese company CNPC and the Silk Road Fund.

Considering the issues of international integration, it should be noted that China is a key partner in the development of the Russian Arctic ¹¹.

of May 7, 2018, No. 204 "On national Goals and Strategic Objectives for the Development of the Russian Federation for the Period up to 2024"]. URL: <https://www.garant.ru/products/ipo/prime/doc/71837200/> (accessed 17 October 2020).

⁷ Varandey terminal. URL: <https://trans.lukoil.ru/ru/About/Structure/VarandeyTerminal> (accessed 17 October 2020).

⁸ К 2025 году Россия будет производить более 68 млн тонн СПГ в год [By 2025, Russia will Produce over 68 Million Tons of LNG per Year]. URL: https://tass.ru/ekonomika/9687375?utm_source=yxnews&utm_medium=desktop (accessed 17 October 2020).

⁹ Administratsiya morskikh portov Zapadnoy Arktiki [Administration of the Seaports of the Western Arctic]. URL: <http://www.mapm.ru/Port/Sabetta> (accessed 17 October 2020).

¹⁰ PJSC NOVATEK. URL: <http://www.novatek.ru/ru/about/company/> (accessed 17 October 2020).

¹¹ People's Republic of China. URL: https://wiki2.org/ru/Китайская_Народная_Республика (accessed 17 October 2020).

The People's Republic of China is a partner in financing a variety of projects. The country is actively involved in the improvement of technologies related to the expansion of the economic potential of the Arctic Sea Corridor and joined it to the Belt and Road Initiative (BRI) sea passage network [4, Zhang X., p. 371].

Chinese companies are actively exploring the Northern Sea Route, sending their dry cargo ships to Europe¹². In September 2020, using the Russian route and realizing all its benefits, the “golden caravan” set off along it. Bulk carriers named “GOLDEN PERL”, “GOLDEN STRENGTH” and “GOLDEN SUEK” took a course to the Murmansk commercial seaport, arrival date — October 2020, after shipping in Murmansk, the “golden caravan” will go to the ports of Europe and Asia. In August 2020, these dry cargo vessels left Murmansk with 200 thousand tons of iron ore concentrate and, using the Northern Sea Route, delivered the cargo to China in a short time.

Climatic conditions, technical equipment, plans and tasks change over time, as well as the ship's schedule of the Northern Sea Route.

Based on the results of their studies, scientists from Russia, the USA, the United Kingdom and others came to the conclusion that the Arctic heats up twice as fast as the globe, as a result, the thickness of the Arctic Ocean ice becomes smaller [5, 6].

Global climate change will make it incomparably easier to extract natural resources and carry out logistics in the Russian Arctic [7].

The current year has become a time of important, successful experiments for the NSR — these are two unique “super early” voyages. The first gas carrier departed in mid-May, the second — with a weekly lag. May in the eastern sector of the Arctic is a harsh and cold month, it is considered to be too early for normal navigation.

Gas tankers “Christophe de Margerie” and “Vladimir Voronin”, accompanied by icebreakers “Yamal” and “50 Let Pobedy”, carried liquefied natural gas from the Sabetta port on Yamal to the Jiangsu port (China) along the most difficult part of the Northern Sea Route. “Christophe de Margerie” is a modern vessel built to meet the harsh Arctic conditions, has a high ice class Arc7, which means that it can navigate the NSR even alone along the entire route —it reached its destination on the 13th day. It passed 2563 nautical miles at an average speed of 8.5 knots. For most of this route (2123 nautical miles), the LNG carrier went in the Yamal icebreaker’s wake at an average speed of 7.9 knots. The use of vessels of this ice class will ensure the growth of cargo transportation along the NSR (Fig. 1).

¹² «Zolotoy karavan» Kitaya predpochel Sevmorput' marshrutu cherez Suetskiy kanal [China's "Golden Caravan" Preferred the Northern Sea Route to the Route through the Suez Canal]. URL: <https://politpuzzle.ru/172629-zolotoj-karavan-kitaya-predpochel-sevmorput-marshrutu-cherez-suetskiy-kanal/> (accessed 17 October 2020).



Fig. 1. The route of "Christophe de Margerie" and "Yamal" along the NSR ¹³.

In order to achieve the target (cargo turnover of 80 million tons per year by 2024), the fish component was included in cargo transportation along the Northern Sea Route. In September 2020, the world's only container ship with a nuclear power generating facility "Sevmorput" (Murmansk home port, FSUE "Atomflot") left the port of Petropavlovsk-Kamchatsky in the direction of St. Petersburg with a cargo of Far Eastern fish, the total volume of which is 6.5 thousand tons and a total of 206 containers with refrigeration units ¹⁴. The nuclear-powered container ship "Sevmorput" is an icebreaking transport vessel of project 10081 with a nuclear power generating facility of KLT-40 type, capable of independently navigating in ice up to 1 meter, transporting 74 units of SLS 506309 (LASH) lighters in the holds and on the upper deck with loading and unloading by ship lighter crane. There is a possibility of transportation of 1324 containers of the international ISO standard in the holds and on the upper deck ¹⁵. Taking into account technical characteristics of the vessel, it can be operated (route: St. Petersburg — Petropavlovsk-Kamchatsky and back) on the Northern Sea Route four times a year.

In accordance with national goals and strategic objectives, the construction of ships for work on the NSR is being carried out. On October 21, 2020, the flag raising ceremony and the signing of the acceptance certificate of the universal nuclear icebreaker "Arktika" between OJSC "Baltic Shipyard" and FSUE "Atomflot" took place in Murmansk ¹⁶. "Arktika" is the head universal nuclear icebreaker of project 22220. "Arktika" left St. Petersburg on September 22, reached the North Pole on October 3, having fulfilled the "maximum program" of ice tests, and on October 12

¹³ Source: URL: rosatomflot.ru (accessed 17 October 2020).

¹⁴ Atomnyy konteynerovoz «Sevmorput» vzyal kurs na morskoy port Sankt-Peterburg [The Nuclear-Powered Container Ship Sevmorput Headed for the Seaport of St. Petersburg]. URL: <http://www.rosatomflot.ru/press-centr/novosti-predpriyatiya/2020/09/08/11334-atomnyy-konteynerovoz-sevmorput-vzyal-kurs-na-morskoy-port-sankt-peterburg/> (accessed 17 October 2020).

¹⁵ Atomnyy konteynerovoz «Sevmorput» [Nuclear-powered Container Ship "Sevmorput"]. URL: <http://www.rosatomflot.ru/flot/atomnyy-lihterovoz-sevmorput/> (accessed 17 October 2020).

¹⁶ Mikhail Mishustin prinyal uchastie v priemki golovnogo universal'nogo atomnogo ledokola «Arktika» [Mikhail Mishustin Took Part in the Acceptance of the Universal Nuclear-Powered Icebreaker "Arktika"]. URL: <http://government.ru/news/40659/> (accessed 22 October 2020).

arrived at the Murmansk home port. The Baltic Shipyard continues the construction of icebreakers of this project — “Sibir”, “Ural”, “Yakutiya”, “Chukotka”; the deadlines are 2021, 2022, 2024, 2026. The icebreakers of this project are equipped with a power generating system “RITM–200” — an innovative water-cooled nuclear reactor. This system is designed in accordance with the latest trends in the world atomic energy development, cost-effective, has no world analogues. Three icebreakers of Project 10510 “Lider” (LK-120Ya) are being built at the “Zvezda” Far East shipbuilding complex — high-tech, unsurpassed vessels.

In November 2020, a universal diesel-electric icebreaker “Viktor Chernomyrdin” (LK-25) of project 22600 was delivered to FSUE “Rosmorport”¹⁷ — it was built and launched at the Baltic Shipyard, completed at the Admiralty Shipyards, its sea testing took place in 2019, the acceptance certificate was signed in September 2020.

Icebreaker “Viktor Chernomyrdin” is the most powerful diesel-electric icebreaker in the world (Fig. 2). Its main purpose is providing year-round navigation in the northern latitudes on the NSR, as well as being used as a research vessel and a cruise liner for excursions to the North Pole. The work of the new icebreaker fleet in the Northern Sea Corridor will help to increase the economic potential of the Arctic zone of Russia. After introduction of the new icebreaker fleet into service, it will be possible to use all the routes of the Northern Sea Route all year round.



Fig. 2. Icebreakers “Arktika” and “Viktor Chernomyrdin”¹⁸.

In the context of infrastructure development in the Arctic, a lot has been done to develop the Arctic ports: both by the state and by private investors. Many northern seaports are being modernized, equipped with new technologies and instruments, and their capacity is being improved [8]. Pevek Port is the northernmost port in Russia; in 2020, a unique project for the floating nuclear thermal power plant installation was implemented there [9]. Some other ports, such as

¹⁷ Vveden v stroy ledokol «Viktor Chernomyrdin» [Icebreaker "Viktor Chernomyrdin" was Put into Operation]. URL: <https://cont.ws/@bmpd/1825728> (accessed 10 November 2020).

¹⁸ Source: URL: rosatomflot.ru (c).

Indiga, Sabetta, Arkhangelsk and Murmansk, are developing, becoming the infrastructure base of the Arctic sea transport system of Russia.

An important indicator is the increase of container traffic in the Arctic basin ports in the first 9 months of 2020. Thus, the number of containers handled in the northern ports amounted to 114.35 thousand TEU, which exceeds the indicator of the same period last year by 2.71%.

For example, transshipment of coastal containers for the reporting period amounted to 111.89 thousand TEU (+ 2.3%). The basin ports handled 2.49 thousand TEU (+9.4%) of refrigerated containers. The port of Dudinka reduced container handling by 0.7% to 45.11 thousand TEU, Arkhangelsk increased it by 22.7% to 27.94 thousand TEU. Container turnover of the Murmansk port decreased by 9.9% to 32.88 thousand TEU. Other ports of the basin handled 8.42 thousand TEU (+ 26.5%)¹⁹. In general, there is a positive dynamics of container turnover in the Arctic ports.

In order to prolong measures aimed at increasing the cargo turnover, the decision to carry goods across Sevmorput in consignments was made. It is assumed that this will ensure the loading of transport corridor, the development of cargo base, the increase in freight traffic and improvement of target economic indicators. The project considers the consolidation of goods to form single consignments with their subsequent shipment along the NSR, as well as creation of favorable conditions for increasing import, export and transit cargo turnover with Europe and Asia. To implement the project, in October 2020, the multifunctional sea transshipment complex (MSTC) "Bronka" and the "Logistic Cluster of North-West Russia" signed an agreement on the implementation of the Northern Sea Route Freight Turnover Aggregator project.

Another proposal for solving the problem of increasing cargo traffic was the idea of expanding the Northern Sea Route in the water area to Murmansk and Kamchatka, i.e. to the ports and terminals of the Pechora, White and Barents Seas. The water area of the NSR now is limited by the Kara Strait in the west and the Providence Bay in the east. The corresponding boundaries were designated due to the peculiarities of international law related to the seas freezing. After working out the issues related to the possibility of expanding the NSR, this idea was abandoned, i.e. The Northern Sea Route will be kept within the same boundaries.

Unfortunately, the ambition to reach the limit of 80 million tons by 2024, in fact, is problematic²⁰, since the volume of mineral raw materials shipments in 2024 will reach 58 million tons, another 5 million tons are estimated to be other cargoes to ensure production, "Northern delivery" and transit.

¹⁹ Moshchnost' morskikh portov Arktiki rastet [The Capacity of the Seaports in the Arctic is Growing]. URL: <https://zen.yandex.ru/media/korabel/moschnost-morskikh-portov-arktiki-rastet-5f86b18aae6a9712bf0a8bae> (accessed 17 October 2020).

²⁰ Kurs na Sevmorput': Rossiya zanyalas' infrastrukturoy v Arktike kompleksno [Heading to the Northern Sea Route: Russia has Taken up the Infrastructure in the Arctic in a Comprehensive Manner]. URL: <https://zen.yandex.ru/media/id/5dc69465c7891f51f5fb5143/kurs-na-sevmorput-rossiya-zanialas-infrastrukturoi-v-arktike-kompleksno-5e060bddcddb7100b0dde197> (accessed 17 October 2020).

After analyzing the real situation in modern conditions, the head of the Northern Sea Route Directorate sent a letter to the Ministry of Transport with a proposal to reduce the forecast for NSR cargo transportation by 25%, i.e. up to 60 million tons.

The reasons for the reduction may be the following:

- Difficult international traffic in the context of sanctions and prejudice against Russia: in this regard, many international companies refused to carry cargo along the Northern Sea Route, even if it would be extremely profitable;
- The COVID-19 pandemic has made certain adjustments, there are problems with shift work, transportation, etc;
- The Vostokugol' Company, which is developing a number of promising areas in Siberia, predicted an explosive growth in coal production. It announced the production increase to 19 million tons per year. These plans were taken into account when drawing up tasks for the development of the Northern Sea Route. But the "optimistic scenario" has not been realized. Now the company produces 1 million tons of coal per year. It is possible that the situation will not change in the coming years;
- According to the plans, the Vostok Oil project was supposed to use the NSR at the level of 25 million tons from 2024, but the documents sent by the oil company to the government contain a volume of 9.25 million tons. The reason is the delay in construction of oil transportation infrastructure to the planned oil terminal on Taimyr;
- PJSC NOVATEK in 2020 informed the government that by 2024 it will transport 35.5 million tons of LNG per year. According to the plans for 2019, the production of 46.7 million tons of cargo was expected, which would be possible only in case of timely implementation of investments in new gas liquefaction capacities — the Arctic LNG terminal and the Obskiy LNG. Several months ago, PJSC NOVATEK announced the postponement of the Obsk terminal commissioning by two years from 2022 to 2024.

As part of the Development Strategy of the AZRF implementation, the Prime Minister of the Russian Federation instructs the ministries to submit to the government of the Russian Federation a forecast of cargo traffic in the water area of the AZRF and the Northern Sea Route for the period up to 2030 and the prospect until 2035, including new obligations assumed by the companies to load the NSR by 2024: PJSC Novatek — 35.5 million tons; PJSC NK Rosneft — 30 million tons; PJSC Gazprom Neft — 6.7 million tons; PJSC MMC Norilsk Nickel — 1.7 million tons. Total: to transfer along the Northern Sea Route 73.9 million tons by 2024.

Despite the difficult economic and political situation, the development of the Northern Sea Route continues, which is reflected in the infrastructure projects of the Arctic, in some cases — unique, high-tech. Presidential Decree No. 645 defines their goals, objectives, key indicators and deadlines, in particular, Ch. IV defines the main directions of the implementation of this Strategy

in individual constituent entities of the Russian Federation and municipalities; Ch. V indicates the stages and expected results of the implementation of this Strategy²¹.

Nevertheless, it should be noted that the development of the NSR infrastructure presupposes:

1) during the modernization of port infrastructure:

- to increase the trafficability of the Murmansk port to 18 million tons;
- to construct a deep-water area in the Arkhangelsk seaport, which includes 2 specialized and 4 universal sea terminals with a total capacity of up to 40 million tons;
- to increase the power of the unique port of Sabetta;
- to build new terminals in the port of Dikson and to increase cargo traffic up to 10 million tons per year;
- to construct the port "Port of the Sever Bay" within the framework of the "Vostok Oil" project;
- to build an LNG transshipment complex in the Ura Bay, Murmansk region, etc.

2) development of transport:

- the key role in the development of the Arctic latitudes belongs to the icebreaker fleet — 41 icebreakers are in operation, 5 of which are nuclear-powered, icebreakers are being actively built;
- aviation plays an important role in cargo transportation to hard-to-reach regions of the Arctic — it is planned to reconstruct eight Arctic airports: Amderma, Murmansk, Arkhangelsk, Naryan-Mar, Dikson, Pevek, Tiksi and Chokurdakh — after modernization, most of them will become all-season and will be able to accept aircraft of all types;
- it is planned to build the Northern Latitudinal Railway.

The implementation of infrastructure projects will ensure the dynamic development of the Northern Sea Route and will become the backbone of Russia's strategic interests in the Arctic.

Conclusion

The facade of Russia faces the Arctic Ocean — 53% of the entire Arctic coastline is the borders of the Russian Federation. Improving the economic development processes of the Arctic zone of Russia is one of the strategic goals, and the implementation of consistent and multi-stage tasks, unique infrastructure and technological solutions will create competitive advantages for the long term.

The efficient operation of the Northern Sea Route can seriously change the freight market, a stable northern corridor will shorten the delivery time for goods from Asia to Europe and vice

²¹ Ukaz Prezidenta RF ot 26 oktyabrya 2020 g. № 645 "O Strategii razvitiya Arkticheskoy zony Rossiyskoy Federatsii i obespecheniya natsional'noy bezopasnosti na period do 2035 goda" [Decree of the President of the Russian Federation of October 26, 2020, No. 645 "On the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2035"]. URL: <https://www.garant.ru/products/ipo/prime/doc/74710556/> (accessed 28 October 2020).

versa. In the foreseeable future, it will become easier to use the NSR due to climatic changes, the construction of the icebreaker fleet of Russia, new vessels of an increased ice class, modernization of infrastructure, the implementation of unique projects, with the creation of conditions for a comfortable life of the population outside the production zones. According to forecasts, the NSR may become part of the maritime trade network, the cost of which will approach 8 trillion pounds.

As part of the implementation of the Development Strategy of the Russian Arctic up to 2035, cargo turnover has become one of the key indicators; it has a phased increase plan: 80 million tons — by 2024; 90 million tons — by 2030; 130 million tons — by 2035.

According to FSUE Atomflot (part of the state corporation Rosatom, an infrastructure operator of the Northern Sea Route), cargo turnover along the NSR amounted to: 31.5 million tons in 2019; 32 million tons in 2020. As of December 22, 2020, 479 vessels with a total gross tonnage of 32.41 million tons were convoyed by nuclear icebreakers²².

The realization of the Vostok Oil project, implemented by PJSC NK Rosneft, is of great importance. On the Eastern coast of the Yenisei Gulf of the Kara Sea in the Sever Bay, the infrastructure facilities of the Oil Terminal “Port of the Sever Bay” will be built. Oil will be transshipped from pipeline transport to ice-class sea vessels, which will deliver it to the ports of Russia, countries of the Asia-Pacific region (APR), Europe, etc. along the Northern Sea Route. It is planned that the initial turnover of cargo will be up to 50 million tons with further increase of up to 100 million tons.

In order to increase the economic potential of the Russian Arctic in the Murmansk region, four investment projects for the creation of infrastructure facilities will receive federal support: the construction of a plant for growing fry of salmon and trout in Retinskoe; the development of the platinoid deposit Fedorova Tundra; the construction of a sea bulk terminal in Min’kino; and the development of the Vitino port and oil depot in the Kandalaksha region. Investment projects for the development of new deposits of mineral raw materials of JSC Apatit and JSC Kovdorskiy MPP found support from the Fund for the Development of the Far East and the Arctic.

The Government of the Arkhangelsk Region and PJSC Promsvyazbank signed an agreement on the development of the regional economy and the special economic zone in October 2020. The parties agreed to jointly implement landmark investment programs within the framework of national projects, to provide support to backbone enterprises, as well as small and medium-sized businesses.

The implementation of strategic plans, unique, high-tech infrastructure projects creates conditions for the active economic development of the northern regions of Russia, rich in deposits.

²² V 2020 godu budet ustanovlen novyy rekord gruzoperevozok po Sevmorputi [A new record for cargo transportation along the Northern Sea Route will be set in 2020]. URL: <http://www.rosatomflot.ru/press-centr/novosti-predpriyatiya/2020/12/22/11352-v-2020-godu-budet-ustanovlen-novyy-rekord-gruzoperevozok-po-sevmorputi/> (accessed 28 December 2020).

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Long-term Dynamics of Economic Development of the Russian Arctic *

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Abstract. About a quarter of the world's natural gas and oil reserves are concentrated in the Arctic, which has led to increased interest of the world powers in this region in recent years. The Russian Federation has the greatest resource potential in this macro-region. This article examines the transformation of economic processes in the Russian Arctic. The relevance of the study is determined by the fact that in order to achieve the main goals and implement the tasks of the modern state Arctic policy of Russia, it is necessary to have a clear understanding of the features and patterns of economic processes taking place in this region. The author has analyzed the indicators characterizing some aspects of the economic development of the territories of the Russian Arctic in 1950–2018. According to the results of the analysis, three fundamentally different periods of the development of this region were identified: 1950–1990 — an intensive stage of economic development of the Arctic territories; 1990–1999 — the stage of market relations formation; from 2000 to the present — the stage of “redevelopment” of the Arctic. The main features of the economic development of the Arctic territories at each stage are shown. Conclusions concerning the tasks of the current stage of development are made. The assumption about the contemporary tendencies and the need to find new effective approaches to the management of the region is put forward.

Keywords: Arctic, region, economic development, investment, industry.

Introduction

The Arctic has been in the focus of attention of the world's leading countries in recent years. The reasons for such interest are obvious: about a quarter of the world's oil and natural gas reserves are concentrated in this macro-region [1, Gautier D.L. et al, p. 1175–1179; 2, Gautier D.L. et al, p. 151–161]. Russia has the greatest resource potential in the Arctic. According to recent assessments [3, Prishchepa O.M., Metkin D.M., Borovikov I.S., p. 14–28; 4, Prishchepa O.M., Nefedov Yu.V., Ayrapetyan M.G., p. 2], the volume of predicted hydrocarbon resources of the Arctic zone of the Russian Federation (AZRF) is estimated at more than 270 billion tons, including about 48.5 billion tons of oil and condensate and over 220 trillion m³ of natural gas. The land area of the Russian Arctic accounts for about 58% of the total volume (156 billion tons of conventional tons), the vast majority — gas-containing objects, the share of water areas — 42%, also predominantly gas resources.

The Arctic also contains significant reserves of other minerals (gold, diamonds, nickel, copper, coal, iron, etc.), biological resources and almost a fifth of the world's fresh water. In addition, the climatic changes taking place in the Arctic [5, Overland J. et al, p. 6–13; 6, Dianskiy N.A., p. 24–33] in the long term can contribute to a fuller realization of its economic potential, expanding the possibilities of exploration and production of minerals on the Arctic shelf, increasing

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the availability of navigation and opening new transport routes in the Arctic Ocean [7, Smith L., Stephenson S., p. 4871–4872; 8, Milaković A. et al, p. 53–60; 9, Zhang Z. et al, p. 960–973].

The strategic importance of the Arctic has actualized the need to develop a fundamentally new state policy of Russia with regard to its Arctic territories. In the late 1990s – early 2000s, attempts to form new Arctic legislation were made, in particular, a draft law “On the Arctic Zone of Russia”, draft of the Fundamentals of State Arctic Policy and the Concept of Sustainable Development of Arctic Territories were prepared. However, the new policy for the development of the Russian Arctic during this period was not clearly substantiated and detailed [10, Lukin Yu.F.], largely due to “lack of political will, proper government funding and disunity of the political elite” [11, Tamizky A. M., p. 1–8].

The state policy in relation to the Arctic territories began to be filled with real positive content with the adoption of the Fundamentals of the State Arctic Policy of Russia in 2008¹. Subsequently, the process of the Arctic legislation formation continued by consolidating the composition of the land territories of the Arctic zone of the Russian Federation (AZRF)², defining the legal status and boundaries of the NSR³, adopting regulations, program and strategic documents that somehow formed the idea of the AZRF as an independent object of state management. [12, Skuf'ina T.P., p. 424–428; 13, Sergunin A., Konyshchev V., p. 75–93; 14, Lipina S.A. et al; 15, Korchak E.A., Serova N.A., p. 145–159; 16, Smirnova O.O., Lipina S.A., p. 8–12; 17, Isaev A.P., Fomina I.A., p. 96–105].

In 2020, a new edition of the Fundamentals of State Policy of Russia in the Arctic for the period up to 2035 was adopted⁴, which defined the main goals of the national Arctic policy: improving the quality of life of the population; accelerating the economic development of the territories of the Russian Arctic and increasing their contribution to the economic growth of the country; environmental protection, protection of the traditional habitat and way of life of indigenous peoples; the international cooperation; protection of Russia's national interests in the Arctic, including in the economic sphere. To achieve these goals, it is necessary to have a clear understanding of the features and patterns of economic processes occurring in this region in the long term.

¹ Osnovy gosudarstvennoy politiki Rossiyskoy Federatsii v Arktike na period do 2020 goda i dal'neyshuyu perspektivu (utv. prikazom Prezidenta RF ot 18.09. 2008 g. № 1969) [Fundamentals of the State Policy of the Russian Federation in the Arctic for the Period up to 2020 and Beyond (Approved by Order of the President of the Russian Federation of September 18, 2008, No. 1969)].

² Ukaz Prezidenta RF ot 02.05.2014 g. № 296 «O sukhoputnykh territoriyakh Arkticheskoy zony Rossiyskoy Federatsii» [Decree of the President of the Russian Federation of May 02, 2014, No. 296 "On the Land Territories of the Arctic Zone of the Russian Federation"].

³ Federal'nyy zakon ot 28.07.2012 g. №132 «O vnesenii izmeneniy v otдельnye zakonodatel'nye akty Rossiyskoy Federatsii v chasti gosudarstvennogo regulirovaniya tovgovogo moreplavaniya v akvatorii Severnogo morskogo puti» [Federal Law No. 132 of July 28, 2012 “On Amendments to Certain Legislative Acts of the Russian Federation in Part of State Regulation of Merchant Shipping in the Water Area of the Northern Sea Route”].

⁴ Osnovy gosudarstvennoy politiki Rossiyskoy Federatsii v Arktike na period do 2035 goda (utv. Ukazom Prezidenta RF ot 05.03.2020 № 164) [Fundamentals of the State Policy of the Russian Federation in the Arctic for the Period up to 2035 (Approved by the Decree of the President of the Russian Federation dated March 05, 2020, No. 164)].

The aim of the study was to analyze the main indicators of the economic development of the Russian Arctic in 1950–2018 within the administrative-territorial boundaries of those constituent entities of the Russian Federation, the territories of which, in accordance with Russian legislation, are fully or partially part of the AZRF: Murmansk and Arkhangelsk regions, Nenets, Yamalo-Nenets and Chukotka Autonomous Okrugs, the Republic of Komi, Karelia and Sakha (Yakutia), Krasnoyarsk Krai.

The information base was the materials of the Federal State Statistics Service, characterizing the socio-economic situation of the regions of the Russian Arctic in 1950–2018, as well as data from the “Historical Materials” project⁵. Due to the absence of a number of statistical indicators until 1990, the study included indicators characterizing only industrial production (1950–2018) and investment activity (1970–2018).

Dynamics of the economic development of the Russian Arctic in 1950–2018

The second half of the 20th century was characterized by intensive economic development of the Far North and the Arctic and a significant increase in the scale of economic activity in this macroregion. Thus, owing to the discovery of the world's largest oil and gas province in Western Siberia in the 1950–1960s, the main fuel base of the country was created in the Arctic, which supplied about a third of natural gas and almost half of the oil produced in the USSR by 1980 [18, Timoshenko A.I., p. 73–95]. The most intensive development of the fuel industry was in 1965–1980, when the average annual growth rate was about 8.8% [19, Peshev N.G., p. 6–16]. Of no less importance was the mining and industrial complex, represented by enterprises of the black, non-ferrous and mining and chemical industries, which developed at a rapid pace. For example, in the Murmansk region, the volume of rock mass production for the period 1950–1990 increased 67 times, and extraction of iron ore — 32 times [Ibid]. In general, industrial production in the Arctic increased by more than 30 times between 1950 and 1990 and developed at a much faster pace than the national average (Fig. 1).

⁵ Historical data. URL: <http://istmat.info> (accessed 04 September 2020).

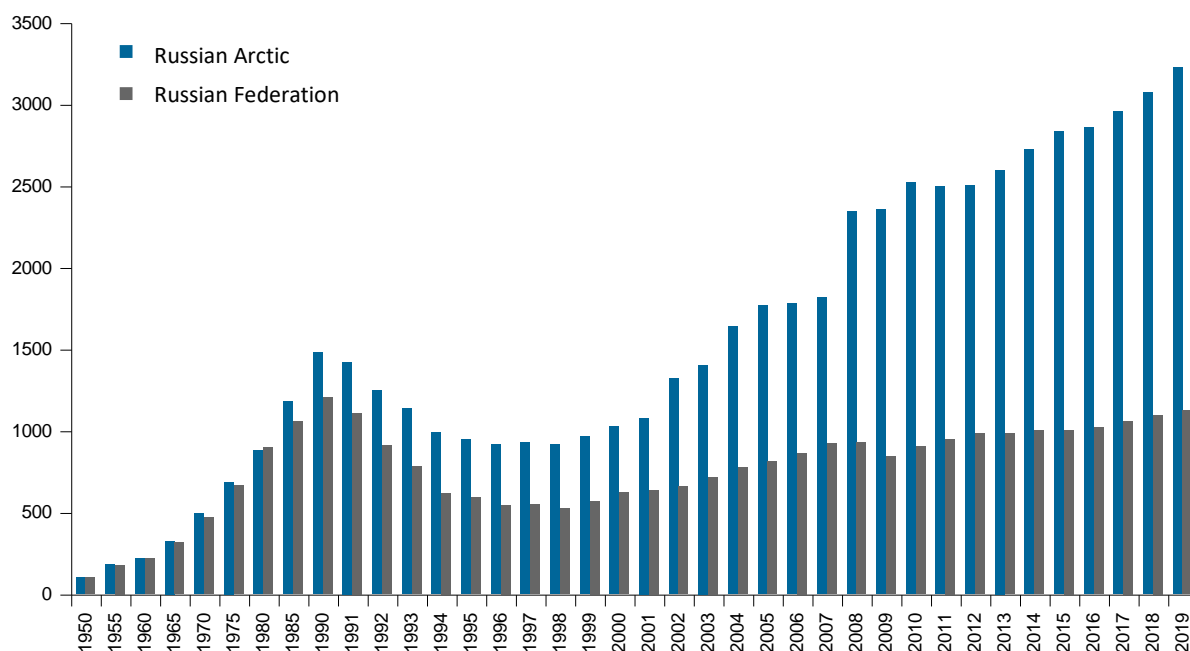


Fig. 1. Dynamics of industrial production in % by 1950, in comparable prices ⁶.

Intensive development of the Arctic territories was largely facilitated by the development of navigation along the Northern Sea Route (NSR), since with almost complete absence of land transport infrastructure, this waterway connected the mining industries of the European and Asian parts of the Arctic. Throughout the Soviet period, the volume of cargo transportation along the NSR grew annually, reaching a maximum (6.58 million tons) in 1987. Then, due to a decrease in state investment in the sea fleet, port facilities and technical reconstruction of the main production facilities, transportation along the NSR began to decline, and with the transition to a market model of the economy, navigation on it actually ceased. Only in 2016, the volume of cargo transported along the NSR surpassed the indicators of the 1980s, amounting to 7.3 million tons, and in 2019 it reached 30.1 million tons.

After the collapse of the USSR, the decrease in the scale of economic activity in the Arctic has become colossal. The average annual rate of decline in industrial production in 1990–1999 was -4.6% (and in some regions it exceeded 7%), resulting in a decline of almost a quarter of all industrial production in the AZRF in just a decade. The greatest negative dynamics during this period was demonstrated by the Chukotka Autonomous Okrug, where the volume of industrial production decreased by 2 times. As Kumo K. and Litvinenko T.V. note, the recession in key gold and tin mining industries for the district, which became unprofitable with the advent of market relations, led to the closure of the largest mining and processing plants in Chukotka and the liquidation of most single-industry workers' settlements and urban-type settlements [20, Kumo K., Litvinenko T.V., p. 50–66].

At the same time, the decline in production in the Arctic regions occurred at a much less significant rate than the national average, since, due to their production specialization, they were

⁶ Source: author's calculations.

less affected by the breakdown of economic relations after the change of state system. In addition, most of the Arctic regions have maintained and even strengthened their export orientation. For example, in the Murmansk region, the share of exports of apatite concentrate in the total volume of production increased from 7.9% in 1991 to 37.1% in 1995.

The fall in industrial production in the Russian Arctic was accompanied by a rather sharp reduction in the volume of investment injections, since the state policy was aimed only at reducing costs in this region. The calculations show that the investment decline in the Arctic regions during this period was deeper than the national average (Fig. 2), and it was not compensated by the relatively more favorable situation in the oil and gas regions, for example, in Yamal. In general, during 1990–1999, capital investments in the Russian Arctic decreased fivefold. The largest decline occurred in the Chukotka Autonomous Okrug: in 1999, the volume of investments in the region amounted to only 3.7% of the 1990 level.

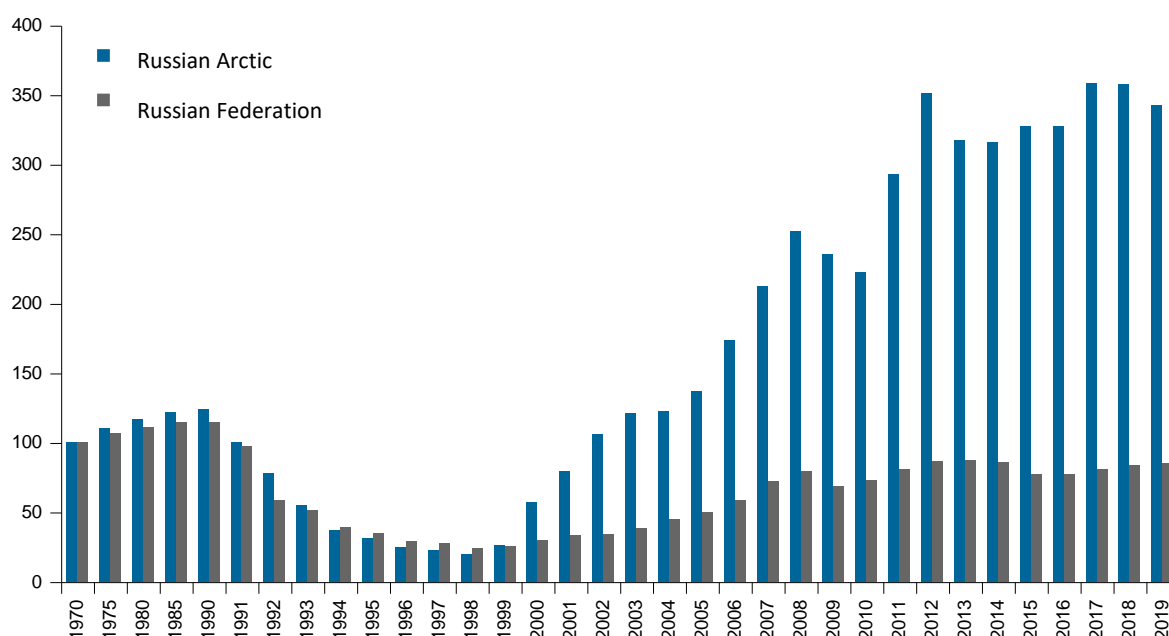


Fig. 2. Dynamics of the investments volume in fixed assets in % by 1970, in comparable prices⁷.

During this difficult transition period, the Arctic transport system, which had always been supported by the state, also began to collapse. With the destruction of the centralized Soviet system, the state management structures of the Far North and the Arctic were abolished, the previously established management of these territories was disrupted, and their material and technical supply was eliminated. As a result, the majority of the Arctic ports became unprofitable, polar stations were reduced, most of the transport ships of the ice categories were taken out of service [21, Ul'chenko M.V., Bashmakova E.P., p. 45–52], many civil aviation airfields were closed (by 1993, only parts of the former united detachments remained from the unified Arctic aviation

⁷ Source: author's calculations.

system, more than 70% of which later ceased to exist) [22, Oleynikov V.A., p. 10–13], a reduction in the rate of renewal of the fleet of mobile vehicles and other equipment in all types of transport took place, as well as a decrease in the volume of repair work of existing infrastructure facilities, and the construction of new ones was suspended.

The lack of government support has led to extremely negative trends in the social sphere: degradation of the social security sphere, the loss of the comparative advantages of the Arctic regions in real incomes of the population, a decrease in living standards, a reduction in employment, etc. [23, Bradshaw M., p. 195–203; 24, Heleniak T., p. 55–205; 25, Fauser V.V. et al, p. 75–89; 26, Volgin N.A. et al, p. 117–133]. All this led to the massive migration of the population from the Arctic regions of the country: in 1990–1999 the population of the Russian Arctic decreased by 9.7% (945 thousand people), and in general over the past thirty years — by 20.8% (more than 2 million people).

The rise in prices on the world raw material market at the beginning of the 21st century (oil, gas, non-ferrous metal ores, diamonds) contributed to the general socio-economic recovery in the country. The economy of the AZRF during this period entered a phase of economic recovery, accompanied by growth in industrial production and increase in investment activity [27, Serova N.A., p. 311–314; 28, Gadzhiev Yu.A. et al, p. 86–100]. Thus, as early as 2000, the volume of investments in the Russian Arctic doubled in comparison with 1999, and the production of industrial products increased by 6.1%. In general, for 2000–2018, investments in the Arctic increased 6.3 times (the average annual growth rate was +10.7% against +5.9% on average in the country), and the volume of industrial production increased 3.1 times (the average annual growth rate was +6.4% versus +3.1% on average in the country). In terms of regional investment activity and industrial growth rates, the leader in 2000–2018 was the Chukotka Autonomous Okrug, where the development of several new gold deposits began (industrial output in the region increased 8 times over the period under review, and investments — 4.2 times). Thanks to large investments in oil and gas production, high rates of industrial production growth were also characteristic of the Nenets Autonomous Okrug (the volume of industry increased 5 times, investment inflows — 6.4 times).

In addition, since the early 2000s, the inflow of investments from abroad also increased significantly (Fig. 3). Despite the negative influence of external factors of this period, the inflow of foreign investment showed an unstable, but growth, and the share of the AZRF in the total Russian volume of foreign investment increased almost three times (from 4.4% in 2000 to 12.2% in 2018).

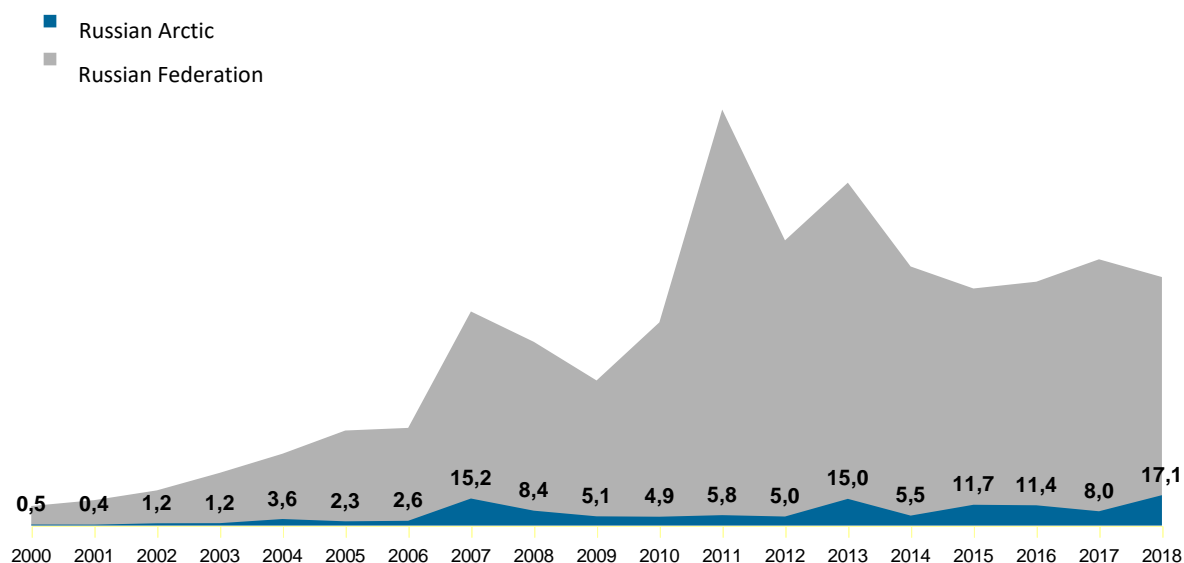


Fig. 3. Volume of foreign investments, USD billion ⁸.

To date, the upward trend in capital investment in the Arctic continues. So, in the first half of 2020, the increase in the volume of investments in the Russian Arctic against the same period in 2019 amounted to +1.6%, while the average investment decline was observed in the country (–4%). The Chukotka Autonomous Okrug showed the greatest investment activity (investment growth was +23.7%), and industrial production also grew (+1.4%) during the indicated period. However, in the rest of the regions (with the exception of the Republic of Karelia and the Arkhangelsk Region) in the first half of 2020, the growth rates of industrial production were negative.

In conclusion, it should be noted that more than 55% of all investment in the Arctic falls on the extraction of minerals, primarily hydrocarbons (this figure in the Nenets Autonomous Okrug exceeds 93%). There is every reason to believe that these investments will only increase in the future, since in July this year, a law was passed on tax and administrative preferences for Arctic projects ⁹, primarily oil and gas. In particular, the new law provides for a transition to additional income taxation (AIT) ¹⁰ from the extraction of hydrocarbons in the Taimyr Peninsula, northern Yakutia and Chukotka, as well as exemption for 12 years from the payment of mineral extraction tax (MET) for LNG and gas chemistry projects (three NOVATEK projects — Arctic LNG-1, Arctic LNG-2 and Obskiy LNG — fall under these benefits) and the provision of a tax deduction for MET for oil production for the Vankor cluster (Krasnoyarsk Krai), which is being developed by Rosneft. In addition, the law includes benefits for entrepreneurs and companies planning to implement investment projects not related to the extraction of hydrocarbons (for example, the construction of ports, industrial enterprises, etc.), which will certainly serve as an incentive for the development of

⁸ Source: Federal State Statistics Service.

⁹ Federal'nyy zakon ot 07.07.2020 g. №193 «O gosudarstvennoy podderzhke predprinimatel'skoy deyatel'nosti v Arkhicheskoy zone Rossiyskoy Federatsii» [Federal Law of July 07, 2020, No. 193 "On State Support of Entrepreneurial Activity in the Arctic Zone of the Russian Federation"].

¹⁰ The essence of the AIT regime: the tax burden on companies increases as the project reaches recoupment.

entrepreneurial activity in the Russian Arctic.

Conclusion

The analysis showed that the economic development of the Russian Arctic took place in three fundamentally different stages. The first stage (1950–1990) was characterized by intensive development of the Arctic territories: high rates of development of fuel and mineral resources, the expansion of specialization industries through the formation of the oil and gas industry, an increase in the share of processing industries in the mining, timber and fishing industries, the development of territorial production complexes (West Siberian, Timan-Pecherskiy, Kola, etc.), the Northern Sea Route, air traffic, etc. Capital investments made in 1971–1980 only for the creation of a fuel, energy and raw material province in the north of Western Siberia exceeded the cost of building such large facilities as VAZ, KamAZ and BAM combined [30, Timoshenko A.I., Elert A.Kh., p. 8]. As emphasized by Leksin V.N. and Leksin V.N., Porfiryev B.N., “more than 90% of the currently used economic and infrastructural potential of the Arctic macroregion was created during the period of its Soviet (socialist) development” [31, Leksin V.N., Porfiryev B.N., p. 4–21].

The second stage (1990–1999) was associated with the country's transition to market relations and was characterized for the AZRF by a sharp decline in investment activity, a decrease in industrial production and a recession in other sectors of the economy. It should be noted that a more rapid than the national average, the investment decline took place in the AZRF against the background of a less significant drop in industrial production. Thus, the Arctic regions “became a kind of buffer, softening the negative consequences of the decline in production in the country, but at the same time found themselves in a much worse position in terms of the reproduction of fixed capital” [32, Didyk V.V., Serova N.A., p. 90–101]. During this period, the standard of living of the population was also rapidly declining in the Arctic regions, unemployment was growing, which ultimately led to a massive outflow of the population to other regions of the country.

The current stage (from 2000 to the present) is characterized for the AZRF, on the one hand, by investment revival, which was facilitated by revenues from large-scale export of raw materials and state funding for the implementation of large infrastructure projects, on the other hand, by continuing negative phenomena in the social sphere (population outflow, the growth of poverty, unemployment, etc.). In other words, the objectives of the latest stage of Russian state policy in the Arctic, related to the achievement of the interests of the industrial development of the Arctic territories, have a pronounced priority over the task of improving the quality of life of the local population. The current trends determine the need to search for new effective approaches to managing this region.

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Chimeras of the Past and Navigation through the Latest Development Conditions, Risks and Opportunities for Managing the Russian Arctic *

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Abstract. The uniqueness of today's social processes triggered by the COVID-19 pandemic determines the lack of insights into the transformation of the socio-economic space of the Russian Arctic. The purpose of this article is to review the past, recent, and future conditions for development and management of the Russian Arctic, considered in the context of the unfolding crisis of a non-economic nature and its consequences. The methodological peculiarity of the review is presentation of the phenomenon of the current crisis in the context of interrelated fundamental problems of the development of the Russian Arctic, the new economic reality, which makes it difficult to reliably predict the future. This naturally led to the substantiation of a series of contradictions and difficulties in implementing the declared development goals of the Russian Arctic, that are specifically reflected in the title of the article — "chimeras", which in biology means an organism consisting of genetically heterogeneous cells. A statistical description of the specifics of socio-economic development of the Arctic regions under the COVID-19 pandemic has been carried out in the context of review of the support measures, examination of the economic structure and the corresponding scale of "disconnection" of the regions' economies during the period of isolation and the subsequent recovery. It is revealed that the Arctic regions demonstrate greater economic resilience compared to the overall Russian situation, which is associated not so much with the strengthening of stabilization measures at the federal level with the support of the regional level, but with the fundamental reasons — the relative simplicity of the Arctic extractive economy, higher population incomes, low level of small and medium business development. Navigation on the risks and opportunities of governing the Russian Arctic has been carried out, linking the fundamentals and the practical implications of the study through the traditional rationale for navigating and considering the practice of managing an object, in our case, the Arctic, as well as routing, which is, choosing the path to follow. In particular, it makes a strong case that the pandemic has deepened the problems and risks that are also major management targets for the "precursor" period and creates a new hypothetical risk — the diminishing scale of the Arctic's social and economic development goals, including practices for securing conditions for increased standards of living and quality of life for its people.

Keywords: COVID-19 pandemic, Russian Arctic, social and economic development, risk, opportunity, management.

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Introduction

This paper continues a series of review articles in the journal “Arctic and North”, the appearance of which was initiated by implementation of the key event “Supporting expansion and strengthening of the international authority of national knowledge bases (banks), including journals and their collections” of the state program of the Russian Federation “Scientific and technological development of the Russian Federation”. As part of this event, the Russian Foundation for Basic Research, for the second year in a row (since 2019), has been holding a competition for financial support for the preparation and publication of scientific review articles in order to “strengthen the international authority of Russian scientific journals and increase their rating in international scientific citation systems by creating conditions for the preparation of original scientific review articles for publication in Russian scientific journals” (from the RFBR announcement about the “Expansion” competition).

In 2019, a review article “Transformation of the Socio-Economic Space of the Russian Arctic in the Context of Geopolitics, Macroeconomics, and Internal Factors of Development” was published in the journal “Arctic and North” No. 41 with the support of the RFBR grant No. 19-110-50269 within the framework of the “Expansion” competition [1, Skufina T.P., Mitroshina M.N.]. The fundamental importance of this review was dictated by the sense of crisis in the theory of development and management of the North and its Arctic component, repeatedly manifested in articles, conferences, scientific and practical works [2, Kryukov V.A., Kryukov Ya.V., p. 26–29; 3, Serova N.A., Gutov S.V., p. 77–80; 4, Samarina V.P., Samarin A.V., p. 91–94; 5, Skufyina T.P., p. 268; 6, Tolvanen A., Eilu P., Juutinen A., Kangas K. et al., p. 832–834, 842; 7, Kryukov V.A., Kryukov Ya.V. et al., p. 59, 98–128, 154–155, 204–214, 149–152]. This includes an inability to cover and solve such significant problems for the Arctic as the balance between the requirements of ecology and economics (the problem aptly described by Heininen Lassi as “political incapacity” [8, Heininen L., p. 195; 9, Markkula I., Turunen M., Rasmus S., pp. 95–197]) between the increased costs of the economy and the need for large-scale development of natural resources of the Russian Arctic, including associated transport and infrastructure facilities, etc. [10, Zaikov K.S., Kondratov N.A., Kudryashova E.V., Lipina S.A., Chistobaev A.I., pp. 6–7; 11, Minakir P.A., Krasnopol'skiy B.Kh., p. 12–13, 22; 12, Serova N.A., Serova V.A., p. 42–43; 12, Features and scenarios..., p. 26–35, 236–237; 13, Larchenko L.V., Kolesnikov R.A., p. 370–373]. The consequence of this inability was the frequent appeal of researchers and politicians to the declarative goals of the Arctic development with a bias towards a “pure” concept of sustainable development. We believe that, to a large extent, the theory's “incapacity” has delayed the emergence of a comprehensive regulatory framework for the development of the Arctic zone of the Russian Federation (AZRF), which actually appeared in the form of a package of interrelated documents only in 2020 [14, Krutikov A.V., Smirnova O.O., Bocharova L.K., p. 255–257; 15, Skufyina T.P., p. 19; 16, Kudryashova E.V., Lipina S.A., Zaikov K.S., Bocharova L.K., p. 446–456].

The set of ideas about the transformation of the socio-economic space of the Russian Arctic is becoming clearly insufficient in today's reality. The radical change in the world economy caused by the COVID-19 pandemic has qualitatively changed the current conditions of development and, probably, the prospects of the AZRF. Changes in social processes turned out to be so significant that economic thought today can become a springboard for resolving a number of controversial issues in the development of the Arctic. Fundamentally new conditions make it possible not only to pose, but also to solve those problems of the socio-economic development of the Arctic that were impossible to discuss within the framework of the previous development trajectory. In other words, the main subject of Arctic regional studies — the conditions for development, risks and opportunities for managing the Russian Arctic — has again come to the surface, and any previous publication of a theoretical and methodological nature, including the discussed review article [1], requires development and modernization.

Problem, purpose and objectives of the scientific review

The uniqueness of today's social life prompts new forms of presentation of scientific results, including review articles. It is possible to survey not only a complex of classical and newest publications that reveal any problem, but also a phenomenon. This review article reflects the phenomenon of the current unique crisis, which initiates fundamentally new topics and aspects of scientific understanding of the development and management of the Russian Arctic.

What are the consequences for the AZRF? How might policy and governance priorities change? But the main question is: when will we return to the former way of life? Forecasts of the world crisis development of international organizations, the strongest states in the world, famous scientists allow us to agree with the answer given in the book by B.D. Medico "Tsunami Coronavirus. When Will We Go Back to Normal?": "There is only one possible answer ... When the tsunami passes, nothing will be the same. We are experiencing a prelude to a new social organization" ¹.

The purpose of this article is to review the past, recent and promising conditions for the development and management of the Russian Arctic, considered in the context of the deployment of a crisis of a non-economic nature and its consequences. But the achievement of this goal in modern conditions will have its own specifics, determined by a unique combination of, on the one hand, fundamental, hereditary problems of the AZRF development, on the other, a fundamentally new economic reality and a future, which is difficult to predict reliably.

Therefore, the first task is to critically review of the declared goals, objectives, conditions for the development of the Russian Arctic in the context of modern opportunities and restrictions on their implementation, generated by the consequences of the COVID-19 pandemic.

¹ Medico B.D. Tsunami Coronavirus. When Will We Go Back to Normal? 2020, 157 p. URL: <https://ru.scribd.com/book/454192592/Tsunami-Coronavirus-When-Will-We-Go-Back-to-Normal> (accessed 20 January 2021).

The contradictory and difficult development goals of the AZRF received a specific reflection in the title of the article — “chimeras”, which means an organism consisting of genetically heterogeneous cells. This heterogeneity lies in the disclosure of a whole complex of fundamental contradictions and a set of problems: 1) the theory of the Arctic managing, including the experience of managing the North during the USSR period, taking into account the limitations of state management in the development of the Arctic under the conditions of a capitalist formation, etc. ; 2) systemic factors of the Arctic development — a harsh climate, a “northern” rise in prices, the legacy of the USSR — monotowns, a large sector of state industry, etc. ; 3) restrictions on the development of economy and social sphere of the Russian Arctic, caused by the global crisis, changing the political configuration and rhetoric, the priorities of the economy, the demand for the basic export products of the Arctic regions, etc.

The second task is to statistically describe the specifics of the socio-economic development of the AZRF regions during the COVID-19 pandemic in the context of a review of support measures, the structure of the economy and the corresponding scale of the “shutdown” of the regional economy during the period of isolation and subsequent recovery.

The third task is to review the likely risks and opportunities for optimizing the management of the Russian Arctic. The solution to this problem will be presented as a generalized conclusion and development of the polemics presented in the solution of the first two problems.

The second and third tasks are designated in the title of the review as “navigation through the latest development conditions, risks and opportunities for managing the Russian Arctic”. This is prompted, again, by the fundamental novelty of management in a pandemic, which has no analogues in recent history. The term “navigation”, that is, the process of controlling some object (which has its own methods of movement) best describes the fundamental specificity and at the same time the practical relevance of the proposed review.

Navigation traditionally includes two components:

- theoretical substantiation and practical application of management methods, in our case — AZRF;
- routing, that is, the choice of the optimal route for the AZRF. These two components of navigation connect the fundamentality and practical meaning of this review to clarify the scientific basis for managing the social and economic development of the Russian Arctic.

On the declared goals, objectives and conditions for the development of the Russian Arctic

The relevance and significance of review and critical understanding of the declared goals and objectives of the AZRF development in the context of modern opportunities and limitations of their implementation, generated by the consequences of the COVID-19 pandemic, is due to the need to solve a large-scale, complex fundamental task. This task is related to the formulation of

the goals of the socio-economic development of the Russian Arctic, presented in state priorities, programme and strategic documents, requiring the formation of a mechanism that can ensure an increase in the level of socio-economic development of the AZRF by managing this territory as a single object of territorial planning [15, Skufyina T.P., p. 18; 17, Gagiev N.N., Goncharenko L.P., Sybachin S.A., Shestakova A.A., p. 116–118; 18, Samarina V.P., Skufina T.P., Samarin A.V., Baranov S.V. p. 2–6].

Arctic researchers have repeatedly described the specifics of transformation of the AZRF legal regulation, noting that such a large-scale task is posed for the first time in the world practice of managing the state of a capitalist formation [14, Krutikov A.V., Smirnova O.O., Bocharova L.K., p. 254–260; 19, Skufyina T.P., Korchak E. A., Baranov S.V., p. 11–13; 20, Bazhutova E.A., Biev A.A. et al., p. 20–22]. At the same time, generalizing scientific research concentrates on the contradictions, identified by us in the previous section when setting tasks [21, Fauser V.V., Smirnov A.V., p. 4–5; 22, Healy A., p. 30–31; 23, Heleniak T., Bogoyavlenskiy D., p. 54–56, 103; 24, Kudryashova E.V., Zarubina L.A., Sivobrova I.A., p. 39–40]. In fact, these studies confirm the fundamental nature of the basic contradiction: on the one hand, social processes that determine the effect of the “northern rise in prices”, which means that they limit economic and social activity; on the other, the goals of management aimed at ensuring the development of the Arctic economy to fill the budget and to ensure social development for the necessary synchronization with world processes [1, Skufina T.P., Mitroshina M.N., p. 89–90]. It is obvious that the conditions of the current large-scale crisis only increase the depth of contradiction.

The essence of this basic contradiction adjusts to a pragmatic position of forming the management of AZRF socio-economic transformations, based on:

- objective attitudes of economic theory, which determines the conditions, factors, sustainable patterns of functioning of different-level objects of the North and a specific object of the Arctic in the system of relations between the capitalist economy of the country and the world [25, Leksin V.N., Porfiryev B.N., p. 641–655];
- taking into account objective risks and opportunities for the development of the northern territories of Russia [7, Kryukov V.A., Kryukov Ya.V. et al., p. 214–217; 26, Laverov N.P.; 27, Skufyina T.P., Korchak E.A., Baranov S.V., p. 5–65];
- taking into account subjective influence, in particular, the global and national rhetoric of the sustainable development goals of the Arctic, since ideas have their own driving force, influence and ensure transformation processes in the Arctic (for example, the ecological policy vector is clearly ensured, which is actually taken into account in the activities of all Arctic countries and enterprises working in the Arctic) [28, An Industry for the Future ...; 29, Mustonen T., p. 20–22, 25; 30, Padrtovaab B., p. 38–44].

It should be noted that the gradual approval of this pragmatic position transforms the legal and regulatory support for the socio-economic development of the Russian Arctic. Thus, the Arctic emerged as an independent object of territorial policy in 2008 with the President's approval of the document "Fundamentals of the State Policy of the Russian Federation in the Arctic for the Period up to 2020 and beyond". The Arctic emerged as an independent management entity in 2014 with the President's approval of the Decree designating its land territories. Since 2015, a large-scale work of specialized authorities, management, scientists and the public has begun on the creation of a draft law "On the development of the Arctic zone of the Russian Federation". This law was conceived as a kind of charter for the integrated development of the AZRF, which was reflected in the first 4 versions of the draft law. However, the last version of the draft law of November 2017, which was never adopted, is devoted only to support zones without positioning the task and prospects for the integrated development of the Arctic, reflected in the relevant targets. We believe this is due to the insufficiency of the modern theory of development of the North and its Arctic component, which was shown in the previous survey study [1, Skufina T.P., Mitroshina M.N., p. 99–103]. Obviously, as we noted above, this is a consequence of the essence of economic relations in the capitalist formation, unable to create conditions for reducing the objective costs of "northernness" in an open economy. Therefore, no real mechanism was proposed to reduce the increased costs of economic and social functioning, which would ensure the comprehensive development of the Arctic. In fact, the discussed versions of the draft law were based on the principle that the state was decisive in ensuring an increase in the socio-economic level of development of the AZRF, and not as a creator of conditions, for example, for investments, but as the main investor. Obviously, the scale of the tasks of the development of the AZRF cannot be provided mainly by the forces of the state, which distinguishes the current reality of capitalism from the more complex socialist formation. This is confirmed by the economic theory, indicating the expectations of low efficiency of public investment without linking with the competitive processes of the business environment [31, Blaug M., p. 362, 548–553; 32, Bloom N., Bond S., Van Reenen J., p. 392–394; 33, Orhangazi O., p. 884].

In 2020, a system of documents was formed, which actually indicated a fundamentally new basis and conditions for achieving the strategic goals and objectives of the AZRF development.

Firstly, the basic principle has been changed from the state as the main investor in the socio-economic development of the AZRF to the state as the creator of institutional conditions that provide support for investors (from small enterprises to corporations), including a series of preferences and tax incentives, which will ensure the development of the territory's economy and then — social development, an increase in the level and quality of life of the population.

Secondly, the new conditions for the development of the Russian Arctic are regulated not by separate documents (which often demonstrate significant gaps for the effective functioning of

a business until 2020), but by an interconnected system of documents, which includes the following basic elements:

- a new platform for the Arctic strategy — Presidential Decree of October 26, 2020 No. 645 “On the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2035”;
- a guarantee of a special economic regime for the AZRF — Federal Law dated July 13, 2020 No. 193-FZ “On State Support for Entrepreneurial Activity in the Arctic Zone of the Russian Federation”;
- politics and national interests in the Arctic — Presidential Decree of March 5, 2020 No. 164 “On the Fundamentals of the State Policy of the Russian Federation in the Arctic for the Period up to 2035”;
- a specific mechanism for the development of the AZRF — RF Government Decree dated April 21, 2014 No. 366 (as amended on June 05, 2019, with changes to the passport dated April 15, 2020 — RF Government Decree dated March 31, 2020 No. 381) “On Approval of the State Program of the Russian Federation “Socio-Economic Development of the Arctic Zone of the Russian Federation”.

Thirdly, the main goals of the AZRF development were confirmed: ensuring the quality of life and well-being of the population of the Russian Arctic, development of the Russian Arctic as a strategic resource base and its rational use in order to accelerate the economic growth of the Russian Federation, including the associated tasks of developing the NSR, solving environmental problems. However, the specificity is determined by the fact that the increase in the socio-economic development of the Russian Arctic, the level and quality of life of its population, infrastructure development is provided only as a result, coupled with the economic effect of business investment in a certain territory. At the same time, the infrastructure support of the state for large investment projects is provided by strict conditions: the cost is more than 300 million rubles, tax revenues from the project implementation must pay back state investments in no more than 10 years, the state subsidy cannot exceed 20% of private investments for the creation infrastructure required for the investment project.

Fourthly, according to the approved national plan for the recovery of the Russian economy, a specific instrument for redistributing income from the implementation of large investment projects to ensure the tasks of recovery growth and socio-economic development of the AZRF is outlined — the Arctic Development Fund, which redirects 50% of federal taxes from the implementation of new Arctic projects on the territory of the Arctic region. The creation of this fund is envisaged at the beginning of 2021.

Fifthly, attention is drawn to the focus on specific mechanisms and institutional conditions for ensuring the socio-economic development of the Russian Arctic, including associated economic

decisions. This is fully consistent with the difficult economic conditions caused by the impact of the COVID-19 crisis.

However, it is worth noting that a number of changes and crisis phenomena that researchers and managers often associate with the modern crisis of a non-economic nature, have been initiated and discussed by specialists for a long time. For example, forecasts and plans for the development of the NSR, elaborated from the standpoint of ensuring existing and promising projects for the development of the raw material base of the Arctic, but at the same time realistic installations for the insignificant possibilities of transit prospects for the development of the NSR [34, S. Kudiyarov, p. 18]². In particular, at the meeting on the development of the NSR in Murmansk on October 21, 2020, M. Mishustin identified the most acute problems and tasks of the NSR development, which are related not to the system of strategic planning, but to ensuring the decisions and development plans that have already been made³. At the same time, it is emphasized: "The infrastructure that we are creating today for Russian cargo is the basis for increasing international transit traffic in the future. The state is investing in infrastructure development projects. Port terminals and a railway network are under construction. The total volume of public investments exceeds 110 billion rubles". The development of the NSR is directly related to a virtually new springboard for investment projects in the Russian Arctic, which is based on the Federal Law "On Tax Incentives for the Search and Evaluation, Exploration and Production of Hydrocarbons in Certain Territories of the Arctic Zone of Russia" signed by the President of Russia on March 18, 2020. The special geopolitical significance of this law, which increases the profitability of Arctic fields, is manifested at least in connection with two factors: firstly, the current state of the global oil market caused by the COVID-19 pandemic, expected to increase in volumes and prices; secondly, the relatively low investment activity of Russian oil companies expected by experts [35, Ogorodnikov E., p. 38–39; 36, Epryntseva E., Popov S., p. 27–28]. According to this law, more comfortable tax conditions have been established for the development of new fields in the Russian Arctic by reducing the severance tax on the basis of assigning a number of offshore and onshore fields to a higher category of complexity. For example, MET rate is 5% for oil for 15 years and 1% for natural gas for 15 years from the date of commercial production, which has considerably enhanced the profitability of new deposits in the offshore waters of the AZRF and the Sea of Okhotsk. Significant benefits are also provided for production in the mainland of the Russian Arctic. For new development areas of the AZRF, located north of 70° north latitude, there are benefits: for the complexity category of the fifth group, the right to voluntary transition to the application of the additional income tax (AIT), within which a preferential coefficient K_g to MET for oil is 0 for 12 years from the start of production, then within 5 years there is an annual growth of 0.2 until reaching 1; if a regional law is adopted by the AZRF subject, a preferential rate of income tax will be applied. For areas located

² FGBU SPM Administration website. URL: <http://www.nsra.ru/> (accessed 20 January 2021).

³ Russian Government website. URL: <http://government.ru/news/40660/> (accessed 25 March 2021).

within 67°–69° north latitude (applicable for the Vankor group of fields), within a 10-year period, there is a 10-year deduction from MET for the creation of infrastructure used for oil production. In the context of expected growth in LNG demand and the declared possibility of the LNG and petrochemical clusters formation in the Russian Arctic, it is extremely important to provide support for new Arctic LNG production projects. The law provides for zero MET rates for 250 billion m³ of produced natural gas and 20 million tons of gas condensate processed into LNG or oil and gas chemistry products within 12 years from the shipment of the first batch [36, Epryntseva E., Popov S., p. 27–28].

Another significant example from the standpoint of required balance of interests of the state and business, initiated for rapid implementation in terms of the need to overcome the COVID-19 crisis and ensure recovery economic growth, is the 2020 amendments to the Tax Code. Thus, according to the Federal Law “On Amendments to Chapters 254 and 26 of Part Two of the Tax Code of the Russian Federation (in terms of clarifying and adjusting certain parameters for calculating the tax on additional income from the extraction of hydrocarbon raw materials and mineral extraction tax)”, signed by the President of Russia on October 15, 2020 (hereinafter referred to as the Law), a significant increase in MET (coefficient 3.5 to the current rate) for the extraction of potash salts, apatite-nepheline ores, apatite and phosphorite ores, non-ferrous metal ores, iron ore, etc. is envisaged from January 1, 2021. The Law concerns the main export products of the Russian Arctic and at the same time is a budget-forming document. When discussing the need to increase MET, the Ministry of Finance of the Russian Federation provides data confirming an increase in the fairness of the tax burden on the mining sector: “Today the effective MET rate in Russia for oil is from 40 to 50%, for gas — 15%, for precious stones — 8%, for precious metals — about 6%, and for solid minerals only 0.5–0.6%. The corresponding tax rates in other countries vary from 2% to 6%. When the coefficient 3.5 was determined, we wanted to keep the levels of tax exemptions for precious stones and precious metals at 8% and 6%, respectively, and raise all the rest to the level of 4% of the effective MET rate to revenue” (data of the Ministry of Finance of Russia, cited in speech A G. Siluanov⁴). Experts confirm the fairness and admissibility of increasing the tax burden in the extraction of metal ores and chemical production [37, Obukhova E., p. 38–39]. Experts also substantiate that MET increase will provide not only the withdrawal of surplus profits by the typical mechanism of capitalism — tax redistribution of raw materials income in favor of society, but also initiates investment in deeper processing [11, Minakir P.A., Krasnopol'skiy B.Kh., p. 12–15; 37, Obukhova E., p. 38–40]. It should be noted that MET increase will not affect new investment projects for production in the Russian Arctic. Thus, the Law provides for a five-year postponement for the application of the multiplying factor for new projects. Thus, the sever-

⁴ Minfin Rossii obsudil s biznesom izmenenie NDPI dlya mayninga [The Ministry of Finance of Russia Discussed Changes in the Mineral Extraction Tax for Mining with the Business]. URL: https://minfin.gov.ru/ru/press-center/?id_4=37193-minfin_rossii_obsudil_s_biznesom_izmenenie_ndpi_dlya_mayinga (accessed 20 January 2021).

ance tax increase will not be a significant limiting factor in the implementation of planned investment projects in the Arctic, which is especially important in the context of necessary provision of recovery growth. At the same time, the adopted adjustments are significant for enhancing the participation of mining companies in solving national tasks, including supporting the population and business obligations of the state during the COVID-19 pandemic, ensuring infrastructure development in the Arctic, etc. It should be noted that MET increase is taken into account in the macro-forecast and planned budget in the form of additional revenues: in 2021 in the amount of 52.8 billion rubles, in 2022 — 53.5 billion rubles, in 2023 — 54.3 billion rubles. The regional budgets of the Russian Arctic will receive 17% of additional income from the mineral extraction tax increase.

Returning to the development of crisis processes, it is interesting to note that the extractive industries not only provided a significant contribution to the decline of industrial production in Russia in 2020, but also slowed down industrial growth that was outlined in the 4th quarter of 2020 due to external reasons. Obviously, the production dynamics in the regions of the Russian Arctic is determined and will be determined mainly by two main external factors: firstly, the speed of the world economy recovery, and secondly, the strength and direction of the sanctions pressure, which significantly and multidimensionally affects the development of new projects in the Russian Arctic.

Thus, it can be noted that the pandemic has not changed the strategic objectives of the Arctic development associated with the development of natural resources and the associated provision of the socio-economic development of the territory. The sustainability of these tasks during the COVID-19 pandemic not only proves their strategic nature, but also confirms the importance of the Russian Arctic development from the standpoint of Russia's social priorities.

At the same time, the question arises: why, when analyzing the specifics of the current crisis impact on a number of components of the AZRF socio-economic development, researchers often talk about qualitative changes? These qualitative changes are associated not only with the collapsing characteristics of the small and medium-sized businesses of the consumer market, tourism, etc. in the AZRF regions, which only repeat global and national trends. Qualitative changes are also associated with the fact that the COVID-19 crisis has significantly accelerated a number of existing processes and marked the beginning of new trends. For example, the global focus on green economy and production ecologization, intensified in 2020, are organically intertwined with the policies of large Russian mining companies in the Arctic, confirming and strengthening investments in environmental projects (including due to major environmental disasters in 2020). Increased attention to the quality of workplaces in the Arctic and to the provision of medical care raises the standards of social responsibility of business to employees and the population. Results of 2020 indicate that the mining companies in the regions of their presence in the Russian Arctic have completely focused on public expectations during the COVID-19 crisis. An effective system was quickly built in the regions of the Russian Arctic, including a set of programs aimed at directly combating

the pandemic and mitigating the negative social consequences [38, Antivirus ..., p. 48–49; 39, Blagov Yu., p. 15].

At the same time, the conditions of the crisis indicated the possibility of solving the problems of high costs, reduction the profitability of products, solving the problems of outdated industries that do not meet modern environmental standards, by means of initiating the threat of unemployment increase for the local population of the Russian Arctic. In 2020–2021 the tendency to switch to a rotational method of work has been strengthened, low-profit production facilities that were maintained in the pre-COVID period are being closed, including due to the achievement of a certain contractual balance between corporations and the state. For example, in the Murmansk region, the city-forming enterprise JSC Kovdor Mining and Processing Plant (one of the largest producers of apatite and iron ore concentrates, the only producer of baddeleyite in the world) announced the introduction of a rotational work method. The shift work started on October 15, 2020: 40 shift workers were recruited in 2021, another 200 employees are planned to be recruited in 2021. Further shift workers' numbers are planned to increase every year. As part of the environmental program implementation, the city-forming enterprise of Monchegorsk, the Kola Mining and Metallurgical Company (Kola MMC), announced the closure of the metallurgical shop in Monchegorsk from March 1, 2021, explaining the shutdown of production by inconsistency with modern environmental requirements. The complete shutdown of the 74-year-old metallurgical production affects more than 700 staff members. As part of the environmental program of the Kola MMC, in December 2020, the oldest smelting facility at the subsidiary of PJSC MMC Norilsk Nickel (the town-forming enterprise in the city of Nickel) was also completely liquidated in the town of Nikel, Murmansk Region. This eliminated sulfur dioxide emissions in the Norwegian transboundary area. According to the plans of Kola MMC to implement the environmental program, it is planned to reduce sulfur dioxide emissions in 2020 by 50%, in 2021 — by 85%. The employees of the Kola MMC, affected by the shutdown of the smelting facilities of the city-forming enterprises, are treated within the framework of the company's social programs. The programs include a powerful social package — an employment program with the preservation of average earnings throughout the year, a program of compensation of relocation expenses both for an employee and for family members, and a release program.

Thus, during the COVID-19 crisis, a certain balance of interests has been achieved. The state confirms the strategic development goals of the Russian Arctic, providing business with favorable development opportunities. In turn, the business implements the expectations of the population and the state during the COVID-19 pandemic, in particular, in the field of corporate social responsibility. However, there are grounds to talk about the accumulation of factors capable of ensuring shifts in relations between business, the state, and the population in the Russian Arctic in favor of strengthening the interests of big capital, mainly adapted to international standards, including non-financial reporting. Thus, the preserved obsolete production in the pre-COVID peri-

od becomes a chimera of today's reality, focused on the greening and digitalization of production by formulating the tasks of the ecological transformation of the Arctic industrial zones, the creation of green industries and high-tech jobs. In turn, this may lead to a change in the planned socio-economic and demographic dynamics of the AZRF regions.

Specificity of social and economic development, shutting down the economy and a set of support measures during the COVID-19 pandemic in the Russian Arctic

Our navigation through the newest conditions, risks and opportunities for managing the Russian Arctic has its own specifics, determined by the internal connection of a range of issues, within which there are global, national factors of influence, political consequences, management responses at all levels of government, as well as historical context that determines the extractive structure of the economy, the strategic goals and objectives of the AZRF development. Thus, as noted in the statement of the research problem, our studied object — the Russian Arctic — has its own specifics, its own mechanisms of movement, but the state navigation determines the route to follow. Lockdown identified the commonality of the economy shutdown dynamics, a certain similarity in the reaction of the social sphere of the Russian regions, and outlined all-Russian large-scale support measures. Therefore, it is not possible and expedient to consider the AZRF routing outside the all-Russian context.

Thus, the COVID-19 pandemic has distorted economic processes in Russia. The consequences of these distortions are the rupture of logistics ties, changes in cash flows, deflation of assets, increase in debt burden, decrease in profits, decrease in income, decrease in the volume of insurance and tax revenues, and, as a result, threat of financial instability and increasing uncertainty of the future economic situation. The most catastrophic consequences of the COVID-19 pandemic turned were in the service sector, the subject of small and medium-sized businesses [40, Epanchintseva A.V., p. 21], whose revenue in 2020 decreased compared to 2019 by almost 80% [41, Zimovets A.V., Sorokina Yu.V., Khanina A.V., p. 1341]. The COVID-19 pandemic affected more than 4 million small and medium-sized businesses (almost 70% of their total number) [42, Andreeva O.V., Kurinova Ya.I., Sukhoveeva A.A., p. 7]. Against the background of the current economic situation, the Government of the Russian Federation identified specific types of economic activities (OKVED)⁵ most affected by the COVID-19 pandemic, and presented a set of measures aimed at reducing the negative impact of the COVID-19 pandemic on key indicators of the economy [43, Asaliev A.M., Stepanov A.A., Oborin M.S., Gordeeva E.V., p. 69]. Specific support measures were developed for small and medium-sized businesses, developers, road carriers, catering, culture and leisure activities, retail and tourism facilities, and air transportation. In particular, as support for developers (Decree of the Government of the Russian Federation of 02.04.2020, No. 423, Decree

⁵ Mery podderzhki biznesa i prakticheskie rekomendatsii dlya kompaniy v usloviyakh pandemii [Business Support Measures and Best Practices for Companies in a Pandemic]. URL: <https://roscongress.org/materials/mery-podderzhki-biznesa-i-prakticheskie-rekomendatsii-dlya-kompaniy-v-usloviyakh-pandemii/> (accessed 20 January 2021).

of the Government of the Russian Federation of 23.04.2020, No. 566), it was planned to subsidize the interest rate on loans to construction companies (upon condition of keeping the number of employees and commitments to complete the construction of houses planned for commissioning in 2020–2021). Tour operators were granted the right to receive subsidies for compensation of expenses connected with tourists' return of money (citizens of the Russian Federation) in the sphere of outbound tourism at non-refundable rates of air carriers and with the taking tourists out of states with an unfavorable situation in connection with the COVID-19 pandemic (Resolution Of the Government of the Russian Federation of 03.04.2020 No. 428, Decree of the Government of the Russian Federation of 03.04.2020 No. 434, Decree of the Government of the Russian Federation of 08.04.2020 No. 461, Decree of the Government of the Russian Federation of 25.04.2020 No. 583, Order of the Government of the Russian Federation from 18.03.2020, No. 660-r).

The main part of state measures consisted of tax instruments [44, Ternopolskaya G.B., Tyutyuryukov N.N., p. 291]. So, in April 2020, as measures to support business, deferrals in taxes and insurance premiums were proposed in cases of a decrease in income by more than 10%, income from the sale of goods, works, services by more than 10%, income from the sale of goods, works, services subject to VAT at a zero rate of more than 10%, as well as losses from income tax (Resolution of the Government of the Russian Federation of 02.04.2020 No. 409, Resolution of the Government of the Russian Federation of 03.04.2020 No. 434). For small and medium-sized businesses operating in the most affected sectors of the economy, the deadlines for the payment of a number of mandatory payments (income tax, single tax under the simplified taxation system and the single agricultural tax, personal income tax for individual entrepreneurs 2019) and the deadlines for the payment of advances on transport tax, tax on property of organizations and land tax have been shifted.

Small and medium-sized businesses from the list of industries affected by the COVID pandemic were offered direct payments from the budget for 2 months from May 2020 for various purposes (Federal Law No. 121-FZ of 22.04.2020, Resolution Of the Government of the Russian Federation of 03.04.2020 No. 434, Decree of the Government of the Russian Federation of 24.04.2020 No. 576); deferral of loans (Federal Law of 03.04.2020 No. 106-FZ, Resolution of the Government of the Russian Federation of 02.04.2020 No. 410, Decree of the Government of the Russian Federation of 03.04.2020 No. 434) in the form of a 6-month grace period for any loan agreements concluded before April 3, 2020; rental holidays on October 1, 2020 (Federal Law of 01.04.2020 No. 98-FZ, Decree of the Government of the Russian Federation of 03.04.2020 No. 434, Decree of the Government of the Russian Federation of 03.04.2020 No. 439, Order of the Government of the Russian Federation of 19.03.2020, No. 670-r). Regardless of industry affiliation, small and medium-sized businesses were offered a refinancing program for loans (Resolution of the Government of the Russian Federation of 24.04.2020 No. 582, Resolution of the Government

of the Russian Federation of 02.04.2020 No. 422 ⁶), the implementation of which was the provision of a loan at a rate of 8.5%, concessional loans to pay salaries and other urgent needs for a period not exceeding 12 months (the loan amount is calculated based on the number of employees multiplied by the minimum wage and 6), concessional loans to replenish working capital for strategic enterprises, reduced acquiring commissions for the online sale of goods.

The funds presented within the framework of the financial, tax and administrative measures proposed by the Government of the Russian Federation and the Central Bank of Russia were targeted and urgent (for example, measures to suspend tax audits and the abolition of tax sanctions were introduced until May 31, 2020, and the lease payment was deferred until 1 October 2020, etc.) [45, Shukaeva A.V., p. 217]. The plan to restore the Russian economy from the consequences of the COVID-19 pandemic was estimated at 6.4 trillion rubles (almost 6% of the country's GDP) [46, Kolkareva I.N., Nekrug A.V., p. 64].

However, according to a number of Russian experts, the state's anti-crisis measures for the period of the COVID-19 pandemic have a number of drawbacks, the main of which are the lack of direct support measures ⁷; indirect financial assistance, which negatively affects the possibility of obtaining preferential loans under anti-crisis programs for individual entrepreneurs, a narrow range of activities according to OKVED in the list of industries affected by the COVID-19 pandemic ⁸, as well as small and medium-sized businesses applying for state aid [47, Glukhov K.V., Soloviev I.A., p. 86]; insufficient thoughtfulness of financial support measures ⁹ (for example, insufficient subsidies for the payment of wages to employees and the amount of preferential loans to prevent bankruptcies of small and medium-sized businesses). In particular, in the regions of the Russian Arctic the salary system includes a regional coefficient and a percentage bonus. For example, in the Murmansk region, the regional salary regulation system includes a regional coefficient equal to 40% of the salary, and the percentage increment is 80%; the minimum wage in the region is 25675 rubles, and the size of the subsidy proposed by the state for the payment of wages to workers in small and medium-sized businesses is 12130 rubles ¹⁰.

⁶ Consultant Plus. URL: <http://www.consultant.ru/> (accessed 20 January 2021).

⁷ Mirovye praktiki podderzhki biznesa v usloviyakh pandemii COVID-19 vzglyadom «ochevidtsev» [World Practices of Business Support in the Context of the COVID-19 Pandemic through the Eyes of "Eyewitnesses"]. URL: <https://opora.ru/news/mirovye-praktiki-podderzhki-biznesa-v-usloviyakh-pandemii-covid-19-vzglyadom-ochevidtsev.html> (accessed 20 January 2021).

⁸ Malyy i sredniy biznes: eksperty predlagayut skorrektirovat' sistemu nalogooblozheniya [Small and Medium Business: Experts Suggest Adjusting the Tax System]. URL: <https://www.oprf.ru/press/news/2617/newsitem/55544> (accessed 20 January 2021).

⁹ Soyuz predprinimateley: mery gospodderzhki biznesa v period pandemii i ikh effektivnost' [Union of Entrepreneurs: Measures of State Support for Business during a Pandemic and Their Effectiveness]. URL: <http://kvnews.ru/news-feed/mery-gospodderzhki> (accessed 20 January 2021).

¹⁰ Arkticheskoe predprinimatel'stvo i pandemiya koronavirusa [Arctic Entrepreneurship and the Coronavirus Pandemic]. URL: <https://goarctic.ru/work/arkticheskoe-predprinimatel'stvo-i-pandemiya-koronavirusa/> (accessed 20 January 2021).

Self-isolation, forced by the COVID-19 pandemic, has led to a decrease in the revenue part of regional budgets. Thus, 65 Russian regions experienced a reduction of income tax revenues in the first six months of 2020, 22 of them — by more than a third, 8 — by more than 50% (including Nenets and Yamalo-Nenets Autonomous Okrugs)¹¹: among the regions, fully referred to the AZRF, the budget deficit in the first half of 2020 in the Murmansk region amounted to 2.482 million rubles, in the Nenets Autonomous Okrug — 1.161 million rubles. In this situation, the overwhelming majority of Russian regions began to actively implement levers to suppress the consequences of the COVID-19 pandemic in their territories.

In the Nenets Autonomous Okrug, regional business support measures included the restructuring of microloans for small and medium-sized businesses, reduced (3%) rates on microloans for enterprises in industries most affected by the COVID-19 pandemic, subsidies to reimburse part of the costs associated with entrepreneurial activities for small and medium-sized businesses operating in priority areas of the regional economy, reduced rates for social insurance of employees (in the amount of 0% for entrepreneurs who paid wages to employees in April–June 2020). The total amount of subsidies for payment of services for small and medium-sized businesses that suspended their activities during the COVID-19 pandemic (10 entrepreneurs) in 2020 amounted to 1.9 million rubles; 3.7 million rubles were allocated for support to reimburse interest on loans and leasing, advanced training and equipment modernization¹².

In the Yamalo-Nenets Autonomous Okrug¹³ the tax rate for taxpayers applying the simplified taxation system has been reduced from 5% to 1% in 2020–2021; in 2020, small and medium-sized businesses that carry out “transportation and storage” according to OKVED are exempt from paying transport tax, entities associated with the industries most affected by the COVID-19 pandemic are exempt from property tax and rent; for organizations engaged in tour operator or travel agency activities, subsidies for reimbursement of costs are offered; for all borrowers of the regional microfinance fund, a deferral was introduced for the payment of the principal debt and accrued interest under loan agreements. In 2020, the Government of the Yamalo-Nenets Autonomous Okrug expanded the access of small and medium-sized businesses to regional support measures by “clarifying” OKVED in terms of their attribution to industries affected by the COVID-19 pandemic. Among the financial measures in the district in 2020, direct payments were made to socially oriented businesses (up to 200 thousand rubles), one-time payments to individual entrepreneurs in the field of personal services and self-employed (30 thousand rubles), payments to

¹¹ Po schetam pandemii. Kak ekonomiki regionov perezhili slozhnoe pervoe polugodie i kak zakonchat vtoroe [Claims on the Pandemic. How the Regional Economies Survived the Difficult First Half of the Year and How They will Finish the Second]. URL: <https://rg.ru/2020/09/09/kak-ekonomiki-regionov-perezhili-slozhnoe-pervoe-polugodie.html> (accessed 20 January 2021).

¹² God aktivnoy raboty. Pogovorim o pokazatelyakh [A Year of Active Work. Let's Talk about Metrics]. URL: <http://nvinder.ru/article/vypusk-no-142-21056-ot-26-dekabrya-2020-g/86844-god-aktivnoy-raboty-pogovorim-o-pokazatelyah> (accessed 20 January 2021).

¹³ Consultant Plus. URL: <http://www.consultant.ru/> (accessed 20 January 2021).

public catering enterprises (30–200 thousand rubles)¹⁴. In total, during the COVID-19 pandemic, more than 5 thousand entrepreneurs took advantage of regional support measures in the Yamalo-Nenets Autonomous Okrug¹⁵.

A wide range of regional business support measures during the COVID-19 pandemic is presented in the Chukotka Autonomous Okrug: a special microloan for businesses operating in the fields of passenger and cargo air transport, tourism, hotel and consumer services, catering, healthcare, education, culture, entertainment, physical education and sports at a rate of 1% per annum; deferred payments under current microloan agreements to small and medium-sized businesses affected by the COVID-19 pandemic; an increase in the amount of support for the payment of interest on loans attracted for investment purposes and in order to carry out northern delivery; reduction of tax rates under the simplified taxation system for all taxpayers and the amount of potential annual income for individual entrepreneurs under the patent taxation system. In 2020, the microcredit company of the Chukotka Autonomous Okrug issued more than 110 million rubles in the form of preferential microloans to support small and medium-sized businesses¹⁶. The measures also included support for social entrepreneurs for material and technical support (up to 200 thousand rubles), as well as grants to entrepreneurs starting in production (700 thousand rubles)¹⁷.

The set of regional measures to support business in the context of the COVID-19 pandemic in the Murmansk Oblast includes the “Governor's Startup” for new and current entrepreneurs (up to 2 million rubles); for small and medium-sized businesses most affected by the spread of coronavirus — an anti-crisis microloan (up to 1 million rubles for up to 2 years at 1% per annum), exemption from transport tax, a reduction in the amount of corporate property tax (by 50%); reduced tax rate under the simplified taxation system (for 2020–2022); increased size of regional subsidies for the payment of wages (27899 rubles)¹⁸.

Thus, the regions of the Russian Arctic significantly expanded the range of support measures proposed by the Government of the Russian Federation, giving an additional impetus to

¹⁴ Vlasti Yamala rasshiryayut dostup biznesa k meram podderzhki iz-za COVID-19 [The Yamal Authorities are Expanding Business Access to Support Measures due to COVID-19]. URL: <https://ria.ru/20200601/1572295060.html> (accessed 20 January 2021).

¹⁵ Bolee pyati tysyach predprinimateley Yamala vospol'zovalis' merami podderzhi v period pandemii [More than Five Thousand Yamal Entrepreneurs Took Advantage of Support Measures during the Pandemic]. URL: <https://nangs.org/news/economics/support/bole-pyati-tysyach-predprinimateley-yamala-vospolyzovalis-merami-podderzhi-v-period-pandemii> (accessed 20 January 2021).

¹⁶ Bolee 110 mln rubley l'gotnykh mikrozaymov poluchil biznes na Chukotke [Business in Chukotka Received More than 110 Million Rubles of Preferential Microloans]. URL: <https://go-pevek.ru/все-новости/более-110-млн-рублей-льготных-микрозаймов-получил-бизнес-на-чукотке> (accessed 20 January 2021).

¹⁷ Malyy i sredniy biznes na Chukotke "podros" na 6% [Small and Medium-Sized Businesses in Chukotka "Grew up" by 6%]. URL: https://prochukotku.ru/news/actual/malyy_i_sredniy_biznes_na_chukotke_podros_na_6_11175/ (accessed 20 January 2021).

¹⁸ «Eto ne pro zarabotok, eto pro vyzhivanie»: chto spaset biznes v Arktike? [“This is not about Making Money, this is about Survival”: What will Save Business in the Arctic?]. URL: https://www.dp.ru/a/2020/05/15/Krizis_s_severnoj_nadbavk/ (accessed 20 January 2021).

the economy and social sphere to overcome the consequences of the crisis caused by the COVID-19 pandemic. The extractive nature of the AZRF economy, as shown by studies of previous crises [48, Pavlov K., Selin V, p. 58–67], also allows us to expect a specific reaction of the socio-economic space of the Russian Arctic to the COVID-19 pandemic. To identify this specificity, we used statistical methods to study the comparative reaction of the Arctic regions to restrictive measures caused by COVID-19, in comparison with the general Russian situation.

The study used operational data on the socio-economic situation of the regions of Russia, provided by the Federal State Statistics Service, according to indicators: industrial production index, retail trade turnover, the number of unemployed. In order to eliminate seasonal fluctuations, as well as the possibility of comparison with the pre-COVID 2019, we calculated (monthly) the ratios of the indicators for 2019 and 2020 to the same periods of previous years (in %) (Tables 1, 2, 3).

Table 1
*Industrial production indices, in% to the corresponding period of the previous year for Russia and the regions of the Russian Arctic*¹⁹

Period	Russia	Murmansk Oblast	Yamalo-Nenets Autonomous Okrug	Nenets Autonomous Okrug	Chukotka Autonomous Okrug
January-2019	101.1	103.8	117.0	96.4	82.2
February-2019	104.1	101.3	121.0	101.6	89.3
March-2019	101.2	103.0	123.4	100.3	131.8
April-2019	104.6	104.4	137.8	97.2	110.8
May-2019	100.9	111.1	128.9	99.4	97.1
June-2019	103.3	103.2	124.8	98.2	105.5
July-2019	102.8	113.7	117.1	96.9	109.5
August-2019	102.9	107.4	112.8	84.2	111.4
September-2019	103.0	106.3	107.6	108.5	87.6
October-2019	102.6	103.2	106.3	93.5	98.6
November-2019	100.3	95.0	109.9	94.0	115.9
December-2019	102.1	97.9	112.5	96.0	98.8
January-2020	101.1	98.5	101.2	98.0	115.9
February-2020	103.3	102.5	103.1	101.0	120.6
March-2020	100.3	99.3	96.6	98.0	71.0
April-2020	93.4	90.5	97.5	101.0	111.4
May-2020	90.4	95.1	93.1	81.9	112.9
June-2020	90.6	98.4	90.1	79.3	93.0
July-2020	92	103.2	90.2	83.2	96.7
August-2020	92.8	102.6	98.0	98.6	99.9
September-2020	95.0	94.4	98.5	69.6	84.7
October-2020	94.1	94.6	102.5	90.3	99.9
November-2020	97.4	107.1	103.8	88.8	100.3

¹⁹ Authors' calculations based on data from the Federal State Statistics Service. URL: <https://www.gks.ru/> (accessed 10 February 2021).

Analysis of industrial production indices indicates that the consequences of the pandemic began to affect the Russian economy as early as April 2020 (Table 1). Thus, in April 2020, the industrial production index amounted to 93.4% compared to April 2019, and then there was a further reduction, followed by an uncertain growth in July. For the Murmansk Oblast, the Yamalo-Nenets and Chukotka Autonomous Okrugs, the behavior of the indices in 2020 is generally similar to the all-Russian dynamics, but there is also a difference — a smaller reduction in production (observed for most points of the dynamic series). The Nenets Autonomous Okrug not only demonstrates more significant reductions in the industrial production index in comparison with the all-Russian situation and other regions of the Russian Arctic, but also does not show a tendency to improve indicators, which is explained by the reduction in hydrocarbon production.

Table 2

Retail trade turnover for Russia and the regions of the Russian Arctic, in % to the corresponding period of the previous year²⁰

Period	Russia	Murmansk Oblast	Yamalo-Nenets Autonomous Okrug	Nenets Autonomous Okrug	Chukotka Autonomous Okrug
January-2019	102.2	99.3	100.8	103.1	104.3
February-2019	102.3	99.5	99.3	102.3	103.5
March-2019	102.4	99.6	100.0	100.5	101.8
April-2019	102.0	99.2	103.6	97.9	103.1
May-2019	101.9	101.4	105.2	95.0	101.1
June-2019	101.8	102.9	104.4	97.0	104.0
July-2019	101.0	99.3	104.3	99.8	100.1
August-2019	100.8	98.6	102.5	97.9	100.7
September-2019	100.7	100.6	102.1	99.3	102.6
October-2019	101.6	101.2	100.1	99.5	103.9
November-2019	102.3	99.7	100.3	101.0	100.7
December-2019	101.9	100.8	97.9	100.6	101.5
January-2020	102.7	99.2	101.6	101.7	100.4
February-2020	104.7	99.3	102.1	104.7	102.4
March-2020	105.7	100.9	100.1	101.5	101.2
April-2020	76.8	89.1	83.0	90.4	100.0
May-2020	80.8	91.9	88.2	92.1	100.2
June-2020	92.3	104.6	97.8	98.2	100.3
July-2020	97.4	97.9	99.4	100.5	101.4
August-2020	97.3	96.4	99.6	97.5	102.4
September-2020	97	93.4	101.9	94.3	102.8
October-2020	97.6	95.4	101.9	95.2	102.9
November-2020	96.9	92.9	101.6	92.5	100.2

The retail trade turnover in Russia, having decreased in April to 76.8%, started to grow in May, but in November 2020 it did not reach the values of 2019 (Table 2). For the Murmansk Oblast

²⁰ Authors' calculations based on data from the Federal State Statistics Service. URL: <https://www.gks.ru/> (accessed 10 February 2021).

in the period April–July, a less significant decrease in the index is characteristic in comparison with the general situation in Russia, and in the period August–November 2020 it is a little more. The Yamalo-Nenets and Nenets Autonomous Okrugs are characterized by a smaller decrease in the index than in Russia as a whole, and for the Yamal-Nenets Okrug, index of more than 100% has been observed since September 2020. Chukotka Autonomous Okrug, during the entire study period of 2020, including the period of the COVID-19 pandemic, demonstrates the same (January and April 2020) and higher retail trade turnover (the rest of the studied period of 2020) in comparison with the pre-COVID year of 2019.

Table 3

*The number of officially registered unemployed in Russia and the regions of the Russian Arctic, in % of the corresponding period of the previous year*²¹

Period	Russia	Murmansk Oblast	Yamalo-Nenets Autonomous Okrug	Nenets Autonomous Okrug	Chukotka Autonomous Okrug
January-2019	94.2	100.0	90.5	83.3	100.0
February-2019	99.9	102.9	91.3	100.0	87.5
March-2019	104.4	105.8	95.7	100.0	100.0
April-2019	107.8	109.0	100.0	100.0	87.5
May-2019	106.3	108.1	100.0	100.0	100.0
June-2019	105.7	105.1	100.0	100.0	100.0
July-2019	105.3	105.4	100.0	80.0	100.0
August-2019	104.8	98.3	100.0	100.0	120.0
September-2019	102.5	96.6	100.0	75.0	120.0
October-2019	102.2	95.2	93.8	100.0	100.0
November-2019	100.5	98.5	106.3	75.0	100.0
December-2019	99.7	97.1	100.0	60.0	85.7
January-2020	95.4	94.2	94.7	60.0	85.7
February-2020	91.4	91.7	95.2	66.7	100.0
March-2020	88.8	89.0	95.5	57.1	87.5
April-2020	160.5	116.4	163.6	71.4	100.0
May-2020	276.2	159.7	263.2	116.7	100.0
June-2020	373.7	177.4	368.8	160.0	116.7
July-2020	455.4	194.9	478.6	200.0	116.7
August-2020	511.6	203.4	507.1	225.0	116.7
September-2020	553.9	210.5	480.0	300.0	116.7
October-2020	537.6	191.7	473.3	200.0	116.7
November -2020	471.5	165.6	394.1	200.0	116.7

For Russia, a sharp increase in the index of the number of officially registered unemployed was indicated in April 2020, which interrupted the 4-month trend (December — March 2020) of a decrease in this indicator (Table 3). Almost the same dynamics, including a 3–4-month pre-COVID period of reduction in the number of officially registered unemployed, is characteristic of the re-

²¹ Authors' calculations based on data from the Federal State Statistics Service. URL: <https://www.gks.ru/> (accessed 10 February 2021).

gions of the Russian Arctic. A significant difference is observed in the growth rate of this indicator, which is significantly lower for all AZRF regions in comparison with the all-Russian figures.

Thus, the statistical data convincingly indicate that the regions of the Russian Arctic demonstrate a greater economic stability in comparison with the all-Russian situation, passing through many restrictions, obstacles, problems and changes caused by COVID-19. This is not so much due to the strengthening of stabilization measures at the federal level by supporting the regional level, but to fundamental reasons — the relative simplicity of the extractive economy in the Arctic [48, Pavlov K., Selin V., p. 66], higher incomes, correspondingly higher purchasing power and large savings of the population of the Arctic [49, Skufyina T.P., Baranov S.V., p. 22–31], a low level of development of small and medium-sized businesses [50, Skufina T., Bazhutova E., Samarina V., Serova N., p. 1024–1026], including sectors especially affected by the consequences of restrictive measures.

Instead of Conclusion

Potential Risks and Opportunities for Arctic Governance Optimizing

In summarising our review study, we want to avoid the typical presentation of conclusion in scientific articles, consisting of brief conclusions, which, in the opinion of the authors, express the essence of the results in a concentrated manner. Firstly, because the questions of the impact of the crisis of a non-economic nature on the development and management in the AZRF remain open, if only due to the fact that we were observing the phenomenon not only still ongoing, but also in a state of turbulence in a number of components of Arctic socio-economic development. Secondly, the review nature of the article has created a palette of new and “old” facts, from which, we believe, the reader will choose his own vision of contemporary reality, draw a different picture of the future of the Russian Arctic, possibly different from the conclusions that we would draw in summary. And, finally, thirdly, there is a feeling of incorrectness of writing the conclusion, stopping in reasoning, thereby recognizing the completeness of the work, and, let us repeat, about the phenomenon still ongoing, new and not enough studied, but obviously creating risks and new possible development trajectories for the Russian Arctic.

This is a statement of the reasons why we chose to move away from the traditional conclusion, shifting to the statement of risks and opportunities for optimizing governance in the Arctic. Moreover, the uniqueness of the COVID-19 crisis creates visibility of greater freedom from the trajectory of previous development, provoking the formulation of not only qualitative socio-economic changes, but also management changes. However, in fact, the pandemic has only deepened the manifestation of those problems and risks that were characteristic and basic objects of management for the pre-COVID period. Let us focus on the risks most dependent on the consequences of the COVID-19 pandemic restrictions and which are the most pressing challenges for contemporary governance.

Firstly, a set of demographic problems, among which, as shown in our review, traditionally negative are considered to be the following: the migration outflow of the population of the Russian Arctic, a high morbidity rate (respiratory diseases, digestive organs and musculoskeletal system are among the most common groups), a high mortality rate [7, Kryukov V.A., Kryukov Ya.V. et al, p. 153–185; 51, Korchak E.A., p. 5–9]. As noted above, the solution to these problems is laid down in the regulatory and legal framework, including strategic legislation, accompanying the AZRF development. At the same time, the correlation of the short-term forecasts corrections of the socio-economic development of the AZRF regions in 2020 towards the worsening, as well as the actual data provided by Rosstat at the beginning of 2021, indicate that the conditions of the COVID-19 pandemic worsened demographic processes for a number of the Russian Arctic regions at the end of 2020. For example, for the Murmansk Oblast — the region with the most diversified economy, the best transport accessibility, the most favorable climate among the regions of the Russian Arctic — the problems of population decline, including migration from the region, are especially urgent. So, in 2005–2020, the population of the region decreased by 13%, including 25% among the employable, and migration was 73% of the region's total population loss between 2005 and 2020. Initial conditions of the Forecast of socio-economic development of the Murmansk region for 2021 and the planning period of 2022 and 2023 set the average annual population, thousand people: in 2020 — 738.0; in 2021 — 731.7; in 2022 — 726.2; in 2023 — 721.5²². According to Rosstat, the actual population of the Murmansk region at the end of 2020 amounted to 733.2 thousand people, accelerating the projected decline in the region's population. The pandemic also poses certain threats, including a decline in production, the use of rotational work method, for an unstable trend of population growth that has emerged in the Yamal-Nenets Autonomous Okrug since 2012 and the outlined stabilization of the population in the Nenets and Chukotka Autonomous Okrugs. The forecast of socio-economic development of the Yamalo-Nenets Autonomous Okrug for 2021–2023 determined the average annual population, thousand people: in 2020 — 545.5; in 2021 — 547.8; in 2022 — 550.4; in 2023 — 553.1²³. It should be noted that positive trend was maintained in 2020 due to natural growth (7.3 people per 1.000 population of the district) and the actual population according to Rosstat data at the end of 2020 was 547.1 (an increase by 0.6% relative to 2019). In the Nenets Autonomous Okrug, according to the Revised forecast of the NAO socio-economic development for 2020 and the planning period 2021–2024, according to the base scenario, the average annual population is predicted, thousand people: in

²² Prognoz sotsial'no-ekonomicheskogo razvitiya Murmanskoy oblasti na 2021 god i planovyy period 2022 i 2023 godov [Forecast of Socio-Economic Development of the Murmansk Oblast for 2021 and the Planning Period of 2022 and 2023]. URL: https://minec.gov-murman.ru/783_pp.pdf (accessed 20 January 2021).

²³ Prognoz sotsial'no-ekonomicheskogo razvitiya Yamalo-Nenetskogo avtonomnogo okruga na 2021-2023 gody [Forecast of Socio-Economic Development of the Yamalo-Nenets Autonomous Okrug for 2021–2023]. URL: <https://de.yanao.ru/upload/uf/338/Prognoz-YANAO-do-2023-g..pdf> (accessed 20 January 2021).

2020 — 44.2; in 2021 — 44.5; in 2022 — 44.7²⁴. The actual number, according to Rosstat data at the end of 2020, is 44.4 thousand people, which generally corresponds to the projected insignificant growth, provided by natural population growth due to high birth rates. In the Chukotka Autonomous Okrug, the stabilization and even insignificant growth (in 2018, 2020 — due to natural and migration growth) of the population was violated in 2020 (the number decreased by 1.0 thousand people, which is 2% from the total population of 49.3 thousand people)²⁵. In the Nenets, Yamalo-Nenets, Chukotka Okrugs, a reduction in number of women of reproductive age is expected, which, along with poor health care problem, high migration outflow, increased unemployment, uncertainty in the speed and timing of economic recovery in connection with the COVID-19 pandemic, reinforces and enhances the high risks of population decline.

Secondly, a common management challenge, typical for all regions of the Russian Arctic, is a set of imbalances in the labor markets [19, Skufyina T.P., Korchak E. A., Baranov S.V., p. 12]: socio-demographic imbalance (due to the young age of unemployed citizens), professional and qualification imbalance in labor supply and demand (against the background of maintaining a high educational level of the population), territorial and sectoral imbalance in labor supply and demand (produced by a low migration attractiveness of arctic territories due to low-paid employment, territorial remoteness, lack of vacancies with the provision of housing). The basic problem of this complex of imbalances, indicated in all forecast and planning documents for the AZRF development, is the reduction in the size of the working-age population, both due to natural aging of the population and due to migration from the Arctic. Short-term forecasts of the socio-economic development of the Russian Arctic regions predict a decline in the population of working age. Our surveys, continuing in 2020–2021 across all regions of the Russian Arctic, confirm the strengthening of this problem in the coming years [52, Baranov S.V., Skufyina T.P., Gushchina I.A., p. 168–170].

Thirdly, the problem of unemployment in the regions of the Russian Arctic, the main specificity of which is a young age of unemployed citizens (the average age of unemployed citizens is 36 years old, the highest unemployment rate is in the age group 20–29 years old), a high share of qualified citizens in the structure of unemployed (more than 60%), the stagnant nature of unemployment (the duration of job search for a quarter of the unemployed is more than a year) [51, Korchak E.A., p. 5–9].

Fourthly, poverty, including child poverty [20, Bazhutova E.A., Biev A.A. et al., p. 16]: more than 8% of the population of the AZRF regions today live below the poverty line; 30% of house-

²⁴ Utochnennyy prognoz sotsial'no-ekonomicheskogo razvitiya Nenetskogo avtonomnogo okruga na 2020 god i planovyy period 2021–2024 godov [Updated Forecast of the Socio-Economic Development of the Nenets Autonomous Okrug for 2020 and the Planning Period 2021–2024]. URL: http://dfei.adm-nao.ru/media/uploads/userfiles/2020/01/10/105-%D1%80_zU1zwzu.pdf (accessed 20 January 2021).

²⁵ Chukotskiy avtonomnyy okrug v tsifrakh [Chukotka Autonomous Okrug in Figures]. Khabarovsk, Khabarovskstat, 2020, 85 p.

holds experience multidimensional poverty (43% of such households are classified as poor; the child poverty rate is 28%).

As noted, the main parameters of the state programs of the AZRF regions, forecasts and development plans take into account these challenges and threats as the main object of regulation. However, the existing management mechanisms are clearly insufficient to minimize these risks, including due to the insurmountable fragmentation of the AZRF management between the state and business, the various goals of these participants. The facts of the closure of a number of industries for reasons not related to the pandemic and the strengthening of the rotational work in 2020 are a reflection of the conflict situation. In fact, the essence of the conflict is a chimera, consisting of the legacy of the Soviet period, which provides a social contract in terms of declaring and providing conditions for the socio-economic development of the population of the Arctic; declared in the international arena strategic goals of ensuring the development of the Russian Arctic on the legally non-binding principles developed by the Arctic Council [8, Heininen L., p. 195–196]; the logic of the functioning of socio-economic capitalist formation. The conditions of the pandemic will probably deepen the risks and the associated conflict potential so that they initiate the main risk — a weakening of the scale of the socio-economic goals of the AZRF development, including the practices of business and the state to ensure conditions for an increase in the level and quality of life of the population of this territory. In contrast to this objective process is the policy of “growing” of Russia in the Arctic: “Everything that happens in the north is of particular interest and value to us. I am not even talking now about the development of the Northern Sea Route. In general, this is our future, including in terms of the extraction of natural resources in the long term. Lomonosov once said that Russia would grow with Siberia. In the next decades, Russia will grow in the Arctic and northern territories. These are absolutely obvious things.” (V. Putin) ²⁶.

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²⁶ Website of the Ministry of the Russian Federation for the Development of the Far East and the Arctic. URL: <https://minvr.gov.ru/press-center/mediagallery/?tags=%D0%9C%D0%A2%D0%9A> (accessed 20 January 2021).

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Assessment of Financial Opportunities for Implementation of Innovation Potential by Mining Enterprises of Non-Ferrous Metallurgy of the North and the Arctic *

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Abstract. The analysis of methods for assessing the financial opportunities for increasing the economic efficiency of industrial enterprises using absolute and relative indicators and coefficients was carried out. A mechanism for determining financial possibilities for realizing innovative potential of northern mining enterprises of non-ferrous metallurgy, based on the method of assessing the three-component coefficient, which allows choosing the most rational strategy of scientific and technological development, taking into account financial resources and features of production functioning in the northern regions of the Russian Federation, was developed. It is shown that the proposed methodology can be used with limited information in the accounting statements provided in public access. On the basis of objective indicators, the research of innovation activity of twenty industrial enterprises of non-ferrous metallurgy directly operating in the North and the Arctic and included as subsidiaries and branches of seven largest corporations — PJSC MMC “Norilsk Nickel”, JSC “Mine Karalveem”, PJSC “Acron”, JSC “Mining company “Berelekh”, PJSC “Seligdar”, OJSC “Susumanzoloto”, JSC “Polymetal” for the period 2013–2019 was carried out. Studies showed the dependence of the innovation activity of northern enterprises of non-ferrous metallurgy on the level of financial security revealed by the method of assessing the three-component coefficient. Scientifically substantiated possibility of developing and implementing a strategy of innovation development of enterprises for the medium and long term periods based on the level of financial security is shown. Enterprises with high financial security or in special cases (with additional investments with normal financial security) are able to generate innovation technologies. As the analysis has shown, the majority of northern enterprises have low financial security, which does not allow them to count on effective innovative development without attracting a significant amount of targeted investments.

Keywords: *northern enterprise, non-ferrous metallurgy, methodology, assessment, financial capability, innovation potential.*

Introduction

The mining industry, including nonferrous metallurgy enterprises, is a determining sector in the economies of the North and Arctic regions and the Russian Federation, which will retain a raw material orientation with a high share of exports and significant potential for innovative development of the mining industry, the greatest importance of which is characterized by copper-nickel, gold, apatite-nepheline and rare metals [1]. The gross value of industrial production of nonferrous metallurgy enterprises, which are essentially city-forming, is about 7% of Russia's GDP and 14% of

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the country's export potential [2]. The raw material base of nonferrous metallurgy in the North and the Arctic of Russia allows ensuring growth of nonferrous metals production for domestic consumption and export. In this regard, the “raw material” orientation of nonferrous metals production and, most importantly, the innovative technologies implementation, are fully correlated with the strategy of transition of the Russian economy to an innovative development path.

Among the key problems and risks that characterize the current state of nonferrous metallurgy is the low level of advancement and implementation of innovative projects for the development and processing in the conditions of the North and the Arctic, the specific features of which are, first of all, high costs. In this regard, it is necessary to develop a modern paradigm of a balanced mining mechanism¹ [3–5].

The aim of the work is to study the financial possibilities of realizing the innovative potential of nonferrous metal mining enterprises of the North and the Arctic to increase the economic development of the macroregion and the Russian Federation.

Materials and methods

A review was carried out showing the developed methods for assessing the financial capabilities of industrial enterprises for making managerial decisions to improve the modernization of economic efficiency using absolute and relative indicators and coefficients [6, 7]. As a result of the analysis and taking into account the limited indicators of financial statements publicly available, a method for assessing the three-component coefficient was chosen. Its calculation methodology was proposed in the works of A.A. Trifilova [8], A.D. Sheremet [9], N.V. Sobchenko [10], Zh.A. Sokolova [11], E.V. Shvarova, J.A. Tkach [12] and other authors. The use of a three-component coefficient allows the enterprise to choose the most rational strategy for the implementation of innovative development, taking into account financial resources and the peculiarities of functioning in the northern regions of the Russian Federation. To determine financial stability, the proposed methodology provides for the calculation of the following indicators:

Lack (surplus) of own current assets C_{COC} :

$$\pm C_{coc} = CK - BA - 3 \quad (1),$$

where CK — own assets (reserves and capital),

BA — non-current assets,

3 — inventories

Lack (surplus) of own sources and long-term borrowed assets $C_{c\Delta}$:

$$\pm C_{c\Delta} = C_{COC} + \Delta K - 3 \quad (2),$$

¹ Elie D. An Analysis of Global Safety Trends in the Oil and Gas Industry — Impacts and Challenges in the Years Ahead // SPE/IATMI Asia Pacific Oil & Gas Conference and Exhibition, 20-22 October, Nusa Dua, Bali, Indonesia. Society of Petroleum Engineers, 2015. DOI: <https://doi.org/10.2118/176502-MS>. URL: <https://www.onepetro.org/conference-paper/SPE-176502-MS> (accessed 10 May 2020).

where C_{COC} — lack (surplus) of own current assets,

ΔK — long-term loans and credits,

3 — inventories.

Lack (surplus) of the main sources of cost formation O :

$$\pm O = C_{co} + KK - 3 \quad (3),$$

where C_{cd} — lack (surplus) of own sources and long-term borrowed assets,

KK — short-term loans and credits,

3 — inventories.

On the basis of the above indicators, a three-component coefficient of financial stability is determined. In the case of the coefficient size greater than 0, the situation is denoted by 1, in the case of the coefficient size less than 0 — 0.

In accordance with the three-component coefficient of financial stability, enterprises are ranked into four groups:

1. High level of own financial resources is characterized by a three-component coefficient “1; 1; 1”.
2. Normal financial solvency with necessary resources is characterized by a three-component coefficient “0; 1; 1”.
3. Satisfactory financial support for operating costs and inventories is characterized by a three-component coefficient “0; 0; 1”.
4. Deficit or absence of financial resources for the implementation of innovative activities is characterized by a three-component coefficient “0; 0; 0”.

Enterprises of the first group, characterized by a high level of financial security, do not require external borrowing for innovative development.

Enterprises of the second group require additional borrowing to develop and implement innovative technologies.

Industrial enterprises of the third and fourth groups lack the basis for developing an innovative development strategy without attracting a significant amount of external financial resources.

Research results of innovative activity of nonferrous metallurgy enterprises in the North and the Arctic of Russia

On the basis of publicly available official reports, analysis of scientific publications in the journals “Gornyi Zhurnal”, “Tsvetnye Metally”, “Obogashchenie Rud”, “Mining Informational and Analytical Bulletin”, “Izvestiya Vuzov. Tsvetnaya Metallurgiya”, “Zoloto i Tekhnologii”, “Zolotodobycha”, as well as expert assessments, the level of innovative activity of 7 largest corporations of nonferrous metallurgy and 17 of their subsidiaries and branches operating directly in the northern territories was determined for the period 2013–2019:

1. PJSC "Mining and Metallurgical Company "Norilsk Nickel" is located in the city of Norilsk. The company produces technical sulfur, technical selenium, cathode copper, precious metal concentrates, nickel matte, primary nickel, nickel carbonyl shot, nickel carbonyl powder, nickel concentrate, electrolyte cobalt, cobalt concentrate, technical sulfuric acid, sodium chloride, sodium sulfate, copper matte, nickel matte ².
2. JSC "Kola Mining and Metallurgical Company" is a subsidiary of PJSC "MMC "Norilsk Nickel". The company is located in the city of Monchegorsk, Murmansk region. It produces nickel carbonyl shot, primary nickel, nickel carbonyl powder, cathode copper, nickel concentrate, cobalt concentrate, precious metal concentrates, technical sulfuric acid, electrolyte cobalt, sodium chloride, sodium sulfate, nickel matte, nickel matte, copper matte ³.
3. JSC "Mine Karalveem" is located in the city of Bilibino, Chukotka Autonomous Okrug. The company produces gold concentrate ⁴.
4. JSC "North-Western Phosphorous Company" is a subsidiary of PJSC "Acron". The company is located in the village of Koashva, Murmansk region. It produces apatite concentrate ⁵.
5. JSC "Mining company "Berelekh" with subsidiaries ⁶:
 - LLC "Udarnik-2000", located in the village of Udarnik, Magadan Region, produces gold concentrate;
 - LLC "Maldyak", located in the city of Susuman, Magadan region, produces gold concentrate;
 - LLC "Elita", located in the village of Maldyak, Magadan Region, produces gold concentrate;
 - LLC "Monolit", located in the village of Shirokoye, Magadan Region, produces gold concentrate;
 - LLC "Palladium", located in the city of Magadan, produces gold concentrate;
 - LLC "Iridium", located in the city of Magadan, produces gold concentrate.
6. PJSC "Seligdar" with subsidiaries ⁷:

² Annual Report of PJSC MMC Norilsk Nickel for 2018, p. 73. URL: <https://www.nornickel.ru/investors/reports-and-results/#2018> (accessed 30 June 2020).

³ Manufactured Products and Sales. URL: <https://www.kolagmk.ru/pages/779-produkciya-i-sbyt.html> (accessed 15 June 2020).

⁴ Constituent Documents of the Company. Annual Report for 2017, p. 6. URL: <https://www.goldpro.ru/rudnik-karalveem/> (accessed 25 June 2020).

⁵ Financial Statements. Annual Reports. PJSC Acron's 2019 Annual Report, p. 38. URL: <https://www.acron.ru/investors/financial-statements/?brand=1988&type=178&year=2020> (accessed 05 July 2020).

⁶ JSC "GDK" Berelekh. Annual Report, p. 8. URL: <https://www.e-disclosure.ru/portal/files.aspx?id=16501&type=2> (accessed 30 June 2020).

⁷ Activity Map. Gold Division. URL: <https://seligdar.ru/geography/gold-division/grk-nizneyakokitski> (accessed 17 June 2020).

- JSC “Zoloto Seligdara”, located in the city of Aldan, Republic of Sakha (Yakutia), produces gold concentrate;
 - LLC “Ryabinovoe”, located in the city of Aldan, Republic of Sakha (Yakutia), produces gold concentrate;
 - JSC “Lunnoe”, located in the city of Aldan, Republic of Sakha (Yakutia), produces gold concentrate;
 - LLC “Samolazovskoe”, located in the city of Aldan, Republic of Sakha (Yakutia), produces gold and silver concentrates.
7. OJSC “Susumanzoloto” with subsidiaries⁸:
- LLC “Electrum Plus”, located in the city of Magadan, produces gold concentrate;
 - LLC “Rudnik Shturmovskoy”, located in the city of Magadan, produces gold concentrate.
 - JSC “Polymetal” with subsidiaries:
 - JSC “Serebro Magadana”, located in the urban-type settlement Omsukchan, Magadan Region, produces gold and silver concentrates⁹;
 - LLC “Mayskoe” Gold Ore Company”, located in the town of Pevek, Chukotka Autonomous Okrug, produces gold concentrate¹⁰;
 - LLC “Primorskoe”, located in the city of Magadan, produces gold concentrate¹¹;
 - LLC “Omolon” Gold Ore Company”, located in the city of Magadan, produces gold concentrate¹².

It should be noted that, despite the direct connection of JSC “Kola MMC” with PJSC “MMC “Norilsk Nickel”, the enterprise was studied separately, taking into account the scale and export significance of products not only for the Murmansk region, but for Russia as a whole.

Fig. 1 shows the assessment of financial possibilities for the innovative projects implementation of nonferrous metallurgy corporations in the North and the Arctic, for which accounting reports are presented, including subsidiaries and branches, for 2013, 2015 and 2019.

⁸ PJSC “Susumanzoloto”. Annual Report, 2019, p. 11, 16. URL: <http://www.e-disclosure.ru/portal/files.aspx?id=6323&type=2> (accessed 03 July 2020).

⁹ Annual Reports, 2019, p. 37. URL: <https://www.polymetalinternational.com/ru/investors-and-media/disclosure-center/annual-reports> (accessed 02 July 2020).

¹⁰ Organizational Structure. URL: <https://www.polymetalinternational.com/ru/about/at-a-glance/group-structure> (accessed 01 July 2020).

¹¹ Organizational Structure. URL: <https://www.polymetalinternational.com/ru/assets/where-we-operate/dukat-hub> (accessed 01 July 2020).

¹² Bashlykova T.V. Sposob izvlecheniya blagorodnykh metallov iz otrabotannykh shtabeley kuchnogo vyshchelachivaniya [Method for Extracting Precious Metals from Waste Heap Leaching Piles]. URL: <https://patents.google.com/patent/RU2622534C2/ru> (accessed 15 July 2020).

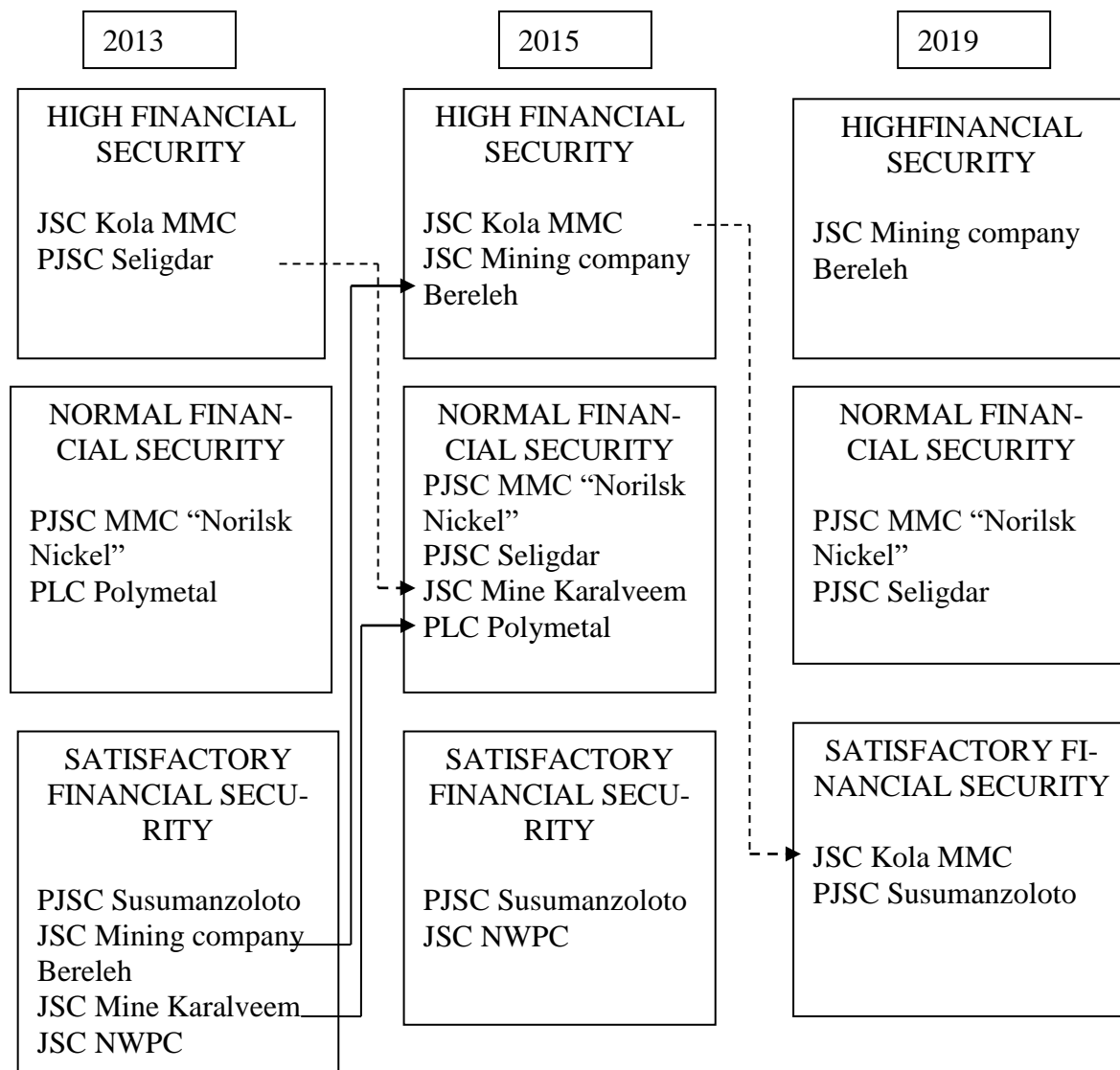


Fig. 1. Assessment of financial possibilities for the innovative projects implementation of nonferrous metallurgy corporations in the North and the Arctic¹³.

The analysis made it possible to determine that the financial possibilities for realizing the innovative potential of northern mining enterprises are not sustainable and, consequently, innovative activity is mainly associated with the availability of the necessary financial resources.

PJSC "MMC "Norilsk Nickel" is included in a group with normal financial solvency, which characterizes the possibility of implementing an innovative development strategy with the attraction of additional funds. Practice has shown that the company has implemented projects. So, in 2017, together with JSC "Mekhanobr Engineering" at the Talnakh Enriching Plant, a technology for charge enrichment of bucking and cuprous ores was introduced, which allows processing low-nickel pyrrhotine [13].

JSC "Polymetal" is also included in the group with normal financial security, which characterizes the possibility of implementing an innovative development strategy with the attraction of

¹³ Note: due to the fact that there are no accounting data for 2019 for JSC Karalveem Mine and JSC Polymetal, the analysis was carried out for 2013 and 2015.

additional funds. Innovative projects have been implemented at subsidiaries. JSC “Serebro Magadana” has developed and implemented the following innovative projects:

- in 2018, the Omsukchan Gold Recovery Plant introduced a concentrate condensation technology, which makes it possible to control the composition of nonferrous metals in the finished product¹⁴;
- in 2019, the Omsukchan Gold Recovery Plant together with LLC PC “Spirit” introduced a screw separation technology, which allows increasing gold recovery into concentrate¹⁵.

In 2018, LLC “Mayskoe” Gold Ore Company”, together with SGS Company (Russia), introduced a combined oxidized ore processing technology, which makes it possible to increase the share of gold in concentrate by 24%¹⁶.

Two enterprises (JSC “Mining company “Berelekh” and JSC “Mine Karalveem”) improved their positions in terms of innovation potential in 2015–2019 comparing to 2013 and moved from the group with a satisfactory level of financial security to the group with high and normal level, respectively. It should be noted that enterprises do not fully use financial opportunities to realize their innovative potential.

PJSC “Seligdar” worsened its financial position. In 2013, it was characterized by a high level of financial security, in 2015 it moved to a group with normal financial security. In 2017, together with the Russian research and innovation company “RIC Center-ESTAgeo”, the technology of heap bioleaching of gold was introduced, which makes it possible to increase gold recovery from refractory ores from 30% to 80%¹⁷. A patent for an invention was received¹⁸. However, in 2019 PJSC “Seligdar” had a satisfactory level of financial support.

JSC “Kola MMC” was part of a group with high security of its own financial resources in 2013–2015. The innovation strategy could be justified without attracting external investment. Thus, the company has implemented the following projects:

¹⁴ Production results for 3 quarter of 2018. URL: <https://www.polymetalinternational.com/ru/investors-and-media/reports-and-results/result-centre/#26-2018> (accessed 07 July 2020).

¹⁵ Rashin A.G., Prokopyev E.S., Patrin S.A. Rezul'taty opytno-promyshlennoy pererabotki lezhalykh khvostov ZIF rudnika «Dzhulyetta» s primeneniem tekhnologii vintovoy separatsii [Results of Experimental-Industrial Processing of Stale Tailings of the Mill of the Juliet Mine Using the Technology of Screw Separation]. URL: <https://zolotodb.ru/article/12242> (accessed 15 July 2020).

¹⁶ Annual Reports, 2019, p. 39. URL: <https://www.polymetalinternational.com/ru/investors-and-media/disclosure-center/annual-reports> (accessed 02 July 2020).

¹⁷ «Seligdar» zapustil opytnoe proizvodstvo po kuchnomu biovyshchelachivaniyu zolota iz upornykh rud [Seligdar Launched a Pilot Plant for Heap Bioleaching of Gold from Refractory Ores]. URL: <https://seligdar.ru/post/8206> (accessed 01 July 2020).

¹⁸ Bashlykova T.V. Sposob izvlecheniya blagorodnykh metallov iz otrabotannykh shtabeley kuchnogo vyshchelachivaniya [Method for Extracting Precious Metals from Waste Heap Leaching Piles]. URL: <https://patents.google.com/patent/RU2622534C2/ru> (accessed 15 July 2020).

- in 2017, together with LLC “Gipronickel” (St. Petersburg), a technology for briquetting of copper-nickel concentrate was introduced, which makes it possible to reduce emissions of pollutants into the atmosphere by 35-40 thousand tons¹⁹;
- in 2018, a technology to control finished products in the briquetting area using artificial intelligence and machine vision was introduced, which makes it possible to improve product quality control²⁰;
- in 2019, together with LLC “Gipronickel”, a technology for electro-extraction of nickel from solutions of chlorine dissipation of nickel powder in tube furnaces was introduced, which makes it possible to increase the production capacity from 120 thousand to 145 thousand tons of electrolytic nickel per year and to increase the level of nickel extraction into concentrate by 1%²¹.

In 2019, JSC “Kola MMC” moved to a group with satisfactory financial security, which affected the decrease in innovative activity.

OJSC “Susumanzoloto” retained its positions in the rating and in the period under review belongs to the group with satisfactory financial security, which affected the low innovation activity (there are no implementations). Without attracting a significant amount of external financial resources, which is currently difficult, it is practically impossible to plan the implementation of the innovative development strategy for long-term and short-term periods.

Studies have shown mainly low innovative activity of nonferrous metallurgy enterprises in the North and the Arctic over the past 8 years.

Conclusion

An assessment of the financial possibilities for the implementation of innovative potential by mining enterprises of nonferrous metallurgy of the North and the Arctic has been carried out.

On the basis of objective indicators, research on innovation activity of twenty industrial enterprises of nonferrous metallurgy for the period 2013–2019 has been carried out. The organizations operate directly in the North and in the Arctic and are included as subsidiaries and branches of the seven largest corporations.

The studies have shown the dependence of innovative activity of northern nonferrous metallurgy enterprises on the level of financial security, revealed by the method of assessing the three-component coefficient. Enterprises with high financial solvency or, in special cases, with additional investments and normal financial security, are able to generate innovative technologies.

¹⁹ Reports and Results. 2017. Annual Report, p. 71. URL: <https://www.nornickel.ru/investors/reports-and-results/#2018> (accessed 30 June 2020).

²⁰ Reports and Results. 2018. Annual Report, p. 101. URL: <https://www.nornickel.ru/investors/reports-and-results/#2018> (accessed 30 June 2020).

²¹ Reports and Results. 2019. Annual Report, p. 73, 82. URL: <https://www.nornickel.ru/investors/reports-and-results/#2018> (accessed 30 June 2020).

As the analysis has shown, most enterprises in the North and the Arctic have low financial security, which does not allow them to have effective innovative development without attracting a significant amount of targeted investments.

The methodology used has shown the possibility of assessing the financial capabilities of enterprises to develop a strategy for innovative development with limited information in the accounting reports publicly available.

Further scientific research and ways to increase innovative activity are required in order to improve the main technological and economic indicators of mining enterprises of nonferrous metallurgy in the North and the Arctic.

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Cooperation between Russia and China in Arctic Shipping: Current State and Prospects*

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Abstract. The article analyzes the cooperation between China and Russia in the field of Arctic shipping. The author compares the tasks of the Northern Sea Route development and the Ice Silk Road construction. This allows identifying the factors that promote and hinder cooperation. The author examines the specifics of the Sino-Russian format of comprehensive partnership and strategic interaction that helps to mitigate contradictions between the national interests of the two states. The author examines the current cooperation between Russia and China in the field of Arctic shipping, identifying strengths, weaknesses, opportunities, and threats in key areas of interaction (SWOT analysis). The author concludes that differences between interests and status of the two states in the Arctic provides Russia a strategic advantage in its relations with the PRC. This balance may be maintained within the framework of a multilateral cooperation. At the same time, cooperation with China in the field of marine security is promising in case of keeping existing power balance. In conclusion, the author suggests areas for cooperation to increase the effectiveness of bilateral interaction in the field of Arctic shipping.

Keywords: Arctic, Russian-Chinese relations, strategic partnership, Arctic shipping, Northern Sea Route, Ice Silk Road.

Introduction

Partnership between Russia and China in the second decade of the 2000s has proven to be one of the most fruitful bilateral formats. Russia attaches great importance to relations with the PRC. In the context of aggravated global problems, China's assertive attitude to supporting good-neighbourliness, building equal and respectful relations and developing bilateral trade, taking into account the complementarity of the economies, is extremely important to Moscow. Both countries share similar views on the problems of international relations and emphasize the inadmissibility of economic sanctions that endanger the well-being of people [1, Luzyanin S.G., p. 578; 2, Ershov V.F., p. 808].

The bilateral partnership covers many areas, and one of the most successful examples is cooperation in the Arctic: resource extraction and shipping development. The Arctic and new sea trade routes, in turn, are of strategic importance for international trade and security [3, Konyshov V.N., Sergunin A.A., p. 43, 52]. In this regard, the international community is increasingly concerned about the further rapprochement of the two states in the field of economic and military

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cooperation in the region, up to the formation of an alliance [4, Conley H.A., Melino M., p. 25–26]¹. Most experts believe that such a scenario can be realized only partially, since the interests of Russia and China in the region largely contradict each other [5, Bertelsen R G., Gallucci V., p. 244; 6, Østreng W. et al., p. 75]. There is also a difference in the motives of the two actors. The key reason for Russia's increased cooperation with China was the sanctions against Moscow imposed in connection with the Ukrainian crisis. The PRC, on the other hand, began its journey to the Arctic long before that. In an effort to join the development of resources and new sea routes, China has built relations with all Arctic countries, not focusing exclusively on the Russian Federation. The global infrastructure initiative “One Belt, One Road” announced in 2013 gradually became a conceptual support for this activity, and in relation to shipping was formed as the idea of building the “Ice Silk Road” [7, Lanteigne M., p. 3; 8, Sørensen C. T. N., Klimenko E., p. 37–39].

Russian and Chinese experts studying the potential of bilateral cooperation in the region also point to the ambiguous nature of the interaction. In general, giving a positive assessment of the joint development of the Arctic and shipping, experts emphasize the need for Moscow to maintain independence from China [9, Konyshov V.N., Sergunin A.A., p. 6; 10, Voronenko A.L., p. 301; 11, Morozov Yu.V., p. 30–32; 12, Aleksandrov O.B., p. 35; 13, Liu H., p. 117; 14, Dow B., p. 70–71]². Russian scientists suggest that China's interests in expanding the rights of non-Arctic states may threaten the policy of the Russian Federation and, in particular, its sovereignty in the Arctic [15, Khramchikhin A.A., p. 94–96]³. In turn, Chinese experts discuss the reliability of Russia as a partner in the Arctic, noting Russia's suspicion about the presence of the PRC in the Far North and, in general, preference to cooperate with European partners [16, Dun Ts., Lukin A.L., p. 162].

Since the experts are mainly focused on studying the difference between the interests of the two states in the Arctic, the new format of “comprehensive partnership” and its role in building bilateral cooperation mechanisms remain outside the scope of research. The real state of affairs in the development of shipping in the Russian Arctic often remains an auxiliary argument rather than a subject of detailed research. In this regard, the purpose of this work is to assess the level and prospects of cooperation between Russia and China in the field of Arctic shipping. Research objectives:

- Determine which national interests support the possibility of cooperation between the two countries in the development of Arctic shipping;

¹ Federation of American Scientists. Changes in the Arctic: Background and Issues for Congress. Report. Congressional Research Service. URL: <https://fas.org/sgp/crs/misc/R41153.pdf> (accessed 08 December 2019).

² Chen S., Zhang T. Ice Silk Road. URL: http://russian.china.org.cn/exclusive/txt/2018-06/25/content_53369435.htm (accessed 12 December 2019); Liu Nengye. Zhongguo de xin sichou zhi lu he beiji [China's New Silk Road and the Arctic]. URL: <http://www.polaroceanportal.com/article/1537> (accessed 15 October 2019).

³ Gudev P. Arkticheskie ambitsii Podnebesnoy. Rossiya v global'noy politike [Gudev P. Arctic Ambitions of China. Russia in Global Affairs]. URL: <https://globalaffairs.ru/number/Arkticheskie-ambitsii-Podnebesnoi-19751> (accessed 15 August 2019).

- Explore what opportunities for the development of bilateral cooperation arise due to the format of comprehensive partnership and strategic interaction;
- Identify strengths and weaknesses, opportunities and threats for interaction between Russia and China in the development of shipping in the Arctic.

Research materials include sources in English, Russian and Chinese, including official documents and statements published on the official websites of ministries of foreign affairs, state councils, governments, as well as scientific publications. Key research methods are comparative analysis to study the interests of countries in the Arctic and SWOT analysis to assess the achievements and shortcomings of bilateral cooperation in the field of shipping.

Comparison of the national interests of Russia and China in the Arctic

Today, Russia and China announced large-scale plans for the development of shipping in the Arctic: Russian, for the development of the Northern Sea Route (NSR), and the Chinese, for the construction of the Ice Silk Route (ISR). Comparison of the two initiatives will clarify how their goals coincide and whether their harmonious interaction is possible.

The Russian project is inextricably linked to the task of the country's survival and well-being. The development of the NSR is designed to strengthen the Russian economy and solve the problem of manageability of the resource-rich regions of Siberia and the Far East. The NSR should become a key highway for the new logistics of vast territories: to increase their interconnection, to ensure the possibility of building enterprises, delivering products to domestic and international consumers. For this reason, the key criterion for any project in the Russian Arctic is the ability to "load" the NSR in order to reach the threshold of 80 million tons of cargo transported annually by 2024 ⁴.

The designated goal turns out to be related to the problems of regional security, both traditional and non-traditional. The long coastline of the Russian Arctic is a natural border. Threats of terrorism, illegal immigration, poaching, smuggling and environmental pollution require an increased focus on securing the areas, developing the adjacent infrastructure and a network of search and rescue stations. In addition, Arctic shipping routes go around territories that are extremely important for the country's strategic security. This makes a special impact on Russia's cooperation in the development of Arctic shipping with any state, including the PRC [5, Bertelsen R.G., Gallucci V., 244–245] ⁵. In particular, the priority for Russia is to maintain a "zone of peace" in

⁴ Президент подписал Указ «О национальных целях и стратегических задачах развития Российской Федерации на период до 2024 года» [The President Signed the Decree "On National Goals and Strategic Objectives of the Development of the Russian Federation for the Period up to 2024"]. URL: <http://kremlin.ru/events/president/news/57425> (accessed 12 October 2020).

⁵ The Naval Doctrine of the Russian Federation, Approved by the President of the Russian Federation No. Pr-1210 of July 26, 2015. URL: <http://static.kremlin.ru/media/events/files/ru/uAFi5nvux2twaqjftS5yriZUVTJan77L.pdf> (accessed 18 October 2020).

the region. For this reason, Russia adheres to a defensive strategy and disapproves of the excessive militarization of the region [17, Burilkov A., Geise T., p. 1046–1047]⁶.

Finally, in the international arena, the development of the NSR increases the value of Russia as a reliable partner capable of implementing long-term projects in the Far North. In this regard, we can agree with the opinion of K. Voronov, an expert at the Institute of World Economy and International Relations of the Russian Academy of Sciences, that the Arctic is the very field where Russia de facto plays the role of a great power⁷. This explains why Moscow is making so many efforts to develop the NSR, despite the high cost and difficulty of working in Arctic waters⁸.

As for the Chinese initiative “Ice Silk Road”, it reflects, first of all, the global ambitions of the PRC [18, Sun Y., p. 15]. Comparing them with the tasks that the Arctic shipping allows Russia to solve, we note that the PRC is also interested in taking advantage of economic opportunities. Shipping can become a new source of energy resources, which will not depend on the “Malacca Strait dilemma” and piracy in the waters of Somalia [19, Li Chzh, Hu M., p. 429, 437; 20, Lanteigne M., p. 143]. In addition, the Arctic shipping will give impetus to the development of Northeast China, the ports of which will receive ships on Arctic voyages. All these opportunities are of interest to the PRC in the medium term, since right now the Chinese fleet is not technically ready to get involved in the development of the Arctic.

As well as for Russia, shipping can increase the national security of the PRC within the framework of its rivalry with the United States and its allies [21, Zhang Ts., Huang D., p. 75–77]. Although China's key interests are related to the Asia-Pacific region, and not the Arctic, the passage of ships through the Bering Strait, the use of the coastline and the Far Eastern ports of Russia for the delivery of goods can help overcome the limitation of the First and Second chain of islands [17, Burilkov A., Geise T., p. 1046–1047; 22, Cole D.B., p. 129]. In this regard, the natural choice for Beijing is to cooperate with Russia and, as far as possible, maintain a constructive relationship with the United States. In this regard, China has taken the following position: to participate in rescue and military operations affecting the national interests of the PRC, and to provide its capital, market, knowledge, technology and experience to “promote peace and security in the Arctic”⁹.

⁶ Fundamentals of the State Policy of the Russian Federation in the Arctic for the Period up to 2020 and Beyond. URL: <http://static.government.ru/media/files/A4qP6brLNJ175I40U0K46x4SsKRHGfUO.pdf> (accessed 02 October 2019).

⁷ Voronov K. ES, Kitay, Rossiya i Arktika: strategicheskie imperativy. Rossiyskiy sovet po mezhdunarodnym delam [EU, China, Russia and the Arctic: Strategic Imperatives. Russian Council on International Affairs]. URL: <https://russiancouncil.ru/blogs/arctic/es-kitay-rossiya-i-arktika-strategicheskie-imperativy/> (accessed 09 October 2019).

⁸ Utverzhden plan razvitiya infrastruktury Severnogo morskogo puti do 2035 goda [Infrastructure Development Plan for the Northern Sea Route up to 2035 was Approved]. URL: <http://government.ru/docs/38714/> (accessed 31 December 2019).

⁹ The State Council of the People's Republic of China. “Full Text: China's Arctic Policy,” 26 January 2018. URL: http://english.gov.cn/archive/white_paper/2018/01/26/content_281476026660336.htm (accessed 13 October 2020); Shouquan fabu: Zhonghua renmin gongheguo guojia anquan fa [Authorized Release: National Security Law of the People's Republic of China]. URL: http://news.xinhuanet.com/politics/2015-07/01/c_1115787801.htm (accessed 04 February 2018).

Finally, from a political point of view, the idea of the ISR has shaped the PRC's view of co-operation in the Arctic as an all-encompassing one, for the benefit of all countries. Now, even in the Arctic, China has declared itself as a “responsible power” capable of proposing an inclusive development strategy. This step is consistent with China's intention to become one of the world's leading states, displacing the United States. To this end, China intends to influence the existing international rules established within the bipolar and then unipolar world.

For this reason, sea transportation has become the main idea around which Beijing's Arctic policy is being built. Lacking territories in the Arctic Circle, China has no hope of influencing the rules for resource extraction. However, the text of the UN Convention on the Law of the Sea, a key document governing shipping, allows China to debate its legal rights in the region and the issue of freedom of navigation¹⁰. In an effort to strengthen its position, the PRC called itself “a country close to the Arctic” and, accordingly, has the right to participate in solving the problems of the region. Thus, the ISR became China's claim to a new status in the Arctic: without an application for sovereignty, but with an emphasis on legal rights and, in particular, the right to be considered an important Arctic actor.

In order not to miss the aforementioned opportunities, China has actively joined the participation in shipping. Thanks to the efforts of the Arctic and Antarctic Affairs Administration and COSCO, the flagship company of China's polar commercial shipping, the country regularly conducts research and commercial voyages. To date, the PRC already has two diesel-electric icebreakers (the modernized former Soviet ship “Snow Dragon” and built in the PRC “Snow Dragon 2”). In addition, a nuclear icebreaker is expected to be built. However, these vessels make up the research fleet. Commercial shipping is still in its infancy due to the lack of its own ice-class vessels and specialized ports.

Comparing the interests of Russia and China in the field of Arctic shipping, it can be seen that the initiatives for the development of the NSR and the construction of the ISR overlap. Both are aimed at connecting the European and Asian markets and both are capable of accelerating the economic development of the regions of the two countries. For Moscow, China is one of the most promising partners along with South Korea and Japan. For Beijing, cooperation with Russia on the NSR is the most feasible alternative, since the Russian fairway is better developed than other Arctic routes¹¹. However, both projects independently serve the interests of Russia and China, and the partners strive to maintain independence in everything, from the diversification of economic cooperation to the training of personnel and the preference of the national language for navigation aids¹².

¹⁰ Full Text: Vision for Maritime Cooperation under the Belt and Road Initiative, 20 June 2017. URL: http://news.xinhuanet.com/english/2017-06/20/c_136380414.htm (accessed 28 May 2018).

¹¹ Zasedanie kruglogo stola foruma «Odin poyas, odin put'» [Roundtable Meeting of the Forum "One Belt, One Road"]. 27 April 2019. URL: <http://kremlin.ru/events/president/news/60393> (accessed 20 January 2019).

¹² Cai M. COSCO. Arctic Circle. 2015. URL: <https://vimeo.com/144905938> (accessed 07 December 2019).

The security sphere, in turn, accumulates contradictions of interests to the greatest extent. The Arctic is a region where Russia has a strategic advantage over China. In this regard, the Russian Federation is not interested in the significant involvement of China in the sphere of Arctic security. The possible exploit of dual-use technologies by the PRC, for example, in the course of hydroacoustic research of the Arctic Ocean, is also the reason for the wary attitude of the Russian side¹³. An additional burden on the development of relations is imposed by interaction in a completely different part of the world: on the border of two countries and in the Asia-Pacific region [17, Burilkov A., Geise T., p. 1046]¹⁴.

At the same time, there are arguments in favor of cooperation. First, there is a shared interest in technological development. In this regard, countries are participating in initiatives that can increase the connectivity and information security of the region. For example, Russia and China intend to join an international project to lay fiber-optic cables along the bottom of the Arctic seas. Bilateral cooperation in the field of remote sensing between GLONASS and BeiDou also has the potential to improve the safety and quality of navigation in the Arctic.

Second, confrontation with the United States is pushing for security rapprochement¹⁵. It is important that if Russia is not interested in strengthening the PRC as a military power in the Arctic, then for China maximizing Russian military power in the region may be beneficial. In case of a conflict with the United States, China will be able to rely on the supply of products through the territory of the Russian Federation, including using the Arctic infrastructure [23, Pan Ts., Lu Ts., p. 118, 122]¹⁶. Nevertheless, due to the indicated significant contradictions, cooperation with China remains very limited in the field of military security in the Arctic, search and rescue, maritime security, and in related areas.

The political dimension of cooperation is also not uniquely favorable. On the one hand, partnership in the Arctic helps to strengthen the positions of both states in the international system, which China and Russia want to see as multipolar [24, Lagutina M., Leksyutina Y., p. 46–47]. At the same time, there are a number of contradictions. First, the key position of China, connected with the idea of expanding the rights of non-Arctic states in the Arctic, with the leading role of

¹³ Koh S.L.C. China's strategic interest in the Arctic goes beyond economics. URL: <https://www.defensenews.com/opinion/commentary/2020/05/11/chinas-strategic-interest-in-the-arctic-goes-beyond-economics/> (accessed 18 May 2020).

¹⁴ Dopolnitel'noe soglasenie mezhdu Rossiyskoy Federatsiyey i Kitayskoy Narodnoy Respublikoy o rossiysko-kitayskoy gosudarstvennoy granitse na ee Vostochnoy chasti [Additional Agreement Between the Russian Federation and the People's Republic of China on the Russian-Chinese State Border on Its Eastern Part]. URL: <http://docs.cntd.ru/document/901945334> (accessed 13 November 2019).

¹⁵ The Guardian. Joint Russian and Chinese Air Patrol Heightens Tension in Korean Peninsula. July 24, 2019. URL: <https://www.theguardian.com/world/2019/jul/24/joint-russian-and-chinese-air-patrol-heightens-tension-in-korean-peninsula> (accessed 07 November 2020).

¹⁶ Zasedanie diskussionnogo kluba «Valday». Vladimir Putin vystupil na itogovoy plenarnoy sessii XVI zasedaniya Mezhdunarodnogo diskussionnogo kluba «Valday» [Meeting of the Valdai Discussion Club. Vladimir Putin Spoke at the Final Plenary Session of the 16th Meeting of the Valdai International Discussion Club]. URL: <http://kremlin.ru/events/president/news/61719> (accessed 17 December 2019).

China as a “responsible power”, completely contradicts the interests of the Russian Federation. Secondly, for Russia, the development of the NSR is a sensitive topic of domestic policy, as it concerns the life and way of life of people living in the Arctic. In this regard, any political decisions of the Russian leadership have far-reaching consequences, including when it comes to closer cooperation with Beijing. For China, however, the Arctic remains a low-risk area.

Cooperation in a partnership format

The partnership format has provided favorable opportunities for cooperation between Russia and China in the field of Arctic shipping. One of the reasons is the flexibility of interaction conditions: the partners are not bound by rigid obligations, which means they can pursue a pragmatic policy without compromising either interests or principles [25, Feng H., p. 9; 26, Korolev A., Portyakov V., p. 418]¹⁷. It was the approach that allowed the two countries to make a decision to pair the Eurasian Economic Union (EAEU) and the “One Belt, One Road” Initiative (despite the contradictions in the interests of the two countries in Central Asia) [27, Alexeeva O., Lasserre F., p. 279–282; 28, Gabuev A., p. 62–63]. This large-scale process now includes the development of the Arctic sea routes¹⁸.

Another reason for the format's effectiveness is active support of the leaders of the two countries, which provided a stable background for cooperation¹⁹. In this regard, it is worth highlighting the active position of the Russian leadership. The new policy associated with entering the Asian markets and the development of the territories of Siberia and the Far East, the so-called “turn to the East”, made the development of the NSR an economic dominant in the Asian direction [29, Pestsov S.K., Volynchuk A.B., p. 85; 30, Sevastyanov S.V., Kravchuk A.A., p. 8–9]. China's cross-border relations are considered today as part of new logistics, and two key projects, transport corridors Primorye-1 and Primorye-2, turned out to be associated with the development of the Northern Sea Route²⁰.

The partnership format contributed to the signing of a number of documents that included the Arctic as one of the areas of focus. In early 2003, the study of the Arctic was mentioned in the Agreement on Cooperation in the Study and Use of the World Ocean, and this document laid the

¹⁷ Wen Stresses Importance of Developing China-EU Comprehensive Strategic Partnership. URL: http://en.people.cn/200405/07/eng20040507_142556.html (accessed 05 September 2020).

¹⁸ Kitay i Rossiya idut v nogu so vremenem [China and Russia Keep Pace with the Times]. URL: <https://tass.ru/interviews/6504703> (accessed 07 July 2019).

¹⁹ Sovmestnoe zayavlenie Rossiyskoy Federatsii i Kitayskoy Narodnoy Respubliki o razvitii otnosheniy vseob"emlyushchego partnerstva i strategicheskogo vzaimodeystviya, vstupayushchikh v novuyu epokhu [Joint Statement by the Russian Federation and the People's Republic of China on the Development of Comprehensive Partnership and Strategic Interaction Relations Entering a New Era]. URL: <http://kremlin.ru/supplement/5413> (accessed 06 December 2019).

²⁰ Programma razvitiya rossiysko-kitayskogo sotrudnichestva v torgovo-ekonomicheskoy i investitsionnoy sferakh na Dal'nem Vostoke Rossiyskoy Federatsii na 2018–2024 gody [Program for the development of Russian-Chinese Cooperation in Trade, Economic and Investment Spheres in the Far East of the Russian Federation for 2018–2024]. URL: <http://russian.mofcom.gov.cn/article/speechheader/201811/20181102808776.shtml> (accessed 14 April 2019).

foundation for further steps²¹. Subsequently, cooperation in the Arctic was included in a number of joint statements from 2017, 2018 and 2019, and the two states agreed to support agencies and companies involved in the development of the NSR and adjacent infrastructure²². The 2019 Joint Statement noted that cooperation would be “based on rights and interests of the coastal state”²³. This was a significant concession from the PRC, in comparison with its earlier declarations about freedom of navigation²⁴.

Finally, the development of bilateral partnerships facilitated the strengthening of existing bilateral cooperation mechanisms and the creation of new ones, including those in the Arctic [31, Sergunin A., Konyshev V., 79; 32, Kobzeva, M., p. 100–101]. The main venues were the meetings of the Legal Department of the Russian Ministry of Foreign Affairs with the Treaty and Legal Department of the Chinese Ministry of Foreign Affairs, as well as the Russian-Chinese Commission for the preparation of regular meetings of heads of government. Within their framework, issues of shipping, maritime law and dispute settlement in the Arctic are discussed. An additional contribution is made by the Intergovernmental Russian-Chinese Commission for Cooperation and Development of the Far East and the Baikal Region of the Russian Federation and the North-East of the People's Republic of China²⁵. Significant support is provided by investment structures and corporations aimed at promoting the implementation of infrastructure projects in Russia, including in the Arctic zone²⁶.

²¹ Soglasenie mezhdu Pravitel'stvom Rossiyskoy Federatsii i Pravitel'stvom Kitayskoy Narodnoy Respubliki o sotrudnichestve v oblasti issledovaniya i ispol'zovaniya Mirovogo okeana [Agreement between the Government of the Russian Federation and the Government of the People's Republic of China on Cooperation in the Exploration and Use of the World Ocean]. URL: http://www.mid.ru/foreign_policy/international_contracts/2_contract/-/storage-viewer/bilateral/PAGE-166/46213 (accessed 16 May 2019).

²² Sovmestnoe zayavlenie Rossiyskoy Federatsii i Kitayskoy Narodnoy Respubliki o dal'neyshem uglublenii otnosheniy vseob"emlyushchego partnerstva i strategicheskogo vzaimodeystviya [Joint Statement of the Russian Federation and the People's Republic of China on the Further Deepening of Relations of Comprehensive Partnership and Strategic Interaction]. URL: <http://kremlin.ru/supplement/5218> (accessed 16 January 2019).

²³ Sovmestnoe zayavlenie Rossiyskoy Federatsii i Kitayskoy Narodnoy Respubliki o razvitii otnosheniy vseob"emlyushchego partnerstva i strategicheskogo vzaimodeystviya, vstupayushchikh v novuyu epokhu [Joint Statement by the Russian Federation and the People's Republic of China on the Development of Comprehensive Partnership and Strategic Interaction Relations Entering a New Era]. URL: <http://kremlin.ru/supplement/5413> (accessed 06 December 2019).

²⁴ The State Council of the People's Republic of China. “Full Text: China's Arctic Policy,” 26 January 2018. URL: http://english.gov.cn/archive/white_paper/2018/01/26/content_281476026660336.htm (accessed 13 October 2020).

²⁵ Ministry of Foreign Affairs of the People's Republic of China. Consultation Between Director-Generals of the Departments of Treaty and Law of Ministries of Foreign Affairs of China and Russia Held in Moscow. URL: http://www.fmprc.gov.cn/mfa_eng/wjbxw/t1337836.shtml (accessed 05 August 2018); Sostoyalos' vtoroe zasedanie Mezhpavitel'svennoy rossiysko-kitayskoy komissii po sotrudnichestvu i razvitiyu Dal'nego Vostoka i Baykal'skogo regiona Rossiyskoy Federatsii i Severo-Vostoka Kitayskoy Narodnoy Respubliki [The Second Meeting of the Intergovernmental Russian-Chinese Commission on Cooperation and Development of the Far East and the Baikal Region of the Russian Federation and the North-East of the People's Republic of China was Held]. URL: <http://government.ru/news/33726/> (accessed 06 September 2020).

²⁶ Russian-Chinese Investment Fund for Regional Development. URL: <http://ifrd.ru/ru/> (accessed 03 October 2020); COSCO SHIPPING Attended the 6th Meeting of the China-Russia Investment Cooperation Committee. URL: <https://en.portnews.ru/news/287783/> (accessed 15 August 2020); VTB i VEB podpisali soglasheniya s China Develop-

A special area of bilateral cooperation also arises due to the interaction of the local administrations of Russia and China, interested in the development of Arctic shipping. Arkhangelsk Oblast, Komi Republic, Murmansk Oblast, Yakutia, Primorskiy Krai are developing relations with the provinces of Heilongjiang and Jilin [33, Ivanov S.A., 416–417]. The Russian side is looking for investments in ports and complex infrastructure projects²⁷. In turn, Chinese partners from the border provinces are presenting cooperation with Russia as part of “One Belt, One Road” and ISR Initiatives, thereby hoping to attract additional state support²⁸.

Assessment of cooperation in the field of shipping in the Russian Arctic

The political component of bilateral cooperation is somewhat ahead of the true scale of China's involvement. It should be admitted that the development of Arctic shipping is mainly due to Russian ships delivering LNG and other cargo to China and back. Only a small part, no more than 1.2% of the total number of voyages on the NSR, is made by Chinese ships²⁹. The partnership itself is still focused on infrastructure projects — that is, on preparing for future active navigation.

In general, three conditional regions can be distinguished where most of the discussed and current Russian-Chinese projects are concentrated: the region of the White and Barents Seas, the Kara Sea and the Sea of Japan. The first and last regions are the gates of the Russian Arctic to Europe and Asia, and the central region, where the largest mining projects are concentrated, serves as a strong point for both the ISR and the NSR. This distribution reflects the inextricable link between the shipping and extractive industries.

Among the three regions, the most successful is the Kara Sea with the largest infrastructure project, the port of Sabetta. The port unites the cargo flows of two projects: Yamal LNG (China's

ment Bank [VTB and VEB Signed Agreements with China Development Bank]. URL: <http://www.finmarket.ru/currency/news/4406111> (accessed 19 October 2020).

²⁷ Kitay planiruet zadeystvovat' port Murmansk dlya tranzita tovarov [China Plans to Use the Port of Murmansk for the Transit of Goods]. URL: <https://severpost.ru/read/44732/> (accessed 06 November 2020); Vlasti Primorya predlozhili Kitayu uchastvovat' v stroitel'stve porta dlya tranzita gruzov cherez SMP [Primorye Authorities Invited China to Participate in the Construction of a Port for the Transit of Goods through the NSR]. URL: <https://www.interfax-russia.ru/far-east/news/vlasti-primorya-predlozhili-kitayu-uchastvovat-v-stroitel'stve-porta-dlya-tranzita-gruzov-cherez-smp> (accessed 18 October 2020).

²⁸ Jiakuai jianshe san qiao yi dao wanshan kou'an jichu sheshi cujin zhong e diqu jingmao hezuo dadao geng gao shuiping wangwentao chuxi 2019 nian di wu jie guoji beiji luntan quanti huiyi [Accelerating the Construction of Three Bridges and One Island, Improving Port Infrastructure and Promoting Economic and Trade Cooperation between China and Russia to a Higher Level. Wang Wentao Attended the 2019 Plenary Session of the Fifth International Arctic Forum]. URL: <http://www.hlj.gov.cn/szf/system/2019/04/12/010897732.shtml> (accessed 17 September 2019); Haerbin Shi Zhang Song Xibin Huijian Mo'ermansike Daibiao Tuan [Meeting of the Mayor of Harbin Son Xibin with Murmansk Delegation]. URL: [http://js.hlj.gov.cn:82/js/detail?id=8add3897dc5d88fcd1e6d9c92f57e241&title=5ZOI5bCU5ruo5biC6ZW/5a6L5biM5p aM5Lya6KeB5pGp5bCU5pu85pav5YWL5Luj6KGo5Zui&to=aHR0cDovL3d3dy5obGouZ292LmNuL3p3Zmlvc3lzdGVtLzlwMTcvMDgvMTUvMDEwODQyNjM5LnNodG1s&sid=\\$sid](http://js.hlj.gov.cn:82/js/detail?id=8add3897dc5d88fcd1e6d9c92f57e241&title=5ZOI5bCU5ruo5biC6ZW/5a6L5biM5p aM5Lya6KeB5pGp5bCU5pu85pav5YWL5Luj6KGo5Zui&to=aHR0cDovL3d3dy5obGouZ292LmNuL3p3Zmlvc3lzdGVtLzlwMTcvMDgvMTUvMDEwODQyNjM5LnNodG1s&sid=$sid) (accessed 20 December 2019).

²⁹ Razresheniya na plavanie sudna v akvatorii Severnogo morskogo puti. Administratsiya Severnogo Morskogo puti [Permits for Navigation of the Vessel in the Water Area of the Northern Sea Route. Administration of the Northern Sea Route]. URL: http://www.nsra.ru/ru/rassmotrenie_zayavleniy/razresheniya.html (accessed 18 June 2020); Gruzooborot portov Dal'nego Vostoka imeet bol'shoi potentsial rosta [The Cargo Turnover of the Ports of the Far East Has Great Growth Potential]. URL: <https://minvr.gov.ru/press-center/news/21572> (accessed 11 August 2020).

share is 29.9%) and the Arctic LNG-2 under construction (China's share is 20%)³⁰. This is where the Russian-Chinese cooperation in the field of shipping is most productive. Within the framework of these projects, a number of Chinese companies are supplying Arctic LNG tankers, module carriers and the modules themselves³¹. A significant event was the establishment in 2019 of a joint company LLC Sea Arctic Transport (NOVATEK, Sovcomflot, China COSCO Shipping Corporation Limited and Silk Road Fund). The Russian-majority company will manufacture icebreaking tankers for the year-round transportation of hydrocarbons and cargo from Europe to Asia³².

The Sea of Japan region is more problematic. Mutual mistrust, accumulated over the long history of cross-border cooperation, hinders interaction, and many projects in the region have been idle for decades [34, Li Tsz., Zhan L., Ma P., p. 37]. However, the current active policy of Moscow on the development of the Far East helped to solve a number of problems of cross-border cooperation and introduced a new, Arctic direction [35, Petrakov V.V., Lukin A.L., p. 89]³³. Two cross-border international transport corridors are now part of a new logistics system linking the European and Asian Arctic (Primorye-1 from Heilongjiang province through the ports of Vladivostok and Nakhodka and Primorye-2 from Jilin province through the port of Zarubino)³⁴. The cooperation between Rosneft and the Chinese Shipbuilding Corporation on the construction of the Zvezda shipyard, which specializes in the construction of Arc7 ice-class gas carriers and other vessels and equipment for oil production and transportation, turned out to be successful³⁵.

The least successful cooperation is in the White and Barents Seas. For several years, Chinese companies have been visiting the region, negotiating and signing agreements, but the im-

³⁰ Tovaroorobot cherez port Sabetta v 2016 g. uvelichilsya v 5 raz, do \$5,2 mlrd [Trade Turnover through the Port of Sabetta in 2016 Increased 5 times, to \$ 5.2 Billion]. URL: <https://tass.ru/transport/3927061> (accessed 10 April 2020).

³¹ Kitay nachal postroyku moduley dlya "Arktik SPG-2" [China Starts Building Modules for "Arktik SPG-2"]. URL: <https://pro-arctic.ru/13/12/2019/news/38555> (accessed 01 June 2020); Kitay postroil dlya «Yamal SPG» pervyy v mire vsezonnyy arkticheskiy tanker [China Builds the World's First All-Season Arctic Tanker for "Yamal SPG"]. URL: <https://regnum.ru/news/economy/2533034.html> (accessed 14 June 2019); "Ya Ma'er, Chuli Beiji Quan De LNG Chaoji Gongcheng. [Yamal, a Super Complex Project for the Production of LNG in the Arctic Circle]." URL: <http://news.CNPC.com.cn/system/2017/04/01/001641559.shtml> (accessed 17 May 2017).

³² «NOVATEK», COSCO SHIPPING, «Sovkomflot» i Fond Shelkovogo Puti podpisali soglasenie v otnoshenii OOO «Morskoy arkticheskiy transport» [NOVATEK, COSCO SHIPPING, Sovcomflot and the Silk Road Fund Signed an Agreement on Arctic Sea Transport LLC]. URL: http://www.novatek.ru/ru/investors/events/archive/index.php?id_4=3243 (accessed 14 June 2020).

³³ Plenarnoe zasedanie Vostochnogo ekonomicheskogo foruma [Plenary Session of the Eastern Economic Forum]. URL: <http://kremlin.ru/events/president/news/61451> (accessed 04 May 2020); Dokumenty, podpisannye po itogam ofitsial'nogo vizita Predsedatelya Kitayskoy Narodnoy Respubliki Si Tszin'pina v Rossiyskuyu Federatsiyu [Documents Signed Following the Official Visit of the President of the People's Republic of China Xi Jinping to the Russian Federation]. URL: <http://kremlin.ru/supplement/5217> (accessed 04 August 2020).

³⁴ Gruzovuyu liniyu Khun'chun' – Zarubino – Ninbo ofitsial'no zapuskayut v Primorye [Freight Line Hunchun – Zarubino – Ningbo Officially Launched in Primorye]. URL: <https://www.primorsky.ru/news/150483/> (accessed 19 September 2020).

³⁵ Novyy etap stroitel'stva. Sudostroitel'nyy kompleks «Zvezda» [New Stage of Construction. Shipbuilding Complex "Zvezda"]. URL: <http://www.sskzvezda.ru/index.php/ru/8-news/142-novyj-etap-stroitelstva> (accessed 06 August 2020); «Rosneft»: mezhdunarodnoe sotrudnichestvo [Rosneft: International Cooperation]. URL: <https://actualcomment.ru/mezhdunarodnoe-sotrudnichestvo-rosnefti--1608101356.html> (accessed 16 February 2018).

plementation of projects (construction of the Belkomur railway, a deep-water port in the area of Mudyug Island, etc.) does not move forward. Even the Russian-Chinese working group, assembled in 2013 with the participation of the Ministry of Transport, the China Development Bank and other influential organizations of the two countries, did not produce significant results³⁶.

The problem here, first of all, lies in the uncertainty of the Russian side in the payback of projects. The new plan for the development of the infrastructure of the Northern Sea Route up to 2035 provides for the completion of a number of infrastructure facilities within the Murmansk transport hub, but the construction of Belkomur and the development of the Murmansk port are considered as tasks for the future³⁷. An additional obstacle is the presence of internal competition for investment between Murmansk and Arkhangelsk and potential external competition with the Norwegian port of Kirkenes, also aimed at obtaining Chinese investments [36, Zaykov K.S., p. 38–39]³⁸.

This study allows us to consider the strengths and weaknesses, opportunities and threats of Russian-Chinese cooperation in the field of Arctic shipping (Table 1).

Table 1
*SWOT analysis of Sino-Russian cooperation in shipping and infrastructure in the Russian Arctic*³⁹

White Sea and Barents Sea	
S	<ul style="list-style-type: none"> The proactive attitude of the local administration and the constant interest of Chinese companies create the basis for further cooperation. The long history of negotiations increases mutual awareness of the Chinese and Russian partners about each other's opportunities and challenges, as well as about future projects. Projects are gradually receiving support from the country's leadership.
W	<ul style="list-style-type: none"> The political will of the Russian side has not yet been consolidated sufficiently to provide a clear roadmap for cooperation. The risk is related to an extreme and fragile environment, current infrastructure problems and the negative impact of European sanctions on business in Russia.
O	<ul style="list-style-type: none"> The territorial proximity to Europe and the developed infrastructure (compared to other parts of the Russian Arctic) offers Russia and China a chance to establish links with European partners and create new Eurasian logistics through the Russian railways network.
T	<ul style="list-style-type: none"> The implementation of projects is highly dependent on political and economic relations with Europe. This could hinder bilateral plans and lead to possible competition between the priorities of Chinese investments, either in the renovated Russian ports, or in similar projects in Scandinavia.
Kara Sea	
S	<ul style="list-style-type: none"> Yamal LNG and Arctic LNG-2, combined with the construction of the Sabetta port, have become success stories for the leaders of both states in bilateral cooperation and multi-stakeholder engagement

³⁶ "Belkomur" dast vozmozhnost' realizovat' bolee 40 krupnykh investproektov ["Belkomur" will Provide an Opportunity to Implement More than 40 Large Investment Projects]. URL: <https://tass.ru/ekonomika/4130386> (accessed 09 December 2019); Kitay zainteresovan v sotrudnichestve s Pomoryem v sfere morskikh perevozok [China is Interested in Cooperation with Pomorie in the Field of Sea Transportation]. URL: <http://dvinanews.ru/-s4yh4897> (accessed 08 November 2020)

³⁷ Utverzhden plan razvitiya infrastruktury Severnogo morskogo puti do 2035 goda [Infrastructure Development Plan for the Northern Sea Route up to 2035 Approved]. URL: <http://government.ru/docs/38714/> (accessed 07 March 2020); Nenuzhnaya doroga: za aktsiyami «Belkomura» opyat' nikto ne prishel [An Unnecessary Road: Again, No One Came for the Shares of Belkomur]. URL: <https://regnum.ru/news/2383716.html> (accessed 08 July 2020).

³⁸ The Dream of an Arctic Railway Fades as Sami Herders Signal 'Veto'. URL: <https://thebarentsobserver.com/en/life-and-public/2020/03/arctic-railway-dream-fades-away-sami-herders-announce-veto> (accessed 16 May 2020).

³⁹ S – Strengths, W – Weaknesses; O – Opportunities; T – Threats.

	<p>with European and Asian partners in the Arctic. These facts strengthen the readiness for further co-operation.</p> <ul style="list-style-type: none"> • NOVATEK's projects receive sustained support from the Russian government, which is a long-term guarantee of stable profits. • Yamal LNG and Arctic LNG-2 share common infrastructure, which increases the return on investment.
W	<ul style="list-style-type: none"> • The risk is related to the extreme and fragile environment, current infrastructure problems and the negative impact of European sanctions on business in Russia.
O	<ul style="list-style-type: none"> • The scale and complexity of projects is a powerful incentive for Sino-Russian technological cooperation in various areas related to the development of the Arctic. • The natural resources of the region provide the basis for long-term activities in these areas.
T	<ul style="list-style-type: none"> • The scale of the project determines its strong dependence on government support and stability in the Russian Federation.
Sea of Japan	
S	<ul style="list-style-type: none"> • Mild climate and territorial proximity to Asian ice-free ports favor cooperation. • Long-term cross-border cooperation ensures mutual understanding and provides well-functioning mechanisms of interaction.
W	<ul style="list-style-type: none"> • Lack of investment attractiveness of the region for Chinese investors and deep-rooted distrust of Chinese partners in the Far East hinder fruitful cooperation. • Clear separation of national interests of the two states in the Asia-Pacific region limits the scope of China's participation in regional development.
O	<ul style="list-style-type: none"> • Improving regional development and connectivity: the link between the Arctic and the Far East in the case of Russia, the link between the Northeast and Arctic Eurasian logistics in the case of China. • Creating a production chain from Arctic hydrocarbons to reprocessed fuels for Asian markets — mainly in the interests of Russia.
T	<ul style="list-style-type: none"> • Dependence of cooperation on the political situation: success or contradictions of cross-border relations and the situation in the Asia-Pacific region.
Shipping in Russian waters	
S	<ul style="list-style-type: none"> • Gaining experience in research and commercial shipping in Russian Arctic waters, including understanding of ice conditions, requirements for vessels and crews, and experience in dealing with Russian authorities. • Willingness to engage in dialogue regarding shipping conditions and regulations combined with the commitment of both countries to the existing legal framework.
W	<ul style="list-style-type: none"> • There is still a significant gap between year-round navigation requirements and the current state of the fleet and logistics.
O	<ul style="list-style-type: none"> • China's ability to navigate the Russian Arctic confirms its status as an "important Arctic actor" and supports Russia's efforts to establish international shipping along the NSR. • New direction of technological and economic cooperation is available both for bilateral cooperation and for building new links between Europe, Russia and Asia.
T	<ul style="list-style-type: none"> • Legal contradictions require a constant balance of interests and confidence-building measures in the long term. • Firm position of the Russian Federation regarding the legal regulation of the NSR and the need to control its own territories complicate cooperation with China on most security issues.

The analysis shows that there are a number of internal factors in the White Sea and Barents Sea region that hinder cooperation, despite its favorable territorial location. The prospects for interaction between the two countries in the region are ambiguous. The Kara Sea region is an example of successful and stable cooperation: bilateral relations here do not depend on the problems inherent in border areas, and large-scale mining projects allow building interaction with a long-term perspective. Partnership in the Sea of Japan related to Arctic logistics still depends on cross-border cooperation and the need to take into account the interests of Japan, South Korea and the United States. In this regard, even non-Arctic-related issues may become an obstacle to interaction. Finally, the shipping itself is mainly carried out by the Russian fleet, which contributes

to the development of the Northern Sea Route. Chinese shipping in the Russian Arctic still retains its image value in promoting ISR and is not a source of significant economic benefits. In the future, cooperation will depend on the readiness of the Chinese partners to compromise on navigation rules in Russian waters.

Conclusions

The partnership format contributes to the development of cooperation between Russia and China in the field of Arctic shipping. Thanks to new mechanisms of interaction and joint political decisions, the format provides a number of additional opportunities for dialogue and projects implementation. At the same time, bilateral cooperation is gradually concentrating around consonant initiatives: the development of the Northern Sea Route and the construction of the Ice Silk Road.

The interests of the two countries in the framework of the initiatives are fundamentally different. The national interest of Russia is to make the NSR a backbone of socio-economic development of the Arctic and a transport corridor from Europe to Asia. Russia needs good reasons to cooperate with China: projects that make a significant contribution to the development of resources and the country's economy. For China, a key incentive to participate in Arctic shipping is the development of new routes for trade with European countries and the delivery of resources. The PRC does not seek to limit itself to cooperation only with the Russian Federation or to invest in infrastructure fully managed by Moscow.

The contradictions between the national interests of Russia and the PRC are especially evident in the security sphere. This leads to political distance between countries and narrows the possible options for cooperation. Moreover, if maximizing China's influence in the Arctic contradicts Russia's interests, then maximizing Russia's influence does not necessarily contradict China's interests. This strategic advantage creates a favorable balance in Russia's interests.

It is important to note, however, that concerns about China's capabilities in the field of military security in the Arctic arise against the background of the absence of effective mechanisms for international cooperation. In this regard, the dialogue of key actors in the region, primarily Russia and the United States, as well as the joint development of interaction criteria can make a constructive contribution to relations with China in the field of Arctic shipping. At the same time, the radicalization of the US position towards Russia and the PRC in the Arctic and the lack of an effective dialogue with Washington can change the balance of power and induce Moscow and Beijing to make undesirable compromises for them. In order to avoid such a situation, it is advisable for Russia to take the initiative to develop an international dialogue on the safety of navigation in the Arctic. Namely, to pay active attention to the development of mechanisms for the management of marine resources in the Arctic Ocean, the exchange of observations of climate and ocean, as well as support for navigation. All these issues are important for the safety

of navigation on the NSR and can become the basis for fruitful cooperation between Russia and the PRC. Russia's chairmanship of the Arctic Council provides additional opportunities to stimulate multilateral dialogue, in which China can play an important, but not exclusive role, while remaining within the existing regime of Arctic governance.

In the political sphere, cooperation serves to form the national image of both Russia and China and contributes to the promotion of the idea of multipolarity. Since both initiatives (the development of the NSR and the construction of the ISR) are aimed at strengthening the interconnectedness of global markets, the warming of relations between Russia and the countries of Europe, and especially Northern Europe, can balance cooperation in the Arctic. In turn, the European countries' distance from cooperation with Russia and China would complicate the implementation of national tasks and negatively affect the development of the region as a zone of peaceful cooperation.

Assessing the involvement of China in the development of shipping, it should be noted that geographically, Chinese companies have declared their interest in cooperation along the entire length of the Russian Arctic from Arkhangelsk to Vladivostok. However, cooperation is mainly focused on the implementation of infrastructure projects in the Barents and White Seas (the gateway of the Russian Arctic to Europe), the Kara Sea (the backbone region for resource extraction in the Arctic), the Sea of Japan (the gateway of Arctic logistics to Asia). At the same time, many projects have been idle for years, indicating a strict dependence on government support. Meanwhile, China remains a promising source of investment in shipbuilding related to the Arctic (ice-class vessels, including those for transporting LNG, drilling platforms and port facilities adapted for the Arctic). In this area, the PRC is actively cooperating with leading Russian, American and European companies, rapidly reducing its own technological gap. On the condition of a parity partnership with Russian companies, Chinese corporations can make a positive contribution to the development of shipping along the Northern Sea Route.

Under these circumstances, the following areas are the most promising for Russian-Chinese cooperation. First, within the framework of the dialogue between the Legal Department of the Russian Ministry of Foreign Affairs and the Legal Department of the Chinese Ministry of Foreign Affairs — the study of mutually beneficial solutions to improve the legal support of shipping. Second, the strengthening of state support and mutual coordination in the framework of the development of port infrastructure projects in the Arctic and the Far East, as well as the construction of Arctic vessels for various purposes. This implies the development of a joint vision of priorities for cooperation in Arctic logistics in relation to the infrastructure of the border areas of the Far East and North-East of the PRC by the responsible agencies and local administrations. Third, strengthening mutual trust through joint exercises in maritime safety and environmental damage management, particularly in the Sea of Japan, as well as multilateral consultations with European and Asian partners to ensure the safety of Arctic shipping. Fourth, public and private

support for scientific projects and exchanges, as well as the development of multilateral dialogue with European and Asian partners in the field of scientific and technical cooperation for shipping in the Arctic.

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Geopolitical Risks of Hydrocarbon Development in the Russian Arctic *

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Abstract. The article is devoted to the issues of geopolitical risks (GPR) in the hydrocarbon development of the Russian Arctic. The authors pay special attention to the analysis of modern geopolitical and geostrategic challenges of the Arctic region development. The article identifies the key geopolitical factors that affect the sustainable development of the Arctic and analyzes the similarities and differences in the geostrategic positions of the Arctic Five. One of the most important factors of the XXI century that determines the alignment and interaction of various geopolitical forces is the struggle for resources. In this regard, an increase in GPR in the Arctic, related to its resource potential, is inevitable. For oil and gas industry facilities, GPR can be transformed into opposite environmental factors in the form of additional opportunities or threats, which the authors identify in detail for each type of risk. The authors focus on such positions of the GPR, which are related to ensuring access and obtaining control rights over the Arctic's hydrocarbon resources from different countries, the uncertainty of the legal status of the Arctic region, and the use of geoecological risks (GER) as manipulative priorities of attention to Russia's actions in the Arctic.

Keywords: *geopolitical risk, geopolitics, geopolitical factor, oil and gas industry, Arctic.*

Introduction

In terms of global geopolitical processes, one of the most important factors determining the arrangement and interaction of various geopolitical forces in the 21st century is the struggle for resources. In this regard, an objective increase in geopolitical contradictions in the Arctic is inevitable, associated with its resource potential and transport value, on the one hand, and with the absence of a recognized and legally formalized demarcation of sea spaces and the shelf, on the other hand. Experts from leading world powers predict the possibility of military conflicts due to growing contradictions on the basis of division of the colossal wealth of the Arctic [1, Nurishev G.N., p. 83]. Modern Russian development of Arctic hydrocarbon resources is associated with geopolitical challenges, the essence of which can be interpreted as the emergence of qualitative signs of changes in the evolution of geopolitical factors affecting the processes of sustainable development of the Arctic region ¹.

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¹ Mitko A.V. Osobennosti arkticheskikh vyzovov rossiyskoy geopolitiki [Features of the Arctic Challenges of Russian Geopolitics]. URL: https://studref.com/420639/politologiya/osobennosti_arkticheskikh_vyzovov_rossiyskoy_geopolitiki (accessed 14 November 2020).

When studying the main trends in risk ratings of oil and gas companies [2, Trubitsina O.P., Bashkin V.N., p. 53; 3, Trubitsina O.P., Bashkin V.N., p. 220], the position of geopolitical background turned out to be among the key positions — “Access to reserves and markets: limiting factors of a political nature and competition for proven reserves”. In this regard, the analysis of geopolitical risks (GPR) in terms of their transformation into opportunities and threats is a priority task of oil and gas facilities in the implementation of Arctic field development projects.

The COVID-19 pandemic is currently a key challenge in the world. The global economic crisis is reducing the need for oil and gas as much as for other energy sources. However, energy demand has always been cyclical. Rise and fall in commodity prices can be predicted by identifying commodity cycles. For example, this is evidenced by the results of a study of super-cycles of rising oil prices by the UN Under-Secretary-General for Economic and Social Affairs, economist at Columbia University José Antonio Ocampo and his colleague Bilge Erten (Fig. 1). According to their predictions, markets will approach a cyclical downturn and, consequently, oil prices will fall in 2020². The forecast has come true. Since that year, a new super-cycle of decline has begun, and the recovery of global energy resources demand is currently largely due to the resolution of geopolitical contradictions.

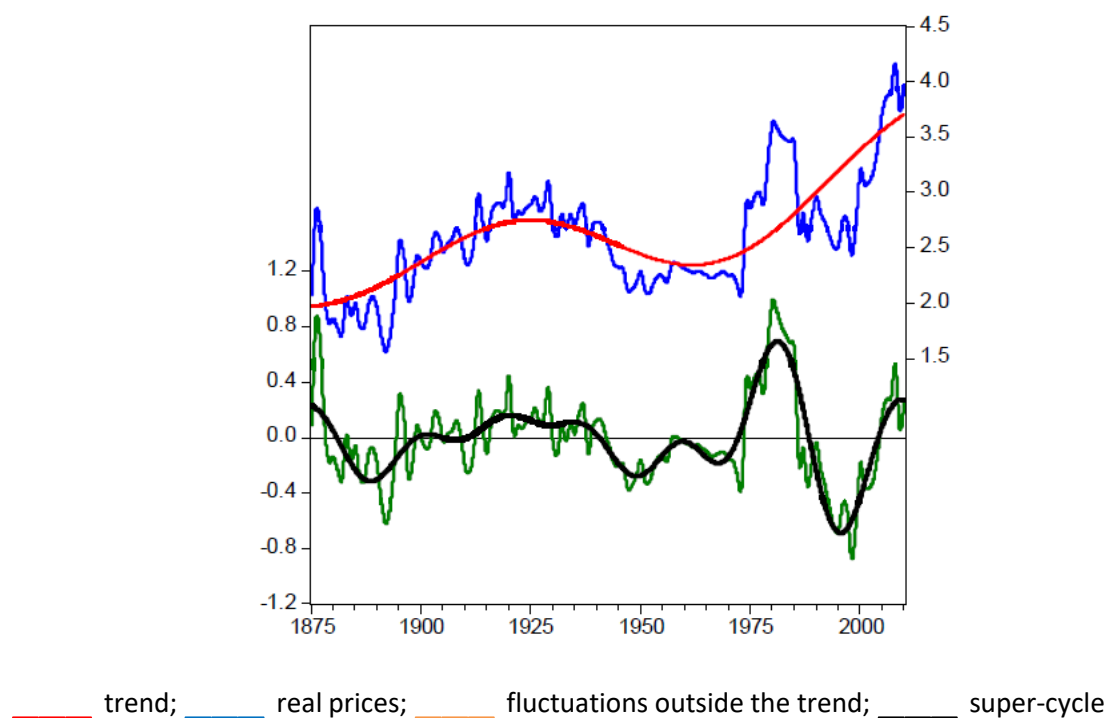


Fig. 1. Oil price dynamics³.

² Syr'evye tsikly: tseny na nef't' upadut v 2020 godu [Commodity Cycles: Oil Prices will Fall in 2020]. URL: <https://www.interfax.ru/business/327893> (accessed 04 February 2021).

³ Ocampo José Antonio. Super-cycles of Commodity Prices since the Mid-Nineteenth Century. Presentation at the International Monetary Fund. March 20, 2013. URL: <https://www.imf.org/external/np/seminars/eng/2012/commodity/pdf/Ocampo.pdf> (accessed 04 February 2021).

In case of compliance with all international sources of law on the part of the states interested in the Arctic, oil and gas companies could focus more on GER issues, which occupy a dominant place in the risk ratings of such companies [2, Trubitsina O.P., Bashkin V.N., p. 53; 3, Trubitsina O.P., Bashkin V.N., p. 220]. However, the situation is not the same. For example, the United States often does not take into account Russian internal decisions on maritime borders, in particular, in the Sea of Japan and in the Arctic Ocean (AO). China is not yet moving towards decarbonization and is very interested in the NSR and LNG transport, in the production of which they have already invested a lot of money (Arctic-LNG-2). Large reserves of oil and gas have been discovered in the area of the Novosibirsk Islands, the production of which, as well as at the Shtokman oil and gas condensate field, will begin when it is economically profitable. Since the Russian Federation intends to defend this region, including by military means, this indicates the presence of threats, including those discussed in the article. It is aimed at identifying key geopolitical factors affecting the sustainable development of the Arctic, as well as analyzing the similarities and differences in the geostrategic positions of the Arctic Five states. At the same time, the authors focus on positions of the GPR, associated with ensuring access and obtaining control rights over the hydrocarbon resources of the Arctic from different countries, the uncertainty of legal status of the Arctic region, as well as the use of GER as a manipulation tool to draw attention to Russia's actions in the Arctic.

Geopolitical features of the Arctic challenges for Russia ***Geopolitical factors***

The geopolitics of the Arctic as a macro-region is determined by its position in relation to other countries in terms of similar or different positions of political systems and geopolitical potentials in conjunction with the presence or absence of mutual interests and problems [4, Baklanov P.Ya., Moshkov A.V., Romanov M.T., p. 9].

The Russian mission in the Arctic is determined by geopolitical factors, the evolution of which presupposes both tendencies to increase their influence on sustainable development processes and the redistribution of their share.

The influence of each factor and the relationship with social categories according to expert estimates by scientists from the Arctic Public Academy of Sciences (APAS) is shown in Fig. 2. The three key factors have the largest share (69%): 1. geographical (30%), 2. military (21%), 3. economic (18%).

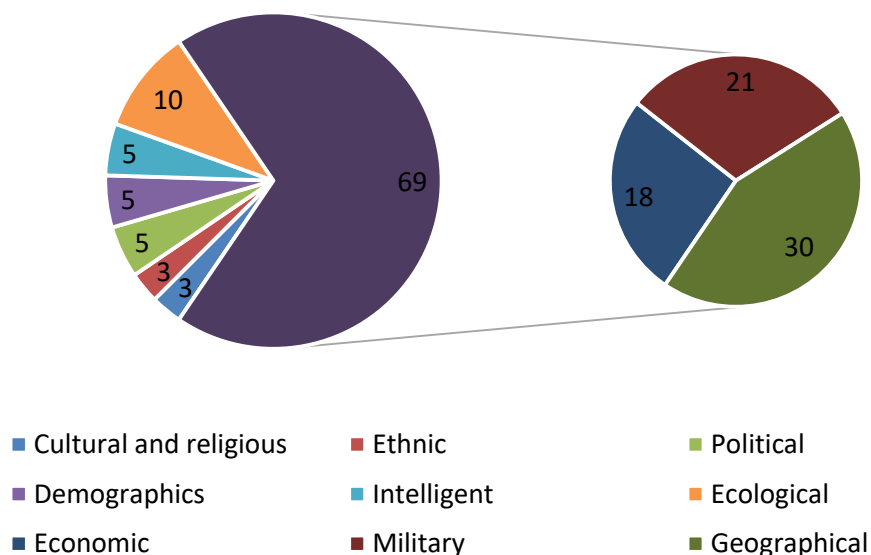


Fig. 2. Influence of geopolitical factors on the sustainable development of the Arctic, %, according to the materials⁴.

Challenges related to the geographic factor, spatial location and natural resources are considered basic in Russia's current context. So, due to changes in its territory and approaches to determining the external boundaries of the continental shelf in the Arctic (instead of the sectoral one to comply with the Convention on International Maritime Law), the evolution of the geographical factor was quite significant in the last century. As a result of the last phase of geographic changes, Russia has undergone a significant "northernization" in the 21st century⁵. Norway and Denmark adjoin Russia through land and sea borders within the Western macro-region, and the United States of America and Canada — within the eastern region. The Arctic and its shelf are directly connected to Russia, USA, Canada, Denmark, Norway. The reason for obtaining the Arctic status and securing the Arctic sectors for them was their northern borders, which extend beyond the Arctic Circle. The length of the coastline of the Arctic Five states in descending order is shown in Fig. 3, based on materials [4, Baklanov P.Ya., Moshkov A.V., Romanov M.T., p. 9].

⁴ Syr'evye tsikly: tseny na neft' upadut v 2020 godu [Commodity Cycles: Oil Prices will Fall in 2020]. URL: <https://www.interfax.ru/business/327893> (accessed 04 February 2021).

⁵ Mitko A.V. Osobennosti arkticheskikh vyzovov rossiyskoy geopolitiki [Features of the Arctic Challenges of Russian Geopolitics]. URL: https://studref.com/420639/politologiya/osobennosti_arkticheskikh_vyzovov_rossiyskoy_geopolitiki (accessed 14 November 2020).

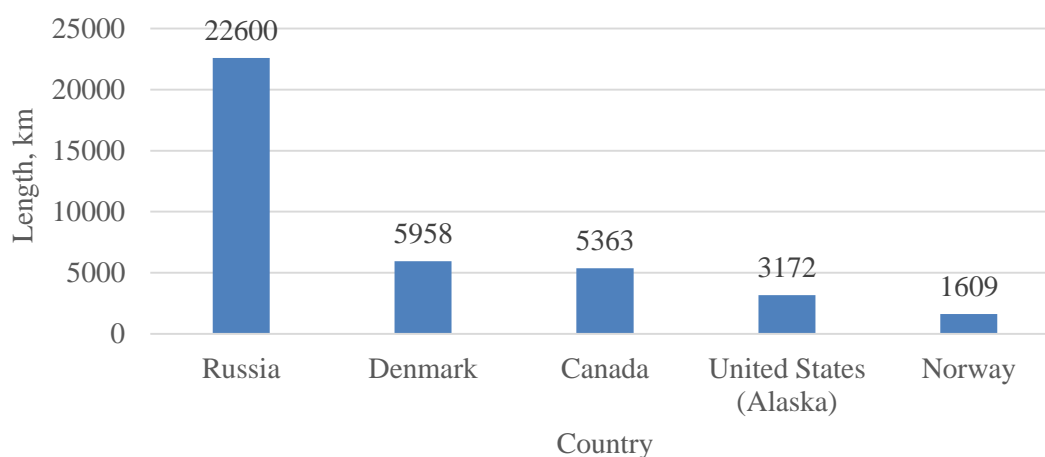


Fig. 3. The length of the mainland coast of the Arctic Five States beyond the Arctic Circle, km, according to the materials [4].

The coastal and insular territories of the Arctic Five states together with the water area of the marginal seas and the Arctic Ocean make up the Arctic transboundary region (ATR). This is a vast circumpolar basin zone, crossed by a large number of state borders: land borders, territorial waters, marine economic zones, the Arctic shelf delimitations. At present, the geopolitical interests of all these countries already intersect in the APR (Fig. 4), and in the future, the intersection zones will not only increase, but also become more complex [Ibid].

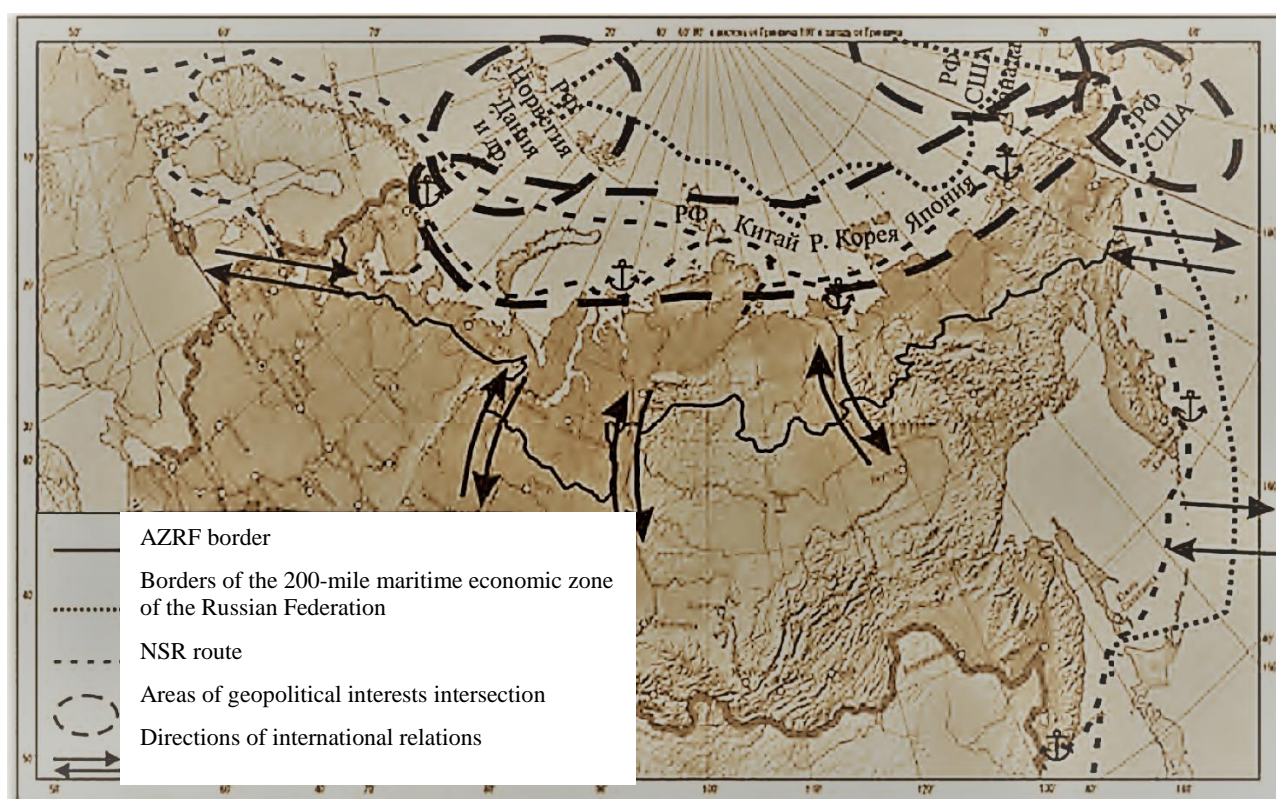


Fig. 4. Geopolitical position of the Arctic zone of Russia [4, Baklanov P.Ya., Moshkov A.V., Romanov M.T., p. 10].

Half of the entire Arctic Ocean shelf is the Siberian Arctic shelf, which contains huge reserves of hydrocarbon resources. Special attention should be paid to the East Siberian Shelf (ESS) in connection with the prerequisites for development of the most serious consequences associated with modern climatic changes. The ESS is the largest and shallowest continental shelf in the World Ocean. With an average depth of about 50 m, it occupies $2.1 \times 10^6 \text{ km}^2$ and covers the Laptev Sea, the East Siberian Sea and the Russian part of the Chukchi Sea. The entire area of the ESS is covered with underwater permafrost, which in the past 30 years has been degrading at a double rate, freeing up access to marine energy reserves, as well as contributing to methane emissions [5, Grinko A.A. et al, p. 561, 6, Gershelis E.V. et al, p. 190].

The challenges of the economic factor include a decrease in the share of added value of high-tech and science-intensive sectors of the economy in the gross regional product of the Russian Arctic, weak interaction of the research and development sector with the real sector of the economy, and the discontinuity of the innovation cycle ⁶.

The specific gradient of the military factor evolution in the Russian Arctic has comprehensively influenced the Arctic activities. It is important to note that the military factor is associated with almost all other factors of sustainable development or security of the Arctic society. The evolution of the military factor technically caused an increase in its share in the system of factors and a qualitative transformation of its content, with an emphasis on the main areas, requiring the abandonment of traditional methods of military operations due to environmental, political, humanitarian reasons, and the development of such vectors as information confrontation in the form of "network-centric" strategies, the massive use of non-lethal weapons in the fight against terrorism in the Arctic and the massive use of robotics ⁷. At the same time, the Strategy for the Development of the AZRF and Ensuring National Security for the Period up to 2035 indicates the challenge of increasing the conflict potential in the Arctic region, dictating a continuous increase in the combat capabilities of the groupings of troops (forces) of the Armed Forces of the Russian Federation, other troops, military formations and bodies ⁸.

The authors believe that the share of the environmental factor is underestimated, since environmental problems in the Arctic identify global trends and it is unacceptable to consider them only as national or regional ones. Today, the desire to make a profit dominates in the Arctic geopolitics, and the current trend of de-ecologicalization not only of Russia, but of the whole world is reflected [7, Lukin Yu.F., p. 6]. Climate warming is most evident in the Arctic, as evidenced

⁶ Decree of the President of the Russian Federation of October 26, 2020 No. 645 "On the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2035".

⁷ Mitko A.V. Osobennosti arkticheskikh vyzovov rossiyskoy geopolitiki [Features of the Arctic Challenges of Russian Geopolitics]. URL: https://studref.com/420639/politologiya/osobennosti_arkticheskikh_vyzovov_rossiyskoy_geopolitiki (accessed 14 November 2020).

⁸ Ocampo José Antonio. Super-cycles of Commodity Prices since the Mid-Nineteenth Century. Presentation at the International Monetary Fund. March 20, 2013. URL: <https://www.imf.org/external/np/seminars/eng/2012/commodity/pdf/Ocampo.pdf> (accessed 04 February 2021).

by a significant increase in air temperature, increased river flow, reduced area of ice cover [5, Grinko A.A., p. 562], which certainly requires enhanced environmental monitoring and accounting when making management decisions. In this regard, the issue of increasing the specific weight of the environmental factor is relevant. The transition to sustainable development makes it necessary to include it in the system of basic socio-economic development indicators. The underestimation of the environmental factor in decision-making is largely due to the lack of value reflection of natural capital and environmental degradation in traditional development indicators. The traditional macroeconomic indicators (GDP, per capita income, etc.) ignore environmental degradation. The growth of these indicators is based on technogenic nature-intensive development, thereby creating the possibility of sharp deterioration in economic indicators in future in case of natural resources depletion and environmental pollution [8, Yashalova N.N., Ruban D.Ya., p. 24]. For example, in the study of determining the relevant indicators for compiling the index of environmental safety of the Russian Arctic and ranking (compiling a rating) of the regions of the Russian Arctic, it is indicated that in the Krasnoyarsk Krai (an outsider of the rating), despite a number of environmental problems, there is a very high level within the regional GDP [9, Bobylev N.G. et al, p. 27, 31, 37], which is reflected in the ecological perception of people living there.

Geostrategic challenges

In terms of their geostrategic relationship to the Arctic, states can be divided into three groups (see Table 1), which “compete both among themselves and in the format of international organizations” [10, Smirnov A.I., p. 44; 11, Trubitsina O.P., Bashkin V.N., p. 58].

Table 1

Geostrategic attitude of groups of states to the Arctic

State group number			
	The first group	The second group	The third group
States	The Arctic Five states (Russia, USA, Denmark, Canada, Norway) have access to the Arctic Ocean.	Subarctic states (Iceland, Finland and Sweden) do not have access to the Arctic Ocean, but are members of the Arctic Council.	Non-regional states (Brazil, India, China, Singapore, South Korea, Japan, EU countries, etc.)
Characteristic	They have the right to develop natural resources of the shelf, the expansion of which to the north is the subject of unresolved interstate contradictions.	They do not have rights to the shelf, but they strive to increase their status and influence in the format of the Arctic Council.	They try to maximize their geostrategic attitude to the Arctic, influence the revision of its status, referring it to the common heritage of mankind.

In the first group, the United States, Denmark, Canada and Norway are NATO members; this exacerbates the potential for a military conflict in the Arctic between NATO and the Russian Federation. Canada, Russia, USA, Norway expressed their intentions to develop the Arctic region in the state policy documents, some of the provisions of which coincide in the following positions [12, Komleva N.A., p. 2]:

- Strategic importance of the Arctic region both for the state and for the whole world;
- Leadership in the Arctic and implementation of the task of strengthening its sovereignty over the relevant sector of the Arctic;
- Development of the economy and social sphere, environmental protection, scientific research, improvement of the management structure of their own Arctic sector in a circumpolar dialogue regime;
- Military presence as an integral part of its presence in the region: creation of Arctic groups of forces (land and sea), new bases for such groupings, strengthening of border formations, improvement of infrastructure.

Along with general positions, there are those that distinguish each state of the first group from others in the form of specific strategies, namely:

- The Danish Arctic Strategy, adopted in May 2011 for the period 2011–2020, is based on the Ilulissat Declaration of May 28, 2008, in which scientific, geological data and international law form the basis for future land allocation. This declaration informs the non-Arctic states about the internal nature of issues related to the division of the Arctic and their belonging only to the Arctic countries. It is also noted that a format close to the Antarctic Treaty (1959) will not be considered⁹. The 2011 Danish Arctic strategy showed the first noticeable signs of a national aspiration toward the Arctic as opposed to only a narrowly focused view of Greenland earlier.
- The attitude of the Arctic states towards this region has been transformed in conjunction with the Ilulissat Declaration. The assessment of the Arctic importance has become deeper among the states of the Arctic Council (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States), founded on September 19, 1996, which was reflected in the formation of guidelines for the foreign and domestic policy of the Arctic Eight. The chronological range of states that have formulated their Arctic strategy is as follows: Norway (2006), Russia (2008), Canada (2009), Finland (2010), Iceland (March 2011) and Sweden, Denmark (May 2011), USA (2013) [13, Allayarov R.A., Shubin S.I., p. 199].
- Fundamentals of the state policy of the Russian Federation (RF) in the Arctic for the period up to 2020 and beyond were approved by the President of the Russian Federation on September 18, 2008. The main national interests of Russia in the Arctic include: use of the Arctic zone as a strategic resource base that provides social and economic development of the country, preservation of the Arctic as a zone of peace and cooperation,

⁹ For more about Camp Century, watch 'The U.S. Army's Top Secret Arctic City Under the Ice! "Camp Century" Restored Classified Film'. URL: www.youtube.com/watch?v=1Ujx_pND9wg (accessed 15 November 2019).

preservation of unique Arctic ecosystems, use of the Northern Sea Route (NSR) as a national unified transport communication of Russia in the Arctic.

- Decree of the President of the Russian Federation of October 26, 2020 No. 645 approved the “Strategy for the Development of the Arctic Zone of the Russian Federation (AZRF) and Ensuring National Security for the Period up to 2035”¹⁰ in order to ensure the national interests of the Russian Federation in the Arctic zone, as well as to achieve the goals defined in the Fundamentals of the state policy in the Arctic. There are also detailed measures for the three-stage implementation (2020–2024, 2025–2030, 2031–2035) of the main tasks in the spheres of social, economic, infrastructural, scientific, technological, environmental development, international relations, ensuring both military security and safety from natural and anthropogenic emergencies. The new Strategy has a special regional section that defines the main directions for the implementation of the Strategy for each territory within the AZRF.
- Norway's strategy for the Arctic differs from the Arctic states in the desire to develop the region in an ideological space, along with geographic and economic. This approach is reflected in Norwegian-Russian relations, recognized in the text of Norway's Northern Strategy. So, for the implementation of learning and research processes in educational institutions of Northern Norway, students and scientists from Russia are established the Scholarship of the Northern Regions. In this way, there is a certain degree of consciousness transformation of the fellows, aimed at implementing the policy of the “country of study” within the geopolitical spaces of other societies that are native to the fellows. Norway, actively preparing to the struggle for its interests in the Arctic, uses the so-called “soft” power, not excluding the development of “hard” power [12, Komleva N.A., p. 5].
- The Canadian Arctic Strategy “Canada's Northern Strategy: Our North, Our Heritage, Our Future” [14, Canada's Northern Strategy] focuses on aspects of public policy related to the integrated development of the northern territories. The document highlights the position emphasizing that the north is an integral part of the identity of modern Canada, historically formed even before the arrival of Europeans to the American continent and associated with the continued development of the north by indigenous peoples. This position is supported by the majority of Canadians, who consider the confirmation of the rights to the Arctic as a priority of the foreign policy of modern Canada [15, Konyshov V.N., Sergunin A.A., p. 77]. As an Arctic country, Canada claims an active leadership role in shaping the governance, sustainable development and environmental pro-

¹⁰ Decree of the President of the Russian Federation of October 26, 2020 No. 645 "On the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2035".

tection of the strategic Arctic region, as well as interacting with other countries to advance its interests [16, Statement on Canada's Arctic Foreign Policy].

- The US Arctic Policy Directive of January 12, 2009 emphasizes that “the United States has broad fundamental national security interests in the Arctic and is prepared to act independently or in alliance with other states to protect these interests” ¹¹ [15, V. Konyshev. N., Sergunin A.A., p. 66]. The US government's strategic priorities in the Arctic are reflected in the US National Strategy for the Arctic Region. For example, the security sphere includes anti-missile defense and warning, deployment of maritime and air systems for strategic maritime transportation and strategic deterrence, operations to ensure maritime security and freedom of the seas, including the NSR. In general, the strategy focuses on ensuring the country's security interests, responsible management in the context of protecting the Arctic environment and preserving its resources, and developing international cooperation in the Arctic ¹². Innovations regarding US government planning for the Arctic region were announced on June 6, 2019 in the Arctic Strategy of the US Department of Defense, which updated the previous 2016 strategy. The new document contains a secret appendix and context of the rivalry of different countries, security threats from Russia and China, highlighted by Secretary of State Michael Pompeo in Finland ¹³. Previously, the Arctic Council had hardly discussed security issues, mainly addressing climate change, environmental protection and sustainable development in the region. In this regard, since 2019, there is a new tendency to take security issues into account in the context of national rivalries ¹⁴.

Threats and opportunities of GPR for hydrocarbon development in the Arctic

The Arctic has enormous oil and gas reserves and is believed to contain about a quarter of the world's undiscovered oil reserves: most of them are located in Alaska, northern Canada, Norway and Russia, including significant amounts in offshore areas. Continuing reduction of sea ice is likely to result in increased oil and gas activity on the shelf, especially in terms of increased offshore oil transportation as the navigation season lengthens and new sea routes open [17, Bashkin

¹¹ National Security Presidential Directive (NSPD-66) and Homeland Security Presidential Directive (HSPD-25). 2009. January 12. URL: <https://polarconnection.org/national-security-presidential-directive-66homeland-security-presidential-directive-25-january-2009/> (accessed 15 November 2020).

¹² Natsional'naya strategiya SShA dlya Arktiki: put' k sotrudnichestvu. Mezhdunarodnyy ekspertnyy Sovet po sotrudnichestvu v Arktike [US National Strategy for the Arctic: A Path to Cooperation. International Expert Council on Cooperation in the Arctic]. URL: <http://www.iecca.ru/zakonodatelstvo/voprosy-prava/item/146-natsionalnaya-strategiya-ssha-dlya-arktiki-put-k-sotrudnichestvu> (accessed 15 November 2020).

¹³ Looking North: Sharpening America's Arctic Focus. Speech. Michael R. Pompeo, secretary of state. Rovaniemi, Finland. May 6, 2019. URL: <https://www.state.gov/looking-north-sharpening-americas-arctic-focus/> (accessed 14 November 2020).

¹⁴ Gorobets A. Novaya arkticheskaya politika SShA [New US Arctic Policy]. URL: <https://icds.ee/ru/novaja-arkticheskaja-politika-ssha/> (accessed 15 November 2020).

V.N., Trubitsina O.P., Priputina I.V., p. 110]. However, warming in the Arctic has an opposite side, which is the gradual destruction of the Polar infrastructure, created in permafrost conditions¹⁵.

Mass attention to hydrocarbon projects of the Arctic shelf is based on the likelihood of discovering the largest deposits here, while onshore discoveries in the last decade are characterized by small reserves. Easily accessible oil and gas resources have already been discovered and used. It is predicted that fossil fuels will remain a significant source of energy until 2050, against the backdrop of global energy demand, which will grow by more than a third by 2035 alone. As the owner of one-third of the world's known natural gas reserves and the largest oil-producing country in the world, Russia is interested in the Arctic as an area of new opportunities, along with both geopolitical and geo-ecological challenges. This region will play a vital role in meeting the world's energy supply in the next few decades [18, Trubitsina O.P., Bashkin V.N., p. 277].

At the same time, it is extremely important to take into account the environmental factor, since in connection with the expansion of oil and gas development projects, especially on the sea shelf, the ecology of the Arctic may suffer. According to the Strategic Action Program for Environmental Protection in the Russian Arctic, "... the increased rates of the oil and gas industry development in the Arctic zone of the Russian Federation (AZRF) in the last decade and the planned development of work on the shelf of the Barents Sea and other Arctic seas create a threat of escalation of the local scale of environmental degradation into a zone-wide one. At present, the direct flow of crude oil into the marine environment, freshwater reservoirs and landscapes of the coastal areas of the Russian Arctic is of a limited nature and is not considered as a factor that significantly complicates the general zonal ecological situation. The danger of pollution of the marine environment with oil is associated with plans for its production on the continental shelf of the Russian Federation" [19, Trubitsina O.P., p. 88].

Activity in the oil and gas industry of the Russian Arctic has been growing in the past few years, and the GER is also growing accordingly. This leads to the formation of "hot spots" and "impact zones", characterized by a high level of chemical pollution of the environment and transformation of the natural geochemical background, degradation of marine flora, vegetation, soils, uncontrolled development of erosion, cryogenesis, formation of sinkholes in vast areas, influx of pollutants in the food chain, a high level of morbidity in the population, air pollution with strontium compounds, heavy metals (in particular mercury), oil products, etc. [20, Morgunov B.A., p. 35; 21, Trubitsina O.P., Bashkin V.N., p. 144].

Thus, it is extremely important to strengthen the importance of the ecological position in the general structure of geopolitical factors affecting the sustainable development of the Arctic region. Currently, many experts in the world are investigating the assessment of probability of en-

¹⁵ Mitko A.V. Osobennosti arkticheskikh vyzovov rossiyskoy geopolitiki [Features of the Arctic Challenges of Russian Geopolitics]. URL: https://studref.com/420639/politologiya/osobennosti_arkticheskikh_vyzovov_rossiyskoy_geopolitiki (accessed 14 November 2020).

vironmental hazard in the absence of an unambiguous answer about the impact of chemical pollution of modern industries on natural ecosystems. However, regardless of the type and nature of production, an enterprise is an element that determines the structural relationship between it and natural environment, while the fragile nature of high latitudes is extremely vulnerable to anthropogenic impact [22, Trubitsina O.P., p. 21].

Globally, the GPR is caused by global processes and trends in use of natural resource potential of the Arctic, both in the interests of the world and individual countries. Possible manifestations of the GPR are the violation of the system of strategic stability in the Arctic geostrategic space. Thus, the GPR represents the likelihood of a change in the geopolitical situation at the regional and global levels, expressed in unfavorable conditions (risk of a hybrid war, military clashes, etc.) or additional opportunities.

The situation with the NSR has contradictory legal subtleties. Norms of the UN Convention on the Law of the Sea of 1982 (hereinafter the Convention) are on the side of unrestricted exploitation of this highway by ships of foreign states. In accordance with the Convention, ships of any states have the right to free navigation within the exclusive economic zone of the coastal state, which is equal to the distance of 200 nautical miles from the coastline minus 12 nautical miles of the territorial sea and 12 miles of the adjacent zone. According to this rule, part of the NSR can indeed be freely used by foreign vessels, including military ones. However, the complexity of the situation is that the sea route along the northern borders of Russia is very changeable and its configuration depends on freezing of the seas, weather and hydrological conditions.

In response to foreign claims, the Russian leadership declares the northern transport highway “a historically established national transport communication”. It also refers to Article 234 “Ice-covered areas” of the Convention. In an extreme climate and severe ice conditions, coastal countries (in this case, Russia) can independently regulate shipping to prevent possible environmental damage. Coastal countries are responsible for Safety and Disaster Prevention. Borders are legally described as “ice-covered areas”. In addition, according to the tradition that has developed over the centuries, the powers over the territory are transferred to the pioneer state. From this point, Russia has much more legal “bonuses”.

But the United States, along with the northern countries of the NATO bloc, is not entirely satisfied with this. NATO warships are increasingly appearing in the region, guided by a one-sided understanding of the provisions of the Convention. Potential objects of control include not only the NSR itself, but also rich deposits of minerals hidden in the continental shelf. Trainings are being organized in the neutral waters of the Arctic zone, in which not only NATO countries participate, but also “neutral” Sweden and Finland.

According to the Russian defence ministry, the intensity and scale of NATO's operational and combat training in the Arctic in 2019 has increased by 17%, while intelligence activities have

increased by 15%. Missile defence systems are being strengthened in coastal states. Some countries are resuming underwater patrols in the region.

Since 2018, the second operational fleet of the US Navy has been re-established and its area of responsibility included part of the Northern Sea Route off the Russian coast. By 2022, the United States together with the Europeans are to form a joint NATO command "Atlantic", which, together with the support command, will ensure the rapid transfer of American troops to Europe. At a distance of 60 km from the Russian border, the Norwegians are building a new radar station. In addition, Norway doubled the number of US Marines deployed in 2018. British submarines with "Tomahawks" have been patrolling the Arctic since 2016, while ground units are honing their "war in the cold" skills in Norway¹⁶.

Thus, the main threats and opportunities of the GPR are as follows:

1. Ensuring access to sufficient reserves of hydrocarbon raw materials in the Arctic from various states, obtaining control rights over its natural resources

Threats:

- Depletion of traditional hydrocarbon deposits (for example, depletion of "light" oil and low-permeability gases resources;
- The need to search for new oil and gas sources and transfer of exploration to more inaccessible areas;
- Loss of control over the Arctic territories;
- Military confrontation of the polar countries on issues related to the delimitation of the Arctic shelf and oil and gas resources located on it.

Opportunities:

- Increased development of unconventional hard-to-recover deposits;
- Expansion of the resource base, including by increasing the share of oil and gas production in the Arctic regions with difficult conditions and low development;
- Development of advanced technologies to exploit new Arctic reserves, previously considered unprofitable due to difficult natural and climatic conditions;
- Ensuring stable access to hydrocarbon reserves;
- Resolving controversial issues of the Arctic territories ownership by global consensus or consensus of global policy actors;
- International cooperation with the attraction of foreign investments and technologies while maintaining the national interests of the state;
- Development of necessary technologies and resources to reduce the level of GPR.

2. Uncertainty of the legal status of the Arctic region

¹⁶ Fedorov E. Severnyy morskoy put': l'dy tayut – napryazhennost' rastet [Northern Sea Route: the Ice is Melting — the Tension is Growing]. URL: <https://topwar.ru/178138-severnyj-morskoy-put-ldy-tajut-napryazhennost-rastet.html> (accessed 04 February 2021).

Threats:

- Increase and complication of the current position of the geopolitical interests' intersection zone of the main geostrategic and regional players;
- Uncertainty in the interpretation of unified international requirements and mechanisms for their application.

Opportunities:

- Resolving controversial issues of the Arctic territories ownership by global consensus or consensus of global policy actors;
- Unification of regulatory requirements and creation of a unified international mechanism for regulating the companies' activities in the Arctic.

3. GER as one of the priorities of attention to Russia's actions in the Arctic**Threats:**

- Putting pressure on Russia in the context of its plans to develop Arctic infrastructure and build an oil and gas complex. The goals and actions of the Arctic states are aimed at proving lack of legal grounds for Russia to develop offshore fields, to use the NSR as an internal passageway, as well as at blaming Russia for its inability to ensure environmental safety when developing deposits in the region;
- Threat of Russian "hybrid war" in the Arctic in the format of coordinated use of political-diplomatic, information-psychological, economic and power tools to achieve strategic goals. In NATO expert circles, as a rule, the concept of "hybrid wars" is already used to denote the role of Russia in crisis points;
- Manipulation of GER through geopolitical provocations in the context of inability of Russian oil and gas facilities to ensure environmental safety in the Arctic. For example, Greenpeace activists advocate the Arctic development as a whole, but oppose individual projects that damage the region's ecology. At the same time, the danger of the project is determined by Greenpeace itself. As a rule, Russian projects (Gazprom and Rosneft) regularly find themselves among the environmentally hazardous ones;
- The sanctions policy against Russia by the European Union and the United States is also aimed at weakening influence in the Arctic region.
- In connection with the above point 4, low oil prices are also perceived by foreign initiators as one of the factors limiting Russia's resources in the NSR development.

Opportunities:

- Russia has developed special rules for the passage of foreign military vessels along the NSR as a retaliatory measure:
 - Firstly, notification of a warship visit must be delivered at least 45 days in advance. The document must reflect the ship's name, sailing time and a clear route. In addition, the notice separately describes the vessel's dis-

placement, draft and propulsion parameters. Formally, all this is required by Article 234 "Ice-covered areas" of the UN Convention.

- Secondly, a Russian marine pilot is mandatorily sent to a military vessel. The movement of the vessel is under the full control of the Russian Navy. In case of an emergency, icebreakers will come to the aid of a military vessel.
- Development of national innovative technologies, know-how, BAT in order to improve the environmental safety of oil and gas development of the Arctic by Russia and reduce the aforementioned threats.

Conclusion

In the modern world, the development of the Arctic region should be aimed at the formation of sustainable development of the polar territories, which is facilitated by the rational placement of production industries (primarily oil and gas), which meets the protection and restoration of the environment, as well as new geopolitical conditions.

The key geopolitical factors affecting the sustainable development of the Arctic are geographic, economic and military. It is necessary to strengthen the role of the environmental factor. Moreover, the environmental problems of the Arctic are an indicator of global trends, and they cannot be regarded as purely national or regional. Despite geopolitical constraints, the strategic importance of the Arctic is growing. International political, military and legal disputes over the possession of its territories, connected with economic interests, are intensifying.

The most important risks of oil and gas development in the Arctic are gas exploration projects, the analysis of their transformation into opportunities and threats is one of the priority tasks of oil and gas facilities. At the same time, the authors draw attention to the following key GPRs: 1) ensuring access to sufficient reserves of hydrocarbon raw materials in the Arctic from various states, obtaining control rights over its natural resources; 2) the uncertainty of the legal status of the Arctic region; 3) GER as one of the priorities of attention to Russia's actions in the Arctic.

Analysis of GPR in terms of their transformation into opportunities is a priority task of oil and gas facilities in the implementation of Arctic field development projects, especially in the context of a cyclic raw materials supercycle of energy prices falling in the world.

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Arctic Frontier: Ice Silk Road and Its Role in China's Advance to the Arctic *

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Abstract. In recent circumstances of world climate change, Arctic zone has become of great interest for those countries actively involved in its development. With the constant climate warming, deglaciation and increasing of sea-level, commercial transport ways through the Arctic Ocean become a possible economic solution for large exporting countries. Due to importance of north passage for China, Beijing proclaimed itself as a "near-circle State" to get advantages from the development of Northern Sea Route (NSR) that can provide direct access to the Arctic zone and its natural resources. Considering this, China has recently published its White Paper on Arctic Policy, where it announces "Ice Silk Road" to be the official Arctic strategy of China. This article underlines the major intentions and interests of China in its Arctic strategy. One of China's intentions is an enhancement of the Northern Sea Route, that still raises concerns from the specialists whether it can be applicable part of Arctic strategy of China. This article approves that according to Ice Silk Road's connotation Russia should play an indispensable role in China's advancement to the Arctic zone through NSR. Moreover, the author investigates the influence of "Ice Silk Road" on Sino-Russian relations. Both China and Russia appear to prioritize this strategy to ameliorate economic situation and infrastructure in less-developed regions of two countries. Though, economic development of Arctic coastal cities is one of the priorities of the Russian Federation, it remains to be attentive to the involvement of China in the development of the region, mainly out of fear that it will influence its legal position in the Arctic region. Meanwhile, it stays important that two governments come to a consensus concerning the legislative basis of NSR usage and have a deep assessment of advantages and disadvantages that come out as a result of their partnership.

Keywords: Arctic, China, Ice Silk Road, Arctic strategy of China, Sino-Russian relations, Northern Sea Route.

Introduction

New Ice Silk Road strategy mostly aiming to explore and exploit northern marine passages by China jointly with Russia was announced by Mr Xi Jinping on July 4th 2017 during his visit in Moscow and further was named as "Ice Silk Road" ("bingshangsichouzhilu")¹. The following publishing of "Chinese Arctic Strategy" in White Book of China on January 26th 2018 only strengthened this position of the Chinese Government upon the Arctic. The initiative is partly arising from the well-known Chinese initiative "One Belt-One Road" (Yi dai - Yi lu) that implies the expanding of Chinese presence not only on the way of ancient silk road but all over the world.

Publishing its strategy in the official document is a historically important moment for China that wished to announce its interests in the Arctic exploration for all the world. In its desire to obtain economic profit from cooperation with Nordic countries and the Russian Federation in Arctic zone, China wants to be in the forefront of environmental, social, technological and regional activ-

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¹ "Xi's Moscow Visit Witnesses Stronger China-Russia Ties". URL: http://www.chinadaily.com.cn/world/2017xivisitgermany/2017-07/05/content_30001609.htm (accessed 11 November 2019).

ities in the region. Therefore, the Arctic strategy of China is a complexity of all aspects of possible cooperation of China in various Arctic fields. Notably, open announcement of its Arctic strategy is China's answer to bipolar logic where two worlds exist as antagonists: "Arctic Countries vs. Non-Arctic countries"[1, Liu G., Yu T., p. 93].

With the first-ever publishing of the document presenting its Arctic intentions, China is stepping onto the new path of the cooperation with other countries, especially the Russian Federation, that is to become its significant partner in commercialization of Arctic routes and deepening its knowledge about the Arctic region.

For a long period, Arctic region has been considered by distinct countries as a remote land, but these days have been showing a gradually arising geopolitical and economic interest to this region from different sides of Globe. The People's Republic of China (henceforth PRC) became one of these interested sides. Its increasing role in the Arctic is dictated by multiple interests: including strategic, economic, environmental, scientific. Having such enormous interest in Arctic exploration and exploitation is typical for China since in its more than 5000 year-history Chinese nation has been always having such traits as a friendly curiosity in matters that seemed to be interesting either in economic aspects or strategic ones. During a long-term trade war with the United States of America (USA), Chinese geopolitical interests have become prioritized as well as a result of China's eager to play a significant role in the power balance of that region along with Russia and the USA. In so doing, Arctic will become another "place of arms" for China in showing its strategic importance for another world.

What is "Ice Silk Road" ² Initiative?

On 26th January 2018, China's State Council published one of the most essential geopolitical assets, which was named "White Paper on China's Arctic policy" (Chinese: "baipishu"). This date can signify a watermark moment for China's history of Arctic exploration. China had proclaimed the building of "Ice Silk Road" almost six months before publishing its significant document during the meeting of Chinese President Xi Jinping and Russian Prime Minister Dmitrii Medvedev. Mr Xi strengthened that elaboration of Northern Sea Route, which is an important channel of "Ice Silk Road" (henceforth ISR) initiative ³. This strategy has become one of the extensive branches of China's "Belt and Road Initiative" (henceforth: BRI) that has important economic value for the country. Globally speaking, ISR was proposed by Chinese and Russian leaders for the sake of cooperation and development in Arctic regions ⁴. From China's perspective it can be only completed with the

²In White Paper this Initiative is called Polar Silk Road, while the author considers "Ice Silk Road" translation to be more accurate and appropriate for its Chinese appellation.

³ China, Russia agree to jointly build "Ice Silk Road". URL: http://www.xinhuanet.com/english/2017-07/04/c_136417241.htm (accessed 15 April 2020).

⁴Zhang Y. Ice Silk Road Framework Welcomed by Countries, Sets a New Direction for Arctic Cooperation. URL: [http://www.globaltimes.cn/content/1144928.shtml#:~:text=In%202013%2C%20China%20proposed%20the,and%20Road%20Initiative%20\(BRI\).&text=After%20a%20long%20period%20of,and%20development%20in%20the%20Arctic](http://www.globaltimes.cn/content/1144928.shtml#:~:text=In%202013%2C%20China%20proposed%20the,and%20Road%20Initiative%20(BRI).&text=After%20a%20long%20period%20of,and%20development%20in%20the%20Arctic) (accessed 28 June 2020)

cooperation of different countries in the facilitation of Northern Sea Route through Arctic Ocean⁵. In this matter, Northern Sea Route is becoming one of the key assets for implementing ISR strategy of China. This corridor (it is also called Arctic Blue Corridor) will be linking China with Northern Europe, North America, and Canada [2, Erokhin V., Gao T., Zhang X., p. 4].

Initially, this concept was proposed by the Russian side at a conference “The Arctic: Territory of the Dialogue”, but was neglected by the Chinese side [3, Tillman H., Yang J., Nielson E.T., p. 347]. Russia, knowing its wide potential of natural resources hidden in Arctic region and growing importance of NSR’s development as the main commercial artery in the future, was the first country to trigger its concept in the mind of the PRC government. Russia has been promoting its shipping lane along the NSR from 1980, but with not much success due to the climate conditions in Arctic, poor seaports conditions, and mainly because of its extremely high charges [4, Hong N.]. After China had obtained its permanent observer status in the Arctic Council, the interest in the Sino-Russian cooperation in Far North has begun more evident. In summer 2013, a commercial vessel of China Ocean Shipping Company (COSCO) took its first trip from Chinese port Dalian to Rotterdam using NSR. The traversing took 33 days – about 2/3ds of the time the voyage normally takes⁶. This voyage had proven the possibility of developing commercial trips through NSR.

The initiative was also welcomed by Arctic countries, especially small ones like Iceland or Denmark. Though the latest has started to worry about the recent growing presence of China in Greenland, they still were willing to discuss future opportunities that can be provided by closer cooperation with China in Arctic [Tillman H., Yang J., Nielson E.T., p. 350]; [5, Sorensen C.T.N., p. 8]. Though Arctic Council remained more conservative in the matter of deciding vote of non-Arctic countries, the economic benefits and development in environmental and technological issues that cooperation with China can bring was the frame of expressed willingness of Arctic countries to cooperate with China.

With the publication of White Paper China strengthened its desire to assert China’s position about the presence in the Arctic. The country had stated that there is no single comprehensive treaty so far that can unite Arctic Affairs in one piece⁷. Near this time China had started to penetrate the idea of being “Near-Arctic State” geographically, pointing out that its territory is situated very close to the Arctic circle. Therefore, nowadays ISR initiative is becoming more than just mutual economic cooperation of China and Arctic states. But to go deeply into this concept we need to start from the NSR as the fundamental asset of China’s desire to cut its way to North.

⁵ The State Council “Full Text: China’s Arctic Policy”. URL: http://english.scio.gov.cn/2018-01/26/content_50313403_5.htm (accessed 20 February 2020).

⁶ Lily Kuo. “A Chinese Cargo Ship is Sailing Across the Melting Arctic to Europe”. URL: <https://qz.com/114206/a-chinese-cargo-ship-is-sailing-across-the-melting-arctic-to-europe/> (accessed 29 May 2020).

⁷ The State Council “Full Text: China’s Arctic Policy”.

Advantages of Northern Sea Route for China

- **Shrinkage of transport routes distance and reduction of transport costs, subsequently.** Nowadays, the only used sea routes for China are those through Malacca strait, Suez Canal and the Indian Ocean. If the vessel is overweighed, it needs to pass through Cape of Good Hope and only then reach Western world. These long-distance travels lead to increased time and transportation costs. Usage of Northern Sea Route would substantially relieve transportation costs by reducing the distance by 1/3 of the existing routes [6, Cui, Shi, Geng K., Zhang R., p.30]. According to author, transport route from Shanghai to ports of Northern Europe could be shortened by minim. 25% and max. 55% that will help to save from 53 bln to 127,4 bln USD every year. Moreover, using this route may shorten transportation time by 40% [7, Schøyen H., Bråthen S.]
- **Security enhancement for passing vessels.** Existing religious and cultural disputes in the regions where transport routes are currently located cause much of the risk for transport vessels. There are multiple unstable factors such as: piracy in the regions between the Indian Ocean Mediterranean Sea, terroristic attacks etc. Considering that cargo ship should pass a certain number of countries where these complex issues have not been settled yet, PRC bears the heavy economic risk. In this case, NSR provides more safe options since territories by the Arctic Ocean have homogeneous cultural and religious aspects, thus are safer for passing ships. Consequently, "Ice Silk Road" would to a certain extent diminish transport risk and increase transport safety, thereby contributing to the development of China's external trade with Western countries.
- **Providing better conservation of imported perishable products in Arctic weather conditions and reduction of equipment costs, subsequently.** While the transportation of some perishable goods can be difficult in the conditions of southern waters, Northern Sea Route would provide better preservation of goods such as fish or meat shipped from Northern countries to China. Recently, Danish shipping operator Maersk has completed several trials of sending cargo through NSR to Russia's port Saint-Petersburg from the Far East. The company admitted that in circumstances of increased demand for perishable goods to be transported to China and vice versa the alternative of NSR may be viable in the nearest future⁸. Though Maersk has been taking the position of not considering NSR to be a feasible commercial alternative to existing east-west routes, recent development in investigating the possible advantages of this route promises that more and more companies could be interested in its usage.
- NSR possesses high potential for countries to use, though for now remains useful only in case of high fuel price. In a view of low fuel price, Suez Canal and the Indian Ocean are yet to be used within the most foreseeable future. Nevertheless, the attractiveness of NSR is left on China's agenda. One of the main challenges for using this route is its high costs for convoy vessels' assistance and other supplementary fees, such as ice pilot assistance, for example. Yet, the attractive

⁸Shipping company Maersk to return to Arctic Northern Sea Route This Summer. URL: <https://www.highnorthnews.com/en/shipping-company-maersk-return-arctic-northern-sea-route-summer> (accessed 16 April 2020).

feature is NSR's unfixed tracks. Considering weather conditions tracks can be changed in favor of cargo ships.

- Another advantage is belonging of this route to the country which has close friendship ties with PRC – Russia. It means that China and Russia must maintain their friends' bond on the highest level since developing and exploiting this Route would bring huge benefits for both in the future.

China's Concerns in the usage of Northern Sea Route

- **Environmental concerns.** The Arctic Ocean is the shallowest and the most severe Ocean on the planet. Its link to the Pacific Ocean through narrow Bering strait can pose problems for cargo ships. Hence, for enhancing commercial routes through NSR the types of ships should be specified.
- Further still, rapid climate changes have worsened the problem of deglaciation making the natural environment of Arctic too frangible. If the deglaciation continues with high-speed it will damage environmental balance that in its turn will influence economic stability and development of the whole world. For that reason, it stays important to research the possible negative influence of commercialization of NSR on the existing environment in the Arctic.
- **Weather challenge.** It is impossible to neglect the temperature factor of Arctic and its vast ice-coverage within almost 8 months in a year. According to the Danish Meteorological Institute within the lowest temperature in 1958 amounted to - 40°C in January. In 2019 January temperature was substantially higher (- 23°C) , which supports the fact of possible using NSR in the nearest future. Nevertheless, weather conditions in the Arctic remain an obstacle for technological and economic aspects.
- **Geopolitical issues and legislative obstacles.** To enhance the smooth passage through Arctic Ocean China's need to regulate legislative moments with its counterparts. Nowadays, the existing complex geopolitical system is one of the significant challenges for China to promote its "Ice Silk Road". Though the number of countries along the Arctic Ocean is significantly less than its number along southern waters, and there are no obvious cultural and religious disputes between countries near-Arctic circle, geopolitical tension cannot be ignored in the light of the recent increase of attention to the Arctic. Within recent years, large Arctic countries such as Canada, Russia and the USA have already announced their policies towards continuous exploitation of Arctic region, but from a geopolitical point of view they didn't come up with the possible solution for mutual peaceful exploitation and exploration of Arctic. Moreover, while China confers the right on freely using Arctic water areas, even using military assistance for supporting its potential infrastructure objects , Arctic-circle countries are taking steps for protection of their geopolitical interests. For example, President Putin issued the executive order of March 5th 2020 that is called "Basic Principles of Russian Federation State Policy in the Arctic to 2035" . This Order lists challenges for national security in the Arctic and provides the ways to ensure it. One of the listed concerns of the Russian Federation is building up a military presence in the Arctic by some foreign states and an increase of conflict potential in the region. Taking into account increasing geopolitical tension in

the Arctic region and the fact that NSR also includes exclusive economic zones, territorial and internal waters, it seems unlikely that Chinese free presence will be welcomed there. According to national and international laws China will still need to even ask for authorization for using waters of Arctic littorals for its cargo vessels, therefore we can't talk about the presence of Chinese military activities in the foreseeable future in this region. Therefore, usage of NSR for external trade has not been yet secured for Chinese vessels, posing difficulties and challenges for "Ice Silk Road" initiative.

- **Problems for heavy-tonnage ships.** The passage which China needs to use is going through the narrow Bering strait and other Arctic straits along the coast of Russia. It is suitable only for vessels with the maximum draft of 12 meters, as several straits like Sannikov Strait or the area near Medvezhyi Islands can't be navigated by the vessels with deeper drafts. Heavy-tonnage ships could sail through more northern passages situated at higher latitudes, but those paths are still uninvestigated for commercial use and require more profound surveys.
- **Bureaucratic obstacles.** Even considering potential advantages of using NSR we can't neglect the fact that there is still no improvement in bureaucratic sphere upon the usage of this route. The processing time for submission to obtain permission for navigation through NSR is relatively long. The waiting time for icebreaker assistance can vary as well. In this stance, NSR can't be seen as a route with economic potential for China. Though, China has started to build its own icebreaker fleet, the position of Russia that considers NSR as "historically shaped national transportation corridor" where all vessels should navigate under Russian control will still pose bureaucratic difficulties to China.

What benefits can China obtain from Ice Silk Road initiative?

Importance of the Arctic region for the PRC has been dictated by several explicit factors. Firstly, the Chinese government is highly interested in searching **for new oil and natural gas springs**. The Arctic possesses a vast deposit of natural resources: it is estimated that it owns 1/4th of world undiscovered reserves of natural resources (along with metals and precious metals), 1/4th of world deposits of natural gas and 10% of hidden oil reserves [8, Gao T.]. The Arctic is estimated to provide up to 60% of the country's ever-growing need for fuel. Chinese companies are involved in barely every project in the Arctic region in various countries. PRC has an interest in buying shares in extracting companies like project Yamal, Nexen in Canada, Elkem in Norway, Kvanefjeld project in Denmark etc. In this case, the most ambitious project that could benefit from the implementation of ISR strategy is the integrated project "Yamal LNG", conducted by Russian independent natural gas producer NOVATEK (owns 50,1%), French conglomerate Total (holds 20%), Chinese National Petroleum Company (CNPC – owns 20%) and China's Silk Road Fund (holds another 9.9% of shares)⁹. Further elaboration of ISR along with NSR development will contribute to the faster natural gas extraction and its shipment to Chinese and East Asian market.

⁹All information on Yamal LNG project can be obtained at its official web page: <http://yamallng.ru/en/>.

Secondly, 90% of all world trade goes between Asia, Europe and North America, hence for China which controls the largest piece of this trade, the Arctic Ocean has currently the highest value since the cost of shipping through it could be much lower for Chinese vessels [9, Kalfaoglu R., p. 113]. For this reason, in the perspective of the ongoing process of Arctic's development, Northern Sea Route (NSR) could become an important transport link that connects Asia, Europe and North America. This fact has much significance for the PRC since having an alternative link to the main importers of Chinese goods and exporters of oil and gas is crucial nowadays for fast-growing economic needs of China. In 2014 the amount of transported cargo via NSR amounted to 3982 tons, in 2015 this quantity increased to 5432 tons, in 2016–7266 tons. In 2020 according to estimates the amount of transported cargo should reach 31 000 tons, and in 2030 – 51100 tons¹⁰. During these times when China Southern sea is a matter of dispute between the PRC and its neighbours in the context of islands sovereignty and Suez Canal regional instability, this alternative route of shipping is of fundamental importance for China.



Fig. 1. Northern Sea Route vs. Existing route¹¹.

Another and third aspect that binds the PRC with its engagement into the Arctic is climate change – a phenomenon which has recently become of the highest rank in China's internal policies. By proclaiming itself a "near-circle" State PRC underlines that climate fluctuations in the Arctic could negatively affect China's North-East, thus emphasizing it aspires to combat climate change consequences with other players. Apart from that, China declared itself to be closer to Arctic with the aspiration to win from drastic climate fluctuations in the nearest future. According to studies [10, Mokhov I., Khon V., p. 94], climate change may affect the conditions of navigation in arctic waters, that can lead to the prolongation of navigation period. It is estimated that by the second half of XXI century the Arctic Ocean could be free from ice¹². For the PRC it is a chance to implement its strategy of creating alternative route for its bulk cargo ships. In these circumstances, the

¹⁰ Zhang T., Chen X. Why did the "Ice Silk Road" is Becoming Popular? URL: http://www.china.com.cn/opinion/think/2017-12/23/content_50157099.htm (accessed 24 April 2020).

¹¹ What is the Northern Sea Route? *The Economist*, 24 September 2018. URL: <https://www.economist.com/the-economist-explains/2018/09/24/what-is-the-northern-sea-route> (accessed 06 June 2020).

¹² Ratnikov A. From the North. Will Russia Be Able to Use Advantages of the Northern Sea Route. URL: <https://lenta.ru/articles/2016/03/15/northsearoute/> (accessed 14 May 2020).

environmental factor is incorporated into economic interests of China that is eager to develop NSR with the help of the Russian Federation (Fig. 1) Environmental implications are not only seen in the ice melting and changing conditions for sea Routes that bring more benefits than losses but more evidently climate change is the key idea for China for remaining an active member of Arctic community as a "near-Arctic" country¹³. By naming itself so China is planting an idea that climate change affects its lands more than we could have imagined.

The environmental factor is also playing its enormous role in the further development of Chinese tourism. Thus, China will benefit from the vast deglaciation of Arctic zone in its eagerness to develop Arctic tourism. Chinese tourists have long ago become one of the important profit sources for the whole world. Engagement between Chinese actors and Nordic and Russian communities is already happening not only on the base of economic development and trade deals but also in the tourist domain that is a strong driver for economic development. With the economic rise of Asia and broad shift of power from the West to the East [11, Smith P.] have led to the fact that more and more Chinese families have resources to travel around the globe. Correspondingly, Chinese tourism is playing more and more significant role in Nordic countries, especially in the Russian Federation where tourism from the East Asia (mostly, China and South Korea) has become a stimulus for market and infrastructure development recently. China's embeddedness into Arctic development will not only attract investments into tourism development but also contribute into economic diversification of Nordic states and Russia - those countries that highly depend on natural resource extraction [12, Jørgensen M.T., Bertelsen R.G., p. 167].

Apart from economic benefits, Chinese interest in Arctic development is going far beyond its monetary gains. The recent engagement of China in cooperation with Nordic countries has raised a high attention of the world to implicit drivers of Chinese Arctic interest. Geopolitical agenda is awaited to be one of them. Rising confrontation of the U.S. and China accompanied by the tendency of rivalry between Russia and the U.S. make these estimations of Chinese crave to stand on the firmer position in Arctic balance of powers more feasible. Certain scientists express opinions that China needs the development of NSR not only due to its strong economic needs but also in eager to enhance its strategic geopolitical position and future military role in the region¹⁴. China has raised its interest in the geopolitical activity in the Arctic region only in the mid-2000s, though it has been a member of the Spitsbergen Treaty from 1925. This immediate turn to the High North can be explained by the recent rising global powers status of China that allows the PRC to start dictating its conditions on the world scene. Escalation of the Sino-US rivalry amid Trade War and further aggressive views of the US towards "Chinese Virus" is linking the PRC to its firm cooperation with the Russian Federation, which has the longest and the most stable shipping passage in its waters. Though geopolitical aspirations of China have become one of the recent

¹³ Hallding K. "China's Arctic Ambitions – Actors, Drivers and Strategies? Stockholm Environment Institute." Sweden. 05 March 2013. URL: <http://www.arcticfutures.se/?tag=stockholm-arctic-seminar> (accessed 14 June 2020).

¹⁴ Trenin D. Russia and China in the Arctic: Cooperation, Competition, and Consequences. URL: <https://carnegie.ru/commentary/81407> (accessed 18 June 2020).

«perils» between members of Arctic Council, notably Russia, it's highly unlikely to see Chinese Naval Forces in Arctic waters in the most foreseeable future. China's eager to participate in activities of this region are mostly dictated by a peaceful economic desire to fulfil its needs and serve its interest.

I cannot neglect Chinese aspiration to boost its scientific and technological research in the terms of Arctic aspect, though from the nearest perspective it cannot be a key driver for China's Arctic ambitions. The most prominent strategy that China wants to stick to is to develop its ice-breaking fleet, that will surpass Russian icebreakers in its technological equipment and technical power. This is rather the area of cooperation of China with Northern European countries, Canada and the USA than the aspect of Sino-Russian cooperation [13, Kobzeva M., p. 100]. However Chinese company COSCO has already shown its unveiled interest for NSR shipping lane. In 2019 it planned to conduct 14 voyages via NSR in a period of July-October¹⁵, and this figure will be increasing from year to year. COSCO aims to be a major partner in the transporting LNG through NSR, investing in projects for building cargo ships with other companies. In 2017 it ratified a plan to build a joint fleet with Mitsui OSK that will deliver cargoes from Yamal LNG [Tillman H., Yang J., Nielson E.T.]. Development of Chinese own icebreaker fleet and the most prominent cargo fleet is the signal of Chinese growing interest and belief in future of NSR shipping, even though nowadays the majority of experts still doubt the possibility of economic advantages of this route. Indeed, to date, the approximate cost of Russian icebreaker is 4.5 mln rubles per day (around \$ 7 000 USD). That is why, the Chinese place a stake on its fleet development, that can reduce shipping costs while using Northern passage.

The last but not the least aspiration of the PRC is the development of its North-East region by being actively involved in ports rejuvenation and building transport corridors connected to the NSR. In this case, China not only seeks profits from the development of Russian ports along the Route but also to provide better conditions for its ports in the North-East region, so-called «rust region» of the country, which is not considered as well-developed one. According to estimates, the opening of the prospective corridor that leads to energy resources of the Arctic will contribute to the diversification of energy supply patterns for the North-East region [14, Feng Y., p. 91]. Such northern ports as Dalian, Tianjin, Qingdao, and transport links of Hunchun and Harbin which have been closely connected to Russian border will get a natural boost for further development [15, Pan Z., Zheng L., p. 120]. Moreover, due to specific conditions of the NSR, requirements for icebreakers are high. The involvement of North-East regions of China could boost the development of shipbuilding in these regions that are not famous for being the main technological and scientific bases of China.

¹⁵Malte Humpert. "Chinese Shipping Company COSCO to Send a Record Number of Ships through the Arctic". June 13, 2019. URL: <https://www.highnorthnews.com/en/chinese-shipping-company-cosco-send-record-number-ships-through-arctic> (accessed 16 June 2020).

Role of ISR initiative on Sino-Russian cooperation

In 2016 Sino-Russian cooperation in Arctic region reached a historical breakthrough, when two sides conducted first joint scientific Arctic research¹⁶. In 2018 Sino-Russian joint scientific investigations were conducted for the second time, signifying the beginning of joint assessment of “Ice Silk Road”¹⁷. With the increase of the shaping of Chinese Arctic policy in media and scientific theses, it becomes obvious that each entity of China (whether it is autonomous region or province or large 1-tier city) can play its role in implementing it. North-eastern region is the one most interested region especially Heilongjiang province that will benefit from the improvement of transport and load base infrastructure as it is situated in the border region with Russia – a country which has autonomous rights for NSR. Since the local governments are active actors in China's legislative power they already plan to participate in the Arctic developing by helping build ports of Murmansk and Arkhangelsk¹⁸.

Despite concerns of the RF the economic benefits and support of the Chinese initiative is strongly needed. Before the Ukrainian crisis, Russia had been reaching agreements with respected extracting firms of the Western countries, such as French Total, American ExxonMobil, Norwegian oil companies etc. But after Ukrainian crises and economic restrictions imposed by the majority of the Western countries, cooperation in Arctic projects became under the threat [16, You Y., p. 78]. Since then, Russian Turn to the East and Chinese BRI initiative became one of the main interlinks of Sino-Russian cooperation. Involvement of China in the gas extraction projects is essential to Russia, especially during the continuing tensions between Russia and Western countries, when sanctions are not easing up but keep tightening with the highest degree¹⁹. With the increasing interest of China in providing secure commercial passage through the Arctic Ocean and diversifying energy supply role of Russia in Chinese economic initiatives had taken an important place. In the shade of recent circumstances when NATO forces are threatening the stability of the region and the USA is occupying more and more explicit position towards Russian military presence in the Arctic, Chinese new ISR initiative could be much of use for the securing Russia's position in this region. Therefore, Russian reluctance should be revised and adapted to the new circumstances.

¹⁶Wang Zhonghui. Zhongeshoucilianhekekaoyuanmanjieshuhuofengshuohekekaochengguo [The First Sino-Russian Joint Arctic Expedition Was Successfully Conducted with Fruitful Results]. URL: <http://www.chinanews.com/gn/2016/10-12/8028900.shtml> (accessed 24 May 2020).

¹⁷Yin Shijie. 2018nianZhonggebeijilianhekekaode duo xiangchengguo [The joint Sino-Russian Arctic expedition of 2018 achieved multiple results]. URL: http://www.xinhuanet.com/politics/2018-10/30/c_1123637355.htm (accessed 24 May 2020).

¹⁸Silk Road Briefing. “China's Arctic Passage Ambitions Grow with Arkhangelsk Port Development”. April 3, 2017. URL: <https://www.silkroadbriefing.com/news/2017/03/29/china-artic-passage-ambitions-grow-with-arkhangelsk-port-development/> (accessed 03 August 2020).

¹⁹Timothy Gardner, Patricia Zengerle. U.S. Senators Move to Tighten Sanctions On Delayed Russia-to-Germany Gas Pipeline. 04/06/2020. URL: <https://ru.reuters.com/article/africaTech/idAFL1N2DG22G> (accessed 12 June 2020).

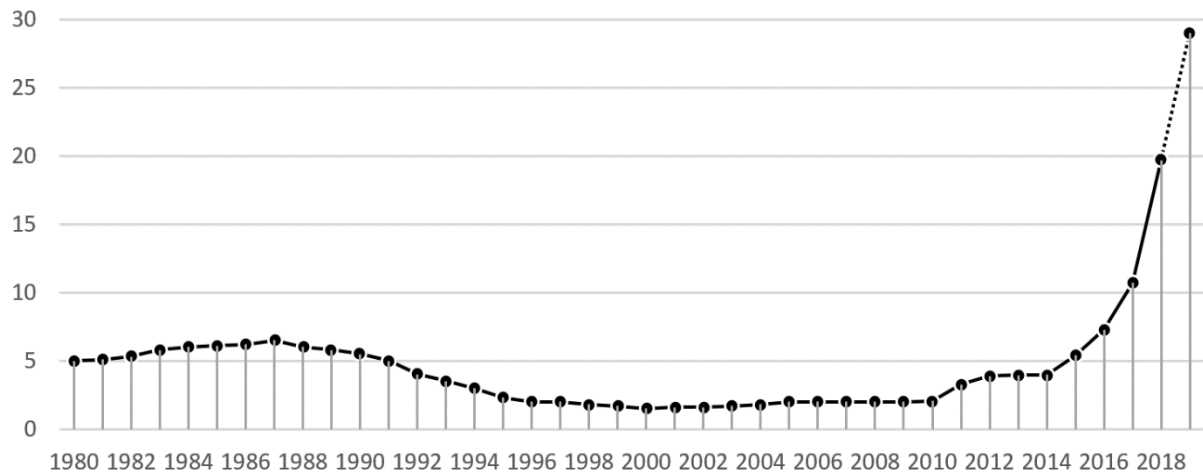


Fig. 1. Annual freight traffic on the Northern Sea Route, in mln tonnes²⁰

It is needless to say, that economic factor of Chinese Arctic strategy will be playing the most significant role in Sino-Russian cooperation since Russia is in the strong need of seeking a stable investor into its Arctic explorations and infrastructure development. ISR initiative will focus mainly on the development of the Yamal LNG project and facilitation of infrastructure of Russian seaports along the NSR shipping line. According to preliminary estimates shipping in the region will increase

China's trade with European countries from 10.95% to 20%. Opening of NSR stable lane will contribute to ensuring energy security due to diversification of fuel supply routes [Kobzeva M., p. 99]. That is why China strongly desires to participate in ports construction, railways and infrastructure building. The key onshore Russian ports include Sabetta, Igarka, Dikson, Tiksi, Pevek and Providenie. They are NSR's mostly undeveloped assets due to its poor investing. ISR initiative can become one of the most attractive resources of funds and promote Arctic ports upgrading and renovation. Not only undeveloped sites of Arctic would receive benefits from Sino-Russian cooperation in Arctic zone. Cross-border regions (Far East of Russia and North-East of China) of two countries might be those mostly involved on account of them being interconnecting bases of ships passing. Hence, China's Arctic strategy will affect increasing cargo turnover and freight shipping on the borders and improve the infrastructure situation of two regions that remain to develop at a slow pace. Significant traffic growth has been already seen from 2010 when petroleum and gas large projects had started, reaching its maximum in 2016. Nowadays, with the active implementation of Chinese strategy cargo traffic volume passing through Sino-Russian borders can be expected to increase (Fig. 1).

Nevertheless, an increasing role and interest of the PRC in the Arctic region is causing concerns and anxiety from the Russian side. Despite mutual economic interest two countries seem not to reach a feasible agreement on the issues other than the Yamal project in the coming future.

²⁰ Shipping and the Northern Sea Route, KBNN: Business Cycle Barometer. 28 February, 2019. URL: <https://www.kbnn.no/en/article/shipping-and-the-northern-searoute> (accessed 03 August 2020).

Russian policy towards the Arctic region is linked with questions of state sovereignty and geopolitical and military presence in the region. While economic development of Arctic coastal cities is one of the priorities of the Russian Federation, it remains to be reluctant to the involvement of China in the development of the region, mainly out of fear that it will influence the regional balance of power and legal institutions that ensure the rights and sovereignty of the Arctic powers [17, Sorensen C.T.N, Klimenko E.]. Therefore, in this stance, China is more seen as a competitor of the Russian Federation than its ally [18, Gutenev P., p. 150; 19, Gudev M., p. 174].

Conclusion

"Ice Silk Road" initiative has appeared in times when it seemed that all international dialogues have their limits. China has shown a new twist in its famous Belt and Road initiative and turned its eyes on the region that has become one of the most strategically and economically interesting areas of the world – Arctic. In its march to the resources and benefits of this region, China may cooperate with its old ally Russia under the new terms. This new cooperation seems to be prosperous for both countries.

Both China and Russia appear to prioritize China's Arctic strategy to ameliorate economic situation and infrastructure in less-developed regions of two countries, but meanwhile, it stays important that two governments come to a consensus concerning several issues upon NSR usage, especially legislative basis of the matter. By developing its onshore ports with the help of the PRC Russia will receive multiple economic gains from increasing ship freighting to China. China in its turn will strengthen its direct access to oil and gas resources of Russian Arctic and become an important player in Arctic zone where the expanding of NATO forces is becoming more evident. Cooperation with the Russian Federation along the NSR and joint assessment of Ice Silk Road Initiative may ameliorate diversification of energy supplies and energy security for China. At that rate in the light of recent circumstances and the unremitted Trade war with the USA China is becoming not the only economic partner of Russian Federation but also a claimant to raise its voice in the geopolitical arena of the Far North.

Russia is losing capital in the face of continuing economic sanctions imposed by the USA and several EU countries that led to closing up cooperation with large petrol companies, ex. Exxon Mobil case. In these circumstances, support of Asian countries which have their interests in the Russian Arctic is indispensable for the RF. In return, it is economically and strategically beneficial for the PRC, that should focus on improving relations with one counterpart for reaching Arctic vast deposits of natural resources and other benefits for the Chinese nation. This reciprocal approach shows China's abidance by three pillars that were mentioned by Erokhin, Gao and Zhang (2018) in their studies: "respect", "cooperation", "win-win" approach. To peacefully approach the Northern natural welfare, China is ready to respect territories belonging to other countries, build up strong cooperation with the RF developing NSR and improving Russian ports along with it and adapt "win-win" concept to ensure two parties can both achieve their goals.

ISR strategy is the component of economic and diplomatic ties of the PRC with the countries situated on the Far North. In the future, it can become the fundament of the international dialogue between China and the Northern countries. But if we look deeper into the nature of this concept we can observe the more sizeable endeavor to be equal to those who had proclaimed itself the rulers of the world long ago and remained to be the powers splitting it. Arctic race with Chinese participation has just begun and it will undoubtedly affect the balance of powers in the future. In its turn, Russia must come to the solution of how not to lose one of its strategic and economic allies and meanwhile strengthen its legitimate position in the Arctic.

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Digitalization in Education and Distance Barriers in the Russian Arctic: Problems and Prospects *

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Abstract. In the era of digital technologies, the issues of providing highly qualified personnel, the effective use of the intellectual potential of the territory and the creation of conditions for its reproduction are of particular importance. These problems are more acute in remote areas of the Russian Arctic. This is due, firstly, to the ultradispersity of the settlement system in the Arctic of the Russian Federation, and, secondly, to the imbalance between the demand and supply of labor resources in territorial and professional terms. Digitalization has become an integral component of education all over the world; therefore, the purpose of this article is to assess the availability of education in the regions of the Russian Arctic and to search for new targets for quality education in the context of digital transformation. The existing educational environment in the Arctic regions is analyzed in the article. The impact of urbanization degree on affordable education in remote Arctic regions is assessed. The financial capabilities of the population are investigated. Based on the analysis, a number of problems associated with the active dissemination of new technologies are identified. Recommendations for improving the educational process are given, taking into account the digitalization of society. The main stages of modernization of the educational process in remote regions of the Arctic are identified.

Keywords: Arctic region, education, digitalization, territorial remoteness, access to education.

The problem of formation and development of human potential of the territory are of great interest for both society and the state. In the age of digitalization and informatization of society, the issues of providing highly qualified personnel, effective use of the territory's intellectual potential and creation of conditions for its reproduction are of particular relevance. These problems are especially acute in small and medium-sized cities in the Russian Arctic. This is primarily due to the specifics of their economic and geographical position in relation to the nearest large urban agglomerations, where the main educational institutions are concentrated. The rapidly developing market of digital technologies creates new challenges for educational institutions; therefore, initiative and ability to think creatively, to find non-standard solutions and to choose a professional path become the most important qualities of a person. At the same time, state policy should be aimed at raising the educational level of the population and increasing human potential as a whole.

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The development of human potential was first considered in the works of A. Smith, W. Petty, D. Ricardo and K. Marx, and the concept has changed in the course of scientific development. Thus, D. Ricardo, J. Mill gave education, acquired abilities and upbringing the most important role in the formation of human potential capable of generating income in the future [1, Sakharovsky S.N.]. The idea of human capital was further developed in the works of T. Schultz, G. Becker, W. Bowen, proving that the qualitative characteristics of the labor force in the economic development of society are of paramount importance [2, Sokolova D.V., Kulakova A.B.]. Today H. Lipovska, I. Odoardi, F. Muratore are studying the influence of the educational process on the formation of human capital [3, Lipovska J., Fischer J., 4, Odoardi I., Muratore F.]. Modern Russian economists have also made a significant contribution to the development of the theoretical foundations of the concept of human potential. N. Dneprovskaya believes that the state policy of recent years is aimed mainly at creating the IT infrastructure of higher education [5, Dneprovskaya N.V.]. Whereas, Mavlyutova G.A. thinks that it is necessary not only to re-equip IT resources in education, but also to talk about the need for a kind of reloading of human potential [6, Mavlyutova G.A.]. A. Marey's view on the issue of digitalization is interesting. She defines it as a change in the paradigm of communication and interaction with each other and society¹, and L. Shmelkova emphasizes that the most important feature of a person adequate to the digital economy is that this person owns digital technologies, applies them in professional activity [7, Nikulina T.V.].

Thus, the abundance of scientific works allows us to conclude that the development of digital technologies affects the formation of human capital, but the issue of inequality in education remains aside, namely, the implementation of the opportunities provided by society and the state in different regions. Therefore, the purpose of this study is to assess the availability of education in the regions of the Russian Arctic and to search for new targets for quality education in the context of digital transformation.

In order to achieve this goal, the following objectives are identified: to analyze the existing educational environment in the Russian Arctic; to assess the impact of the degree of urbanization on affordable education in remote regions; to explore the financial capabilities of the population in the context of the availability of educational services; to identify problems and prospects for the development of education in the Arctic, taking into account the digitalization of society.

The level of urbanisation as a factor of the education accessibility in the Arctic

The accessibility of education is influenced by many factors (economic, territorial, social, etc.). In the Arctic, the study of the territorial factor (place of residence, level of urbanization, the number of universities in a certain territory, etc.) acquires particular importance, since all its settlements are located in extreme natural and climatic conditions and have a territorial gap and remoteness from regional centers.

¹ Marey A. Tsifrovizatsiya kak izmenenie paradigm [Digitalization as a Paradigm Shift]. URL: <https://www.bcg.com/ru-ru/about/bcg-review/digitalization.aspx> (accessed 15 September 2020).

An important indicator of territorial inequality in education is the type and size of the settlement (Table 1). Most Arctic regions are characterized by the focality of settlements concentration [8, Korchak E.A.]

Table 1

Distribution of urban districts and municipal areas in the Arctic regions of the Russian Federation, 2019

Arctic Regions	The number of urban districts and municipal areas with a population:			
	> 150 thousand people	75–150 thousand people	10–75 thousand people	< 10 thousand people
Republic of Karelia	0	0	3	0
Komi Republic	0	1	0	0
Arkhangelsk Oblast (without NAO)	2	0	3	2
Nenets Autonomous Okrug	0	0	2	0
Murmansk Oblast	1	0	12	4
Yamalo-Nenets Autonomous Okrug	0	2	8	4
Krasnoyarsk Krai	1	0	2	0
The Republic of Sakha (Yakutia)	0	0	0	5
Chukotka Autonomous Okrug	0	0	1	7
Arctic zone of the Russian Federation	4	3	31	22

Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation²

The data in Table 1 show that in the Arctic zone of the Russian Federation, most urban districts and municipal districts belong to small and medium-sized cities and have a population of less than 75 thousand people, which corresponds to almost 90% of their number (on average in Russia, the number of medium and small cities makes up 26% of the total number [9, Sekushina I.A.]). Despite the small number of urban districts and municipal areas, an analysis of the ratio of urban and rural populations showed that the majority of the population of the Russian Arctic regions lives in cities (Fig. 1).

² Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 05 December 2020).

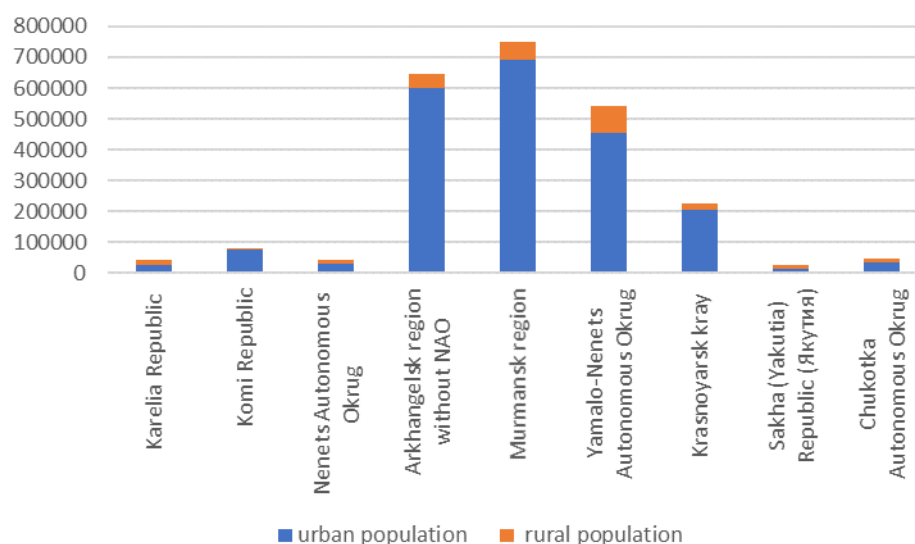


Fig. 1. The level of urbanisation in the Arctic regions of the Russian Federation, 2019 ³.

The most “strong” educational institutions are mainly located in regional (republican) centers. On the contrary, “ordinary” institutions are located mainly in villages, urban-type settlements and regional centers. In the Arctic conditions, in some territories there are no educational institutions at all (Republic of Karelia, Sakha (Yakutia), Nenets Autonomous Okrug). For example, in the Nenets Autonomous Okrug there is no one university at all. This region topped the list of regions with the least provision of local youth with educational places ⁴. In some municipalities of the Yamalo-Nenets Autonomous Okrug, there are almost 3500 tundra preschoolers and only about 10% of them receive preschool training ⁵; on the territory of the Gydan tundra of the Tazovskiy district, there are 213 children from the indigenous peoples of the North aged 0 to 7 years, 198 children of them [10, Novitskaya V.A., Yafizova R.I.] together with their parents lead a nomadic and semi-nomadic lifestyle, which significantly limits access and equal opportunities to receive education.

Despite the rather high proportion of the urban population, the Arctic regions are characterized by a low density and high ultradispersy of its settlement (Table 2).

Table 2

Population size and density in the Arctic regions of the Russian Federation, 2019

Arctic Regions	Population size, thousand people	Population density, people / km ²
Republic of Karelia	616.1	0.99

³ Ibid.

⁴ Eksperty nazvali regiony Rossii s samym nedostupnym vysshim obrazovaniem, Yanvar' 2017 [Experts Named the Regions of Russia with the Most Inaccessible Higher Education. January, 2017]. URL: <https://www.rbc.ru/society/30/01/2017/588f0cab9a794716f7e77440> (accessed 15 December 2020).

⁵ Informatsionnyy portal «Go Arctic». Kochevoe obrazovanie [Information Portal "Go Arctic". Nomadic Education]. URL: <https://goarctic.ru/society/kochevoe-obrazovanie-cto-vy-khoteli-znat-no-boyalis-sprosit/> (accessed 15 December 2020).

Komi Republic	825.4	3.31
Arkhangelsk Oblast (without NAO)	1140.3	3.43
Nenets Autonomous Okrug	44.0	0.25
Murmansk Oblast	744.7	5.16
Yamalo-Nenets Autonomous Okrug	543.0	0.7
Krasnoyarsk Krai	2870.1	0.21
The Republic of Sakha (Yakutia)	969.5	0.06
Chukotka Autonomous Okrug	50.0	0.07
Arctic zone of the Russian Federation	7803.1	0.94

Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation⁶

The low settlement density in the Arctic regions increases the service radius and thereby makes various services, including educational ones, inaccessible for a part of the population.

Analysis of the educational environment of the Arctic regions

Currently, most of the Russian Arctic regions have all stages of education: primary, secondary and higher professional institutions (Table 3).

Table 3

Dynamics of the number of educational organizations⁷ in the Arctic regions of the Russian Federation in 2015–2019, %

Arctic Regions	2015/2016 academic year			2018/2019 academic year		
	General education	Secondary vocational education (including branches)	Higher education (including branches)	General education	Secondary vocational education (including branches)	Higher education (including branches)
Republic of Karelia	214	18 (0)	5 (3)	205	23 (5)	4 (2)
Komi Republic	359	23 (0)	9 (6)	336	31 (4)	6 (3)
Arkhangelsk Oblast (without NAO)	348	27 (1)	5 (3)	341	40 (1)	5 (3)
Nenets Autonomous Okrug	37	2 (0)	0	26	3 (0)	0
Murmansk Oblast	164	23 (5)	7 (5)	165	25 (6)	5 (3)
Yamalo-Nenets Autonomous Okrug	130	7 (1)	7 (7)	129	9 (2)	3 (3)
Krasnoyarsk Krai	1010	54 (8)	23 (14)	981	107 (35)	13 (6)
The Republic of Sakha (Yakutia)	628	37 (0)	15 (10)	636	57 (12)	9 (4)
Chukotka Autonomous Okrug	41	4 (0)	2 (2)	41	4 (0)	1 (1)

Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation⁸

⁶ Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 10 December 2020).

⁷ Private educational institutions were not counted.

Over the past five years, the number of state organizations providing the general education training program has decreased in almost all regions of the Russian Arctic, with the exception of the Murmansk region (the number of institutions increased by 1 unit) and the Chukotka Autonomous Okrug (no dynamics). The problems of developing small schools in hard-to-reach regions of the Arctic (Arctic uluses of the Republic of Sakha (Yakutia), settlements in the Nenets Autonomous Okrug and Yamalo-Nenets Autonomous Okrug) remain. For example, rural schools in the Republic of Sakha (Yakutia), which have a student enrollment of less than 100 students, are transferred from the status of a general secondary to basic schools, and some even to primary schools, and 53% of rural schools are small with an average enrollment of 50 to 120 students [11, Neustroev N.D., Neustroeva A.N.].

It should be noted that the number of higher educational institutions has also decreased significantly, mainly due to the reduction in the number of their branches. Currently, a serious problem for the Arctic regions is the growing shortage of labor resources, in particular, the issue of highly qualified specialists is acute. Therefore, against the background of the observed negative dynamics, there is a clear lag of the educational system from the needs of the market economy in these regions.

In the field of vocational education, on the contrary, there is a positive dynamics, which was especially manifested in the Krasnoyarsk region (from 54 to 107 institutions), the Republic of Sakha (Yakutia) (from 37 to 57 institutions) and the Arkhangelsk region (from 27 to 40 institutions). This growth is due, on the one hand, to the active development of the Arctic territories, on the other hand, to the preservation of the traditional way of life of the indigenous peoples of the North and the popularization of professions in demand in the Arctic (reindeer husbandry, fishing, sea animal hunting).

The next aspect that we would like to consider in the context of assessing the educational environment is the formation and development of automation of educational institutions in the Arctic regions.

According to the Rating⁹, reflecting the level of automation of educational activities in general education programs (excluding pre-school education), the Arctic regions (with the exception of the Krasnoyarsk region and the Republic of Karelia — no data available) can be divided into three groups¹⁰:

⁸ Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 15 November 2020).

⁹ The rating was developed by a group of experts for the analysis of Russian regional information systems in the field of general education, which shows the current level of automation of educational activities for general education programs in all constituent entities of the Russian Federation and determines the degree of compliance of regional UFTR systems (Unified Functional and Technical Requirements for Information Systems).

¹⁰ Rating of subjects of the Russian Federation by the level of automation of educational activities in general education programs (excluding preschool). Federal portal "Russian education". URL: <http://www.edu.ru/map/technology/> (accessed 20 December 2020).

Group 1 — regions with a low level of automation of educational activities (Arkhangelsk region and Chukotka Autonomous Okrug);

Group 2 — regions partially corresponding to the uniform functional technical requirements (UFTR) with the level of automation of educational activities (Murmansk region and Nenets Autonomous Okrug);

Group 3 — regions with a high level of automation of educational activities (the Republic of Sakha (Yakutia), the Yamalo-Nenets Autonomous Okrug and the Komi Republic).

Informatization and digitalization are taking place in different regions at different rates. In some regions, equipping with computers is just beginning, while some regions are already successfully functioning in a single information space (Fig. 2).

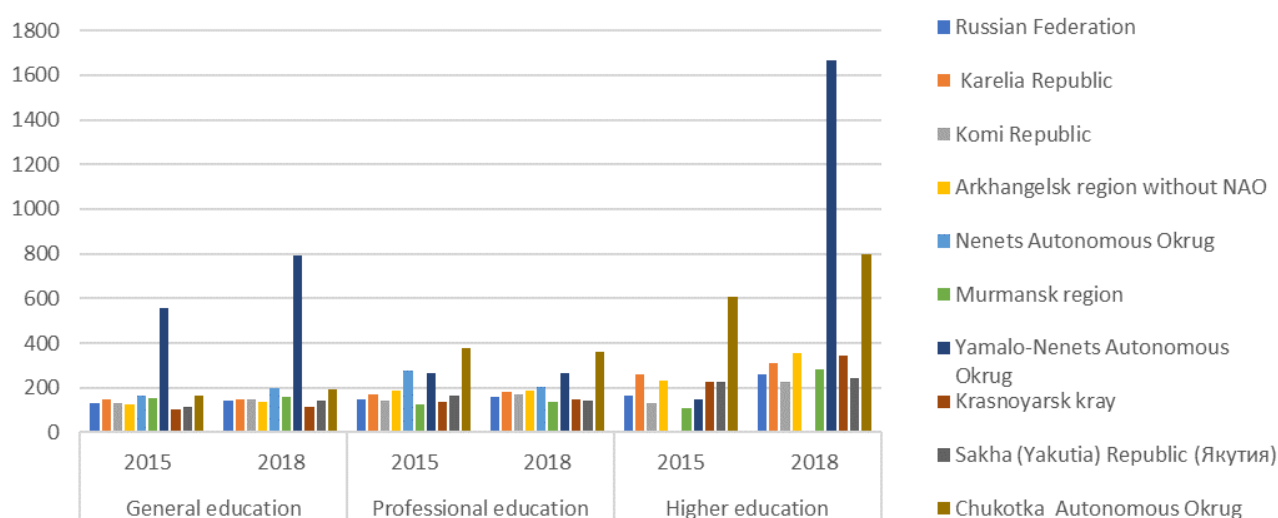


Fig. 2. Equipment of educational organizations with personal computers in the Russian Arctic regions, 2018¹¹. Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation¹²

The above data give grounds to assert that, firstly, the process of equipping the Arctic territories with resources is rather slow and uneven; secondly, the problem of informatization and automatization is most acute in remote Arctic regions. Nevertheless, the digital barrier¹³ among residents of the Arctic regions is gradually decreasing (Table 4).

¹¹ The number of personal computers per 1000 students.

¹² Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 01 February 2021).

¹³ Digital barrier — limiting the capabilities of a social group due to its lack of access to modern means of communication.

Table 4

The use of information technology and telecommunication networks in households in the Arctic regions of Russia in 2015 and 2019¹⁴

Arctic Regions	Number of households – total thousand units, 2019 (2015)	of which had (in % of the total number of households)			
		Personal Computer 2019 (2015)	Internet access 2019 (2015)	Internet access from a personal computer 2019 (2015)	Broadband Internet access 2019 (2015)
Republic of Karelia	270.8 (272.5)	71.3 (75.1)	77.7 (74.6)	68.4 (73.0)	77.3 (74.6)
Komi Republic	365.6 (367.2)	76.4 (84.8)	79 (83.2)	71.3 (80.0)	78.8 (82.0)
Arkhangelsk Oblast (without NAO)	485.4 (486.5)	74.6 (78.5)	77.5 (76.8)	70.4 (76.3)	74.0 (76.8)
Nenets Autonomous Okrug	15.6 (15.6)	75.7 (77.7)	74.8 (69.9)	67.8 (68.8)	67.5 (56.0)
Murmansk Oblast	340.5 (343.0)	79.1 (88.6)	84.2 (87.3)	77.5 (86.4)	83.6 (83.5)
Yamalo-Nenets Autonomous Okrug	186.5 (192.4)	92.4 (91.2)	95.0 (91.7)	90.2 (90.2)	93.9 (82.9)
Krasnoyarsk Krai	1 125.9 (1126.9)	63.0 (72.0)	69.5 (68.7)	60.1 (66.2)	66.4 (62.2)
The Republic of Sakha (Yakutia)	330.6 (330.6)	61.4 (70.2)	87.6 (75.5)	52.3 (56.9)	77.6 (55.0)
Chukotka Autonomous Okrug	21.7 (21.9)	92.0 (77.1)	93.4 (73.0)	91.2 (60.8)	50.6 (50.5)

In 2019, most households started using mobile phones or smartphones, mobile computers and e-book readers to access the Internet, as indicated by the declining share of households accessing the Internet from a personal computer, while the number of households with access to the Internet also increased. Also, from the authors' point of view, the decline in the number of personal computers indicates an increasingly widespread practice of replacing stationary personal computers with laptops. This is understandable from the financial standpoint: the purchase of mobile devices, as a rule, is cheaper than the purchase of a personal computer. But the unstable and sometimes incomplete “coverage” of the Arctic regions with mobile network leads to technical problems of using the Internet (connection quality, access in remote areas), which especially affects its use for educational purposes, where a continuous process of connecting to the resource is usually required.

It should be noted that, according to the authors, for the development of the educational environment in the Arctic regions (and not only in the Arctic), it is important to overcome not only the digital divide (the difference between participants in the educational process who have access to the Internet and digital devices at school and at home, and those who do not have Internet access), but also to level the so-called gap in digital use (the inequality between those who use digital technologies for educational and creative activities, and those who use them for everyday routine

¹⁴ Selective federal statistical observation on the use of information technologies and information and telecommunication networks by the population. URL: https://gks.ru/free_doc/new_site/business/it/fed_nabl-croc/index.html (accessed 01 February 2021).

activities — communication, sales/purchases, etc.). Perhaps, the transition of educational institutions to an alternative personalized educational process will help to reduce the gap in digital use.

Thus, the analysis showed that the educational environment of the Arctic regions is developing unevenly, in some regions the educational environment has a level of development comparable to the Russian average, in others, its development is severely delayed, including due to the low degree of digitalization and automation of educational processes.

Analysis of financial capabilities of the Russian Arctic population

Accessibility to educational services is determined not only by the territorial factor (geographic) and the availability of educational institutions, but also by the financial capabilities of the population. They can be assessed by various indicators, but the main and determining indicator is the level of the population's monetary income. Let us analyze the dynamics of the average per capita income of the population of the Arctic regions in recent years (Fig. 3).

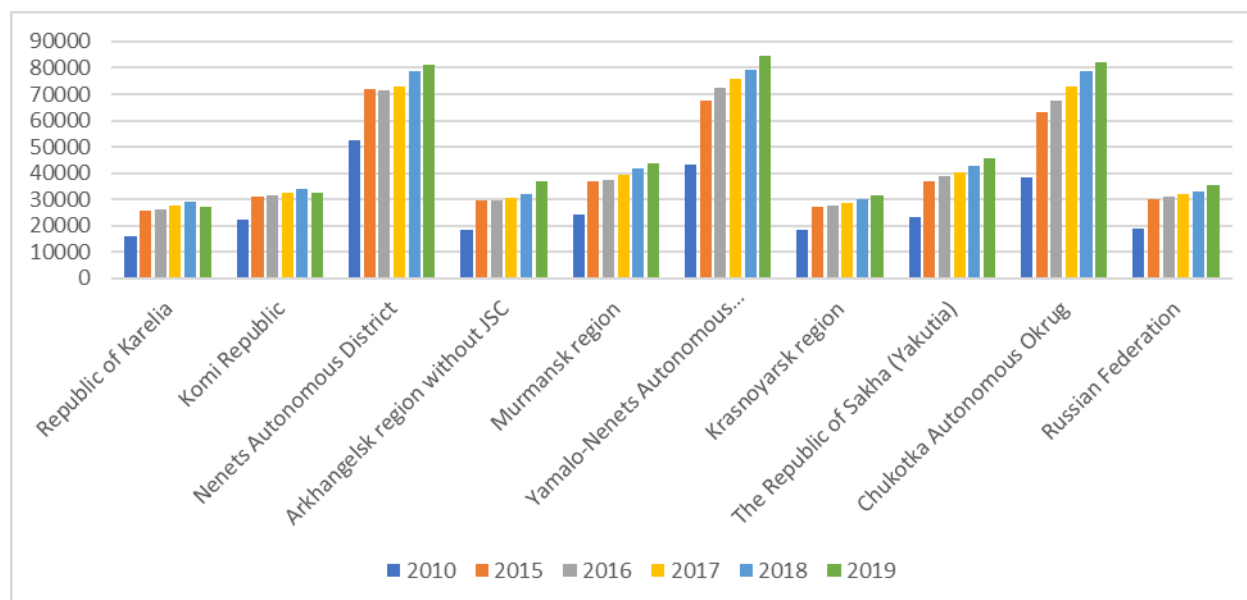


Fig. 3. Dynamics of the average per capita income of the Arctic population, rubles¹⁵.

In absolute terms, incomes of the population in the Arctic regions tend to grow and exceed the national average. A significant deviation in the level of income is observed in the Nenets, Chukotka and Yamalo-Nenets Autonomous Okrugs (more than 2 times from the average Russian level). At the same time, starting from 2013, the rate of income growth has slowed down both in Russia as a whole and in the Arctic regions. However, it is impossible to judge the satisfaction of the population with the level of their well-being and financial capabilities only by the trend of growth in the population's income in absolute and relative values.

In fact, the population assesses its standard of living not by the average rate of income growth, but by the growth in the ability to meet their needs at the expense of the income received. To a certain extent, the “purchasing power” of monetary incomes of the population of a particular

¹⁵

Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 15 November 2020).

region can be determined by the ratio of monetary incomes to the regional subsistence minimum [12, Chapargina A.N.].

If we compare the incomes of the Arctic population with the level of the subsistence minimum, we will note that, despite their growth, the living standard of the Arctic population is approaching the standard of living of the average Russian (Fig. 4). It should be noted that during the period under study, the share of the subsistence minimum in the population's income is growing, which suggests a decrease in the standard of living, and accordingly, in their financial capabilities.

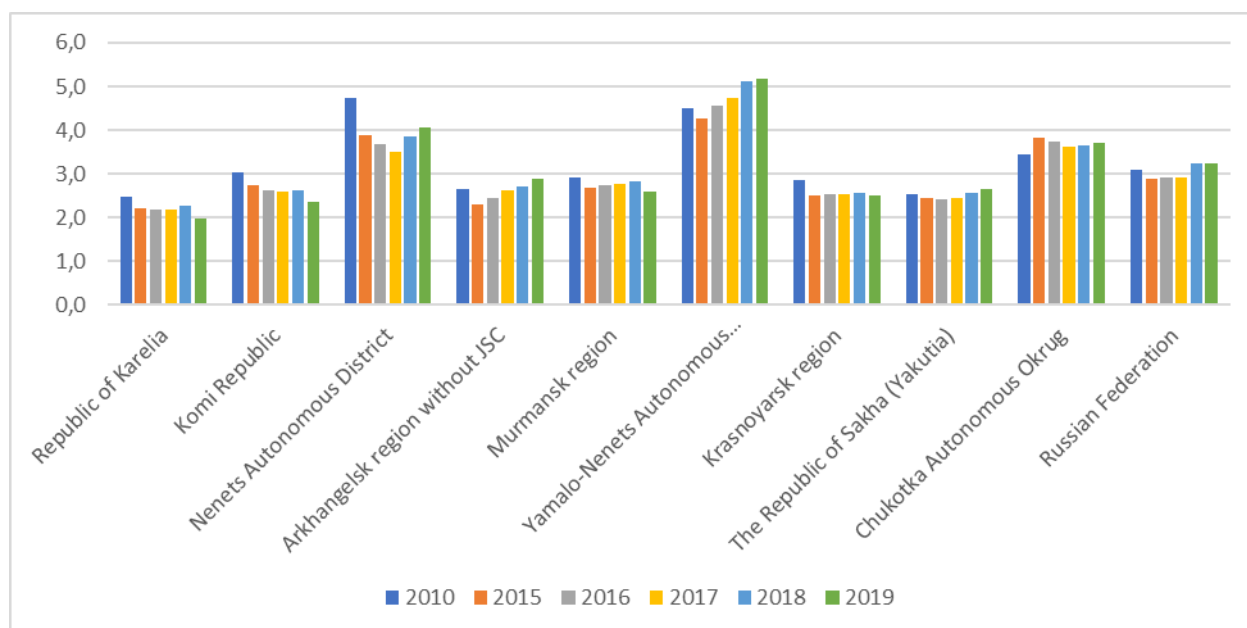


Fig. 4. Ratio of the subsistence minimum and population income in the Arctic regions of the Russian Federation.
Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation¹⁶

The perception of the level and quality of life depends to a large extent not only on the social status of the person, but also on his expectations. The availability and quality of education is an element of human potential formation. Moreover, accessibility should mean the equality of educational opportunities: economic (financial) and transport (geographical) [13, Novikov A.M.]. The results of the above analysis proved that the regions of the Russian Arctic have an ultradispersed settlement, respectively, the population of these regions, in terms of geographical accessibility, cannot have equal educational opportunities. As for the financial affordability of education for the Arctic population, a comparison of the main income indicators with the national average showed, that the financial capabilities of the population living in extreme climatic conditions are rather weak (Figure 3, 4). The obtained correlation between the level of per capita income of the Arctic population and the volume of paid services in the regional education system, which is defined as strong (Table 5), seems interesting.

¹⁶

Regions of Russia. Socio-economic indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 15 November 2020).

Table 5

The volume of paid services to the population per capita in the education system (rubles) and the correlation between average per capita income and services

Arctic region	2010	2015	2016	2017	2018	2019	Correlation (income:services)
Republic of Karelia	2480.2	3338.4	3528.3	3564.9	3775.6	4181.3	0.89
Komi Republic	1863.9	3366.7	3403.1	3557.3	3759.9	3809.5	0.99
Nenets Autonomous Okrug	1045.8	2633.1	2598.5	2734.3	2737.3	2894.3	0.96
Arkhangelsk Oblast (without NAO)	1835.6	3917.9	3621.0	3394.9	722.5	3641.7	0.33
Murmansk Oblast	2932.6	3960.5	4147.5	4320.4	4669.6	5058.4	0.98
Yamalo-Nenets Autonomous Okrug	2375.6	2943.3	2885.0	3046.3	3146.7	3259.5	0.99
Krasnoyarsk Krai	1753.9	3417.7	3061.2	2887.3	3087.1	3249.4	0.89
The Republic of Sakha (Yakutia)	3016.1	5196.0	5562.1	5874.8	6761.6	6761.6	0.99
Chukotka Autonomous Okrug	673.8	3642.6	5461.6	5383.9	5694.7	5680.5	0.96
Russian Federation	228.7	3687.8	3847.0	4176.5	4464.1	4747.5	0.996

In general, the correlation value by region is more than 0.9; it is insignificant only in the Arkhangelsk region, due to a sharp decline in paid educational services in 2018. The obtained result can be interpreted in two ways. On the one hand, the increase in paid services can be assessed as a positive dynamics of growth in the standard of living of the population, since educational services are becoming more accessible. On the other hand, this trend can lead to an increase in income inequality and, as a consequence, reduce the availability of educational services.

Challenges and prospects of digitalization of education

The development of information technology transfers the educational process to a completely new level of development, and digital literacy is becoming an increasingly important component of success for the education and development of children. However, despite the active introduction of digitalization in all spheres of human life, including education, a number of problems associated with the progressive spread of new technologies should be noted.

The first problem is that society still has a digital divide in the use of technology, both at the level of Internet access (wealthier people have better digital access [14, Ma J.KH., Vachon T.E., Cheng S.]) and special skills for the application of information innovations. For example, in Russia, online education in schools is 0.1% versus 3% abroad¹⁷. The problem of using online platforms for distance learning in Russian schools¹⁸ (especially in some Arctic regions, where the Internet is still lacking¹⁹) in the context of the COVID-19 pandemic was especially evident.

¹⁷ Issledovanie rossiyskogo rynka onlayn-obrazovaniya i obrazovatel'nykh tekhnologiy [Research of the Russian Market of Online Education and Educational Technologies]. URL: <http://files.runet-id.com/2017/rif/presentations/19apr.rif17-2.3--dreval.pdf> (accessed 17 October 2020).

¹⁸ URL: <https://rg.ru/2020/07/14/tolko-25-procentov-shkol-okazalis-gotovy-k-distancionnomu-obucheniiu.html>

¹⁹ Severnaya shkola. Problemy i resheniya v sfere obrazovaniya v Arktike [Northern school. Challenges and Solutions for Education in the Arctic]. URL: https://aif.ru/society/education/severnaya_shkola_problemy_i_resheniya_v_sfere_obrazovaniya_v_arktike (accessed 17 October 2020).

The second problem is related to socio-economic inequality in digital educational use. It should be noted that such inequality exists even after achieving equality in digital access, and it remains a problem for both high-income and low-income countries [15, Hilbert M.]. In general, children with a higher socio-economic status are more likely to use computers for educational purposes²⁰, and vice versa, students with a lower socio-economic status are more likely to use digital devices for social networking and gaming and are therefore less prepared for academic tasks [16, Van Deursen A., Van Dijk J.].

The third problem is a rather low level of digitalization in the educational process due to territorial remoteness. The significance of the territorial barrier is due to territorial mobility. The most accessible quality education is for those who are not “tied to a place” and are ready (and can afford) to “travel for quality” of educational services. Territorial mobility is important both at the stage of obtaining general education and at the stage of obtaining higher education.

The identified problems are typical for Russia as a whole, and the specific features of the Arctic regions development, including the harsh natural and climatic conditions, the discomfort of living, the focus of settlement, the uneven development of the social and transport infrastructure, exacerbate them even further.

In the current pandemic situation, the urgent digital transformation in all spheres of society has necessitated the introduction of new targets in the educational process as well. This is caused, first of all, by the presence of problem areas in the educational environment: insufficiently developed infrastructure of data transmission channels in schools, unpreparedness of teachers to work in an online format and a lack of high-quality online resources. It should be noted that education is not designated as a priority industry for digital transformation in all Arctic regions, with the exception of the republics of Karelia and Komi, Yamalo-Nenets Autonomous Okrug (Table 6). Most of the regional projects in the field of the digital economy in the Russian Arctic are implemented in the areas of “information infrastructure and security” and “digital public administration”.

Table 6

Regional projects and priority areas of digitalization in the Arctic regions of the Russian Federation

Arctic regions ²¹	Regional projects in the field of “Digital Economy”	Priority areas of digitalization
Republic of Karelia	Creation of data transmission infrastructure for public authorities and households Creation of data transmission infrastructure for medical and educational organizations Development of communication networks at transport infrastructure facilities Introduction of digital technologies in the areas of public administration, business and society	Transport Building Housing and communal services Urban environment Agriculture
Komi Republic	Information infrastructure and security Digital government Digital technologies, smart city	Transport, housing and communal services Urban environment Health care

²⁰ ITU (2011). Measuring the information society. Geneva: ITU. URL: <http://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2011.aspx>. (accessed 11 December 2020).

²¹ No data available for Krasnoyarsk Krai.

Arkhangelsk Oblast (without NAO)	Human resources for the digital economy Information infrastructure and security Digital government	Public services and management Culture and tourism Transport, housing and communal services Urban environment Health care Personnel and education Financial and economic activities
Nenets Autonomous Okrug	Normative regulation of the digital environment Information infrastructure and security Digital government	Education Health care Transport, housing and communal services, energy
Murmansk Oblast	Information infrastructure and security Digital government	Industry Health care Housing and communal services, Urban environment Education
Yamalo-Nenets Autonomous Okrug	Information infrastructure and security Digital government Human resources for the digital economy	Transport, housing and communal services Building Urban environment Health care
The Republic of Sakha (Yakutia)	Information infrastructure and security Digital technologies Digital government	Industry Computer software development Urban environment Health care Personnel and education
Chukotka Autonomous Okrug	Information infrastructure and security Digital government	Health care Personnel and education Urban environment, housing and communal services Energy

Source: compiled by the authors based on data from the Analytical Center for the Government of the Russian Federation²²

For the further development of the educational sphere, as well as the widespread implementation of digital technologies in educational process in the Arctic, in our opinion, it is necessary to pay attention to the following activities:

- to form a legislative framework on the digitalization of education. Regional programs for the development of the digital economy have been developed and approved in the republics of Karelia and Sakha (Yakutia), as well as in the Chukotka Autonomous Okrug. The other regions of the Russian Arctic do not have such programmes;
- to modernize the forms of knowledge transfer and transmission in the educational process, primarily with the use of digital technologies;
- to develop remote education channels to remove territorial barriers, for example, in the Yamalo-Nenets Autonomous Okrug, there is an experimental educational project "No-

²² Tekushchee razvitie proektov v sfere tsifrovoy ekonomiki v regionakh Rossii, iyun' 2019 [Current Development of Projects in the Field of Digital Economy in the Regions of Russia. June 2019]. URL: <https://nangs.org/analytics/analiticheskij-tsentr-pri-pravitelstve-rf-tekushchee-razvitie-proektov-v-sfere-tsifrovoj-ekonomiki-v-regionakh-rossii-iyun-2019-pdf>

madic Schools”²³, which is focused, on the one hand, on the preservation of traditional forms of management, native language and national culture of the indigenous small-numbered peoples of the North, on the other hand, it is aimed at ensuring quality education in a modern northern school. Implementation of the project has already started in the Nadym, Priuralskiy, Purovskiy, Tazovskiy, Shuryshkarskiy and Yamal districts.

- to intensify interaction of authorities and companies in the raw materials sector within the framework of corporate social responsibility in order to attract investment in education and highly qualified personnel. For example, in the Murmansk region, a joint project of the Heads of municipalities of Apatity and Kirovsk with the FOSAGRO company — PhosAgro Schools has been implemented for five years in order to implement the educational paradigm School—College / University—Enterprise. The main task of this project is to train the engineering elite and ensure the inflow of highly educated personnel into the company;
- to create new forms of communication “region — municipal district — educational institution”, by means of creating regional centres providing continuous social and pedagogical support to children in the society and the region. A positive example is the implementation of a new regional project in the Yamal-Nenets AO “Yamal Schools — Wi-Fi Territory”, which is aimed at developing the information and technological educational environment of region’s schools and providing access to educational content of the global Internet²⁴.

Within the framework of the presented activities, the following stages of modernization of the educational process in remote regions of the Arctic can be distinguished:

Stage 1 — technical equipment of classrooms (high-speed Internet connection, computers, interactive whiteboards, etc.) within the framework of the national project “Education” and “Science and Universities”.

Stage 2 — training of the teaching staff in the context of digitalization (seminars, webinars, online courses, etc.).

Stage 3 — creation and development of educational portals that allow the educational institutions of the Arctic to be included in a unified information space of the educational environment.

Since digital technologies are likely to become the dominant force in society in the foreseeable future, the problem of the education availability in the specific conditions of the Arctic is gradually leveled out. Digitalization will expand the coverage of the population with educational services, since residents of the Arctic regions (including geographically remote ones) will be able to take an active part in online events that were previously not available to them.

²³ Informational portal. Yamal. Education. URL: https://edu.yanao.ru/pro/SitePages/kohev_school.aspx (accessed 02 February 2021)

²⁴ Informational portal. Yamal. Education. URL: <https://edu.yanao.ru/pro/SitePages/Wi-Fi.aspx> (accessed 02 February 2021).

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Population Formation and Development Dynamics of the Russian Far North in the 1920s *

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Abstract. Based on the analysis of All-Union Population Census of 1926 and a wide range of general and regional scientific research, the author studies the processes of demographic and economic development of territories located in the Russian North and conventionally designated by the author as regions of European, Ural, Siberian and Far Eastern North. The paper identifies key trends and features of Northern regions' development in the 1920s, caused by the first Soviet reforms of the administrative-territorial structure of the country, economic development and national state policy, which had an impact on the demographic processes in the regions including population size, its composition and settlement structure. It is found that the economic development was the most active in the bordering areas, where intensive development of industry and transportation implied the need to strengthen national defense and expand trade and economic ties. This mainly concerned the regions of the European and Far Eastern North. The regions that were rich in natural resources, especially gold deposits, such as Yakutia, also developed more actively. Other regions of Ural and Siberian North developed in a more traditional way, based on growth of wood harvesting and fishing industry. Improving of living conditions of the indigenous peoples of the North, material support for their farms, medical care and legal assistance, introduction of education among the population in the 1920s had a positive impact on the economic and demographic development of the indigenous population.

Keywords: *Russian North, European North, Ural North, North of Siberia, North of the Far East, administrative-territorial structure, economic development, population size, structure of settlements, indigenous population, national policy.*

Introduction

The unprecedented historical experience of the economic and demographic development of the northern territories during the Soviet period deserves special attention of researchers. The period of the 1920s, which was characterized by rather complex political, socio-economic and demographic processes associated with the end of World War I, the Civil War, as well as the establishment of Soviet power and the restoration of the national economic complex, was particularly important and crucial in the development of the North. It was during this period, in the context of a deep transformation of society and the first socialist transformations, that the centuries-old structure of the country's economic, political and socio-cultural life was restructured, a new concept for the exploration and development of the North was formed. The formation of the population and the economic structure of the northern territories as a whole obeyed the general historical patterns of development, but had their own specifics in different regions. A retrospective analysis of the northern territories of the European part, the Urals, Siberia and the Far East allows us

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to give a more complete picture of the general trends and features of the socio-economic development of the territories in this period and fill some gaps in the historiography of the study.

The problems of the northern regions development in historical retrospect and at the present stage attract a wide range of researchers in different directions: demographers, historians, geologists, ethnographers, political scientists, economists, etc. To date, there is a considerable number of scientific works in the historiography of the Soviet North, including general problems of the exploration and development of the northern regions, and special demographic studies. During the Soviet period and at present, a number of publications have been published, including academic scientific research in national regions: Tuva, Yakutia, Yamalo-Nenets Autonomous Okrug, etc.¹, as well as large publications on the history of the European North, Siberia and the Far East in the Soviet period, including sections on the study of the northern regions population². In addition to the array of published general and regional works related to the research topic, the documentary basis for the research was the materials of the All-Union Population Census of 1926, which served as comparable statistical data characterizing various statistical parameters of the Northern regions³.

According to demographers, the All-Union Census of 1926 was the most democratic Soviet census of the population, taking into account a number of various parameters, including demographic ones, the structure of administrative-territorial administration in the regions, etc. Only Tuva was not covered by the All-Union Census of 1926, as it was not part of Russia during this period. However, the republic was under the protectorate of Russia and the processes taking place on the territory of Tuva were closely intertwined with the interests of the Soviet state. Therefore, the Tuva Republic is also one of the objects of scientific research.

¹ Istoriya Tuvy v 2-kh tomakh [History of Tuva in 2 Volumes]. Moscow, Nauka, 1964. Vol. 1, 410 p. Vol. 2, 453 p.; Istoriya Tuvy v 3-kh tomakh [History of Tuva in 3 Volumes]. Novosibirsk, Science. Vol. 1, 2001, 410 p., Vol. 2, 2007, 430 p., Vol. 3, 2016, 455 p.; Istoriya Tuvy v 2-kh tomakh [History of Tuva in 2 Volumes]. Ekaterinburg, Publ. house of RAS, 2010. Vol. 1, 415 p. Vol. 2, 367 p.; Istoriya Yakutskoy ASSR v 3-kh tomakh [History of the Yakut ASSR in 3 Volumes]. Moscow-Leningrad, Publ. house of AS of the USSR. Vol. 1, 1955, 432 p., Vol. 2, 1957, 420 p., Vol. 3, 1963, 364 p.; Komi kray: ocherki o desyati vekakh istorii [Komi Region: Essays on Ten Centuries of History]. Syktyvkar, Komi Publ. House, 2003. 368 p.

² Istoriya Sakhalina i Kuril'skikh ostrovov s drevneyshikh vremen do nachala XXI stoletiya [The History of Sakhalin and the Kuril Islands from Ancient Times to the Beginning of the 21st Century]. Yuzhno-Sakhalinsk, Sakhalin Book Publ. House, 2008. 712 p.; Severo-Zapadnaya Sibir' v 1917–1941 godakh. Natsional'no-gosudarstvennoe stroitel'stvo i naselenie [Northwestern Siberia in 1917–1941. Nation-building and Population]. Nizhnevartovsk, 2002. 264 p.; Rybakovskiy L.L. Naselenie Dal'nego Vostoka za 150 let [The Population of the Far East for 150 Years]. Moscow, Nauka, 1990. 170 p.; Istoriya Dal'nego Vostoka SSSR / Rossii v 5-kh tomakh. 1989–2018 gg. [History of the Far East of the USSR / Russia in 5 Volumes. 1989–2018]; Istoriya Sibiri s drevneyshikh vremen do nashikh dney v 5-ti tomakh [History of Siberia from Ancient Times to the Present Day in 5 Volumes]. Leningrad, Nauka, 1968–1969.; Korotaev V.I. Na poroge demograficheskoy katastrofy: prinuditel'naya kolonizatsiya i demograficheskiy krizis v Severnom krae v 30-e gody XX veka [On the Threshold of a Demographic Catastrophe: Forced Colonization and Demographic Crisis in the Northern Territory in the 1930s of the 20th Century]. Arkhangelsk, Pomor University, 2004. 136 p.; Traektorii proektov v vysokikh shirotakh [Project Trajectories at High Latitudes]. Novosibirsk, Nauka, 2011. 440 p.; Zubkov K.I., Karpov V.P. Razvitie rossiyskoy Arktiki: sovetskiy opyt v kontekste sovremennykh strategiy [Development of the Russian Arctic: Soviet Experience in the Context of Modern Strategies]. Moscow, 2019. 367 p.

³ Vsesoyuznaya perepis' naseleniya 17 dekabrya 1926 g.: kratkie svodki [All-Union Population Census December 17, 1926: Brief Summaries]. Moscow, 1927–1929; Vsesoyuznaya perepis' naseleniya 1926 goda [All-Union Population Census of 1926]. Moscow, Central Statistical Office of the USSR, 1928. Volume 9 – Volume 17.

Purpose, objectives and research methods

The purpose of this study is to characterize the main trends in the demographic and economic development of the northern regions during the period of beginning of the Soviet power transformations in the 1920s. The objectives of the study include analyzing the main trends in the population formation — size, composition and settlement structure of the Northern regions, based on the reconstruction of administrative-territorial reform of the northern regions, the study of the economic level of their development in the context of the new economic policy that began in the 1920s.

The theoretical and methodological basis of scientific research is the concept of modernization and urbanization transition. The application of concrete-historical analysis in combination with comparative historical and statistical methods provides an opportunity for a more thorough comprehensive study and identification of the development specifics of various northern regions during the 1920s.

Chronological framework of the study

The chronological framework of the study covers the period of the 1920s. During this period, in the conditions of a new Soviet state formation, a unified course for forced industrial modernization within the framework of the new economic policy was adopted. At the same time, the question of the development and implementation of a new Soviet policy in the North was raised. This was primarily related to the strengthening of strategic and geopolitical position of the new state and its borders in the North. In addition, the acceleration of economic and transport development of the resource-rich eastern and northeastern territories solved the problem food supplies for the European part of the country and enabled the export of raw materials to foreign markets.

During the 1920s (1923–1929), a new administrative-territorial structure of the country was formed: provinces, counties and volosts were abolished and more enlarged regions (krais), districts and regions were created. At the same time, throughout the studied period, the territories of the North were constantly changed, separated from or included in various administrative units, which was reflected in changes in the territorial area, density and number of rural-urban settlements and population.

In the late 1920s, the process of national-state reform began — the formation of national republics and districts, which to a large extent concerned the territories of the North. The establishment of self-government institutions in the national districts and their inclusion in the country's economic turnover contributed to the restoration and development of economic life of the northern outskirts, the improvement of social, medical and health services for the population.

Territorial scope of the study

A number of objective and historical circumstances were taken into account in determining the territorial scope of the study. The boundaries of the northern territories did not always coincide with the boundaries of the country's administrative structure. A number of researchers formally divide the northern regions into two zones depending on the meridional or latitudinal direction — the Near and Far North, the European and Asian North. Taking into account the spatial localization, historical features of reclamation and development of the northern territories, their administrative-territorial structure in the 1920s, this study has identified the following zones: European North (Arkhangelsk Oblast, including the territory of the future Nenets National Okrug, Murmansk Oblast, the Republic of Karelia and the Republic of Komi); Ural North (Tobolsk Okrug, including the territories of the future Ostyako-Vogulskiy and Yamal National Okrugs); North of Siberia (Turukhansk Krai, including the territories of the future Taimyr and Evenk National Okrugs, the Republic of Yakutia and the Republic of Tuva, which was under the protectorate of Russia); North of the Far East (Sakhalin Okrug, Kamchatka Okrug, including the territories of the future Magadan Oblast, Chukotka and Koryak National Okrugs).

At the time of the All-Union Population Census in 1926 (Table 1), a number of the studied regions were not yet distinguished as independent territories within their present boundaries. The Soviet administrative-territorial system was just beginning to form⁴.

In the pre-Soviet period, almost all northern regions, despite their geographical dispersion, were at a rather low starting level of socio-economic development, in contrast to the central regions of Russia.

The economic and demographic development of the regions proceeded slowly. Since the 18th century, the population of the northern territories as places of exile and hard labor was replenished by exiled settlers. State policy of agrarian colonization at the end of the 19th century permitted more active economic development of the remote northern regions of the Urals, Siberia and the Far East by the peasant population. Nevertheless, the extreme natural and climatic conditions and the remoteness of the regions from the existing economic and transport infrastructure of large industrial centers impeded the economic development and settlement of vast Arctic spaces.

⁴ The Nenets National Okrug was formed in 1929, before that, its territory was part of the Arkhangelsk gubernia. Ostyako-Vogulskiy National Okrug (since 1944 Khanty-Mansiysk National Okrug) was formed in 1930, before that, the territory of the district was part of the Tobolsk Okrug of the Ural Region, formed in 1923. From 1934 it was a part of the formed Obsko-Irtysh Oblast, from December 1934 it became part of the Omsk Oblast. The Yamal (Nenets) national district (since 1940 - the Yamal-Nenets national district) was formed as part of the Ural region in 1930. Until 1930, the territory of the Okrug was also part of the Tobolsk Okrug of the Ural Oblast. In 1934, it became part of the Obsko-Irtysh Oblast, then Omsk Oblast. The Evenk National Okrug was formed in 1930 as part of the East Siberian Krai, and since 1934 as part of the Krasnoyarsk Krai. The Taimyr National Okrug was formed in 1930 as part of the East Siberian Krai, in 1934 it became part of the Krasnoyarsk Krai. The Tuva People's Republic was formed as an independent state in 1921, was included in the composition of Russia as the Tuva Autonomous Oblast in 1944. The Chukotka and Koryak National okrugs were formed in 1930 in part of the Far Eastern Krai, in 1934 were included in the Kamchatka Oblast. Magadan Oblast was part of the Kamchatka Oblast until 1938.

European North in the 1920s

The regions of the European North suffered greatly from the hostilities and occupation of the territory by Western invaders during World War I and the Civil War. However, despite all the hardships of the post-war devastation, the economy of the regions was restored by the mid-1920s. The course towards industrialization and rapid economic recovery of the European North was of great strategic importance for the consolidation of Soviet power and the strengthening of borders. In the process of administrative and territorial transformations of the 1920s, the Komi Autonomous Oblast, the Karelian Autonomous Republic and the Murmansk Province were formed. In 1929, with the formation of a new administrative-territorial unit — the Northern Territory with the center in Arkhangelsk — the Arkhangelsk, Vologda and North Dvina Provinces and the Komi Autonomous Oblast (Zyryan) were united. Until 1936, all territorial transformations took place within the boundaries of the new region.

Regions of the European North, despite the common geographic localization, differed in characteristics and indicators of economic and demographic development. The most developed parts were the Arkhangelsk Province and the Karelian Republic. This is evidenced by the most developed structure of rural-urban settlements and quantitative indicators of the number of settlements in these regions. The largest area in the European North belonged to the Arkhangelsk Province and the Komi Autonomous Oblast. The areas of the territories of the Karelian Republic and the Murmansk Province were almost three times less. At the same time, the population density by regions was different: in the Arkhangelsk Province it was 1 person/km², in Komi — 0.5 people/km². The lowest indicator was in the Murmansk Province, the highest in the Karelian Republic — 0.2 people/km² and 1.9 people/km², respectively (Table 1). According to the data of the 1926 All-Union Population Census, the Arkhangelsk Province included five counties, 28 volosts, 13 urban and 3022 rural settlements. Of the 13 urban settlements, 9 were in the Arkhangelsk Uyezd and one each in the other uyezds. There were 1341 out of 3022 rural settlements in the Arkhangelsk Uyezd, 180 — in the Mezensk Uyezd, 215 — in the Onega Uyezd, 145 — in the Pechora Uyezd, 1126 — in Shenkursk Uyezd (Table 1). There were 15 rural settlements with a population of 4.4 thousand people on the island territories. On average, the population density was small and amounted to 1 person/km². There was a significant difference by district: the highest indicator was in Shenkursk Uyezd — 4.4 people/km², in Arkhangelsk Uyezd — 2.8 people/km², the smallest indicator was in Pechora Uyezd and on the islands — 0.2 people/km² and 0.04 people/km² respectively. The population of the Gubernia was 429.1 thousand people, of which 96.5 thousand people — urban population, 332.7 thousand people — rural population, including 2.4 thousand people of nomadic population of the tundra regions of the Mezensk and Pechora Uyezds.

In the second half of the 1920s, the Arkhangelsk Province economically was a rapidly developing region of the timber industry with its center in the port city of Arkhangelsk. The increased demand for timber export from the European North on the international market accelerated the development of the timber industry complex, which in turn ensured high rates of mechanical

growth of the urban population during this period. However, this concerned only the port cities, from which timber was exported, where most of sawmills were concentrated. In addition, in the 1920s, there was still a seasonal migration of the population to cities from nearby areas for seasonal work in the European North. Therefore, the size of the urban population during this period could fluctuate. In general, the urbanization process in the province, as can be seen from the table, proceeded at an uneven pace (Table 1). The total percentage of the urban population in the province was 22.5%. Such a high figure was achieved at the expense of the Arkhangelsk Uyezd — 36%, which was twice as high as in the country, as well as at the expense of the Pechora Uyezd — 17.5%, which had a small total population. In other uyezds, the percentage of the urban population was small. Thus, the rural-urban structure of the Gubernia's settlements was formed in the 1920s at the expense of rapidly developing regions, including at the expense of the Arkhangelsk Uyezd, which concentrated not only almost the entire urban population, but also more than half of the rural population of the entire Arkhangelsk Gubernia.

According to the All-Union Census of 1926, the distribution of the rural and urban population by sex in the Arkhangelsk Gubernia was characterized by a certain distortion of the structure: there were 225 thousand women per 204 thousand men. At the same time, this difference in the ratio was small in urban settlements, and the number of women was almost 20 thousand higher in rural areas. There were 1.1 thousand women per 1 thousand men (Table 2). The reasons for this disproportion were hidden in the general demographic trends and the intensification of migration processes in the conditions of industrial development of the regions and more active mobility of the male population.

Table 1
Administrative-territorial structure and population of the northern regions of Russia in 1926

Gubernias, uyezds, okrugs	Area sq. km.	Number of volosts and districts	Number of village and settlement councils	Number of city councils	Number of settlements		Number of inhabitants			Average number of inhabitants		Population per 1 sq. km	Percentage of urban population
					Urban	Rural	In urban settlements	In the countryside	Total	Per 1 settlement	Per 1 village		
RSFSR	19748296	4079	55923	554	1240	486033	17440478	83417507*	100857985*	240	171	6.9	17.3
European North													
Arkhangelsk Gubernia:	438119	28	260	4	13	3022	96467	332717 330309**	429184 426776**	141	109	1.0	22.5
Arkhangelsk Uyezd	81490	9	109	1	9	1341	82457	146941	229398	169	110	2.8	36.0

Mezen Uyezd	113432	5	32	1	1	180	2952	37119 35792**	40071 38744**	215	199	0.35	7.3
Onega Uyezd	26330	5	30	1	1	215	5258	32408	37666	179	151	1.4	14.0
Pechora Uyezd	94456	3	14	-	1	145	3264	15375 14294**	18639 17558**	120	99	0.2	17.5
Shenkursk Uyezd	22406	6	70	1	1	1126	2536	96440	98976	88	87	4.4	2.5
Islands of the White Sea and the Arctic Ocean	100005	-	5	-	-	15	-	4434	4434	296	296	0.04	0
Komi (Zyryansk) Autonomous Oblast:	434149	95	134	1	3	1316	6765	200443 197493**	207208 204258**	155	150	0.5	3.2
Sysolsk Uyezd	36459	27	38	1	3	647	6765	66442	73207	113	103	2.0	9.2
Izhmopchorsk Uyezd	27711	28	31	-	-	166	-	30723 27773**	30723 27773**	167	167	0.14	0
Ust-Vymsk Uyezd	69269	21	30	-	-	240	-	46925	46925	196	196	0.7	0
Ust-Kulomsk Uyezd	110710	19	35	-	-	263	-	56353	56353	214	214	0.5	0
Karelian ASSR:	143340	55	186	6	14	2841	61017	208717	269734	95	74	1.9	22.6
Petrozavodsk Uyezd	1500	9	43	1	2	621	29713	60962	90675	146	98	6.0	32.0
Kemsk Uyezd	40900	15	39	2	7	310	22414	25424	47838	151	82	1.2	46.8
Olonets Uyezd	7140	7	24	1	1	516	1766	34764	36530	71	67	5.1	5.0
Padansk Uyezd	26100	5	20	-	1	168	727	13207	13934	82	79	0.5	5.2
Povenets Uyezd	13200	7	27	1	2	613	4203	36330	40533	66	59	3.1	10.3
Pudozh Uyezd	10400	5	17	1	1	292	2194	23519	25713	91	81	2.5	8.5
Ukhta Uyezd	30600	7	16	-	-	321	-	14511	14511	45	45	0.5	0
Murmansk Gubernia	137459	9	44	1	3	228	9799	13207	23006	96	58	0.2	42.6
Ural (Tobolsk) North													
Tobolsk Okrug	1176358	5	87	1	3	776	21206	170758 119062**	191964 140268**	180	153	0.16	11.0
North of Siberia													
Yakut ASSR	4023307	22	357	5	6	10261	15751	263058	278809	24	24	0.1	5.6
Turukhansk Krai	1566844	-	-	-	-	-	-	25000	23622***	-	-	0.02	-
North of the Far East													
Sakhalin Okrug	37988	4	43	1	1	145	2748	9111	11859	81	63	0.3	23.0
Kamchatka Okrug	1038996	8	132	1	1	328	1670	30134	31804	96	92	0.03	5.2

Compiled and calculated according to: All-Union Population Census of December 17, 1926: brief summaries. Moscow, Central Statistical Board of the USSR, 1927-1929. pp. 6-23.

* — excluding population undistributed in settlements,

** — excluding the nomadic population of the tundra,

*** — the population of the Turukhansk Krai is calculated according to: All-Union Population Census of 1926. Moscow, Publication of the Central Statistical Office of the USSR, 1928. Volume 9, Pp. 2–13, Volume 17, Page 2–3.

Table 2

Distribution of the urban and rural population of the northern regions in 1926

Gubernias, okrugs	All population			Urban population			Rural population			Women per 1 thousand men		
	Men	Women	Both genders	Men	Women	Both genders	Men	Women	Both genders	Total population	Urban	Rural
РСФСР	48160653	52697332	100857985	8457891	8982587	17440478	39702762	43714745	83417507	1094	1062	1101
European North												
Arkhangelsk Gubernia	204241	224943	429184	47629	48838	96467	156612	176105	332717	1101	1025	1124
Komi (Zyryansk) Autonomous Oblast	94494	112714	207208	3326	3439	6765	91168	109275	200443	1193	1034	1199
Karelian ASSR	131839	137895	269734	30650	30367	61017	101189	107528	208717	1046	991	1063
Murmansk Gubernia	12728	10278	23006	5715	4084	9799	7013	6194	13207	808	715	883
Ural (Tobolsk) North												
Tobolsk Okrug	93359	98605	191964	10064	11142	21206	83295	87463	170758	1056	1107	1050
North of Siberia												
Yakut ASSR	147438	131371	278809	8360	7391	15751	139078	123980	263058	891	884	891
Turukhansk Krai	12221	11401	23622	-	-	-	12221	11401	23622	933	-	933
North of the Far East												
Sakhalin Okrug	7021	4838	11859	1622	1126	2748	5399	3712	9111	689	694	688
Kamchatka Okrug	17595	14209	31804	946	724	1670	16649	13485	30134	808	765	810

Compiled and calculated according to: All-Union Population Census of December 17, 1926: brief summaries. Moscow, Central Statistical Board of the USSR, 1927-1929, pp. 48–53.

The Komi Autonomous Oblast was formed in 1921 from the eastern parts of the Arkhangelsk and North-Dvina Gubernias of the RSFSR. Ust-Sysolsk became its administrative center. The region included the entire Ust-Sysolsk Uyezd, 21 volosts with the population of the Yarensk Uyezd and the Izhmo-Pechora Uyezd. In 1923, the Verkhnepechorsk (Troitsko-Pechora, Savinoborsk, Shchugorsk) volosts of the Cherdyn Uyezd of the Perm Gubernia were transferred to the region. In 1926, the region included four uyezds: Sysolsk, Izhmo-Pechorsk, Ust-Vymsk and Ust-Kulomsk, 95 volosts, 3 urban and 1316 rural settlements. The new oblast occupied a rather large territory, comparable in area with the Arkhangelsk Gubernia. At the same time, the number of settlements in Komi was twice less. The population density was 0.5 people/km². This indicator varied by districts from 2.0 people/km² in the Sysolsk Uyezd to 0.14 people/km² in the Izhmo-Pechora Uyezd. The oblast was characterized by an agrarian specificity and an absolute predominance of the rural

population. According to the 1926 Census, 200.4 thousand (96.7%) out of 207.2 thousand of the population were rural residents, 2.9 thousand of which were people of nomadic population of the Izhmo-Pechora Uyezd (Table 1). The level of population urbanization in the region during this period was minimal. The percentage of the urban population was characterized by the lowest value in comparison with the neighboring territories and all the studied northern regions — 3.2% (6.7 people of the urban population). The urban population was concentrated in three urban settlements. The most populated in the region was the Sysolsk Uyezd (73.3 thousand people), where the entire urban population was concentrated. The percentage of the urban population in this district was three times higher than in the whole region — 9.2% (Table 1). The regional center of Ust-Sysolsk (since 1930 — the city of Syktyvkar) had 5.1 thousand residents, the factory settlements Kazhim and Nyuvchim — 1.0 and 0.7 thousand people respectively. There were 647 rural settlements in Sysolsk Uyezd out of the total number of 1316 in the region, of which only 18 were large settlements. Thus, the rural network of settlements in the Komi Oblast was characterized by the presence of the majority of small villages and hamlets, where the rural population was concentrated [1, Zhrebtsov I.L., Beznosova N.P., p. 75]. With the formation of the new national statehood, the economic recovery of the region proceeded at a rapid pace in the context of the new economic policy. By the mid-1920s, the economy of the region has already developed at a faster pace. The economy of the region was restructured for the purposes of industrial development and utilization of its rich natural resources, construction of transport and industrial processing enterprises. Reconstruction of mining plants, as well as of the Seregovskiy salt plant was made. Logging production was actively developing. In 1926, a sawmill was built in the city of Ust-Sysolsk, the construction of a meat and fish cannery began in the village of Ust-Usa, power plants were built in Ust-Vym, Izhma and in some other settlements. The base of the construction industry was formed in Ust-Sysolsk. Despite the apparently rather stable economic situation in the region, researchers note that in the mid-1920s spontaneous peasant colonization continued actively, during which the Komi Autonomous Oblast was losing the peasant population, migrated in search of a better life to Siberia and beyond the Urals. V. I. Korotaev, a famous demographer, writes that in 1924–1925 more than a thousand people left the Komi Oblast for the Urals and Siberia [2, Korotaev V.I., p. 24]. The distribution of the rural and urban population of Komi by sex was also characterized by the predominance of the female population. There were 113 thousand women for 94 thousand men. In rural areas, this ratio difference was more noticeable. While on average there were 1199 women per 1000 men in rural areas, there were 1034 women in urban areas. This distribution of the population is explained by the same reasons: labor migration of men from rural to industrial areas.

The territory of the Karelian Republic was formed throughout the entire period of the 1920s. It included the Kemsk, Olonets, Petrozavodsk Uyezds, part of the Olonets Gubernia and five Pomor volosts of the Arkhangelsk Gubernia. In 1924, two more volosts were detached from the Leningrad Gubernia, and the islands of the White Sea, bordering the Kemsky Uyezd, were trans-

ferred. Thus, the Karelian Republic with the center in Petrozavodsk included seven uyezds: Kemsk, Olonetsk, Padansk, Povenetsk, Pudozhsk, Ukhta⁵ (since 1927, uyezds were replaced by 26 districts) and 55 volosts, 14 urban and 2841 rural settlements. Approximately the same number of urban and rural settlements was in the Arkhangelsk Gubernia, the area of which was almost three times larger than the territory of Karelia (Table 1). This indicates a more densely populated structure of rural-urban settlements and a denser concentration of the population in the region — about 2 people/km². This is the highest indicator of population density among the regions of the North. In several uyezd of the republic, the population density was even higher than the average. Thus, there were 6 people/km² in the Petrozavodsk Uyezd, 5.1 people/km² — in Olonetsk Uyezd, 3.1 people/km² — in Povenetsk Uyezd. 208 thousand (77.4%) people out of 270 thousand were rural, the urban population was 61.0 thousand people (22.6%). Seven of the fourteen urban settlements were located in the Kemsk Uyezd, the rest were distributed in other uyezds, except for Ukhta. The Petrozavodsk and Kemsk Uyezds had the highest percentage of the urban population — 32% and 46.8%, which was explained by the beginning of labor migration in connection with the industrial development of the region. In general, the republic, like the neighboring regions during this period, was characterized by a low level of urbanization with a predominantly rural population. The military events of the World War I, the invasion of the interventionists and the subsequent peasant revolts in the bordering volosts after the establishment of Soviet power had a negative impact on the demographic situation in the Karelian Republic. According to experts, during the war, more than 5 thousand people migrated to Finland, and after the peasant uprising, more than 11 thousand people migrated. [3, Musaev V.I., p. 35, 37] After a fairly rapid economic recovery in the region in the second half of the 1920s, industrial sectors were formed in the republic at an accelerated pace, the capacities of enterprises of the timber and sawmill industries were increased, the construction of the Kondopozhskaya hydroelectric power station began as well as the foundation of new enterprises in the pulp and paper industry and the development of mineral resources in the region. This contributed to the attraction of population to the areas of industrial development. The distribution of the population of the Karelian Republic by gender was different, there was a slight increase in the number of women in rural areas, but there were 991 women on average per 1000 men in the urban areas (Table 2). The female population was less exposed to migration activity; in addition, the industrial specialization of the republic's industry attracted the male population to the cities.

Murmansk Gubernia was formed in 1921 from the Aleksandrovsk Uyezd of the Arkhangelsk Gubernia with the center in the city of Murmansk. It included 9 volosts, 3 urban and 228 rural settlements. The territorial area of the Gubernia was comparable to that of the Karelian Republic. However, the number of settlements, especially rural ones, was almost 12 times less. On average,

⁵ Atlas Karelii. «Olonetskaya guberniya i Kareliya v sostave RSFSR – SSSR – RF» [Atlas of Karelia. "Olonets Province and Karelia within the RSFSR – USSR – RF"]. URL: <http://nwpi.krc.karelia.ru/atlas/home/ot-pjatin-novgorodskih-dor-respubliki-karelija/oloneckaja-gubernija-i-karelija-v-sostave-rsfsr-sssr-rf/index.html> (accessed 21 November 2020).

there were 96 inhabitants per settlement. The population density in the province was low among the regions of the European North — 0.2 people/km². In addition, the population of the Murmansk Gubernia in comparison with other northern regions of the European part was almost 10 times less — 23 thousand people. The lowest population was observed only on Sakhalin 12 thousand people (Table 1). The urban population was 9.8 thousand people. The Gubernia had the highest percentage of the urban population among all northern regions — 42.6%. The urban population was concentrated in three cities — Murmansk, Aleksandrovsk and Kola. In 1926, the cities of Aleksandrovsk and Kola were transformed into villages, and the urban population decreased accordingly. These data from the 1926 All-Union Census indicate that the Murmansk Gubernia, still very “young” in the first half of the 1920s, was the least developed economically and demographically. The entire territory of the Gubernia was located practically beyond the Arctic Circle. The main economic activity was fishing, animal husbandry and reindeer breeding. Harsh climatic conditions and industry specificity made the region the least attractive for the permanent population, which prevented not only natural, but also mechanical growth.

Since the mid-1920s, the situation in the region changed dramatically. With the beginning of industrial development, the ice-free Murmansk port played an important role for the Murmansk Gubernia, which carried out export–import trade operations and subsequently became the most important center of foreign trade with Western countries. Shipbuilding and ship repairing industry, construction of new industrial enterprises developed at a rapid pace, the Murmansk railway was reconstructed. After the construction of the Umsk timber mill in the province, the development of the timber industry began. The labour migration from neighbouring villages and hamlets and from other regions to build new plants and factories increased the rate of urban population in the region. Murmansk was the only rapidly developing city and a center of attraction for migrants, mainly young working-age males, due to the industry specifics of the region and the population. It was at the expense of Murmansk, according to the statistics of 1926, that the Gubernia had the highest percentage of the urban population among the neighboring territories, as well as among all the northern regions — 42.6% (Table 1). The distribution of the urban and rural population in the province by gender in 1926 was distinguished by the predominance of the male population both in urban and rural settlements. In urban settlements, there were 4 thousand women for 5.7 thousand men, in rural areas there were 6 thousand women for 7 thousand men. In general, there were 808 women per 1000 men in the province (Table 2). This was due to the harsh natural and climatic conditions, the inaccessibility of the region and its industry specifics.

In the 19 — early 20 century, the territory of the future Nenets National Okrug was part of the Mezen and Pechora Uyezds of the Arkhangelsk Gubernia. In the 1920s, it also underwent territorial changes. In 1921, the Komi Autonomous Oblast was formed, which included the Pechora Uyezd. A little later, six volosts downstream of the Pechora were returned to the Arkhangelsk Gubernia, and the eastern part of the future Nenets National Okrug remained in the Komi Republic. This division of the traditional habitat of the Nenets population had negative consequences. In

fact, the close clans of Samoyeds, reindeer pastures, summer and winter camps, separated by administrative borders, destroyed the unified economic system of the indigenous nomadic population. The situation became more complicated for the administrative authorities in management of these territories. In order to manage the nomadic population, nomadic indigenous councils were created. Economically, like other regions, these territories experienced post-war difficulties, exacerbated by the introduction of new economic measures and government taxes. In 1924–1925, the Soviet leadership abolished taxation in order to support the economic development of the population. Fishing, animal husbandry and reindeer breeding were the main economic activities. In 1924, three enlarged volosts were formed in the Pechora Uyezd: Pustozersk (to which the Ermitsk volost was annexed), Telviska (which included the territory of the Bolshezemelskaya tundra) and Ust-Tsilma. The center of the district was the village of Ust-Tsilma.

According to the health department of the executive committee of the Northern Territory, quoted by V.I. Korotaev, the population of the district in 1926–1927 amounted to 12.4 thousand people. 5 thousand of them are representatives of the indigenous Nenets, the rest are representatives of the Komi and Russians. The author pointed out that this figure is approximate, which is associated with the difficulties of accounting for the indigenous nomadic population and the inaccessibility of territories [2, Korotaev V.I., p. 80]. The main factor was that during this period, there was a process of national-state formation of the future Nenets National Okrug with the redrawing of the borders of territories and settlements. This process was completed only by 1929.

Ural North in the 1920s

The territories of the future national okrugs of the Ural North — the Nenets and Ostyako-Vogulskiy, were originally part of the Tyumen Gubernia of Tobolsk, Surgut and Berezovsky uyezds of Western Siberia. After formation of Ural Oblast in 1923–1929 and the transformation of uyezds, 15 okrugs were formed, including the Tobolsk Okrug with the center in the city of Tobolsk. Okrug was formed from the northeastern part of the former Tyumen Gubernia: Berezovskiy (without a part of the Sartynya Volost), Surgut, Tobolsk (without a part of the Istyatskaya and Malinovskaya volosts) and a part of the Verkh-Pelymskaya Volost of the Turin uyezds. The Okrug includes five districts: Berezovskiy, Kondinskiy, Obdorskiy, Samarovskiy and Surgutskiy, including three urban and 776 rural settlements. The Tobolsk North occupied a huge territory — more than 1 million km². For comparison: the area of the entire Ural Oblast, which included the Tobolsk Okrug, was 1.7 million km². At the same time, the population density, in comparison with the regions of the European North, was the lowest even in comparison with the small Murmansk Gubernia, where the indicator was 0.2 people/km²; it was 0.16 people / km² in the Tobolsk Okrug. In comparison with the regions of Siberia and the Far East, the lowest population density was in the Turukhansk Krai, Yakutia and Kamchatka — 0.02, 0.1 and 0.03 people/km², respectively (Table 1).

According to the All-Union Census of 1926, the population of the Okrug was 192 thousand people, the urban population included 21.2 thousand people who lived in three urban settle-

ments: Tobolsk, Surgut, Berezov, two of them (Surgut and Berezov) were designated as rural settlements in 1926. Consequently, the urban population has decreased due to territorial and administrative changes. The percentage of the urban population in the Okrug was low — 11%. The urban settlements were inhabited mainly by the Russian old-time population. The largest rural settlements with predominance of the Russian population were Obdorsk, Nizhnevartovskoe, Kondinskoe, Saranpaul, Nakhrachi, Leushi, Bolchary, etc. there were 180 inhabitants per town and village. The rural population, as well as in the whole country, prevailed in the Okrug — 170.7 thousand people, 51.7 thousand of which were nomads of the northern regions. There were 776 rural settlements in the settlement structure. The structure developed at a very slow pace, especially in the remote northern regions, where the nomadic population predominated. In general, the settlement structure in the district was determined by natural and climatic conditions, the level of economic development and transport accessibility of the region. In the 1920s, the Tobolsk North also experienced difficult times of post-war devastation and economic crisis. After the expulsion of Kolchak's army in 1921, the territories were engulfed in revolts, which were extinguished by 1922 and a gradual recovery of the region's economy began. During the New Economic Policy period, the region's economy was characterized by some recovery, the revival of fair trade and private entrepreneurship. The scope of business activities of the Tobolsk North was very limited and was conditioned by natural landscapes with a characteristic abundance of water and forest resources in the region. It was represented by fish and bread trade, retail trade, as well as timber and fish industry, transportation services, etc. According to the Soviet leadership, the inclusion of the Tobolsk North into the Urals industrial complex should have facilitated the involvement of vast forest lands and natural resources in various industrial sectors, including metallurgy, and the integration of the territory into the country's economic complex. However, in the 1920s, this was almost unrealistic due to the underdeveloped communications and the actual transport isolation of the region. In contrast to the regions of the European North after the recovery period, in the mid-1920s, the economic development of the Tobolsk Okrug was limited by the intensification of logging and fishing industries (hunting, fishing and reindeer husbandry). The main focus of the Soviet leadership was on the development of the fishing industry and further development of the resources of the Irtysh region, the middle and lower Ob regions. At the same time, the private sector began to be gradually excluded out of the industry.

The zone of denser population settlement passed through the southern territory of the Okrug and included a more developed structure of rural and urban settlements, as well as workers' settlements and settlements at railway stations ("railway stations") [4, Tatarnikova A.I., p. 22]. The northern territory of the Okrug was traditionally occupied by a nomadic and semi-sedentary indigenous population: Voguls (Mansi), Ostyaks (Khanty), Zyryans, Selkups and Samoyeds (Nenets). Indigenous peoples had their own habitats, where they have coexisted peacefully since ancient times. As in the territory of the future Nenets National Okrug, indigenous councils were created in the territories of the Tobolsk Okrug for the administrative management of territories,

which also gave the leadership the opportunity to obtain more detailed information about the population of the territories. State support of the indigenous peoples of the North in the 1920s, their exemption from paying taxes and fees improved the living conditions of the indigenous population, and contributed to the strengthening of their economic position.

The gender distribution of the rural and urban population in the Okrug was characterized by a general tendency towards the prevalence of the female population. In rural areas, the difference in the male to female ratio was more pronounced. In urban settlements, there were 11 thousand women for every 10 thousand men, while in rural areas there were 87 thousand women for 83.3 thousand men. On average, there were 1056 women per 1000 men (Table 2). This distribution of the population was explained by the general demographic trends in the country and the migration activity of the male population.

North of Siberia in the 1920s

In 1922, the Presidium of the All-Russian Central Executive Committee adopted a resolution on the formation of the Yakut ASSR with the administrative center in Yakutsk. Among all the northern regions under consideration, Yakutia was the largest administrative-territorial unit in the country. Its territory stretches for more than 4 million km² (Table 1). The Autonomous Republic included the Yakutsk Gubernia, the Khatango-Anabarskiy district of the Yenisei Gubernia, the Olekminsko-Suntarskiy Volost of the Kirenskiy Uyezd, the islands of the Arctic Ocean and the Okhotsk Uyezd of the Kamchatka Oblast. In 1923, the Okhotsk Uyezd was transferred to the Kamchatka Gubernia. In 1926, instead of five uyezds, six okrugs were created, which were divided into uluses, volosts, village councils, naslegi and naslegi councils: Verkhoyansk, Vilyuiskiy, Kolymskiy, Lenskiy, Olekminskiy and Yakutskiy. According to the 1926 All-Union Census, the republic included six urban settlements: Verkhoyansk, Vilyuisk, Kolymsk, Olekminsk, Yakutsk, as well as Tommot, founded in 1923⁶ and 10261 rural settlements. This is the largest number of rural settlements in comparison with other northern regions. Nevertheless, with such a number of settlements, the population density in the republic, as noted above, was characterized by one of the lowest values among the northern regions of the European part, the Urals and the Far East — 0.1 people/km² (Table 1). Settlement structure of Yakutia in the first half of the 1920s developed at a slow pace, settlements were small, with an average of 24 people. It is also the lowest among the northern regions. The specifics of agriculture in the region (nomadic and sedentary cattle breeding, reindeer herding) determined the dispersion of the settlement system and, accordingly, a low population density with a relatively uniform development of large territories of Yakutia. In the second half of the 1920s, the Soviet leadership tried to pursue a policy of consolidation of rural settlements, but later it turned into a policy of “forced concentration of the rural population” and was negatively perceived by the local population [5, Gavrilyeva T.N., p. 468.]

⁶ Yakut ASSR. URL: <http://bsk.nios.ru/enciklodediya/yakutskaya-assr> (accessed 20 October 2020).

The population of Yakutia, according to the 1926 Census, was 278.8 thousand people. The rural population predominated, it amounted to 263 thousand people, the urban population — 15.7 thousand people. Consequently, the percentage of the urban population was low — 5.6%.

The period of the 1920's was rather difficult and full of military and political events for Yakutia. After the expulsion of Kolchak's army, the establishment of Soviet power on the territory of Yakutia and the formation of an autonomous republic, a new stage in the political and socio-economic development of the republic began. The recovery period of the economy and the NEP implementation had positive results in the region, the pre-war level of development was achieved in a number of indicators (cattle breeding, agriculture). The industry of Yakutia was at the initial stage of development, almost at the level of handicraft production. In 1923, there were 8 state and 11 private enterprises, which included a power plant, metalwork and mechanical workshops, a flour mill, a printing house, etc.⁷ A significant event and stimulus in the economy and transport development of Yakutia was the discovery of a gold deposit in 1924 in the Aldan region, where its production became the first in the country in a few years. The mines of Lebediniy, Zolotoy, Turuk and others were opened. Since the mid-1920s, an intensive inflow of migrant workers to the mines began. Population of the mines increased to 13.5 thousand in summer of 1925, however by November, it gradually decreased to 8 thousand people⁸. The first workers' settlements appeared, a new city of Tommot was formed in the Aldan region. Geological exploration and development of coal deposits, as well as tin, tungsten and other natural resources of the region, continued. Active industrial construction began. By the end of the 1920s, sawmill, leather shoe and brick factories were opened. In 1925, the construction of the Amur-Yakutsk Mainline (AYAM) marked the beginning of the transport development of the region and contributed to an increase in the mechanical population growth not only in mines, but also in other industries and transport. The indigenous national population continued to engage in nomadic herding and reindeer breeding, while part of the population switched to a semi-sedentary lifestyle. The economy of Yakutia continued to be dominated by hunting and fishing, with a special emphasis on furs, which were in great demand on both the domestic and foreign markets.

Thus, in comparison with the neighboring Tobolsk Okrug and the Turukhansk Krai of Siberia, Yakutia was a rapidly developing region during this period, attracting an active working-age population not only from neighboring areas, but also from remote ones. The ratio of the male and female population in the republic was characterized both in urban and rural areas by predominance of the male population. Thus, there were 7.4 thousand women for 8.3 thousand men in urban settlements and 124 thousand women for 139 thousand men in rural settlements. In general, there were 891 women per 1000 men in the republic (Table 2). This disproportion was explained

⁷ Antonov E.P. *Promyshlennoe osvoenie Yakutii v 1920–1930-e gg* [Industrial Development of Yakutia in the 1920s – 1930s]. URL: <https://zaimka.ru/antonov-yakutia/> (accessed 20 October 2020).

⁸ Ibid.

by harsh climatic conditions, industry specificity of the region, focused on exploration and extraction of natural resources, development of mining industry and transport construction.

Territories of the future Evenk and Taimyr (Dolgano-Nenets) national okrugs in the 1920s were part of the Turukhansk Krai of North-Eastern Siberia. The territorial area of the Turukhansk Krai was 1.5 million km² and was one of the largest administrative-territorial units. It should be noted that the area of the Krasnoyarsk Okrug, which included the Turukhansk Krai, was only 208 thousand km². The population density in the Krai was the lowest (0.02 people/km²), actually at the level of the islands of the European part, the territory of which was 15 times smaller (Table 1). The population in the Krai was rural, with 23.6 thousand people. In 1921, after the expulsion of Kolchak's army and the establishment of Soviet power in the region, three volost executive committees of Verkhneimbatskiy, Monastyrskiy and Dudinskiy were formed. The policy of the Soviet leadership in the region was carried out within the framework of the general state course to support the national indigenous population by organising aboriginal councils, establishing economic relations, cultural enlightenment, education and healthcare. In 1924, the indigenous population, like in other national northern regions, was exempted from paying taxes, and benefits for the supply of goods were established. In the middle of 1923, the "Integral-Soyuz" cooperative was organized in the Turukhansk Territory, which united the consumer, commercial and agricultural activities of the population. In the mid-1920s, under the conditions of the new economic policy, more than a dozen trading posts were founded in the Turukhansk Krai, where bread and other goods were exchanged for furs and fish. New consumer cooperatives were created to supply the population with goods and products. At the trading posts, cultural bases with medical and veterinary posts and elementary schools were formed. In total, five cultural bases and eight schools were opened. The first hospital in the village of Dudinka on Taimyr was opened in 1927. In total, by the end of the 1920s, five medical departments and first-aid posts were formed on the territory of Taimyr - in Dudinka, Volochanka, Tolstoy, Nos and in the Khatanga tundra [6, Bicheool V.K., p. 105]. In 1925, within the framework of the administrative-territorial reform in the Turukhansk Krai, three districts with the Russian population were formed: Dudinskiy, Monastyrskiy (Turukhanskiy), Verkhneimbatskiy, and six national districts: Eloguiskiy, Zatundrinskiy, Ilimpiyskiy, Podkameno-Tunguskiy, Tazovskiy and Khetskiy⁹. In 1927, the first settlement was built on the territory of Evenkia — the Turin cultural base — the future center of the formation of the Evenk National Okrug, with a hospital, a veterinary center and an elementary school. At that time, the traditional livelihoods of the indigenous nomadic population (hunting, fishing, reindeer breeding) were preserved in these areas. However, the indigenous population was gradually involved in new economic relations. Discovered in the early 1920s by the Yamal expedition on the study of natural resources of the region, large reserves of coal in the Taimyr Peninsula and the richest Norilsk nickel deposit contributed to the beginning of the industrial development of the region. Nevertheless, the population of the

⁹ Encyclopedia of the Krasnoyarsk Krai. Turukhansk District. URL: <http://my.krskstate.ru/docs/regions/turukhanskiy-rayon/> (accessed 26 October 2020).

Turukhansk Krai, and in particular the regions of Taimyr and Evenkia, formed very slowly during this period, mainly due to a small natural increase. In the ratio of the region's population by gender, as in neighboring Yakutia, the male population prevailed due to the harsh natural and climatic conditions and the specifics of the fishing industry. There were 11.4 women per 12.2 thousand men, on average there were 933 women per 1000 men (Table 2). In 1928, the territories of Taimyr and Evenkia were withdrawn from the Turukhansk Krai, and in December 1930, on the general wave of national state building, the Evenk and Taimyr (Dolgano-Nenets) national okrugs were formed.

During the 1920s, Tuva (Uryankhai Krai) was not officially part of Russia, but was under its protectorate (since 1914). During this period, Tuva was characterized by similar trends in development with the national northern territories of Russia, the period was rich in terms of military-political events and revolts. In the early 1920s, military operations to expel the White Guards from the territories continued in some border territories of Tuva and Mongolia. In this regard, there were frequent migrations of the indigenous population to neighboring territories, for example, to Altai. Since 1921, the period of the formation of Tuva statehood began. In that year, the All-Tuva Khural proclaimed the formation of the People's Republic of Tannu-Tuva Ulus (in 1926–1944 — the Tuvan People's Republic). Its independence was officially recognized by Russia and in 1926 by Mongolia. The territorial area of Tuva during this period was about 200 thousand km² and was divided into khoshuns (in 1921 — 7, in 1941 — 16). The urban population was concentrated in a single city — the capital of the Republic, Kyzyl (since 1926). E.D. Prokofyeva provides data on the population of Tuva in the 1920s, which, according to various sources, was not the same. In 1922, according to the materials of the Commissariat of Nationalities, 100 thousand people lived in Tuva, of which 30 thousand were Russians and 70 thousand were Tuvians. Another source for the same year cited a figure of 120 thousand people. Periodicals cited lower figures. So, in 1925, according to their data, the population was 63 thousand people, including 51 thousand Tuvians [7, Prokofyeva E.D., p. 80]. The population was distributed unevenly across the territory, the population density in 1929 was 0.38 people/km². In the west and in the center of Tuva, the density was much higher. 70% of the population of Tuva was concentrated in the Kemchik and Taiginskiy khoshuns [7, Prokofyeva E.D., p. 80]. The Soviet leadership provided economic and socio-cultural support to the republic. In strengthening its influence, it relied on the Russian labor colony, formed in 1921 on the territory of Tuva. The Russian population appeared in Tuva since the 19th century due to the active agrarian colonization policy of the tsarist government, its number was about 20% according to various sources.

At the beginning of the 20th century, there were 340 settlements with a Russian population of about 12 thousand people in Uryankhai. Half of them were established at the beginning of the 20th century. More populated territory was the Khemchik river basin (82 settlements) and the Turano-Uyuk steppe (66 settlements — 2.5 thousand people). The largest number of the population by this time settled in the area adjacent to Tannu-ola (modern Tandinskiy district). The main

population was agricultural. The large population was actively settled during the 1920s in the areas of Kaa-khemu and Tandy, where the Tuvinians had previously settled [7, Prokofyeva E.D., p. 156]. During the period of economic recovery, then under the NEP conditions, nomadic cattle breeding, fur and fishing remained the main economic activity of the indigenous population. In the Russian colony, they were engaged in agriculture based on individual peasant labor, as well as in gold mines and handicraft enterprises (pottery, soap, tar and pitch, sheepskin-leather, felting-pimokat, shoemaking, locksmithing, confectionery sausage-making, etc.). Gold mining enterprises became the basis of the Tuvinian industry. Due to intensification of gold mining in the republic, the number of workers in this industry doubled in 1928–1932. [8, Mollerov N.M., p. 121]. At the end of the decade, state farms appeared in Tuva — TOZs, TUZHs, the first agricultural artels (collective farms), the process of modernizing agriculture began. In the mid-1920s, the Tuvintsencoop cooperative was launched in Tuva, which played an important role in the development of Tuva's industry, in foreign and domestic trade. Besides, Tuvinbank was opened, a power plant was built, gold mining and handicrafts were established, and a printing house was opened. At the same time, the state-cooperative sector of the economy brought more than half of the revenues to the budget. In 1926–1929, a geological expedition of the Academy of Sciences of the USSR worked on development of coal deposits, and a comprehensive expedition for the study of national problems, which provided assistance in the creation of a number of scientific, cultural and educational institutions worked in 1930–1931. In 1931, a demographic and agricultural census was carried out in Tuva, the population of which was 82.2 thousand people; 64.9 thousand of them were Tuvans, 17.3 thousand belonged to other nationalities, mostly Russians. The population of the republic lived in 13 thousand yurts, 1.4 thousand chums and about 5 thousand houses. The overwhelming majority of the population (76.1 thousand people) belonged to the agricultural sector, 88% of Tuvan households in 1931 continued to lead a nomadic lifestyle¹⁰. According to the 1931 Census, there were similar trends in the gender distribution of the population in Tuva as in neighbouring regions. The number of men slightly exceeded the number of women: for 42 thousand men there were 42 thousand women. There were 935 women per 1000 men¹¹.

Despite the state independence, socio-economic transformations on the territory of the Tuva Republic took place under the patronage of Russia in the 1920s and, in general, predetermined similar trends in demographic development with other northern regions. The inclusion of the republic in Russia's zone of interest, the active establishment and expansion of economic and trade relations contributed to the migration inflow of the Russian population to Tuva, as well as the return migration of the Tuvinian population from neighboring regions.

¹⁰ 85 let Tuvinskoy sel'skokhozyaystvennoy i demograficheskoy perepisi 1931goda [85th Anniversary of the Tuvan Agricultural and Demographic Census of 1931]. URL: <http://mkzyzl.ru/about/info/news/7964/> (accessed 27 October 2020).

¹¹ Ibid.

North of the Far East in the 1920s

The Far Eastern region had a particularly important geostrategic and geopolitical significance. The most distant region from the centre of the country was an integral part of trade, economic and foreign policy relations with the Asia-Pacific countries, which necessitated strengthening the positions and defense capabilities of the young Soviet state in this region. The period of the 1920s was the most difficult for the Far Eastern regions. When the restoration of economic life was in full swing in other northern regions, military operations against the Japanese interventionists and White Guards continued in the Far East. In 1920, on the territory of the Far East and Eastern Siberia, an independent Far Eastern republic was formed with the administrative center in the city of Verkhneudinsk. It included Zabaikalskaya, Amurskaya and Primorskaya regions, Kamchatka (transferred to the RSFSR in 1921) and the right of way of the Chinese-Eastern Railway (CER). In 1923, after the defeat of the intervention and the White movement, the republic was abolished and it was annexed to Russia as Far East region with Zabaikalskaya, Amurskaya, Primorskaya and Kamchatskaya gubernias with the center in Vladivostok. In 1926 the region was transformed into the Far Eastern Krai, which included 9 okrugs, divided into 75 districts with the center in the city of Khabarovsk. The northern regions of the Krai were included in the Kamchatka and Sakhalin okrugs [9, *Dal'niy Vostok Rossii...*, p. 110.] In terms of territorial area, the Kamchatka Okrug was the largest northern region, comparable in size to the Tobolsk North — 1 million km². (Table 1) The region was characterized by the lowest population density among all northern regions, this indicator was comparable to the population density of the Turukhansk Krai and the islands of the Arctic Ocean — 0.03 people/km² (Table 1). The settlement structure of the population in the Kamchatka Okrug consisted of 1 urban settlement and 328 rural settlements, which indicated a poorly developed settlement structure. On average, there were 96 people per one settlement. In contrast to the southern belt of the Far East regions, which were developed due to active mechanical growth of population, the process of development and settlement in Kamchatka was very slowly due to the harsh climate and inaccessibility of the region. Transport communication between settlements was difficult within the peninsula, as well as external. Initially, the Okrug was divided into 8 districts: Anadyrskiy, Bolsheretskiy, Karaginskiy, Penzhinskiy, Petropavlovskiy, Tigil'skiy, Ust-Kamchatskiy and Chukotskiy. According to the All-Union Census of 1926, the population of the district was 32 thousand people. The rural population prevailed — 30 thousand people. The urban population was concentrated in the city of Petropavlovsk-Kamchatskiy and amounted to 1670 people. The level of urbanization was minimal, the percentage of the urban population was 5.2% (Table 1). According to the 1926 Census, the population distribution of the Kamchatka Okrug was similar to situation in other northern regions, where the number of men exceeded the number of women: for 17.5 thousand men there were 14.2 thousand women. On average, there were 808 women per 1000 men (Table 2). This was due to the remoteness of the region from transport interchanges with limited navigation, harsh climatic conditions and the specialization of the region on the fishing industry. The territory of Kamchatka was rather poorly included in the economy of

the country and the region. The underdevelopment of the Kamchatka Okrug hindered its socio-economic and demographic development. On the other hand, its main fishing and processing industries were owned by Japanese entrepreneurs on a concession basis. Such an economic policy in Kamchatka was due to the interest of the management in attracting foreign investments. After the expulsion of the Japanese interventionists and the restoration of the regional economy, the situation in the economic life of the district changed dramatically. In 1924, the first state-owned enterprise, the Okhotsk-Kamchatka Joint-Stock Fishing Company, was founded. In order to provide the joint-stock company (exploitation of fisheries, supply of the local population, purchase of gold and furs) with labor resources, seasonal hiring of workers was organized. Japanese migrants worked in concessional Japanese enterprises. At the same time, the number of Japanese workers on the peninsula was approximately the same in relation to Russian workers. In the late 1920s, the number of Japanese workers was 2788 people, Russian workers — 2 898 people. [10, Elizarova V.O., p. 67]. Since the mid-1920s, the public sector in the industry gradually strengthened. In a short time, fish canning factories and a number of auxiliary enterprises (timber processing plant, shipyard, tin can factory, etc.) were built [11, Ilyina V.A., p. 14]. An important role in this period was played by the formation of transport communications, which established a year-round connection between Kamchatka and the mainland. Transport development significantly accelerated the economic and demographic development of the region. The agricultural and forestry industries were further developed. Geological exploration expeditions of the region began. At the same time, the problem of labor shortage due to seasonal recruitment has not been resolved. In 1930, Kamchatka began accepting the first settlers for the planned organized resettlement of the population to the underdeveloped regions of Siberia and the Far East.

Traditional crafts — hunting, fishing, reindeer herding — remained the basis of economy of the indigenous peoples of Kamchatka. The nomadic Koryaks and Evenks had reindeer breeding as their main economic activity while the sedentary Koryaks, Itelmens and Aleuts fished and hunted sea mammals. In the late 1920s, a state monopoly on fur production and trade was established. The indigenous population was actively involved in this industry [12, Kirillova A.I., p. 43]. In 1925, the Far Eastern Committee for Assistance to the Peoples of the Northern Outskirts of the Region was created, which was of great progressive importance in the economic development of the indigenous population. In 1930, the Chukotka and Koryak national okrugs were formed from the territory of the Kamchatka Okrug. There were three districts left in the Kamchatka Okrug: Bolsheretskiy, Petropavlovskiy and Ust-Kamchatskiy. In general, the economic and demographic development of Kamchatka in the 1920s was inextricably linked to solving primarily foreign policy and geostrategic problems.

During the 1920s, Sakhalin Island was in the midst of foreign political events and diplomatic struggles. In 1920, the territory of Southern and Northern Sakhalin was occupied by Japan, only in 1925, after the diplomatic agreements and the withdrawal of Japanese troops from Primorye, the northern part of Sakhalin returned to Russia, and the southern part of it officially remained under

the protectorate of Japan. Since that time, socio-economic and demographic processes in the northern and southern territories have proceeded in accordance with the state policy of the countries. In 1926, the Sakhalin Okrug was formed with the center in the city of Aleksandrovsk as part of the Far Eastern Territory. The Okrug includes four districts: Aleksandrovskiy, Rykovskiy, Okhinskiy and Rybnovskiy. The Sakhalin Okrug occupied the smallest territorial area among all northern regions — 38 thousand km². At the same time, the island, as well as the vast territory of the Kamchatka Peninsula, was characterized by the lowest population density — 0.3 people/km².

The population, according to the 1926 All-Union Population Census, was almost 12 thousand people. In comparison with 1923, the population decreased by almost 3 thousand people. According to the published data of the occupation authorities of Japan, the population of Northern Sakhalin in 1923 was 15.2 thousand people, of which 50% were Russians, the rest were Japanese, Chinese, Koreans [13, *Istoriya Sakhalina i Kuril'skikh ostrovov...*, p. 403]. In 1926, the population consisted of Russian old-timers (67.9%), foreigners (17.1%) — Chinese, Koreans, Japanese and representatives of indigenous peoples — Nivkhs, Orochons, Tungus and Yakuts (15%) [13, *Istoriya Sakhalina i Kuril'skikh ostrovov...*, p. 408]. The rural population prevailed — 9 thousand people, the urban population was 2.7 thousand people. At the same time, the Sakhalin Okrug had a fairly high percentage of the urban population — 23%, comparable to the actively developing Arkhangelsk Gubernia or the Karelian Republic (Table 1). In 1926, in order to provide the region with labor resources, the Council of People's Commissars of the RSFSR adopted a decree on benefits for those moving to Northern Sakhalin (exemption from the army service, from agricultural and trade taxes). This measure stimulated a quite rapid inflow of population to the region. In the second half of the 1920s, the population doubled due to peasant resettlements. In 1926–1929, its number was 26.5 thousand people. [13, *Istoriya Sakhalina i Kuril'skikh ostrovov...*, p. 408]. The rural-urban structure of the harsh and inaccessible region of the Far East was underdeveloped, it included 1 urban settlement and 145 rural ones (Table 1). The number of settlements was small, with an average of 80 inhabitants.

Sakhalin was somewhat different in its economic development during the 1920s from Kamchatka and other northern regions of Siberia. During the years of occupation, Japan has shown an active business position in relation to the region. In order to accelerate the development of Sakhalin and service its occupation forces, transport communications (bridges, roads and railways, telegraphs, etc.) were being built on the territory. In particular, the development of transport was aimed at the exploitation and development of oil fields. A number of industrial enterprises were built: power plants, mechanical workshops and sawmills, fish farms. Since the 19th century, Sakhalin, as already mentioned, was the main coal-mining region of the Far East. The fishing industry played an important role in the region's economy, and the agricultural industry was actively developing. The population was formed unevenly, migration flows were directed to the centers of industrial activity, timber processing, fishing and mining industries. The bulk of Sakhalin's labor resources were provided by organizational kits and recruits. The living conditions of the

migrants were rather difficult, with return migration reaching 25%. The indigenous population, as evidenced by the 1926 Census, constituted a small part of the Sakhalin population and was engaged in traditional trades — hunting, fishing, reindeer husbandry, and, like in other northern regions, was gradually involved in the economic life of the region. The distribution of the population by gender was characterized by a predominance of the male population. In 1926, there were 4.8 thousand women for every 7 thousand men. In the city, the difference between the genders was less than in the villages. On average, there were 689 women per 1000 men. This distribution is typical for a number of northern regions due to the harsh climatic conditions, the inaccessibility of the region and the specifics of the economy, where male labor is predominantly involved.

Conclusion

Thus, the dynamics of the northern regions development during the 1920s was conditioned by the general trends of the Soviet state policy. With the beginning of the reform of the country's administrative-territorial structure, the regions of the North were subjected to a large-scale re-drawing of territories. With the changes in the territorial area, the territorial management system changed, as well as the population size and the structure of settlements. In general, the northern regions occupied vast areas in scale, stretching for thousands of kilometers. The largest area belonged to the Republic of Yakutia — more than 4 million km², more than 1 million km² was occupied by the Turukhansk Krai, the Tobolsk Okrug, the Kamchatka Okrug and the territories of the islands of White Sea and Arctic Ocean. At the same time, the indicators of population density per 1 km² compared with the indicator for the RSFSR (5.1 people/km²) were incomparably small, in some regions they did not even reach 1, the lowest indicator was in the Turukhansk Krai, in Yakutia and on the territory of the Kamchatka Peninsula and the islands of the White Sea and the Arctic Ocean. This indicated, on the whole, poor economic development and settlement of the Northern territories at the beginning of the 20th century. After the end of the World War I, the Civil War and the expulsion of the invaders from the territory of the state, a period of economic recovery began in all regions, and then a unified course for industrial modernization was adopted within the framework of the new economic policy. These measures contributed to the rapid restoration and further economic development and settlement of the North. At the same time, as shown by historical and comparative analysis, the development of various regions of the North during this period, despite a number of similar trends, differed and was largely determined by such factors as the level of economic development, the presence of rich natural resources and external state borders.

European North during the 1920s was a rapidly developing region with a timber industry complex, a fishing industry and sea foreign trade ports in the city of Arkhangelsk and the city of Murmansk. It was the so-called “currency shop of the country” or “currency sawmill”. The intensive increase in production capacity was determined not only by the more developed level of the region's economy, but also by the proximity of the western borders and the need to strengthen

the borders of the new Soviet state. The Far Eastern North was also the epicenter of international diplomacy during this period and, as part of trade and economic relations with the countries of the Asia-Pacific region, was of particular importance to the state. In addition, Sakhalin was a developed center of the coal mining, forestry, fishing and gold mining industries at the beginning of the 20th century. The accelerated industrial development of these northern territories also resulted in rapid population growth and growth of urban settlements.

The development of the North of the Urals and Siberia during this period proceeded at a slower pace. By the beginning of the 20th century, these territories were characterized by poor economic development, lack of communications and transport isolation. In this regard, after the recovery period, from the mid-1920s, the economic development of these regions was reduced to the intensification of logging and various branches of the fishing industry. In some regions, industrial production remained in its infancy. In this regard, the density and size of the population there was small, the structure of the settlements was characterized by the dispersion of settlements across the territory. The exception was Yakutia, where in the mid-1920s the Aldan gold deposit was discovered, which became the center of attraction for investments and labor migrants.

State transformations of the 1920s influenced the formation of the population of the northern regions — the size of the population, including urban and rural, as well as changes in the gender structure and ethnic composition. The growth of the urban population was observed in the regions of the European North — the Arkhangelsk and Murmansk gubernias and the Karelian Autonomous Soviet Socialist Republic, as well as in the Sakhalin Okrug of the Far East North. The high rate was explained by the influx of the urban population from neighboring districts, as well as from other regions for the construction of new enterprises, for working in the fishing, coal and gold mining industries on preferential terms. At the same time, the indicator of the urban population in these areas in percentage terms was 1.5–2 times higher than the average for Russia, although the North was characterized by a predominance of the rural population.

In the gender structure of the population, the European North (with the exception of Murmansk Gubernia) and the Ural North tended to be dominated by women. In the North of Siberia and the Far East, the male population predominated, which was due to the harsh climatic conditions, the inaccessibility of the regions and the industry specifics, where the male population is predominantly employed.

The general trend in the development of regions during the 1920s was a state national policy towards the indigenous peoples of the North. At the first stage, this policy provided material support to indigenous households, exempted them from taxes and duties, improved living conditions, introduced medical services, established indigenous councils in the regions — Soviet authorities and incorporated indigenous territories into the national economy. All these measures had a positive impact on the attitude of the population towards the new government and, in general, on the economic and demographic development of the indigenous population. By the end of the 1920s, the next stage of national policy emerged — the formation of national districts in the resi-

dence areas of the indigenous peoples of the North and the transition from measures of their state support to the transformation of life and activities on the basis of a socialist structure.

Thus, the beginning of the first transformations of the Soviet power in the field of administrative-territorial structure, economic development and national policy determined the main trends in the formation of the population and economic development of the regions of the North in the period of the 1920s.

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Transformation Processes and Nutrition Factor in the Far North Residents' Resilience System *

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Abstract. One of the global challenges of our time is the conflict of man and human communities with the rapidly changing world order, which has an aspect lying at the intersection of culture and human physiology — the conformity of food behavior to lifestyle and the environment. The vitality and resilience of modern humans is subjected to special challenges. Comfortable conditions of existence in the modern world have a reverse side, expressed in diseases associated with sedentary lifestyle, psychotraumatization, violation of the usual nutrition pattern. These changes are especially noticeable on the example of indigenous peoples of the North, who have lived in relative isolation for a long time, as well as on the example of migrants forced to work in unusual natural and climatic conditions and, in general, abruptly and for a relatively short period of time (which does not allow "launching" the adaptation mechanisms) to change the whole habitual way of life. These categories of population are of special interest for researchers, including in connection with the reactions of body to changes in the food model. The idea of optimal food for the human body, formed in the course of nutriological studies, often contradicts the food traditions of peoples living in conditions far from being favourable. Since the end of the 19th century, balanced consumption of fats, proteins and carbohydrates was perceived as a civilization sign of mature modern society, and any deviations were treated as primitive practices. Over time, the approach to studying the lifestyle of traditional societies evolved from the perspective of the mechanism of human adaptation to different habitats. Traditions, including eating habits, are regarded as an optimum point of survival with the highest level of food, fuel and other material resources available in a given habitat. In addition to the problems of traditional and modernized food supply, the article focuses on the painful conditions associated with the disruption of the habitual way of life, work and nutrition of various groups of northern residents — in historical retrospect and at the present stage. Archive and literary sources, results of modern medical and social research and own field material (ethnosociological and biomedical) were used for the analysis. As a result of the generalization of the data set, which includes the authors' own research, it has been concluded that, in addition to ensuring the supply of basic foodstuffs, preventive medicines and high-quality preventive medicine for permanent residents and temporary workers in the Arctic, it is advisable to take into account the survival practices of indigenous peoples that have been developed over the centuries, creating the conditions for new settlers for assimilation. The credibility of these traditions is given by their high viability and their focus on the ethnic survival of indigenous people in the North.

Keywords: *Arctic, indigenous peoples of the North, transformation process, adaptation, resilience, food behavior, nutrient.*

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Relevance of the research topic

Researchers note that most of today's diseases are related to improper nutrition. Ethnic groups live in different geographical conditions, the availability of necessary nutrients varies, so in the process of adaptation to natural and climatic (and then to social) conditions, the human body changes, a culture of consumption is formed (for example, tabooing some types of food — inaccessible or those that body of a representative of the ethnic group cannot digest), along with food distribution system — daily, seasonal, as well as by age, gender and social strata. It can be assumed that modern peoples are the descendants of those who were able to adapt their sustenance to existence conditions; other human groups either perished or were absorbed by more resilient populations. In the process of this adaptation, a certain part of national cultures have developed an “economical” culture of food consumption, in which the body makes reserves of nutrients that are “spent” in conditions of food scarcity, or adapts to obtain the necessary substances from poorly edible food.

A special place among such cultures is occupied by Arctic peoples living in extremely unfavorable conditions, first of all, the nomadic reindeer herders. In the 1920s, in the framework of discussions among the members of the Committee for Assistance to the Peoples of the Northern Frontiers¹, the reindeer-herding peoples were perceived as the most resilient ones. Nowadays, however, the problems of their survival, especially the health problems that are stressed due to the violation of the traditional way and rhythm of life, cause concern among researchers and medical practitioners. In this regard, there is a special interest in the experience of self-preservation of these peoples, including in relation to nutrition.

The hypothesis underlying this article consists of two theses: 1) adaptive practices developed at the optimum point, corresponding to the best survival with the amount of resources that could be extracted from the environment; 2) traditional adaptive practices were preserved in collision with civilization because they were able to smooth out the negative social and material consequences of modernization.

Level of research on the adaptive role of nutrition

An interdisciplinary approach of representatives of various sciences is widely used in the discussion of nutrition problems: sociologists [1, Noskova A.V.], medical specialists [2, Kaznacheev V.P., Panin L.E., et al; 3, Lobanova L.P., Lobanov A.A. et al; 4, Prodovol'stvennaya bezopasnost'...; 5] and hygienists [6, Kochkin R.A. et al; 7, Eganyan R.A.; 8, Nikiforova N.A, Karapetyan T.A. et al], geographers and economists [9, Erokhin V.L.], ethnologists [10, Kabitskiy M.V.; 11, Arutyunov S.A., Voronina T.A.] and culturologists [12, Chudova T.I.], even political scientists [13, Ichijo A.] rely on conclusions made by specialists in distant sciences. Of particular note is a number of works carried

¹ State Archives of the Russian Federation. F. R-3977. Committee for Assistance to the peoples of the northern outskirts under the Presidium of the All-Russian Central Executive Committee [Protocols].

out by interdisciplinary teams of authors, which are distinguished by a comprehensive approach, as well as an orientation towards applied results [14, Borinskaya S.A., Kozlov A.I. et al; 1].

The issues of unchanged food traditions preserved by ethnic groups under conditions of urbanization and globalization [10] do not cease to be relevant. Of particular interest is the Far North, where the population demonstrates the adaptive capacity of human body to the negative living conditions. Traditionally, the following population groups are considered: the indigenous small-numbered peoples of the North (ISPN); representatives of other peoples permanently residing in the North and being already autochthonous population: Russians, Komi, Karelians, etc.; migrants living in the Far North for 1–2 generations and have already adapted to the harsh natural and climatic conditions; "migrants" who arrive in the North temporarily, for a short time, for a season, or those who work in periodic modes (rotational workers, Arctic sailors, military personnel, hydrometeorological service workers). The health condition of the latter category is more demanded; the research interest to the other groups of "northerners" is caused by health changes under the influence of westernization and modernization. The possibility to observe the state of health of a generally small, but very diverse population of the Northern territories allows comparing the adaptation mechanisms of people genetically adapted to living in the North and representatives of other cultures that have a different physiological mechanism [4].

The general conclusion of numerous medical publications is that the nutrition factor is the most important element of human health in the Far North. The specificity of health of the indigenous peoples of the North, who are moving to a sedentary lifestyle, is being investigated precisely in connection with changes in nutrition. For example, the functional activity of the thyroid gland is being studied, and it can be seen that the consumption of traditional types of food affects positively, while the negative results clearly correlate with the consumption of unfamiliar food [5]. The practical results of the research are the conclusions about necessity of "development of functional products...for prevention of consequences of living in an uncomfortable environment", while taking into account various groups of northerners, depending on adaptation of their organism to conditions of the North, terms of living there and types of labor activity [8, p. 23]. Physicians and hygienists write, in particular, about the "polar metabolic type" formed in conditions of life and labor activity in the North, which requires food with an increased proportion of proteins and fats while reducing the role of carbohydrates [15, Vorobyeva N.A., Vorobyeva A.I. et al].

Recent literature contains review publications [8; 14], focusing on those features of organism functioning in the conditions of the Far North which are formulated as "polar stress syndrome" (pathological reactions of organism to high latitude conditions), manifested in a complex of maladaptation processes [16, Khasnulin V.I., Khasnulin P.V.].

Research sources

The issues of nutrition as a reflection of public health state attracted the attention of a team of authors, consisting of historians and physicians, as part of their research on the phenomenon of human resilience in extreme conditions. The research results underlying this article are based on a set of archival documents and publications of physicians of the late 19th – early 20th centuries. The information obtained from these sources, as well as the field materials of the authors (expeditions in 2015, 2016, 2019) are used as the basis for a historical and comparative analysis, the purpose of which is to clarify the adaptive capabilities of a person in the North in historical retrospect and at the present stage.

Basic information about the health status of various groups of the population living in the Far North, at least until the 1930s, was obtained from sources of a subjective nature. These sources included descriptions of travelers, observations of doctors. To a large extent, their assessment was based on their own ideological attitudes. What was seen in a negative light by supporters of “cultural influence”, was assessed differently by observers oriented towards the uniqueness of people's experience.

The research underlying the article is an attempt to cross-study the adaptive capabilities of people to complex changes, including an abrupt change in the entire way of life. As an example, a relatively new social formation was taken — the inhabitants of the Varnek settlement on Vaigach Island. During three field seasons, the authors observed the socio-cultural and medical basis of life of this small community [for more details see: 15, Vorobyeva N.A., Vorobyeva A.I. et al, 17, Troshina T.I., Morozova O.M., 18, Svetlichnaya T.G., Vorobyeva N.A.]. “Reading” of well-known ethnographic sources and modern socio-medical literature is carried out through the prism of this observation and the concept formed under its influence.

Traditional nutrition of the indigenous small-numbered peoples of the North

Traditions of food are formed in the process of population's adaptation to the natural, climatic and social living conditions. The calorie content of food, its vitamins saturation should mitigate the negative consequences of these conditions, which is especially important for the inhabitants of the Far North, assimilated by humans relatively late. The economic resources of the Far North, in particular the lack of plant food, with which the human body receives the necessary vitamins and minerals, as well as the specificity of the daylight hours, when most of the year people do not receive the necessary ultraviolet light for their development, have to be considered in understanding the optimum nutrition of the inhabitants of the region. On the other hand, on the side of the nomads of the North is their way of life and living in different natural zones (tundra, forest-tundra, taiga), providing a variety of available food products, which was of significant importance in poor conditions for human life. An example of successful adaptation to difficult natural and climatic conditions were the Nenets, who, according to the testimony of a doctor who observed their life at the beginning of the 19th century, “have no diseases”: “... accustomed to the climate,

being in continuous labors and studies, eating moderate and always the same food from infancy, they truly enjoy health" [19, Belyavskiy F.I., p. 172].

Due to the harsh conditions of the Arctic region, the "protein-fat diet" is of particular importance in the nutrition of indigenous ethnic groups to ensure excess human energy consumption in a cold climate [20, Baturin A.K., p. 321, 323]. The necessary vitamins were obtained from meat (primarily venison) and fish. In terms of the "average" optimal diet for a person, food of reindeer breeders was excessively protein-rich: 35-40% of calories came from protein (for comparison: in the temperate climatic zone — 12-15%). This corresponded to the daily food intake of about 600-800 grams of venison per day. However, the lack of animal fats, calcium and vitamins remained [21, Grigulevich N.I., p. 148-149; 4, Prodovol'stvennaya bezopasnost'].

As nutrition specialists believed at the end of the 19th century, "protein food cannot be exclusive, since it would have to be consumed too much, it is difficult for digestion" [22, Munk Im., p. 6]; at the same time, the northerners, primarily the indigenous population, had no choice, they had to consume a lot of protein, which was "burned" by a large number of physical actions and the need to generate heat to resist the cold.

Moreover, reindeer were primarily a means of transportation for northern nomads and only in extreme cases were used as "live canned food", when no other food sources were available, such as hunting or fishing [19, Belyavskiy F.I., p. 166]. The eggs of wild birds, an important source of protein, were consumed in large quantities.

For a long time, the fish-based diet of the inhabitants of the Arctic Ocean coastline was perceived as flawed. At the beginning of the 20th century, it was argued that "fish meat provides fewer nutrients than the meat of warm-blooded animals" [22, Munk Im., p. 13]. Later it was recognized that in terms of protein content, some types of fish are superior to meat, and up to 86% of fats composition in fish meat is unsaturated acids that are well absorbed by the human body. Fish contains many vitamins (including such important vitamins in fish oil as A, D, E), as well as micro and macro elements. It is not a coincidence that, as we know from the observations of travelers, even the Russians (Pomors), eating mainly fish, preserved good health state in the North. Sometimes they were forced wintering during the voyages, and, using exclusively fish oil as liquid food, the Pomors arrived home even in full health.

At the end of the 19th century, nutritionists paid attention to the need for regular meals, which must include hot liquid food at least once a day. In the North, the system of cooking and storing food did not allow such a prescription to be fulfilled. Hence, by the way, the tradition of drinking tea among Russians, primarily living in the northern part of the country, as well as the use of hot reindeer blood by the Nenets. The animals were not necessarily killed for this: it was enough to make an incision, which healed quickly, and the person received the required amount of hot, nourishing, well-digestible liquid food. In addition, hot blood of a freshly slaughtered deer, according to both population and doctors, was the best preventive measure against scurvy. Deer feed on plant food, which is inaccessible to the inhabitants of the north for most of the year; thus,

the animal's blood is saturated with useful substances that it needs for an active life in the harsh North. By eating it, people also get them. Blood does not contain parasites that can be found in raw meat. In the absence of cows among reindeer breeders, "complementary feeding" of children began early enough with "a piece of soft reindeer meat with blood, which was tied to a string so that the child would not swallow the piece or choke on it" [23, Martynov S.V., p. 51, 54]. (By the way, based on this, Russia produces a biological supplement "Pantogematogen" — hematogen based on deer blood).

Difficulties with obtaining fuel and using utensils for cooking in nomadic conditions led to the use of raw or poorly preserved meat and fish food. The Nenets ate slightly dried meat and raw fish (stroganina) since childhood, which, according to doctors, led "to the spread of gastric diseases, the main of which is helminths...". However, fermentation of food was a kind of food preservation. According to a specialist in the field of food culture, a fermented product "due to the fermentation of raw materials and raw food diet" [12, Chudova T.I., p. 41] was an additional supply of vitamins in conditions of their deficiency for most of the year due to geographical conditions.

In the process of economic interaction of the population of the European tundra (Nenets and Sami) with the newcomer Russian and Komi population, food borrowings also took place. Since the 18th century, the Nenets exchanged flour for making flatbread or adding it to meat dishes. The diet of the indigenous inhabitants of tundra and the settlers (Russians and Komi), who also ate mainly deer meat and fish, as a result, began to converge. It should be noted that other peasants of the Northern territories had a larger and more varied diet than the inhabitants of the farming regions whose diet consisted mainly of plant food, some milk, and seldom — meat or fish. Even in comparison with the Vologda peasants, the inhabitants of the northern territories of European Russia consumed food one and a half times more — in terms of calories [24, Bolshakov A.M., p. 112].

It has been repeatedly noted that among many population groups of the North — Russians, Komi, Karelians, Nenets and Lapps — in conditions of a lack of bread, it was customary to mix dry grass and tree bark into flour, as well as "chaff, rowan leaves and borshchak ..." [25, Aleksandrov N.S., p. 46]. Even when there was enough bread, the set of products of plant origin included "cabbage soup", which was cooked from wild plants. Such nutrition terrified pre-revolutionary doctors. In their view, this was one of the most striking manifestations of the people's poverty and lack of nutrition. Under the influence of hygienists, the population abandoned such additives to bread. However, in the difficult years of the Civil War, due to the cessation of grain delivery from other regions and due to a poor harvest, the peasants of the Arkhangelsk province "threshed dried straws of the dead harvest, oilcakes of the previous harvest, fish bones, small fish-fry, collected herbs with mortars— all this was ground into flour with mortars, then they baked it in iron pans, baked for the table... " ². In 1919, a representative of the American Red Cross, who travelled along

² Рukopisnyy fond Onezhskoy rayonnoy biblioteki. Korotkikh M. Vospominaniya [The Manuscript Collection of the Onega Regional Library. Korotkikh M. Memories]. URL: <http://www.onegaonline.ru/biblio/see.asp?kod=312>.

the western coast of Arkhangelsk province, stated in his report that “residents mix straw and moss with flour so that there would be enough for a longer period”³. In the 1920s, the really locust years, the assertion that 20–50% of the inhabitants of Pomorie were starving was based on the fact that “the population eats mostly fish, while straw, chaff and moss are mixed into bread”⁴.

And were herbal additives to bread so harmful in northern conditions, when meat and fish were the most accessible food? After all, this tradition was constantly recorded by observers. Incidentally, when there was a shortage of food during wars and other popular disasters, scientists studied the various surrogates that were traditionally used for food, and it was proposed to take into account the methods of extracting nutrients and useful substances from them, to teach the population “in case of starvation” [25].

When there was a shortage of tea, which, as mentioned above, replaced the necessary hot and liquid food for the northerners, the population used various additives, for example, “they drink a thick drink made from chaga (a growth on a birch tree) or add it to tea” [23, Martynov S.V., p. 46], – but the drink must be hot. In the “hungry years” (1918 and 1919), northern doctors noted that “tea drinking is an urgent need of the population, and the deprivation of this need cannot pass without leaving a trace, without causing suffering to the people...”. Tea was necessarily supplemented with sweets, and “sugar in its chemical composition is a carbohydrate, therefore its consumption is not only a taste whim, but an essential need of the body, as a nutrient that gives heat energy in the human body ...”⁵.

Returning to the issues of cultural borrowing, it should be noted that the Russian population of the mainland tundra adopted the food traditions of the Nenets and liked “sour fish”: slightly salted fish was kept in barrels for several days in the sun or put in a stove. As a result, it became soft, and even gelatinous (while the bones remained white, and not blackened, as in rotting), acquired a sour taste and a strong smell, “so disgusting that an unaccustomed person can hardly bear it.” The gelatinous sour mass was scooped up with spoons and was considered to be a delicacy. It can be assumed that with a monotonous diet and in the absence of natural hot spices, such food aroused the appetite. Doctors of the past could not understand “why such food passes unpunished for the body ... There are not even symptoms of gastrointestinal disorders, usual for spoiled food.” Incidentally, according to Dr. Martynov, in this case, as with the blood of a freshly slaughtered deer, the newcomers, who at first felt nauseous from the sight and smell of “sour fish”, soon got used to it. Natural disgust turned out to be weaker than the fear of contracting scurvy. The Pechora residents themselves claimed that such a fish “gives vigor to the body. It is healthy for heart and good for people. If you eat fresh fish, it does not give much food and is only

³ The State Archive of the Russian Federation. Fund R-16, Inventory 1, Case 76, Sheet. 44. Telegram from Major Williams, Deputy Commissioner of the American Red Cross. January 1919, Soroka village.

⁴ GAAO. Department of documents of socio-political history. Fund 1, Inventory 1, Case 566, Sheet 81. Political summary of the Mezensky district, June 1921.

⁵ Kargopol Municipal Archives. Fund, 75(30), Case 31, Sheet no/№ Report of the agronomist to the meeting of the county council of national economy, 1918.

needed for gentlemen, but sour fish is healthier for peasants... ". Medicinal properties were also attributed to sour fish; allegedly, she helped even with impotence [23, Martynov S.V., p. 37, 39–40, 42].

Reindeer meat, in order to get it "with a smell", was stored in springs and put in barns for the whole summer, where it soured and gave off a strong smell; the population also attributed properties useful for the body to such (practically rotten) meat [23, Martynov S.V., p. 42]. As the "civilization" spread in the tundra, taste preferences also changed. However, at the end of the 1920s, a doctor who conducted medical examination of the Sami noted that the elderly preferred rotten meat.

Since the nutrition of ethnic groups depends on available resources, body needs and existing food preparation technologies, food prohibitions and restrictions existing in almost any culture are of particular interest. According to the researchers, the prohibitions and restrictions associated primarily with the physiological characteristics of a person were fixed in this way. For example, the indigenous population of the Far North does not eat such a protein-rich food as mushrooms, since the body of a tundra inhabitant does not have enough enzymes involved in the breakdown of polysaccharides during digestion. For the same reason, the northern peoples' bodies do not accept lactose — milk sugar.

Many food prohibitions have gradually died out. This may be due to the adaptation of body to the available types of food, which were previously poorly absorbed, or with economic circumstances — both with an increase in the volume and variety of food, and with its limitedness. For example, if in the 1830s the traveler recorded that the Nenets "will not eat carrion, nor do they eat dogs, squirrels, cats, ermines and snakes" [19, Belyavskiy F.I., p. 166]; then already at the end of the 19th century, it was noted that rich Komi reindeer herders feed their Nenets farm laborers with garbage.

Migrants in the Far North

All residents of this region, including the Nenets, were once an immigrant population.

During the resettlement of the Nenets from the mainland tundra to the islands of the Arctic Ocean (AO), their good health contributed to their rapid adaptation to the climate, and already in the report for 1909–1910, it was noted that in all the colonies of Novaya Zemlya there was not a single case of death or even a serious illness, and the physical condition of the resettled residents was quite satisfactory [26, Materialy po issledovaniyu Novoy Zemli, p. 189, 195]. The only people who died were those of a very advanced age. Noting among the colonists "a large percentage of senile and late senile age" who are "still vigorous and able to work", the doctor asked himself: "What matters here? Is it tribal resilience, life close to nature, albeit harsh, or the exceptional purity of the air of Novaya Zemlya?": finding no specific answer, he makes a general conclusion that all of the above "testifies to the viability of the Samoyed population" [26, Materialy po issledovaniyu Novoy Zemli, p. 202].

Indeed, for the inhabitants of the North, based on local resources, the cold was not terrible if they consumed a large amount of meat food. For northern peoples, stress was associated not with the climate to which they had historically adapted, but with the disruption of their usual way of life. Having relatively easily got used to more severe climate of the islands of the Arctic Ocean than on the mainland tundra, the Nenets tolerated changes in their usual way of life much worse. Panting from the stuffiness in huts that were built for them, the colonists of Novaya Zemlya lived in tents for a long time until they appreciated the convenience of wintering in houses with a Russian stove. Nenets children did not feel well in the school arranged for them at the meteorological station on Vaigach Island: their feet were sweating in the room even without shoes to such an extent that the skin peeled off... [27, Kozmin N., p. 320].

Reindeer husbandry in the archipelago did not root, and the population lacked the reindeer blood saving from scurvy. A new sedentary lifestyle with seasonal fishing trips, life in Russian huts, which seemed too stuffy to them, replacing fresh food inaccessible at certain times — meat and fish — with unusual imported food required state support. The only noted case of mass disease was associated with the fact that “potatoes, onions, meat, cabbage, cucumbers, oil were not brought to the camp — they were necessary on Novaya Zemlya as a remedy for scurvy ...” [26, Materialy po issledovaniyu Novoy Zemli, p. 189, 190].

While the indigenous inhabitants of the mainland tundra in the northeast of the Arkhangelsk province did not suffer from scurvy at all, the autochthonous population of the Kola Peninsula (Lappish Sami) faced this disease (possibly due to their earlier “inclusion in civilization”). Anti-scurvy therapeutic measures were described by a Russian doctor: “Against scurvy, local Lapps use cloudberry, sorrel boiled with reindeer milk, rosemary infusion, pine bark infusion, fresh reindeer blood, as well as a gymnastic tool — they bow in front of the holly image, the patient is dressed in 2-3 short fur coats, after bows they give a little rest, and then start again. Sometimes sick person faints and dies ... The task is to cause profuse sweat, in the local expression, “knead the blood” stagnant in the veins” [28, Gulevich V.R., p. 124]. For all the whimsicality, these activities included a classic set of remedies: fortified food, exercise, activation of metabolic processes.

The experience of the temporary population of the Far North shows the moment when an organism collides with the climatic challenges of an extreme region. The difficulties of life in the Arctic and the special role of food in these conditions are known from the subjective assessments of Arctic travelers. For example, V.Yu. Vize⁶, describing the wintering on Franz Josef Land (1912–1913), noted the “terrible power” and “hatred for all living creatures” of the polar nature, which killed people with scurvy. At the same time, from his own experience, he was convinced that a person quickly enough gets used to working at low temperatures, but food begins to play one of the most important roles, all thoughts often concentrate on it. “With a belly tightly packed with

⁶ Vize Vladimir Yu. (1886–1954) — polar explorer, geographer, ethnographer, oceanologist, meteorologist, corresponding member of the USSR Academy of Sciences. Member of the expedition of G.Ya. Sedov (1912–1914), head of the expedition, which carried out through voyages along the Northern Sea Route in 1932 and 1934.

porridge and bread" Vize experienced "torments of hunger" caused by "deadly monotonous diet" [29, Vize V.Yu., p. 88, 102, 103, 104, 105]. Northern doctors found that a person who arrived in the North needed a special "transitional diet".

The diet of tundra natives was more than unattractive to the newcomers. Fish oil was disgusting for them, they could not eat fish constantly (for example, the cod harvested in large quantities for the workers of Murmansk construction in 1916 was almost all wasted, since the visiting workers categorically refused to eat it). Fish of the so-called "Pechora salting" (sour), which was almost a delicacy for the inhabitants of the Pechora Territory, was perceived by visitors as spoiled food, and they were forced to drink reindeer blood only by the danger of contracting scurvy.

Many cultural food prohibitions disappeared among migrants precisely due to the lack of habitual and necessary nutrients. Finding themselves in new natural and geographical conditions, they switched to food that was completely unacceptable for them from a cultural point of view, if it allowed them to smooth out the negative consequences for the body, being a kind of "medical nutrition". The employees sent to the North got used to such food, overcoming the natural disgust, which turned out to be weaker than the fear of contracting scurvy.

Scurvy was one of the most severe diseases associated primarily with northern conditions. It began "with aversion to food, [then] weakness, indifference. <...> Forces are falling, the person is already lying ... The patient falls into quiet delirium and die..." [28, Gulevich V.R., p. 119–120]. The causes of scurvy were stated by doctors of the late 19th century, for example, insufficient food, especially the lack of fresh food and vegetables, poor-quality drinking water, as well as excessive drunkenness or even "not drinking spirits". At the same time, it was noticed that if the nomads do not have scurvy, then the sedentary population regularly encounters it.

It can be assumed that even without medical advice, "by trial and error", at the cost of which was health and even life, the newcomer population adapted to the harsh climate and unusual food. At the beginning of the 20th century, scurvy has practically disappeared among Murmansk fishermen, which can be explained by the adaptation of the organism to living conditions in high latitudes, even during a short seasonal labor, but repeated annually.

Experiments on the implementation of a "civilized" food model

By the end of the 19th century, scientific concept of a healthy diet was formed, which should be balanced in organic matter, available for assimilation by the human digestive system and harmless from parasites and infections. The urban educated strata were the first to receive information about the latest achievements in medicine, and then the traditions of Europeanized nutrition also fell into the environment of the common people. A significant part of the Russian population of the circumpolar zones by the end of the 19th century has already adapted to modern food, largely thanks to seasonal occupations, military service and the penetration of other-class elements into the national environment.

The traditional food of the common people was assessed by experts as harmful to health. According to the doctor of the late 19th century, peasant cabbage soup, wholemeal pies with cabbage or potatoes, raw vegetables are extremely harmful food: "When I tried the food of the peasants ... I constantly upset my digestion; only their simplicity and habit make them able to digest this rough and tasteless food "[30, Gryaznov P., p. 144].

Too much food at the expense of fiber with insufficient fats and proteins, which, according to scientists of that time, were necessary for the normal functioning of the body, is harmful to health, said P. Gryaznov, doctor of medicine. To the disadvantages of traditional nutrition, he attributed the low use of salt in the preparation of daily food, since "to digest rough food requires a significant supply of hydrochloric acid in the stomach" [30, Gryaznov P., p. 149, 153, 154]. Observing the peasants, the doctor noted constant catarrh of the gastrointestinal tract, which led to prolapse of the intestine and the appearance of hernias ⁷. In his opinion, the reason was the wrong diet, although most likely it was the result of hard physical work.

The addiction of northern residents (Russians, Komi, Lapps) to meat and fish "with a smell" could not fail to receive an appropriate assessment. Struggling with the really unusual for a person of another culture the use of "Pechora salted fish", the production of which was seen primarily in the lack and high cost of salt, doctors recommended the use of saltpeter and salicylic sodium as preservatives [28, Gulevich V.R., p. 77]. Presumably, such additives did not have the best effect on the health of people accustomed to traditional food (at present, saltpeter is encrypted as E252, and salicylic acid is prohibited for use in the food industry in many countries).

For residents of the Nenets village on Vaygach Island, the difficulties of traditional food consumption include seasonal bans on the catch of certain types of game and fish. And if the inhabitants can eat fresh reindeer meat only during the slaughter period (fresh reindeer blood, if necessary, can be obtained from alive animal), then they eat fish all year round, and the surplus of fresh fish is preserved (salted). In addition, ready-made (commercial) foods with a high salt content are consumed almost daily, which also means a violation of the traditional diet. To remove excess sodium chloride from the body, the population consumes a lot of water (primarily in the form of tea). Salt is also harmful because it increases appetite and allows people to eat more food than they need in terms of the amount of energy expended. In combination, such diet "brings" tundra residents closer to common diseases of modern humans.

At the beginning of the 21st century, the influence of modern concepts of tasty and healthy food and storage and preparation technologies continue to influence the lifestyle and health of indigenous groups. Even at the beginning of the 20th century, the population of the tundra became addicted to drinking tea with sugar, which "they bought for any money and drank several times a day" [23, Martynov S.V., p. 46]. Doctors admit that the systematic use of freshly brewed tea contributes to the accumulation of vitamin C in the liver, kidneys, spleen, adrenal glands,

⁷ In the 19th century, there were no direct methods for studying the state of the gastric mucosa, and acute gastritis and functional dyspepsia were called "catarrhs".

which facilitates the work of these organs in a healthy person and helps to heal faster in case of their illness. At the same time, the negative impact of this habit borrowed from the outside on the body of the tundra inhabitant is also noted [5, Tipisova E.V., Lobanov A.A. et al].

The most clearly manifested “diseases of civilization” include repeatedly described drunkenness of both the indigenous peoples of the North and the newcomer population. To explain the development of drunkenness among the indigenous minorities, there are versions from “external” origin (getting drunk by traders coming to the tundra) to disruption of the usual rhythm of life, primarily idleness and the absence of traditional occupations [31, Andronov S.V., Lobanov A.A. et al]. Observations of pre-revolutionary travelers are confirmed by modern researchers, in particular, the authors of this article during field work on the island. Vaygach faced with the fact that the “working” Nenets did not drink at all. In order to occupy the population in the village, various “public works” are organized, for example, the construction of wooden walkways, garbage collection, and so on.

There is no genetic predisposition to alcohol among the Arctic peoples [14, Borinskaya S.A., Kozlov A.I., Yankovskiy N.K., p. 125–127]. Physiologically, drunkenness of the indigenous peoples of the North may be associated with a violation of traditional nutrition. The “protein-lipid” diet, according to the researchers, has an anti-stress effect, since the metabolism of dietary fats produces a large amount of substances that reduce the production of steroids in the adrenal glands, as a result of which the content of “fear hormones” (corticosteroids) decreases in the blood. Among the tundra population, the “hormones of joy” previously obtained from traditional food [5, Tipisova E.V., Lobanov A.A. et al] are now less and less available due to a change in the diet. Reducing the usual amount of fat in the diet leads to an increase in the concentration of corticosteroids, therefore, to an increase in the level of anxiety, which is relieved relatively easily, although for a short time, by alcohol.

Pre-revolutionary doctors associated the abuse of alcoholic beverages by people temporarily working in the North with an unusual diet. For example, V.R. Gulevich, who provided help to seasonal fishermen in the 1870s-80s, associated this with monotonous food (consisting, among other things, of flour, cereals, salt, fresh or salted fish, tea and sugar), which leads to a loss of appetite, and since food plays an important role during hard work in difficult climatic conditions, “a worker resorts to wine, which stimulates appetite” and allows to get energized, even when “after a hard day he gets sleepy, but he needs to handle fish ...”. The doctor recommended adding onions, horseradish, mustard and other spices to the food to make it more appetising [28, Gulevich V.R., p. 101].

Dr. Gulevich considered vodka as a remedy against scurvy, which is a problem for either drunkards or those who do not drink strong drinks at all. But those who consume alcohol on a daily basis in limited quantities, according to his observations, have never been sick with it: “... Moderate consumption of strong drinks is a remedy, which has a tonic effect on the stomach, pro-

motes digestion and supports nutrition ...”, in contrast to “excessive drunkenness”, which through the development of scurvy “leads to fatty degeneration of our vessels” [28, Gulevich V.R., p. 122].

Interesting fact is that Soviet doctors were sympathetic to the therapeutic properties of alcohol in the North. In accordance with the recommendations, the fishermen were given vodka, however, in small quantities (a bottle for a month) and in small portions, depending on the time spent in the fishery.

The issue of smoking addiction among indigenous peoples (both sexes and all ages) remains interesting, which, as international practice shows, affects almost all aboriginal peoples. It is believed that joint smoking contributes to the maintenance of social ties, demonstrates equality. Doctor F. Belyavskiy, describing the life of the northern aborigines, whom he observed in the 1820s, emphasized that “... they do not indulge in drunkenness and very few of them drink wine; most of them do not use it at all”, but he noted their only “most important passion”: “to smoke tobacco, which is exchanged with Russians in large quantities”, smoking the pipe in a circle [19, Belyavskiy F.I., p. 157, 162].

According to the survey, the inhabitants of Varnek village smoke in all respects, starting with adolescents (the average age of starting smoking is 12.5 years). Tobacco consumption ranges from 10 to 20 cigarettes per day [18, Svetlichnaya T.G., Vorobyeva N.A.]. With regard to the northern peoples, it can be assumed that smoking a pipe or cigarettes allows some relaxation, rest, as well as warms the body and dulls the feeling of hunger. On Vaygach, tobacco products have a special attitude: at local sanctuaries and even at the cemetery, one can see broken cigarettes brought as a kind of sacrifice. According to local mythology, having got into a snow storm, one must stop, have a smoke, and the lost road will be found [21, Grigulevich N.I.].

On the other hand, smoking and working in cold conditions increase the risk of lung diseases for the indigenous population thrice [32, Lobanov A.A., Andronov S.V. et al].

Soviet "northern delivery" for residents of the Arctic

Active development of the Arctic began in the first decades of the 20th century, and even the indigenous peoples of the North were not sufficiently adapted to it. Establishment of polar meteorological and radio stations began in the western part of the Russian Arctic during World War I, and in the eastern part during the Civil War. The Soviet government was did not want to abandon the polar stations and military posts established in the years preceding the revolution, since the defence of the northern coast remained relevant. By this time, the country was faced with a grave food problem, and polar explorers were allowed to use “state-owned” deer for food. But the Nenets drove their herds to the far tundra, as a result, the polar explorers faced a lack of fresh food, which led to the spread of scurvy.

The Soviet experience in life ensuring of the new population of the Far North was formed in hard conditions in difficult contact with scientific ideas of that time. Doctors believed that replacing meat with another protein-containing food, namely fish, was undesirable at polar stations,

since the fish was delivered mostly salted, or sour (“Pechora salting”), which was thought to contribute to the scurvy development.

According to the norms of starving time, the polar ration was quite substantial. In 1920, 1.5 kg of sugar, 0.5 kg of jam, 0.5 kg of coffee and cocoa, 200 g of tea, 200 g of cheese, 2 kg of salt, corned meat (14 kg of meat and 18 kg fish); 2 kg of fat, 6 kg of cereals, 16 kg of flour, 4 kg of crackers, dried and salted vegetables, dried fruits, canned milk and fish, as well as lemon juice, mustard, vinegar essence, allspice and other spices⁸, which helped to flavour the generally monotonous “polar” food, were given to a person per month.

Apples for compote, jam, cocoa, condensed milk were delivered to boarding schools on the islands. Goats were kept for children to get fresh milk, which they drank with more pleasure than compotes and fruit and berry food, which they were not used to⁹; it is strange, since lactose intolerance has been repeatedly noted, at least among adult representatives of the indigenous minorities. Subsequently, the taste preferences of the Nenets changed, probably under the influence of active educational work of Soviet medicine. In conditions of restriction of traditional diet, which has medicinal properties for such “northern” diseases as scurvy (vitamin C deficiency) and nyctalopia (vitamin A deficiency), modern residents of Varnek village are particularly fond of sweets, citrus fruits, butter — products that are not traditional for the Nenets food culture, and it can be assumed that special need for them is explained by their potential preventive properties.

Medical nutritionists of the early 20th century were supporters of only fresh food, while they believed that replacing meat with vegetable food, such as bread, was undesirable, since for a person engaged in physical labor, such food would have to be consumed in too much volume, which could harm the digestive tract. Canned meat was believed to be as nutritious as meat, but it becomes boring rather quickly, which, coupled with the oppressive Arctic climate, can lead to loss of appetite and weakening of the body. In addition, in the 1920s, the quality of canned food has sharply decreased, for example, meat and vegetable substitutes have appeared. In conditions of a shortage of beet sugar, cane sugar was added to condensed milk, and vegetable fats were added instead of animal fats. Other surrogates have also appeared: canned soups — “a kind of dried noodles made from plant nutrients with addition of meat extract and a certain amount of fat”; powdered milk, egg powder. Bread was increasingly replaced by biscuits and crackers, which, in case of prolonged use, also contributed to the lack of essential nutrients in the body.

Sausages (meat processed for long-term storage) in the absence of refrigerators could quickly deteriorate, becoming dangerous food for humans. In addition, when manufacturing sausages, meat began to be substituted with lard, peas. Necessary for those engaged in physical labor, especially in difficult climatic conditions, meat was replaced by equivalent caloric values of smoked, salted and dried fish. Observing the health of people working in the Arctic has convinced

⁸ GAAO. Fund 211, Inventory 1, Case 6. Sheet The norm of polar soldering for a hydrographic expedition. June 1920.

⁹ GAAO. Fund 211, Inventory 1, Case 131, Sheet turnover 25, 27, 30, 39, 31. Reports at the 5th Congress of Soviets of Novaya Zemlya, 1929.

that such substitutions are undesirable. This contributed to a very good food supply for polar explorers and northern sailors in the 1930s, during the period of the development of the Northern Sea Route. The northern delivery for the population of the Arctic ocean islands was based on special nutritional standards, which included products that served as prophylaxis against diseases: in addition to bread, fish and meat, there were cereals, peas, fresh vegetables, sauerkraut, potatoes, dry vegetables, animal and vegetable oils, eggs, sugar, potato flour, dry compote, cranberries, currants, tea, salt, canned vegetables, fresh fruits, condensed milk, pasta, wheat flour, onions. For an adult person, the calculation assumed more than 5852 calories, for a schoolchild living in a boarding school — 4185 calories, for a sick person — 5082 calories¹⁰.

The nutritional values of other products were also investigated, which, unlike berries, can be obtained in the Far North for most of the year. Thus, a kilogram of northern mussels contained 563 calories, while the meat of this mollusk contains a large amount of protein, valuable fatty acids, glycogen, proteins, mineral salts, phosphorus, iron, vitamins A, B1, B6, C. Inferior in caloric content, in the amount of protein and fats to other northern products (herring, cod, navage, etc.), mussels contained carbohydrates and nonnitrogenous extractive substances that “stimulate the appetite” [33, Sbornik nauchnykh trudov..., p. 80–84]. Nutritional value of traditional food products of the indigenous peoples — venison and guillemot eggs — was substantiated [33, Sbornik nauchnykh trudov..., p. 84].

Even prisoners of the polar camps were better supplied than other Gulag inhabitants in those years [31, Gurskiy K.P., p. 19, 76]. Cut off from the mainland, carrying out a task of the highest state importance in the difficult conditions of the Arctic, workers — both prisoners and civilians — needed to be healthy and active, which was provided precisely by food. Providing “polar rations” to all categories of the camp population turned out to be less costly than ensuring the maintenance of weakened people who, in conditions of being cut off from the mainland for several winter months, could not be evacuated.

At present, food standards are being actively developed for people working in the Far North; the experience of ethnic groups living here is taken into account; modern pharmaceutical industry makes it possible to find therapeutic forms of replacing missing nutrients and vitamins.

Experience of lifestyle regulation aimed at self-preservation in the Far North

Representatives of the indigenous peoples of the North gave an impression of being healthy people on researchers of the past years. The reason for this is quite understandable: only the strongest survived in the harsh climatic and socio-economic conditions; high infant mortality rate, almost no chance of survival for any weak, sickly person, almost unchanged number of tundra population for many decades are a confirmation of this. Given the difficult living conditions in the tundra, according to the author of the report “On the organization of medical care for the

¹⁰ GAAO. Fund 211, Inventory 1, Case 155, Sheet 40, 41. Nutritional norms of the population of the Arctic Ocean, 1933-1934; Ibid Case 139-B, Sheet 67. The norm of nutrition for children aged 14-16 years old boarding school on Novaya Zemlya. 1930-1931.

Samoyeds of the Arkhangelsk province" (1924), there was "a fairly high average age", when "70-year-olds are not uncommon, you can also meet 90-year-olds", indicating "high resistance to conditions" ¹¹.

The era when people physically worked "to a sweat" is over, and thus the life of people has become much easier, its duration has increased, many diseases associated with physical fatigue and occupational traumatism have disappeared. At the same time, reducing physical activity, but maintaining the traditional model of nutrition, people do not spend received energy, which leads to "diseases of civilization" — obesity, cardiovascular diseases, gallstones, diabetes and so on.

As a matter of fact, all modern medical and social studies of indigenous minorities come to a common result: the most widespread are overweight, arterial hypertension, diseases of musculoskeletal system, and bronchopulmonary pathology. There are also quite understandable differences with the newcomer population: the indigenous people suffer from high blood pressure less often than migrants, which confirms the significance of differences in the consumption of traditional food products and their influence on the development of cardiovascular pathology. Indigenous minorities, especially those engaged in traditional activities, are more likely to have pulmonary diseases, which is explained by the nature of their work in the open air throughout the year and the corresponding way of life. Doctors conclude that the consumption of traditional products is indispensable for maintaining the health of indigenous people and the necessary level of adaptation through nutrition to the harsh conditions of the Arctic of the alien population. Nevertheless, socio-economic changes lead to a decrease in the consumption of traditional food, and, accordingly, affect the deterioration of the population's health [11, Arutyunov S.A., Voronina T.A.; 18, Svetlichnaya T.G., Vorobyeva N.A.].

Comparing the tissue metabolism indicators of various groups of population, modern physicians are increasingly convinced that the best results are shown by the residents of territories in which "civilization" has been present for a relatively long time compared to the population of "poorly developed territories", which is explained by a significant difference in the diet: "due to the developed logistics, the availability of imported foodstuffs is higher ... The production of venison also meets the needs of the population ... Expansion of the diet ... of food and sufficient import of vegetables and fruits, probably, makes it possible to compensate for the potential damage from the additional environmental load associated with the industrial development of the territory" [31, Andronov S.V., Lobanov A.A. et al].

At the same time, when studying the biological equivalence of imported food products most often used to replace local fish and venison, scientists from the Yamal-Nenets Autonomous Okrug (YNAO) found that a diet enriched with venison and local fish statistically significantly increases antiatherogenic fractions of blood lipids, increases the elasticity of the vascular wall, helps to maintain normal body weight, improves microcirculation, oxygen uptake in tissues, tissue fluid

¹¹ GAAO. Fund 760, Inventory 1, Case 2, Sheet 129-131. Data on the organization of medical care for the Samoyeds of the Arkhangelsk province (1924).

exchange and antioxidant protection of the body against free radicals [35, Lobanov A.A., Bogdanova E.N. et al]. Based on the study of ethnographic materials reflecting the tradition of obtaining nutrients from various local sources, experimental studies are being carried out in order to create a diet more adapted for life in the North [36, Kostritsyn V.V., Lobanov A.A. et al]. Thus, the rate of consumption of deer meat, fish and other traditional food products was revealed, the regular use of which reduces the risks of developing chronic non-obstructive bronchitis of the indigenous population of the Arctic zone of the Russian Federation. For the same purpose, recommendations are given on organizing a new way of life for the indigenous peoples. For example, it was found that using stove heating doubles the chances of chronic bronchitis [32, Lobanov A.A., Andronov S.V. et al; 36, Kostritsyn V.V., Lobanov A.A. et al].

The resilience that distinguishes the nomadic peoples of the North is also present in ability to accept new things relatively easily. Historical and contemporary experience shows that the popularization of knowledge and explanatory work affect the indigenous peoples quickly. For example, a fairly large number of extreme factors affect the body of those living in the Far North: cold exposure, heliomagnetic radiation, altered photoperiodism (polar night and polar day), other additional negative health effects, including bad habits (tobacco smoking, excessive alcohol consumption, etc.) exacerbate the risk of diseases, for example, arterial hypertension.

One of the essential indicators of the viability of an ethnos is its focus on collective preservation technologies. This is a subconscious rejection of "harmful" food, and the search for ways to get rid of diseases, and a conscious attitude to the rejection of addictions. Every third resident on Vaygach island admitted that he had tried to quit smoking during the year [18, Svetlichnaya T.G., Vorobyeva N.A.]. And when asked about the motives for quitting smoking, the indigenous inhabitants of the Yamalo-Nenets Autonomous Okrug are much more likely than residents of other regions of the country to indicate socially significant ones: taking care of their own health and health of their offspring, a bad example for children, etc. [38, Gagarinova I.V., Popov A.I. et al; 21, Grigulevich N.I.]. In the village of Varnek, by the decision of a local asset, alcoholic beverages are not delivered to the island store. In response, "consumer cooperation" "took revenge" by not importing cigarettes. Now alcohol and tobacco are delivered to Vaygach in small quantities only as personal gifts from guests of the island.

Concerned about the quality of consumed water, the Nenets living on Vaygach melt snow for making tea, which is brought from remote, clean glaciers in summer, and until recently they caught small icebergs that float into the bay (now, due to climate warming, this source of fresh water practically inaccessible).

The health status of the inhabitants of the islands, who are forced to lead a sedentary lifestyle according to local conditions, is negatively affected by a lack of physical activity. The mainland Nenets, who are engaged in nomadic reindeer herding, which implies constant movement, are faced with a similar problem less often, in contrast to the islanders who have switched to a sedentary lifestyle. Over the past few decades, the Nenets of Varnek village have managed to

move away from the nomadic way of life: deer graze on the island without special supervision, moving independently from place to place in search of pasture. At the same time, despite the presence of vehicles (for example, snowmobiles, on which they move along the tundra not only in winter, but all year round), men try to make long journeys to fishing places on foot. Aimed at self-preservation, without even engaging in fishing, they walk along the coast. Previously, this method was used to collect discarded sinkers for firewood. Now the fuel is brought to the island ready-made, but the need for constant movement remains. Women, who, due to natural conditions, cannot work in vegetable gardens, wash their tiny dwellings several times a day (in permafrost conditions, houses are built small in size), or go on long walks with men.

In this one can see a form of resilience possessed by the Nenets people. This aspiration to self-preservation in any conditions, for maintaining the traditional way of life, even in a modified form, should be supported in every possible way. For example, “ethnosport” as a form of modernization of traditional types of physical activity should be developed more actively [39, Kylasov A.].

So, the problem of ethnic survival for the indigenous peoples of the North is acute; and people understand this — both consciously and subconsciously. On the example of the population of Varnek village on Vaigach island, this is manifested in the desire to go to doctors, even without a particular reason, as a preventive measure; special attitude to nutrition, dissatisfaction with the lack of fresh food in the store, the need for vegetables and fruits, especially citrus fruits, as a need for vitamin C due to the loss of the traditional form of obtaining it.

Results

Analysis of literary and archival sources, a new “reading” through the information obtained in them of the results of medical research give the authors of the article grounds to be optimistic about the issue of preserving the indigenous Arctic population. Discussions about the fate of the small northern ethnic groups have been conducted for many decades, the opinion of experts fluctuated from the assertion that they are “undoubtedly doomed to extinction” [40, Beldtsytskiy N., p. 32], to the conviction of their high resilience. The focus on ethnic survival, a certain “hidden passionarity” can serve as a mechanism, the use of which will allow fulfilling an important historical mission of Russia — preservation of the unique culture of the peoples of the Far North. Propaganda efforts, coupled with other already existing mechanisms of state support, will enable the self-preservation mechanism to be activated and enhance the effect of its action.

The reliance on historical material convinces that the decline in the health level of the indigenous population of the Far North, caused by significant violations of the traditional nutrition system and lifestyle, can be overcome with reliance on the internal resources of both the human body and the society itself. Of course, the issues of support for northern ethnic groups cannot be removed from the agenda. With regard to the labor resources attracted to work in the Arctic, the task of improving the quality of life with the help of nutrition, preventive drugs and high-quality preventive medicine remains relevant. At the same time, one should take into account the whole

complex of traditions accumulated by various groups of the population living in the North with regard to the food system and way of life.

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Logistic Basis for Organizing Weekend Recreation for the Population of the Arkhangelsk Urban Agglomeration *

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Abstract. Weekend rest is an important part of a person's recreational cycle. Northerners need a good rest to maintain their health. The choice of a place for vacation is associated with restrictions on the time of movement, since its period should not be longer than 2–3 days. The purpose of the research is to select the most suitable transport areas for residents of the Arkhangelsk urban agglomeration, taking into account the landscape and tourist resources. Based on the study of vehicles and the geographical location of tourist services, three sectors were identified, limited by five-hour transport accessibility from the cities of the Arkhangelsk agglomeration. The most promising for priority development is the southern sector, the centers of which can be the villages of Kholmogory and Emetsk. Excursion, relaxation, ecological and sports tourism can be offered there at any time of the year. The transit position of the main roads of the region gives this sector the advantages of attracting tourists from other regions. The western and eastern sectors have significant recreational potential, but their use is constrained by poor transport accessibility. The western sector with the center in the city of Onega is promising for the development of seaside relaxation tourism in summer and sports tourism in winter. The eastern sector with two centers in the villages of Pinega and Karpogory is promising for ecological, sports and excursion tourism throughout the year.

Keywords: *tourism, weekend recreation, transport accessibility, Arkhangelsk urban agglomeration.*

Introduction

Holiday rest (weekend tourism, suburban tourism, weekend) is the most important component of a person's weekly recreational cycle. Possibilities of spending a short break at the end of the week depend on good transport accessibility of potential destinations. Well-organized tourist infrastructure in an attractive recreational area provides additional opportunities for its touristic use not only for weekend rest, but also for quarterly and annual recreational cycles. The necessity to organize holiday rest is an important task to improve the standard of living in uncomfortable conditions of the Arctic. The problem of choosing a recreation place for residents of the Arkhangelsk urban agglomeration became especially relevant during the quarantine of 2020, when the possibilities of moving to other regions of Russia and the world were officially limited. Low population density, small number of roads and long distances between settlements in the Arkhangelsk region limit the choice of possible places for short-term rest to several traditional destinations near Arkhangelsk. But a good rest requires a change of scenery. Given that holiday tours generally cover 2-3 days (from Friday to Monday), well-organized logistics is an important condition for the development of such tourism [1].

In 2020, another concept for the development of tourism in the Arkhangelsk region was adopted. It indicates the prospective tourist zones, the main regional trends, the priority tourism

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activities proposed for the region¹. However, there is no mention of weekend tourism in it. In our opinion, for the Arkhangelsk region, with its remoteness from the main centers of tourist flows, territorial disunity of attractive recreational facilities, the tourism development strategy should be associated, first of all, with local residents — consumers of the local tourist product. In this regard, weekend tourism is the most promising form of tourism.

Therefore, the aim of our study was to develop a strategy for choosing tourist destinations for short-term vacations, taking into account the recreational attractiveness and transport accessibility for the population of the Arkhangelsk urban agglomeration.

Materials and methods

Approaches to the study of weekend tourism (suburban tourism) are presented in the article of E.S. Vopilova [2]. The issues of organizing such recreation for residents of the Arkhangelsk agglomeration are discussed in the work of I.A. Potapov, A.S. Bezborodov [3]. These authors limit the area suitable for suburban tourism to a distance of 2-3 hours from the locations of tourism flows formation. This is due to the fact that this territory, called the “suburban area”, is adjacent to the outer boundaries of the agglomeration, determined by hour and a half transport accessibility from the center to the periphery during commuting [4]. Weekend recreation areas are now expanding beyond the suburban areas and are being developed in relatively remote areas [5]. With the improvement of transport accessibility (increased speed of travel, use of new modes of transport, increased comfort for night crossings), the border of weekend tourists movement can be postponed, conditionally limited by transport accessibility up to 8 hours [6]. We believe that with the existing transport geography of the Arkhangelsk region, the boundaries of the weekend recreation zone are at a distance of five hours of transport accessibility from the center of the agglomeration. Depending on the mode of transport used, this distance can be covered faster or slower, but it is not tiring for short-term rest.

Our research is based on materials obtained from the study of landscape preferences in choosing a recreation place of residents of the Arkhangelsk region [7]. Typical and unique landscapes of the northern part of the Arkhangelsk region were selected (this is the territory of the Arkhangelsk agglomeration), and on the basis of a sociological survey of potential tourists, the most attractive of them in aesthetic and emotional terms were identified. These were landscapes with water (rivers, lakes, sea), hills, karst and vegetation. The survey involved 50 people aged 18 to 55; they were offered 15 photographic scenes of landscapes in the north of the Arkhangelsk region. The respondents rated these scenes on a 7-point scale. The areas of greatest interest to respondents were landscapes of forest rivers and lakes (of considerable width and mirror area), seascapes, territories with morainic terrain and limestone cliffs of Pinega [7].

¹ Ob utverzhdenii Kontseptsii razvitiya turizma v Arkhangel'skoy oblasti [On Approval of the Concept for the Development of Tourism in the Arkhangelsk Oblast]. URL: www.regulation.dvinaland.ru/docs/anti-corruption/3144/ (accessed 26 October 2020).

We compared the geographical distribution of such landscapes and transport routes in the territory logistically accessible for weekend tourism for the population of the Arkhangelsk urban agglomeration. After that, we examined the transport and geographical position of settlements that can be used as support centers for serving tourists. The distance from tourist accommodation to tourist facilities during weekend rest is limited not only by the time but also by the cost of travel. Therefore, as a criterion for the profitability of the transport and geographical location of the support centers for serving tourists, we used the material and time costs of potential tourists when moving from Arkhangelsk (the center of the agglomeration) to these settlements. We expressed the assessment of the time and cost of travel to the place of rest in points (Table 1). The sum of points at which the travel time and cost of regular flights were evaluated is a general indicator of the material and time expenditure of tourists. Since the territories differ in terms of tourist potential, we analyzed their possibilities for organizing recreational activities and identified a priority tourist specialization. Weekend tourism programs can include: relaxation tourism, excursion tourism, ecological tourism, sports tourism, rural tourism. We studied the current state of the tourist infrastructure within the transport accessibility for potential tourists of the Arkhangelsk agglomeration and identified the problems and advantages for the development of the tourist business in different areas of the territory under study. As a result of the research, we have identified the most promising places for the development of weekend tourism.

Table 1

Assessment of material and time costs of tourists [by 8]

Travel time	Point	Travel costs	Point
up to 2 hours	1	up to 300 rubles	1
up to 3 hours	2	up to 600 rubles	2
up to 4 hours	3	up to 900 rubles	3
up to 5 hours	4	up to 1200 rubles	4

Results and discussion

The territory available for weekend tourism for residents of the urban agglomeration is limited by transport accessibility along the main highways departing from its centers. The Arkhangelsk region is characterized by a low density of roads (the density of highways is 11.4 km per 1000 km², of railways — 3 km per 1000 km²).

The Arkhangelsk urban agglomeration with a population of 570 thousand people (2020) is located in the north of the Arkhangelsk region. It includes Arkhangelsk, Novodvinsk, Severodvinsk cities and rural settlements located between them. Historically, the agglomeration core is Arkhangelsk. Novodvinsk originated from a remote area of Arkhangelsk as a result of separation from it. Severodvinsk, due to its military-industrial specialization, was originally a closed city, but after the abolition of this status, it became another agglomeration core. Independent recreation areas were formed around each city, representing gardening associations. Since some residents of the agglomeration come from suburban villages, their rest is associated with their “small homeland”. A few departmental recreation centers and pioneer camps within the boundaries of the agglomera-

tion were owned by several enterprises. The only sanatorium “Belomor’e” is located at the southern border of the agglomeration. Most of these recreation centers have ceased to function. The “Belomor’e” sanatorium in the Primorskiy District and the “Kiyskiy” rest house in the Onega District are still operating. They usually focus on an annual recreational cycle, but sometimes offer weekend tours. We do not consider them in this article. Thus, the weekend rest for the majority of Arkhangelsk urban agglomeration residents was originally represented by a dacha (or country) recreation.

Currently, the preferences of citizens in choosing a weekend rest have changed. With the increase in mobility and material capabilities, new requirements for places of rest have emerged. One can get from the cities of the Arkhangelsk agglomeration (Arkhangelsk, Severodvinsk, Novodvinsk) to potential recreation areas within a five-hour transport accessibility in five directions. These are the federal highway M-8, routing from the agglomeration to the south, the Arkhangelsk — Vologda railway, also directed to the south, the Arkhangelsk — Karpogory railway and the Arkhangelsk — Pinega highway, leading to the southeast and east (right bank of the Northern Dvina river) and the Severodvinsk — Onega highway (Onega tract), following to the west — southwest. The M-8 federal highway and the Arkhangelsk — Vologda railroad can be called the best. Several passenger transports operate daily in these directions. There is one passenger run on the Arkhangelsk — Karpogory railway (in summer there is one run every day in both directions, the rest of the time — one run four times a week). The roads “Arkhangelsk — Pinega” and “Severodvinsk — Onega” do not have a hard cover throughout their entire length, which increases the travel time, especially in the off-season.

Thus, on the basis of the existing geography of roads, three sectors can be distinguished in the five-hour zone of transport accessibility, where the development of weekend tourism for the Arkhangelsk agglomeration residents is possible: southern (settlements and tourist facilities are accessible along the M-8 highway and the Arkhangelsk — Vologda railway), western (accessibility along the Onega tract) and eastern (accessibility by the Arkhangelsk — Karpogory railway and the Arkhangelsk — Pinega highway). The southern sector includes the south of the Primorskiy administrative region of the Arkhangelsk region, the Kholmogorskiy region, the north and east of the Plesetsk region (up to Plesetsk town), the west of the Vinogradovskiy region (up to Dvinskoy Bereznik town). The western sector includes the west of the Primorskiy and northeast of the Onega regions (up to Onega town). The eastern sector includes the southeast of Primorskiy, north and north-east of Kholmogorskiy, north and north-east of Pinezhskiy districts (Fig. 1). It is necessary to take into account the presence of local roads within each sector, which can also be used for the movement to places of rest (for example, the Kudem narrow-gauge railroad between Severodvinsk and Beloe Ozero village).



Fig. 1. Geographical location of sectors for weekend recreation. 1 — Primorskiy; 2 — Plesetskiy; 3 — Onezhskiy; 4 — Kholmogorskiy; 5 — Pinezhskiy; 6 — Mezenskiy; 7 — Leshukonskiy; 8 — Vinogradovskiy.

Let us consider tourist resources of the allocated sectors of the weekend recreation area in places with the most attractive landscapes for potential tourists.

Southern sector. It is characterized by vast aquatic taiga landscapes (lakes: Kholmovskoe, Smerdye, Siyskie, Obozero, rivers: Northern Dvina in the middle and lower reaches, Emtsa, Vaymuga, Onega in the middle reaches). They can be used both for relaxation tourism (rest on the shores of a picturesque waterway) and for sports tourism (kayaking, yachting). Moraine relief with level differences is encountered throughout the sector. This is a favorable factor for the recreation of population living on the flat territory of the Arkhangelsk agglomeration, as it contrasts with the usual environment. In addition, the slopes of the moraine hills can be used for skiing (as at the Mechka camp site, where ski slopes are equipped). A clear advantage of this sector is the presence of region's oldest settlements with excursion potential. These are large villages (formerly cities) Kholmogory and Emetskiy, which are older than Arkhangelsk. Kholmogory is known as the birthplace of M.V. Lomonosov (Kurostrov island, where the scientist was born, is located nearby). However, this fact is not used as a tourist brand of the territory, which is why Kholmogory is losing opportunities for the development of excursion tourism. In Kholmogory and the surrounding area, there are monuments of church architecture (the Antonievo-Siyskiy monastery, ancient temples).

The territories along the banks of the Northern Dvina are old-developed, local villages can be used for rural recreation. The part of the southern sector, which is adjacent to the railway, may also be interesting because the way to the Kenozerskiy National Park begins from the Plesetsk station, which makes it possible for the development of ecological tourism. Besides, there is Mirnyy city near Plesetsk, which can be visited by tourists, but this requires a special pass, which limits access to it. The main specializations of the southern sector are excursion, relaxation, ecological

and rural tourism. Tourist and rural tourism facilities are available all year round. The main tourist service centres in this sector can be Kholmogory, Emetsk, Plesetsk.

The main advantage of the western sector is the presence of the sea and the beach line of the eastern coast of Onega Bay (Pokrovskoe — Tamitsa), which is favorable for relaxation tourism. The seascapes of the Onega coast of the White Sea are highly appreciated by potential tourists. Together with pine forests and moraine relief, a favorable microclimate for summer holidays is created by the sea. Sports tourism is also possible. There is a slalom track with a drag lift on Molodezhnaya mountain, near Onega. Onega has a local history museum, a house-museum of the Arctic explorer A. Kuchin. In the vicinity there are villages with preserved ancient buildings, monuments of church architecture (Vorzhogory). Hence, rural tourism is possible. The peculiarity of this sector is its seasonality. In summer it is mainly seaside relaxation, in winter — sports tourism. Rural tourism can be realized all year round. The center of tourism service can be Onega city. The development problem is the difficult transport accessibility along the Onega highway. However, the resumption of railway communication on the Arkhangelsk — Onega route may improve the situation.

The eastern sector begins with the largest attraction of the region — the museum of wooden architecture Malye Korely, which is located 20 km from Arkhangelsk. The territory has a moraine relief, which also resonated with potential tourists. An important tourist resource of this sector is the karst relief and caves along the banks of the Pinega river, which are called by potential tourists the most exotic and contrasting places in the region. The Pinega Nature Reserve is located near the Pinega river, the adjacent territories are conducive to the development of ecological tourism. The Pinega river is used for sports tourism. Hilly terrains are used for skiing. Local villages are also among the oldest settlements in the region; their authenticity and the opportunity to live far from civilization contribute to the development of rural tourism. Thus, the specializations of tourism in this sector can be excursion, sports, ecological and rural recreation. The seasonality of visiting the caves should be noted (only in the cold season). The villages of Pinega and Karpogory can be proposed as reference centers for the development of weekend tourism. Sector development is hampered by poor transport accessibility.

Space-time costs. We identified possible routes of transport accessibility of potential weekend recreation sites based on an analysis of the public transport schedule.

The destinations in the southern sector are the most equipped with regular routes for passenger transportation. At the same time, the Kholmogory part of the sector is accessible by motor transport along the federal highway M-8, the Plesetsk part — along the Arkhangelsk — Vologda railway (the shortest route) and along the local paved road. There are 6 direct passenger bus routes to Kholmogory daily and up to 16 transit routes from Arkhangelsk and Severodvinsk. Travel time is on average 1 hour 25 minutes, travel costs — from 240 rubles. There are 5 direct and up to 16 transit bus routes daily from Arkhangelsk and Severodvinsk to Emetsk. Travel time is on average 2 hours 20 minutes, travel costs — from 500 rubles. The M-8 highway is the main one in the

Arkhangelsk region. There are several local roads to move between settlements within the sector. The Novodvinsk — Kholmogory road, which runs parallel to the federal highway along the Northern Dvina, is an alternative route that can be used to get from the agglomeration to Kholmogory, but the quality of its coverage is worse. In the area of Kholmogory and Ust'-Pinega there are ferries across the Northern Dvina, which allow to get to the Arkhangelsk — Pinega road in the eastern sector of the sector, to visit the sights of the Pinezhskiy region. On the M-8 highway, one can get to Dvinskoy Bereznik, the southern outskirts of this sector, in 3 hours 40 minutes. There are up to 13 direct and transit bus routes from Arkhangelsk and Severodvinsk per day. The travel cost is from 1 174 rubles. Plesetsk can be reached by five regular railway routes from Arkhangelsk and Severodvinsk (travel time is up to 5 hours, travel costs — from 400 rubles). In addition, there are 6 bus routes (direct and transit) from Arkhangelsk and Severodvinsk to Plesetsk. The travel time is 4–5 hours, travel costs — from 490 rubles.

The eastern sector has the smallest density of roads. The Primorskaya, North-Kholmogorsk and North-Pinega parts of the eastern sector are accessible by the Arkhangelsk — Pinega road, the Karpogorsk part — by the Arkhangelsk — Karpogory railway. In the immediate vicinity of Arkhangelsk there are the most famous destinations — the museum of wooden architecture Malye Korely, the temple complex in Lyavlya, the ski slope in Koskovo. These facilities are located along the Arkhangelsk — Pinega road and are the most accessible by transport. A regular bus to Malye Korely from Arkhangelsk makes 24 runs a day on weekdays and 19 runs on weekends. There are 2 regular runs to Koskovo a day. Further, the quality of the road surface decreases, asphalt is not available everywhere. But this is the only route along which one can get to Pinega and the most exotic sights of the Arkhangelsk region — karst landscapes. There is one daily bus trip from Arkhangelsk to Pinega, travel time is on average 4 hours. The cost is 750 rubles. The tourist complex Golubino, which is located near Pinega, has a transfer for tourists. The road can be impassable during the off-season. The train to Karpogory makes one daily trip in the summer and one trip four times a week during the rest of the year. Travel time is 5 hours 5 minutes, travel costs — from 606 rubles. Karpogory can also be reached by the Pinega — Karpogory highway, but it has a poor quality and does not function in the off-season. There are no official bus passenger runs from Arkhangelsk to Karpogory, but taxis run daily. A dirt road from Karpogory, sometimes turning into a country road, stretches along the coast of Pinega further through the villages.

The western sector is currently accessible only along the Onega tract. The road is partially asphalted, in the off-season its passability deteriorates. There are 2 bus routes daily from Arkhangelsk, travel time is 4 hours 45 minutes, cost — from 650 rubles. There is an alternative, more comfortable route along the Arkhangelsk — Vologda railway to the Obozerskaya station, then along the Obozerskaya — Belomorsk railway line. However, there is currently no direct passenger traffic on the Arkhangelsk — Onega route.

Space-time costs of travelling to places of rest in the above-mentioned centers of each sector of the weekend recreation area are expressed in points (Table 2). The lower the point, the lower the travel cost.

Table 2

The results of assessing the material and time costs of tourists (compiled by the author)

Sector, support center	Distance from Arkhangelsk in a straight line, km	Travel time, points	Travel costs, points	Overall rating, points
South-central sector				
Kholmogory	64	1	1	2
Emetsk	133	2	2	4
Plesetsk (train)	203	4	2	6
Plesetsk (bus)	203	4	2	6
Dvinskoy Bereznik	216	3	4	7
Eastern sector				
Pinega	138	3	3	6
Karpogory	199	4	3	7
Western sector				
Onega	150	4	3	7

Thus, the lowest material and time costs are for tourists visiting Kholmogory and Emetsk, the highest — for those visiting Dvinskoy Bereznik, Onega and Karpogory. It is noteworthy that with almost the same distance of some support centers from Arkhangelsk (Emetsk and Pinega, Plesetsk and Dvinskoy Bereznik, Plesetsk and Karpogory), their total points of material and time costs differ. The probable reasons for this are poor transport organization and roads quality (in case of Pinega).

Provision of recreational facilities for tourists in sectors of holiday area

We have analyzed the proposals for tourists' accommodation, which are offered on the official tourist portal of the Arkhangelsk region, as well as from some tour operators. Common features of accommodation facilities that can be used for weekend tourists (as well as for longer vacations and not only for residents of the Arkhangelsk agglomeration) are their small capacity. Small hotels and tourist centers prevail, many of which are more consistent with the status of a guest house (Table 3). Most of the hotels and hostels do not have a "star" certification. One of the reasons for this is the inconsistency with modern standards, small number of rooms, lack of amenities in the room and the minimum list of services provided to guests. Some accommodation facilities operate only during the warm season. There are few classic country hotels. Most of the accommodation facilities are designed for group or family visits. Bathhouses, barbecue, fishing (hunting) are among the attractions that owners of accommodation facilities can offer to tourists. Such approach to the recreation organization limits the contingent of potential tourists and deprives the opportunity of choice.

Table 3

Accommodation facilities for tourists within the weekend tourism zone

Sector	Hotels (total number of places/number of objects)	Recreation centers (total number of places/number of objects)	Guest houses (total number of places/number of objects)	Rest houses (total number of places/number of objects)	Total (total number of places/number of objects)
Southern	295/7	340/8	111/9	-	746/24
Eastern	326/4	62/1	93/6	-	481/11
Western	250/4	20/1	51/4	180/1	501/10
Total	871/15	422/10	255/19	180/1	1728/45

As the table 3 shows, most of the accommodation facilities are in the southern sector of the weekend tourism zone of the Arkhangelsk agglomeration. Recreation centers and guest houses prevail here. Four out of seven hotels are located in Plesetsk, there are no large ones among them. The only classic country hotel-club is located in the Primorskiy district in the village of Belomorye, its capacity is 32 beds. The average capacity of recreation centers is 30 beds, the largest base, Mechka, is designed for 100 beds.

Hotels prevail in the eastern sector, but there are only two large ones — one is located in the village of Malye Karely, the other is in Golubino. It should be noted that these are specially created country hotels with a developed program of attractions for tourists. Hotels also prevail in the western sector, all of them are located in Onega, only two of them are relatively large. One of them is built specially for sportsmen — skiers, it is also used by sports tourists. In this sector there is a classic seaside holiday home Kiy-Ostrov (open in summer). However, it cannot offer tourists comfortable accommodation, since its rooms are not provided with amenities. The western sector has an advantage in the number of locations only due to three large objects. Thus, there are 45 official accommodation facilities with 1728 beds in a potential weekend recreation area for residents of the Arkhangelsk urban agglomeration. At the same time, the population of the agglomeration is about 600 thousand people (2020). The territory is also visited by tourists from other regions; therefore, the available fund of accommodation facilities is not enough. According to I.A. Potapova, A.S. Bezborodov, in 2009 the total number of accommodation places for weekend tourists was 1122 beds (the authors considered the suburban tourism zone, which includes only Primorskiy and Kholmogorskiy districts) [3]. At present, the number of beds has decreased to 861 (excluding the Belomorye sanatorium). Old camp sites, designed for a significant number of tourists, have closed; new accommodation facilities are usually small in capacity. As the research data show, the most promising area for tourist infrastructure development is the Kholmogory part of the southern sector. Kholmogory and Emetsk, potential support centers of this part, are the most accessible by transport; tourists from the Arkhangelsk agglomeration will have the lowest material and time costs when travelling there. In addition, the natural landscapes are attractive to potential tourists, and the resources located there allow the development of several directions of tourism that can be used in any season. The advantage of the southern sector is its transit. From its territory one can get to the eastern and western sectors for excursion purposes, while the main place of

stay can be hotels, recreation centers and guest houses in the southern sector. Transit includes roads that pass through the southern sector (the M8 highway, the Arkhangelsk — Vologda railway), along which tourists from other regions come to Arkhangelsk. During the summer, they use the ferries in the Kholmogory region to get to the sights of Pinega. This fact should be taken into account when planning the creation of accommodation facilities. Comfortable roadside hotels, motels could be a good incentive to attract tourists there. Kholmogory is the closest historical settlement to the Arkhangelsk agglomeration, which can be used as a place for a short-term rest when creating the appropriate infrastructure. The presence of preserved church architecture, the memorial museum of M.V. Lomonosov, the local history museum, bone carving craft can become a basis for the development of various excursion programs. The creation of a recreational environment in the village will attract tourists and improve the quality of life of local residents. The vast rural landscapes presuppose the development of special estates, which are designed to immerse themselves in the life of the villagers. This direction of tourism is gaining popularity. The development and popularization of recreation in country hotels located on the banks of rivers and lakes in a small distance from the city will help to realize the recreational cycles of agglomeration residents. The impetus for the development of the western sector of the weekend tourism zone will be the resumption of railway passenger traffic from Arkhangelsk to Onega and the improvement of quality of the Onega tract coverage. This will help to make sector destinations more accessible. The prospects for the western sector are in the development of seaside relaxation tourism, since this is the most favorable place for such a vacation in the Arkhangelsk region. At the same time, it is possible to implement not only a weekly, but also an annual recreational cycle. It is successfully carried out in the oldest operating recreation center Kiyskiy, which is located there. Since seaside tourism is in seasonal demand, it would be advisable to disperse the number of rooms in mini-hotels and guest houses in summer cottages on the coast of Onega Bay. Winter tourism is associated with the existing ski complex. There is a potential for the creation of other similar complexes in this area. The eastern sector of the weekend tourism zone is distinguished by the existence of two centers, the availability of which is non-competitive. One can get to Karpogory by passenger train, to Pinega — only by bus. At the same time, the only road by which one can get from the Arkhangelsk agglomeration has a poor quality of coverage. The prospects for this sector are related to the complete reconstruction of the road to Karpogory. The development impulse is possible with the extension of the railway from Karpogory to the Komi Republic, which will make this territory a transit area and expand the circle of potential tourists. For the eastern sector, ecological, excursion and rural tourism, excursions to the neighboring southern sector will be promising.

Conclusion

As a result of the study, it was found out that the territory where it is advisable to develop weekend recreation for the population of the Arkhangelsk urban agglomeration is limited by a

five-hour transport accessibility line along five highways: the M8 highway (final point — Dvinskoy Bereznik), the Arkhangelsk — Vologda railway (final point — Plesetsk) and the Arkhangelsk — Karpogory railway (final point — Karpogory), local roads Arkhangelsk — Pinega (final point — Pinega) and Severodvinsk — Onega (final point — Onega). Thus, this territory can be divided into three sectors, depending on the direction of the road departing from the agglomeration: the southern sector (transport accessibility of tourism facilities along the M8 highway and the Arkhangelsk — Vologda railway), the western sector (accessibility along the Severodvinsk — Onega road), the eastern sector (accessibility on the roads Arkhangelsk — Pinega and Arkhangelsk — Karpogory). Promising tourist specialization of the southern sector can be excursion, relaxation, ecological and rural tourism, of the western sector — seaside relaxation, sports and rural tourism, of the eastern — ecological, excursion, sports and rural tourism. Analysis of the accommodation availability for potential tourists showed that the simultaneous capacity of hotels, recreation centers, and guest houses located there is 1728 beds in 45 accommodation facilities. Most of them are in the southern sector. Small hotels and recreation centers prevail, many of them have not been certified for star quality due to the scarcity of services provided. The problem of organizing weekend recreation in the region is mono-orientation of the offered attractions. Visitors are supposed to come there in large groups, individual rest is possible in rare cases. Analysis of the material and time costs of potential tourists showed that the lowest level of them will be when visiting the Kholmogory part of the southern sector. Consequently, tourism facilities located there are most accessible by public transport for tourists from the Arkhangelsk agglomeration. Taking into account the transit position of this area on the main roads of the Arkhangelsk region, it can be assumed that its tourist infrastructure and objects of exhibition will be in demand by tourists from other regions travelling to the north. Kholmogory and Emetsk, the oldest settlements in the Arkhangelsk region, can become the main of the tourist service centers in the southern sector. Moreover, Kholmogory and the surrounding area with significant tourist potential can become one of the main tourist centers in the north of the region. The main attention should be paid to the country hotels establishment. Development of the western and eastern sectors is limited by low quality of roads. Therefore, measures are needed to improve their transport accessibility for tourists. In this case the advantages of the western sector as a center of seaside relaxation tourism, and the eastern one as a center for ecological and sports tourism can be fully exploited.

Thus, as a supplement to the adopted concept of tourism development in the Arkhangelsk region, the cluster “Weekend tourism” should be added. Its resource base will be the southern sector of the weekend recreation area allocated by us, including the Kholmogory district with transport accessibility along the M-8 highway. As an alternative weekend rest, short-term cruises along the Northern Dvina, the White Sea, rail trips, which are becoming popular in the world and are well within the time frame of a given tourist destination, can be offered [6, 9, 10].

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The Arctic Business Trip of the President of the Russian Academy of Sciences A.M. Sergeev to Yakutia: the Main Results and Prospects for Russian Science Development *

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Abstract. The analytical review is devoted to the progress and results of the three-day business trip (March 17–19, 2021) of the President of the Russian Academy of Sciences, Academician A.M. Sergeev, to the Republic of Sakha (Yakutia) as part of a large group of scientists from the Russian Academy of Sciences and its Siberian branch. During this period, he visited more than 20 scientific and educational objects in Yakutsk and Tiksi village, met with their leaders, got acquainted with the main directions of their activities. The article reveals and analyzes numerous meetings of the President of the Russian Academy of Sciences with scientists, his speeches at conferences and round tables, where his key positions and assessments regarding the role of science in the development of Russia and Yakutia are outlined in the light of the requirements of the decree of the President of the Russian Federation “On measures to improve the efficiency of state scientific research and technical policy”. Special attention is paid to the results of meetings with the leadership of the Republic of Sakha (Yakutia), the Academy of Sciences of the republic, visits to the Federal Research Center “Yakutsk Scientific Center of the Siberian Branch of the Russian Academy of Sciences” and its institutions, North-Eastern Federal University named after M.K. Ammosov, scientific and educational laboratory “Agrokub”, the Polar Geocosmophysical Observatory, the station of rocket sounding of the atmosphere and the wind-diesel complex. The article contains innovative material on a comprehensive development plan for the Tiksi village. Speaking about the importance of a business visit to the Republic of Sakha (Yakutia), the author notes that this trip took place in the Year of Science and Technology in Russia, on the eve of the Russian Federation's chairmanship in the Arctic Council, and thus emphasized the importance of the region in the Arctic state policy and gave a good impetus for further development of scientific organizations and science in Yakutia. According to the results of work in Yakutia, the President of the Russian Academy of Sciences A.M. Sergeev highly appreciated the scientific and technological potential of the region, noted the most promising areas of fundamental and applied research that can ensure breakthrough development of the region.

Keywords: the Arctic, science, Russian Academy of Sciences, RAS, Republic of Sakha (Yakutia), Yakutsk Scientific Center, NArFU, Polar Geocosmophysical Observatory, Roshydromet, Tiksi, President of RAS A.M. Sergeev.

Briefly about Arctic Yakutia

The Republic of Sakha (Yakutia) (hereinafter — RS (Ya)) is the largest region of the Russian Federation. Over 40% of the republic's territory is located beyond the Arctic Circle. Yakutia is located within three time zones; their difference with Moscow time is +6, +7, +8 hours.

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Yakutia is one of the most isolated and inaccessible regions in the world: more than 85% of the territory is accessible only by seasonal modes of transport (river, sea, winter roads). Aviation is the only year-round type of conveyance.

The share of RS (Ya) reserves in the mineral resource potential of Russia is the following: 82% for diamonds, 17% for gold, 61% for uranium, 82% for antimony, 5% for iron ores, 5% for coal, 28% for tin, 8% for mercury. There are significant reserves of rare earth elements, silver, lead, zinc, tungsten, and many other ones, up to the last elements of the periodic table. The Republic of Sakha (Yakutia) economy is based on industry, the development of which is primarily associated with the development of the richest natural resources. Diamond mining occupies the leading position in the mining industry. The Yakut diamondiferous province is the largest in Russia, accounting for 90% of reserves and 95% of production. Fuel and energy raw materials (coal, gas, oil, condensate), found in more than 20% of the continental territory of Yakutia, are of great strategic and economic importance. Today, there are 900 explored deposits of hard coal, brown coal, coking coal, and coal shows.

The main document establishing the strategic goals for the Arctic zone of RS (Ya) development is the "Strategy for the socio-economic development of the Arctic zone of the Republic of Sakha (Yakutia) for the period up to 2035", approved on August 14, 2020, by the Decree of the Head of the Republic No. 1377.

On December 1, 2020, the Order of the Government of RS (Ya) No. 1111-p approved the unified action plan for the implementation of the "Strategy for the socio-economic development of the Arctic zone of the Republic of Sakha (Yakutia) for the period up to 2035" and "On the main directions of state policy of RS (Ya) in the Arctic zone of RS (Ya) for the period up to 2024".

The Arctic zone includes 13 transpolar regions of Yakutia. Only 67.5 thousand people, or 7% of the republic population, live in 97 settlements on the area that occupies more than half of the entire republic territory.

The Arctic regions have decentralized power supply based on low-power sources of electricity, mainly diesel power plants. All districts have problems in the social sphere: high depreciation of facilities, undeveloped engineering infrastructure, lack of accessible Internet connection.

The promising socio-economic development of the Arctic zone of the Republic of Sakha (Yakutia) is based on five development vectors: social, industrial, transit, environmental and innovative.

RAS President Sergeev A.M. in Yakutia. The first day of work (March 17, 2021)

From 17 to 19 March, a representative delegation of the Russian Academy of Sciences headed by its president, academician Aleksandr Mikhaylovich Sergeev, visited the Republic of Sakha (Yakutia). The delegation also included the administration of the Siberian Branch of the Russian Academy of Sciences (SB RAS), headed by the chairman, academician V.N. Parmon. During

these three days, he held several critical working meetings, took part in scientific events, got acquainted with the institutions and objects of science of the SB RAS.

On the first day of work, the president of the Russian Academy of Sciences, A.M. Sergeev, held a working meeting with the head of the Republic of Sakha (Yakutia) A.S. Nikolaev, where topical issues of science and scientific research in the region were discussed. It was noted that the administration of the republic pays special attention to interaction with the Russian Academy of Sciences, as well as with the Siberian and Far Eastern branches of the Russian Academy of Sciences.

Together with his colleagues, academician A.M. Sergeev took part in the grand opening of the memorial plaque "Memorable places of great expeditions of the Russian Academy of Sciences of the 18th century". It should be noted that the first scientific landing in these regions (the Great Siberian Expedition, organized by the Imperial Academy of Sciences and Arts) started in 1733 and reached Yakutia in 1736, even though the Imperial Academy itself was formed in 1724. A.M. Sergeev is the 22nd president of the Academy of Sciences in its entire history, the 10th elected president, and the 3rd one in recent history.

Then the RAS president held a working meeting, heard the reports of the administration of the Federal Research Center "The Yakut Scientific Center of the Siberian Branch of the Russian Academy of Sciences" (hereinafter — FRC "YSC SB RAS"). The event was attended by the leadership of the republic, representatives of the SB RAS. Today it is the largest complex research institution in the northeast of Russia, employing more than 2.2 thousand people, a quarter of whom are scientific employees. It currently includes seven institutes: Institute for Biological Problems of Cryolithozone, Yu. G. Shafer Institute of Cosmophysical Research and Aeronomy, V.P. Larionova Institute of the Physical-Technical Problems of the North, N.V. Chersky Mining Institute of the North, Institute of Oil and Gas Problems, Institute for Humanitarian Research and North Indigenous Peoples Problems, M.G. Safronov Yakut Scientific Research Institute of Agriculture.

After the meeting, the RAS president, answering journalists' questions, drew attention to the fact that Yakutia had great potential due to the scientific and technological development of the region. He emphasized that the conversation with scientists showed that they were aimed to obtain new results to make science a real driving force of the economy. According to the academician, at meetings with the head of the republic, administration of the Yakutsk scientific center, scientific institutes, the participants exchanged views and outlined the formation of several new projects and programs together with the region, which should have a socio-economic effect. "First of all, it involves new approaches to studying and exploiting of the mineral resource base. Over the past 30 years, state exploration of mineral resources has not been carried out properly. Both the old data, which have been available since the Soviet time, and the new data show promising min-

eral deposits in Yakutia. Therefore, it is important to combine the efforts of both investors and authorities”¹.

On the same day A.M. Sergeev visited the scientific complex of the North-Eastern Federal University named after M.K. Ammosov (hereinafter referred to as NEFU), the test center of the Institute of Engineering and Technology, the Faculty of Geology and Survey laboratories, the international center for the development of promising competencies "Future Skills: NEFU", the Mammoth Museum. He particularly highlighted the high level of the Yakut Federal University in medical and Arctic research. "The fact that one of the laboratories has managed to genetically isolate a mutation that cause a hereditary genetic disorder, which is represented in Yakutia more than in the rest of the world, is the achievement of the highest level. Moreover, if you (researchers and physicians) suggest treatment methods, this will be a top-notch result. It makes a strong impression." At the same time, the President of the Russian Academy of Sciences noted that the university's achievements are related to the needs coming from the region².

The president of the Russian Academy of Sciences then visited the Geological Museum named after N.V. Chersky of Diamond and Precious Metal Geology Institute SB RAS and the Federal Cryostorage of Plant Seeds of the Melnikov Permafrost Institute SB RAS. That made a strong impression on the members of the delegation.

In the evening, a meeting with the scientific community of Yakutia and the administration of the Academy of Sciences of the Republic of Sakha (Yakutia) was held³. At the round table "Issues of preservation, development and scientific support of the linguistic and cultural diversity of the peoples of the Russian Federation", the head of the RS (Ya) A.S. Nikolaev and the RAS president A.M. Sergeev made an introductory statement, which highlighted the status of the languages of the indigenous small-numbered peoples of the North in the Republic of Sakha (Yakutia) and the importance of preserving and developing the linguistic and cultural diversity of the peoples of the Russian Federation. It was emphasized that the scientific, educational, methodological, and informational potential of the republic is actively used in the implementation of the language policy. The director of the Institute for Humanitarian Research and Indigenous Studies of the North SB RAS N.I. Popova made a report on the scientific support of the functioning of the state and official languages of the Republic of Sakha (Yakutia). The deputy director for Science of the Institute of Modern Languages and International Studies of NEFU L.S. Zamorshchikova presented a report on

¹ Aleksandr Sergeev: Rukovodstvo Yakutii zainteresovano v razvitii nauki [Aleksandr Sergeev: The leadership of Yakutia is interested in the development of science]. URL: <https://www.sakha.gov.ru/news/front/view/id/3265069> (accessed 25 March 2021).

² Prezident Rossiyskoy akademii nauk Aleksandr Sergeev posetil SVFU [President of the Russian Academy of Sciences Aleksandr Sergeev visited NEFU]. URL: <https://www.sakha.gov.ru/news/front/view/id/3265212> (accessed 25 March 2021).

³ Prezident RAN Aleksandr Sergeev posetil Akademiyu nauk respubliki [RAS President Aleksandr Sergeev visited the Republic's Academy of Sciences]. URL: <https://www.sakha.gov.ru/news/front/view/id/3265186>; O vstreche s prezidentom Rossiyskoy akademii nauk A.M. Sergeevym [About the meeting with the President of the Russian Academy of Sciences A.M. Sergeev]. URL: https://www.s-vfu.ru/universitet/rukovodstvo-i-struktura/instituty/unesco/news_detail.php?ELEMENT_ID=149248 (accessed 25 March 2021).

the preservation of linguistic and cultural diversity and sustainable development of the Arctic and Subarctic of the Russian Federation, as well as the head of the UNESCO International Chair of NEFU A.V. Zhozhikov had a speech about the digitalization of the linguistic and cultural heritage of the indigenous peoples of the Arctic⁴. It was noted that language, reflecting the surrounding reality, reacts vividly to changes. Migration, urbanization, various social interactions, contacts, rapid and intense rhythm of life, massive flow of information lead to frequent switching of language codes, to a language shift.

The president of the Academy of Sciences of the Republic of Sakha (Yakutia), Corresponding member of the RAS V.V. Filippov informed the president of the Russian Academy of Sciences about the activities of the highest scientific organization of the region. It was noted that the future of the Academy of Sciences of the republic is associated with the development and implementation of strategic projects, the creation of a system of scientific and methodological support for regional projects. At the end of the meeting, the participants discussed the implementation of the second stage of the Program of Comprehensive Scientific Research in the Republic aimed at the development of its productive forces and social sphere for 2020–2022, as well as the Development Program of the Scientific and Educational Center of the Republic of Sakha (Yakutia) “North: Territory of Sustainable Development”. At the end of the meeting, A.M. Sergeev noted the high scientific and technological potential of the region, support for science, funding of fundamental and applied research by the republic, and highly appreciated the work carried out by the leadership of Yakutia together with academic and university science to preserve and develop the diversity of languages and culture.

The second day of work (March 18, 2021)

On March 18, the Russian Academy of Sciences president, A.M. Sergeev, took part in the meeting, where the issues of the integrated development of the Arctic territories of the Republic of Sakha (Yakutia) and the Krasnoyarsk Krai were discussed. The participants outlined the prospects for the development of the mineral resource base and the possibilities of developing new deposits, where strategically important minerals are concentrated⁵. It was emphasized that, unfortunately, this area has been underdeveloped: most of the geological research was carried out back in Soviet times. Serious work in this direction is just beginning. A.S. Nikolaev noted that the volume of exploration work in the Arctic of Yakutia should be increased by a factor of 10 and instructed the regional cabinet of ministers to prepare a list of relevant proposals with the involvement of federal departments. He stressed that JSC Rosgeologia, which signed a cooperation

⁴ Uchenye SVFU predstavili proekty prezidentu RAN Aleksandru Sergeevu po voprosam sokhraneniya i razvitiya rodnykh yazykov [Scientists from NEFU presented projects to the President of the Russian Academy of Sciences Aleksandr Sergeev on the preservation and development of native languages]. URL: <https://www.sakha.gov.ru/news/front/view/id/3265371> (accessed 25 March 2021).

⁵ V Arkticheskoy zone Yakutii mogut uvelichit' ob'em geologorazvedochnykh rabot v 10 raz [In the Arctic zone of Yakutia, the volume of geological exploration can be increased by 10 times]. URL: <https://www.sakha.gov.ru/news/front/view/id/3265241> (accessed 25 March 2021).

agreement in 2019, will also take part in this work. The RAS president noted the great potential of the republic and announced the readiness of the Russian Academy of Sciences to participate in the comprehensive development of the Arctic zone.

As part of a working visit to Yakutia, the president of the Russian Academy of Sciences A.M. Sergeev visited the scientific and educational laboratory “Agrokub” on the basis of the Khatasskaya secondary school named after P.N. and N.E. Samsonovs (the village is located on the territory of the urban district “Yakutsk city”). School principal N.V. Sleptsov spoke about the work of the laboratory, the progress and the four-year results of its activities. The delegation visited the laboratories of biotechnology and agrobiotechnology, where technologies and features of growing horticultural crops are being developed. The conditions have been created here for schoolchildren to master modern agricultural technologies, including biotechnology and robotics. A.M. Sergeev noted that it is necessary to increase the interest of children in modern agriculture in order to make a promising scientific and technological career in the future ⁶. The visit to this laboratory by the RAS president, in our opinion, was not accidental. It was fed on the necessity to overcome the agrarian crisis in Yakutia and the transition of the republic's Arctic agro-industrial complex to dynamic development with the participation of the state, local authorities and business, as well as the entry of scientific and educational institutions into it ⁷.

A.M. Sergeev took part in the representative scientific forum “Universities and the development of geostrategic territories of Russia” ⁸. The event was held at the North-Eastern Federal University with the support of the Ministry of Education and Science of the Russian Federation, the Russian Academy of Sciences and the Government of Yakutia. The forum was held in face-to-face and distance format. The participants discussed the problems of sustainable development of geostrategic territories in Russia, as well as the implementation of the program of fundamental scientific research in the Russian Federation for the long term (2021–2030). The moderator was A.S. Fedotov, Permanent Representative of the Republic of Sakha (Yakutia) under the President of the Russian Federation. Deputy Prime Minister in charge of science and education in the Republic of Sakha (Yakutia) S.V. Mestnikov in his report spoke about the national project “Science” and the established scientific and educational center “North — Territory of Sustainable Development”, which united the institutes of fundamental academic science and universities in partnership of five constituent entities of the Russian Federation: Yakutia, Kamchatka, Magadan Re-

⁶Prezident RAN posetil nauchno-uchebnuyu laboratoriyu «Agrokub» [The President of the Russian Academy of Sciences visited the Agrokub scientific and educational laboratory]. URL: <https://www.sakha.gov.ru/news/front/view/id/3265449> (accessed 25 March 2021).

⁷Rodnina N.V. O merakh po razvitiyu Arkticheskoy zony Yakutii [On Measures for the Development of the Arctic Zone of Yakutia]. *Akademicheskij vestnik Yakutskoy gosudarstvennoy sel'skokhozyaystvennoy akademii* [Academic Bulletin of the Yakutsk State Agricultural Academy], 2020, no. 10 (15), p. 26-30; Rodnina N.V. O prodovol'stvennom obespechenii Arktiki Yakutii [On the Food Supply of the Arctic Yakutia]. *Akademicheskij vestnik Yakutskoy gosudarstvennoy sel'skokhozyaystvennoy akademii* [Academic Bulletin of the Yakutsk State Agricultural Academy], 2020, no. 10(15), p. 47–50.

⁸V Yakutskye obsudili voprosy razvitiya nauchno-tekhnologicheskogo potentsiala regionov [In Yakutsk, issues of developing the scientific and technological potential of the regions were discussed]. URL: <https://www.sakha.gov.ru/news/front/view/id/3265245> (accessed 25 March 2021).

gion, Sakhalin, and Chukotka. The president of the Academy of Sciences of the Republic of Sakha (Yakutia), Corresponding member of the RAS, V.V. Filippov, made a report about the interaction of the regional science of Yakutia with the Russian Academy of Sciences and its regional branches — Siberian and Far Eastern.

The RAS president A.M. Sergeev began his speech by saying that the regions of the Russian Federation, including the Republic of Sakha (Yakutia), can become engines of the country's scientific and technological development. He noted that “this thesis is important because we are tired of waiting for our serious scientific and technological advancement and are accustomed to ascertaining our not very leading position on this parameter in the world. There is an index of innovative development, which is calculated through serious formulas and indicators. This index is recognized all over the world. According to this index, Russia has not improved its position over the past ten years. We are in the 42nd place. This shows that we either have to admit that we will not be able to be scientifically and technologically oriented, or we have to take a new look at the situation and make some suggestions and measures to find out how we can move forward. In addition to the general statement that the innovation situation is unsatisfactory for all of us, we have internal figures that do not suit us. Of course, the first figures are the volume of GDP that goes into science, which is still around 1%, although we have been saying for many years that we need more. Let me remind you that in the first edition of the Law on Science, which was adopted in 1996, there was a figure of 4% as a guideline.”⁹ He further pointed out that at the beginning of the 2000s, this point was removed from the law, and now the percentage of funds allocated for science is either slightly less or slightly more than one percent. He drew attention to the importance of allocating funds for science from business. According to him, business representatives all over the world understand that a suitable investment in science is an opportunity to increase added value regularly. The investments in science predetermine new knowledge that is not yet on the market: “If you can get it into the market fast, you are the king. Why does it not work? Now the question of stimulating business investments is being raised very seriously”. In the final part, he spoke about the increased attention to the Arctic territories as a zone of economic interests around the world, about the potential of Yakutia in science, cryo-storage facilities and about “what is the Arctic without Yakutia?”.

The chairman of the Yakutsk Scientific Center SB RAS, corresponding member of RAS, M.P. Lebedev, spoke about fundamental scientific research in the interests of sustainable development of the northern and arctic territories of the Russian Federation.

The rector of the North-Eastern Federal University named after M.K. Ammosov, A.N. Nikolaev, made a report on the topic “The scientific and innovative potential of the university is a driver of sustainable development of the northern territories”, in which he noted that the mission of NEFU is the formation of a new generation of professionals realizing the values and goals of sus-

⁹ Regional'nyy vektor liderstva [Regional Leadership Vector]. URL: <https://scientificrussia.ru/articles/regionalnyj-vektor-liderstva> (accessed 25 March 2021).

tainable development of the North and the Far East, influencing the solution of global problems of humanity.

At the event, the director of the Melnikov Permafrost Institute SB RAS, M.N. Zheleznyak, spoke about the implementation of the program of fundamental scientific research in the field of geocryology. The director of the Yakutsk Scientific Center, A.N. Romanova, informed the participants of the forum about the indicators of scientific activity, fundamental scientific research, which are carried out on its basis. The head of the Diamond and Precious Metal Geology Institute SB RAS V.Yu. Fridovskiy presented the results of scientific research on the geology of solid minerals in the Verkhoyansk-Kolyma fold area and the Siberian craton.

Within the framework of the forum, the chairman of the SB RAS Academician V.N. Parmon took part in the round table “Science, Universities and Youth”, where participants discussed ways to attract young people to science, problems of developing higher education in Russia and its regions. According to him, there are five main factors that attract young people to science. The first is interesting scientific work. There is a lot of such work in the Siberian branch, and one can always find a good advisor. The second factor, which is weakened in the regions, is the availability of modern research equipment; world-class scientific research is impossible without it. The third necessary factor is affordable housing. V.N. Parmon emphasized: “There should be modern comfortable and inexpensive rental housing for graduates of universities and postgraduate studies.” The fourth factor is a decent salary, which allows science to be fully invested and does not waste precious time and energy on part-time work. The fifth factor is the opportunity to realize not only scientific interests but also the interests of a young family, and hobbies — sports, culture, theaters, the ability to communicate with friends, etc.¹⁰

The event made a significant contribution to understanding the challenges that will contribute to the development of science and education in the Arctic zone of the Russian Federation.

The third day of work (March 19, 2021, Tiksi)

On March 19, 2021, Yakutia celebrated the “Day of the Arctic”. A.M. Sergeev and a large group of scientists flew to Tiksi, where they visited the Polar Geocosmophysical Observatory of the Yu.G. Shafer Institute of Cosmophysical Research and Aeronomy SB RAS, Federal Research Center “Yakutsk Scientific Center SB RAS”, station of rocket monitoring of the atmosphere, wind-diesel complex. The RAS vice-president, the chairman of the SB RAS academician V.N. Parmon, the chairman of the Federal Research Center “YSC SB RAS”, the corresponding member of the RAS M.P. Lebedev, the permanent representative of the Republic of Sakha (Yakutia) under the President of the Russian Federation A.S. Fedotov, acting First deputy chairman of the Government of the Republic of Sakha (Yakutia) D.D. Sadovnikov, the minister for the Development of the Arctic and Affairs of the Peoples of the North of the Republic of Sakha (Yakutia) V.N. Chernogradskiy and

¹⁰ Rukovodstvo RAN i SO RAN plodotvorno porabotalo v Yakutii [The management of the RAS and SB RAS fruitfully worked in Yakutia]. URL: <http://www.sbras.info/articles/sciencestruct/rukovodstvo-ran-i-so-ran-plodotvorno-porabotalo-v-yakutii> (accessed 25 March 2021).

other heads of scientific, educational and industrial structures were working in Tiksi¹¹. The purpose of the trip was to get acquainted with the system of organizing academic science in Yakutia, with the possibilities of creating new scientific and testing sites and scientific stations in the Arctic zone.

First of all, the delegation visited the wind farm built in 2018 by RusHydro and the Japanese company NEDO. According to the head of the Bulun power grids of JSC Sakhaenergo A.N. Kozakov, the station is part of a wind-diesel complex with a capacity of 3 MW plus a 1 MW battery. Now the whole complex is being tested together with Japanese specialists. The station generates electricity to the typical grid in the village. According to him, everything works fine, and there are no special comments¹².

Further, A.M. Sergeev visited the Polar Geocosmophysical Observatory (PGO), designed to carry out continuous geophysical measurements in the meridional chain of complex points — geomagnetic field variations, auroral absorption of radio waves, ionosphere characteristics, optical glow of the night sky and auroras, and intensity of cosmic rays. The observatory includes a scientific instrument park, as well as an atmospheric rocket sounding station.

During the visit, the guests showed a genuine interest in the history of the creation and formation of the PGO and the research conducted there. The M-211 atmospheric rocket sounding station, equipped with the latest MR-30 geophysical rocket complex, which allows making experiments at altitudes from 50 to 300 km, was of particular interest. The president of the Russian Academy of Sciences, academician A.M. Sergeev expressed gratitude to the observatory staff for their dedicated work in the harsh Arctic. In the discussion, recommendations on possible options for integrating PGO research into large Russian scientific projects were given¹³.

It should be noted that the Arctic Hydrometeorological Observatory was created within the framework of a specialized international project of the national meteorological services of the Russian Federation, the United States of America, and Finland as a key link in the system of international hydrometeorological observations and scientific research in the Arctic. It fills a severe observational gap in the Arctic Asia region that existed before its discovery¹⁴.

A.M. Sergeev took part in the round table "Climate test site in the Arctic and the development of alternative energy". Electricity supply to the Arctic territory of Yakutia became the main topic of the round table. According to the minister for the Development of the Arctic and the Af-

¹¹ Prezident RAN Aleksandr Sergeev posetil v Tiksi Polyarnuyu geokosmofizicheskuyu observatoriyu [RAS President Aleksandr Sergeev visited the Polar Geocosmophysical Observatory in Tiksi]. URL: <https://yakutia.info/article/198837> (accessed 25 March 2021).

¹² Prezident RAN v Den' Arktiki posetil Bulunskiy rayon Yakutii [The President of the Russian Academy of Sciences visited the Bulunskiy District of Yakutia on the Day of the Arctic]. URL: <https://www.sakha.gov.ru/news/front/view/id/3265489> (accessed 25 March 2021).

¹³ Efremova M. Otmetit' Den' Arktiki — v Arktike! [Celebrating Arctic Day in the Arctic!]. URL: <http://www.ras.ru/news/shownews.aspx?id=059b7fd8-6a94-4054-895b-3e583e68b89a#content> (accessed 30 March 2021).

¹⁴ Reshetnikov A.I., Makshtas A.P. Arkticheskaya gidrometeorologicheskaya observatoriya «Tiksi» [Arctic Hydrometeorological Observatory "Tiksi"]. *Trudy Glavnoy geofizicheskoy observatorii im. A.I. Voeikova* [Proceedings of the Main Geophysical Observatory named after A.I. Voeikov], 2012, no. 567, p. 268.

fairs of the Peoples of the North of the Republic of Sakha (Yakutia) V.N. Chernogradskiy, “The Arctic regions of Yakutia belong to the zone of decentralized power supply, except for the village of Cherskiy, Nizhnekolymskiy ulus. Local power engineering is based on low-power sources of electricity, mainly diesel power plants. There is no year-round land transport system connecting the Arctic zones with neighboring territories and settlements. Seasonal modes of transport are used for freight transport — winter roads and inland waterways. Climatic conditions, significant infrastructural restrictions cause increased resource intensity and rise in price in its extreme arctic form”¹⁵.

In these conditions, according to the opinion of the delegation members, alternative energy in sparsely populated, inaccessible polar territories is of great interest for study in isolated energy systems, as well as the construction of new sources of electricity and heat — mini-nuclear power plants, thermal power plants on local fuel, power plants on liquefied natural gas. It will contribute to the development of the Northern Sea Route, change the logistics of the northern delivery, make it possible to realize the industrial potential of the Yakut territory, and will significantly reduce the costs of supporting life of Arctic villages.

The presentations highlighted the importance of supporting the Research and Education Center “North”, which is the main strategically important project for integrated development of the Arctic region, solving social and economic problems, preserving national identity, strengthening and developing the potential of the Arctic zone of Yakutia. The scientific community is tasked with increasing the effectiveness of scientific approaches and making specific proposals. The main feature of this project is the creation of a growth point in priority areas of the socio-economic development of the Arctic¹⁶.

Upon returning to Moscow

The general results of the visit to Yakutia were summed up on April 2, 2021, in Moscow, where the president of the Russian Academy of Sciences, A.M. Sergeev, held an online press conference at the International Multimedia Press Center of the MIA “Russiya Segodnya” with the participation of the head of the Republic of Sakha (Yakutia) A.S. Nikolaev. The head of the Republic of Sakha (Yakutia) said that the republic is ready to co-finance a comprehensive scientific expedition to explore the north-west of Yakutia. About 60 million rubles will be allocated for these purposes in 2021. The expedition will have not only scientific objectives but also the task of a comprehensive study of a huge territory, comparable in size to India, as well as contributing to the maximum

¹⁵ Energeticheskiy potentsial Arktiki stal glavnoy temoy kruglogo stola v Tiksi s uchastiem prezidenta RAN [The energy potential of the Arctic became the main topic of the round table in Tiksi with the participation of the President of the Russian Academy of Sciences]. URL: <https://www.sakha.gov.ru/news/front/view/id/3265556> (accessed 25 March 2021).

¹⁶ Rossiyskaya akademiya nauk okazhet sodeystvie realizatsii krupnykh nauchnykh proektov v Yakutii [The Russian Academy of Sciences will assist in the implementation of large scientific projects in Yakutia]. URL: <https://www.sakha.gov.ru/news/front/view/id/3266213> (accessed 05 April 2021).

preservation of the environment and to the improvement of living standards of people who live in the harshest natural and climatic conditions¹⁷.

The RAS president expressed the opinion that 2021 is a geopolitically important year: Russia becomes the chairman of the Arctic Council for the next two years and should propose various initiatives in science related to the Arctic region. He spoke about possible projects in the field of cryopreservation of plant seeds, research of paleontological fauna, study of permafrost, prospects of Yakutia as a center for creation and testing of new materials in extreme natural conditions, study of the properties of mechanisms and engineering structures.

During an online press conference, the president of the Russian Academy of Sciences, A.M. Sergeev, proposed to initiate the creation of an international cryostorage of seeds in Yakutia since the Spitsbergen cryostorage is collapsing due to the permafrost thawing. Yakut scientists made a small cryostorage of plants several years ago, which contains about 10 thousand specimens. It is located at a depth of 12 meters, where the temperature is maintained at about minus 10 °C all year round¹⁸.

The role of science in the development of Russia and Yakutia: key positions and assessments of the RAS President A.M. Sergeev

“The competitive future of our country should definitely be formed through scientific and technological development, through the development of scientific and technological outposts. Yakutia can become one of them. There are several important reasons: first, it is an infinite store-room of mineral resource base. Second, the cold for Yakutia is not only its symbol, its complexity, but also its wealth. It can be seen that now many technologies are connected precisely with the fact that we should test materials and living systems in extreme conditions. Third, it is necessary to provide people with comfortable social conditions and the circumstances in which they want to make an economic breakthrough. People need to see opportunities for creativity.

Yesterday I studied the social and demographic parameters of the republic and was surprised that the population is growing at a reasonably good rate. In Yakutia, social, linguistic, and cultural issues are resolved in the right way. These three factors make Yakutia a geostrategic outpost in terms of scientific and technological development.

Over the past ten years, Russia has not improved its position in the global ranking of innovative development of countries, including due to insufficient funding.

The head of Yakutia is working to ensure that the republic has scientific and technological development. He understands that the republic can develop only on the basis of science and tech-

¹⁷ Aleksandr Sergeev o perspektivakh kompleksnoy nauchnoy ekspeditsii po issledovaniyu severo-zapadnykh rayonov Yakutii [Aleksandr Sergeev on the prospects for a comprehensive scientific expedition to explore the northwestern regions of Yakutia]. URL: <http://www.ras.ru/news/shownews.aspx?id=9c0d2ccc-c1a8-4d4b-a7c3-1dc41c82a761&print=1> (accessed 05 April 2021).

¹⁸ Glava RAN predlozhit sozdat' v Yakutii al'ternativnoe vseмирnomo khranilishche semyan [The head of the Russian Academy of Sciences proposed to create in Yakutia an alternative to the world seed repository]. URL: https://news.ykt.ru/article/118345?news_recent_main= (accessed 08 March 2021).

nology. This is my primary impression that the authorities of Yakutia are interested in science. If science and government work together, then everything will succeed.

Many great scientists were educated in Yakutia and work in academic institutes, the university, and the Academy of Sciences of the Republic of Sakha (Yakutia). Its own national Academy of Sciences is also very important.

The wealth of Yakutia is the cold that preserved the oldest artifacts. About 75% of all mammoth burials known globally have been found in Yakutia and have become the object of biological and paleogenetic research today. Yakutia's scientists first grew grass, the seeds of which were found in the remains of mammoths. Now the mammoth from a symbol of antiquity, eternity, and paleontology can become a symbol of modern science, which promotes Yakutia. So it's not just a tourism brand, it's a scientific brand.

Yakutia has significant prospects in the development of wind and diesel energy. This is an area of powerful winds in the Arctic, where there is so much energy, and it could be at the center of the modern trend of transferring the world's industry to hydrogen energy. Yakutia can become a testing ground for the creation of the latest energy industry.

Outwardly, Tiksi now looks like a deserted city. In the 1970s and 1980s, Tiksi was the capital of the Soviet Arctic, but then the outflow of people began, the military left. This was not a positive development. Now we see abandoned five-story buildings, but we see new developments as well. It is good that Tiksi will now be mastered entirely. Scientific development is equally important."

Tiksi

The seaport of Tiksi, built in the 1930s, serves as a base port in the North-Eastern sector of the Arctic from the beginning of the Northern Sea Route operation. The village of Tiksi has been selected as a preliminary area for creation a model of the Arctic territories development.

The comprehensive development plan for the village of Tiksi includes seven projects¹⁹:

- Project No. 1 "Renewal of social infrastructure, provision of the Internet access. Development of cooperation with the Russian Ministry of Defense on social issues";
- Project No. 2 "Energy-efficient settlement of the Arctic";
- Project No. 3 "Proving ground of REC "North: Territory of Sustainable Development";
- Project No. 4 "Tourist cluster "Russian Arctic North";
- Project No. 5 "Creation of an emergency rescue unit and an Arctic crisis management center in the village of Tiksi";
- Project No. 6 "Modernization of transport infrastructure (seaport Tiksi, airport, land transport, including seasonal), ensuring the delivery of goods";

¹⁹ These are the data of the report of the Permanent Representative of the RS (Ya) under the President of the Russian Federation A.S. Fedotov on March 4, 2021 at the plenary session of the VI International Conference "The Arctic: Off-shore Projects and Sustainable Development of Regions" (Moscow).

- Project No. 7 “Eco-friendly settlement of Tiksi — cleaning Tiksi from scrap metal”.

The vast improvement of the village of Tiksi will significantly contribute to the implementation of the Russian Arctic development strategy and ensure the advancement of a reliable national security base. Units of the new anti-aircraft missile regiment, equipped with S-300 systems, are stationed in the north of Yakutia. Together with the missile men, the wireless observer units and air direction centers, deployed on the mainland coast of the Laptev Sea and on Kotelnii Island, have entered combat duty²⁰.

The development of the port infrastructure of Tiksi is impossible without a stable cargo base. As of the beginning of 2021, 24 licenses for hydrocarbons production inland and on the continental shelf of the Republic of Sakha (Yakutia) were issued. In the western sector of the Arctic zone of the Republic of Sakha (Yakutia), the development of the Tomtor rare earth metal deposit is an anchor project; in the eastern sector, two large mining projects for tin and gold extraction are planned for implementation.

The industrial development of Eastern Siberia leads to the formation of new cargo types in the form of hydrocarbon and solid mineral projects. For example, in 2020, a unique operation was carried out on the transshipment of oversized cargo for the Irkutsk Polymer Plant of Irkutsk Oil Company²¹.

The activity of large oil and gas companies PJSC Rosneft Oil Company and PJSC Surgutneftegaz, as well as work under the state contract of JSC Rosgeologia, the Tomtor rare earth metal deposit project, may lead to the discovery of new deposits and attract venture capital investments in exploration of deposits through oil and gas processing projects.

Favorable conditions have been created for investors in the Yakut Arctic projects. Thus, licenses for prospecting and exploration of minerals can be obtained without auctions for up to 7 years based on applications alone, and the tax regimes of residents of the Arctic zone of the Republic of Sakha (Yakutia) are close to the tax conditions of projects in priority development areas.

As a result of the comprehensive development plan implementation, Tiksi will become the hallmark of the Russian Federation as a model of polar, environmentally friendly, and energy efficient village.

Conclusion

It should be noted that the three-day Arctic trip of the RAS president, academician A.M. Sergeev became a momentous event for the Russian Academy of Sciences, higher education in Russia, and the Republic of Sakha (Yakutia). The President of the Russian Federation, V.V. Putin,

²⁰ Podrazdeleniya novogo zenitnogo raketnogo polka RF razmestili na severe Yakutii [Units of the new anti-aircraft missile regiment of the Russian Federation were deployed in the north of Yakutia]. URL: <https://yk24.ru/index/obshchestvo/podrazdeleniya-novogo-zenitnogo-raketnogo-polka-rf-razmestili-na-severe-yakutii> (accessed 10 December 2020).

²¹ V otkrytom more zavershilas' perevalka krupnogabaritnykh gruzov s morskikh sudov na barzhi dlya Irkutskogo zavoda polimerov [Transshipment of oversized cargo from sea vessels to barges for the Irkutsk Polymer Plant has been completed on the high seas]. URL: <https://baik24.ru/text/31-07-2020/056/> (accessed 25 March 2021).

declared 2021 the Year of Science and Technology in Russia, and on March 15 he signed a decree "On Measures to Increase the Effectiveness of State Science and Technology Policy". It almost coincided with his business visit to Yakutia. A.M. Sergeev visited Yakutsk, Tiksi, held a lot of important and necessary meetings on the integrated development of the Arctic regions, alternative energy, activities of scientific centers, met with scientists at the Academy of Sciences of the republic, expressed support for the scientific and educational center "Sever", visited the northernmost region of Yakutia, Bulunskiy district, where he saw how people live beyond the Arctic Circle. As the analysis shows, the joint work of the heads of the federal and regional levels of the Russian Academy of Sciences during these days has made it possible to develop very important areas of joint activity and cooperation in the use of scientific achievements in the social and economic development of the Republic of Sakha (Yakutia), to determine new areas of work of scientific institutions.

The primary purpose of the RAS delegation visit was to work out a number of strategic issues for the regional science development, implementation of large scientific projects, acquaintance with the work of the Federal Research Center "YSC SB RAS", branch scientific institutions of the SB RAS, interaction with NEFU named after M.K. Ammosov, Academy of Sciences of the Republic of Sakha (Yakutia). Last time the RAS president, Academician Yu.S. Osipov, visited the region 25 years ago. According to the results of work in Yakutia, the RAS president A.M. Sergeev highly appreciated the scientific and technological potential of the region, noted the most promising areas of fundamental and applied research that can provide breakthrough development. These are mineral resources, the study and use of cold, as well as the socio-demographic potential of Yakutia.

The current visit took place on the eve of Russia's chairmanship in the Arctic Council and emphasized the importance of this region in the Arctic policy of the state. It provided a good impetus for the further development of scientific organizations and science in Yakutia. We would like the RAS delegations to visit other subjects of the Russian Arctic in the next two years and decide on the spot on their scientific and technical development.

Today, the Academy of Sciences of the Republic of Sakha (Yakutia) accumulates all available scientific potential of the republic, among the advantages of which are the development of scientific schools, promising areas of fundamental and applied research, stable interaction with the regions and the compliance of the research with their needs, a high level of integration with universities, state academies of sciences, communication with sectoral science, federal research centers. At the same time, as the results of the RAS work showed, its activities have significant reserves for further development.

A significant result of the business visit of A.M. Sergeev in Yakutia in terms of the development of the Arctic and support of science was the order of the Government of the Russian Federation of March 22, 2021 No. 716-r, which approved the development program of the Northern (Arctic) Federal University for 2021–2035 (Rector — professor E.V. Kudryashova). In the next 3 years, the university will receive 1.5 billion rubles from the federal budget for the implementation of the program: 500 million rubles annually. Within the framework of its development program, the im-

provement of research and innovation activities will be carried out, including updating of the scientific and instrumental base.

The Institute of Europe of the Russian Academy of Sciences team contributes to the study and development of the Arctic. In 2020, 33 scientific articles were published, including 3 publications (of which 2 are foreign) in journals of Scopus and Web of Science databases, 3 articles in RCSI journals; 8 papers in journals approved by the Higher Attestation Commission, 5 publications in journals indexed in the RSCI, chapters in monographs, articles in collections — 14 ones. Employees took part and made presentations at 10 scientific forums, including 3 international conferences and one all-Russian with international participation, and participated in the expert work of the State Duma Committee on Ethnic Affairs, The Council for the Arctic and Antarctic under the Federation Council and the newly created Project Office for the Development of the Arctic.

In their activities in the Arctic, they used the possibilities of successful interaction with the Northern (Arctic) Federal University named after M.V. Lomonosov, Peter the Great St.Petersburg Polytechnic University, National University of Oil and Gas “Gubkin University”, USA and Canada RAS Institute, the University of the Arctic (in terms of participation in Arctic events in European countries).

Scientific articles and reports on conferences and round tables following the research focused on the study:

- the activities of the Arctic Council and Iceland's chairmanship in it, the further transformation of the Arctic strategies and policies of European states at the present stage;
- peculiarities, difficulties, and prospects of international cooperation between Russia and the countries of Europe, Asia, and North America in the Arctic after 2014;
- the results of the implementation of the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2020;
- the content of the Fundamentals of State Policy of the Russian Federation in the Arctic for the period up to 2035 dated March 5, 2020 and the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2035;
- the activities of the security forces of the Russian Federation to protect the national interests and sovereignty of Russia, to oppose the NATO bloc in the Arctic region;
- the state and development prospects of the Arctic zone of the Russian Federation and the Northern Sea Route (economy, education, health care, transport, climate change, scientific research, indigenous peoples of the North, ecology, demography, icebreaker fleet, etc.).

There is an understanding that the Arctic requires constant special attention of the state. The specific conditions of the Arctic require new approaches to its development: from the identification of individual goals and objectives to the development of fundamentally different economic mechanisms based on the results of scientific research.

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Marine Plastic Debris Pollution in the Western Sector of the Russian Arctic *

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Abstract. The article discusses the pollution of marine environment with plastic waste, in particular, the accumulation of microplastics in the oceans, which is one of the most serious environmental problems both in the world and in the Russian Arctic. Alongside with other world oceans, the Arctic Ocean and the Barents Sea have become places of plastic accumulation, causing great harm to the fragile ecosystem of the Arctic region. Researchers have found microplastics not only in Arctic waters, but also in the ice of the Arctic seas. Plastic debris is carried by ocean currents from more densely populated areas of the planet. Local sources, such as fishing and other commercial activities, as well as waste water, are one more reason. Microplastics adversely affect living organisms in the ocean. In particular, plastic can cause physical harm and disrupt body formation of marine animals, as well as cause death by suffocation or ingestion of plastic. At the same time, plastics can accumulate persistent organic pollutants on their surface, which can poison marine animals, damaging the entire food chain.

Keywords: *marine ecosystem, debris, biodegradation, plastic pollution, microplastics, the Arctic.*

The problem of marine ecosystems garbage pollution has been quite acute for more than half a century and has become a growing concern of environmentalists. The main source of marine pollution is anthropogenic impact, and the most widespread type of marine debris is plastic. As early as 1907, a number of low-cost polymer synthesis technologies were optimized, resulting in mass production of light, strong, inert and corrosion-resistant plastics. Since mass production began in the 1940s, the amount of plastic produced has grown rapidly and by 2009 it was already about 230 million tons [1].

Conventional materials such as glass, metal and paper are being replaced by economical plastic packaging of a similar design. Fishing gear such as nets, fishing lines (one of the main pollutants of the marine environment) are also being replaced by plastic ones that are lighter and stronger than natural materials. Thus, more than a third of plastic resin production is converted to consumer material, which includes disposable items. Due to their high molecular weight and hydrophobicity, polymers are extremely resistant to biodegradation, with the exception of biopolymers (such as chitin, chitosan, cellulose, etc.). However, certain microorganisms have been identified that are capable of biodegradation of specific types of plastics such as polyethylene, PVC and polystyrene. However, such destruction of plastics can take a long period of time, since some additives, such as antioxidants and stabilizers, can slow down the rate of degradation (can be toxic to microorganisms) [2, 3].

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The annual global demand for plastics is constantly increasing and in 2011 it amounted to 245 million tons [4]. In this regard, according to scientists, in 2010, from 4.8 to 12.7 million tons of plastic were thrown into the world's oceans, and these figures are getting higher every year.

The ever-increasing volumes of plastic production, together with a fairly long lifetime (about 1000 years), make the problem of plastic pollution of the marine environment and the ecosystem one of the most significant nowadays.

Currently, another problem related to plastic has arisen — the problem of marine ecosystems pollution with microplastics. Despite the fact that microplastics in the marine environment were discovered several decades later than plastic, the problem of microplastics pollution has already become a global environmental problem.

Microplastic is a term used to describe the vast volume of microscopic plastic debris currently found throughout the world's oceans. Microplastics are plastic particles ranging in size from about a few microns to 5 mm. Microplastics can be found almost everywhere, from beaches and coastlines to subtropical oceanic whirlpools, polar ice caps and even the deepest parts of the ocean.

Microplastics are divided into 2 types by their origin: primary and secondary.

Primary microplastics are microgranules of plastic specially produced and added to various products. This plastic is commonly used in facial cleansers and cosmetics, or as fillers for soft furniture, toys, and as a primary raw material for the production of macroplastics.

Secondary microplastics are plastic fragments less than 5 mm in size, which are formed by the destruction of larger plastic debris both at sea and on land. Over time, physical, biological and chemical processes reduce the structural integrity of plastic debris, resulting in its fragmentation into smaller particles and degradation. Large amounts of secondary microplastics are generated by washing synthetic things in washing machines.

Microplastic contained in cosmetics and formed during washing gets in wastewater. The main problem is that microplastics are so small in size (Fig. 1) that they are not captured by wastewater filtration systems, and, as a result, these particles enter water bodies and become an environmental hazard [1].



Fig. 1. Microplastic from cosmetics.

Plastic debris on beaches has a high oxygen availability and direct exposure to sunlight, so it degrades quickly, becoming brittle over time, cracking and “yellowing” (Figure 2). With the loss

of structural integrity, these plastics degrade more rapidly in the environment as a result of abrasion, wave influence and turbulence [1].



(I-II) various types of expandable polystyrene, (III) non-woven geotextile material, (IV) facing fiberglass profiles, (V) gabion mesh with plastic coating (PVC / HDPE), (VI) fragments from a textile big bag (PP).

Fig. 2. Plastic with fragmentation on the seashore.

Microplastics can have a negative impact on organisms living in the ocean. In particular, plastic can cause physical harm and disrupt the body formation of marine animals, as well as cause death by suffocation or ingestion of plastic. The scientific literature has noted the physical effects of microplastics on small organisms, such as internal abrasions and blockages. It was also found that microplastics blocks the gastrointestinal tract, disrupts the body growth and the reproductive system functioning. Microplastics have been found in the blood, lymph and liver of some animals. At the same time, plastic is able to accumulate persistent organic pollutants on its surface, which can cause poisoning and store in the marine animals bodies, causing harm to the entire food chain [5]. In addition, plastic has a negative aesthetic impact on the environment.

Due to the fact that about half of all plastic is lighter than water, it can move on its surface with world currents and spread throughout the planet. At the same time, due to the peculiarities of ocean currents, the Arctic, the Arctic Ocean and the Barents Sea can become a place for plastic accumulation, causing great harm to the fragile ecosystem of the Arctic region. In addition, the Barents Sea is an active fishing area. In this regard, plastic and paint particles from fishing boats can get into the sea water, as well as both pieces of fishing nets, often made of plastic, and their whole fragments. The Barents Sea and the Arctic Ocean serve as drainage points for large Arctic rivers, such as the Pechora, the Northern Dvina, and others. They also carry plastic particles that enter their waters with industrial and domestic wastewater.

At present, the western part of the Russian Arctic is rather poorly studied for pollution by marine debris. However, current studies allow us to describe the situation in this sector of the Arctic.

A group of scientists from the Marine and Freshwater Research Center and the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS) [6] explored a part of the Barents Sea in the area of the Svalbard archipelago, located on the western border with the territorial waters of the Russian Federation. The authors note that the content of plastic particles ranges from 0 to

1.31 particles per m^3 , with plastic particles being detected in 95% of the analyzed samples. According to the researchers, the source of this debris can be both the transportation of pollution by ocean currents from more populated areas of the planet, and local sources, such as fishing and other commercial activities, as well as sewage.

There is also an acute problem of the ingestion and absorption of microplastics by marine dwellers (including crustaceans, molluscs, fish and marine mammals). This issue is extremely poorly investigated on the territory of the Russian Federation in general and in the Arctic zone of the Russian Federation in particular. Currently, there is no information on the concentration, type and form of plastic absorbed by marine animals in the western part of the Russian Arctic. At the same time, there are a number of works reflecting this situation in the regions bordering on the Russian Arctic. According to studies in the Greenland Sea [7], the concentration of microplastics in water was 2.4 ± 0.8 particles / m^3 , and microplastics in fish were found in 34% and 18% (in triglops and cod, respectively) of the fish sampled for analysis. Microplastics have also been found in crustaceans sampled off the coast of the Svalbard archipelago. Particles of plastic were found in each of 20 samples of Gammarida crustaceans. Most of the particles consisted of polymethacrylamide, a thermoplastic widely used in the marine industry as a coating to prevent fouling of ships, as well as anti-corrosion and waterproof coatings [8]. The results show that microplastic penetrates even the most remote parts of the planet, causing harm to organisms living there. The content of plastic particles is at comparable levels that have been found in more industrialized regions of the planet, indicating the transfer of particles by ocean currents.

It is also worth noting the discovery of microplastics in the Arctic sea ice. According to the results presented in the work of a group of researchers from the Thayer School of Engineering at Dartmouth College and Marine Biology and Ecology Research Center [9], the content of plastic particles in ice cores of central part of the Arctic Ocean is in the range of 38 to 234 particles per m^3 , which is significantly higher than the heavily polluted ocean currents. According to the authors, this is due to the effects of concentration in the process of ice formation.

Summing up, it should be noted that the scientific results described above indicate an increasingly aggravating situation with microplastics pollution of the world's oceans. Arctic pollution is of particular concern, as its fragile ecosystem is most susceptible to even the smallest changes. Microplastics can harm the ecosystems of the region, which can result in economic, environmental and aesthetic losses for the population of regions and entire countries. In this regard, it is necessary to take measures to identify and reduce the negative consequences of microplastic pollution of the ecosystem.

Recommendations

Based on the above data, it is obvious that there is almost complete lack of information on the content of microplastics in surface waters, sea animals and ice in the Russian part of the Arctic.

As a result, a large-scale international research programme aimed at establishing a microplastics monitoring system in the Arctic seas may provide a solution.

Assessment of environmental damage and risks associated with the Arctic ecosystem pollution by microplastics, based on the results of scientific research, is an important factor for further research to reduce possible ecological losses and search for ways to decrease risks for the population, including the reduction of ichthyofauna in the Russian Arctic.

Reducing the flow of marine debris and plastic into the waters of the Arctic seas is an important task, the goal of which is to alleviate the anthropogenic load on the region as a whole. Emissions reduction is possible in several ways:

1. increase the share of biodegradable plastics in the total volume of plastic production;
2. proliferation of waste recycling facilities that can dispose and recycle plastic;
3. increase fines for waste disposal in the water protection zone;
4. information and educational work with the population on the topics of plastic pollution;
5. use of alternative plastic household items and items of daily use;
6. introduction of separate waste collection.

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On the Methodology of Subglacial Oceans *

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Abstract. Throughout all periods of development, the history of mankind has been closely intertwined with the sea. Craving for perception of the unknown has always been favored for humans. The interrelations between people and water element were actively considered by the representatives of natural, exact and engineering sciences. Humanitarian thought can also make a contribution to the study of the oceans. The authors propose substantiation for the formation of the methodology of subglacial oceans. The methodology refers to the theory of thought and action. Modern methodology is capable of constructing the ways of thinking that solve new issues and problems. Openness to criticism of methodological thinking is its strong and promising aspect. The study of the exploration techniques of the “second space”, starting with the first steps and up to the modern attempt to create an underwater prototype of the International Space Station, leads the authors to the conclusion about the possible equivalence of space and Arctic technologies. Exploration of the ice cosmic worlds of Pluto, Jupiter and Saturn may precede the study of the Arctic region. The Arctic has the potential to become a testing site for future space missions. The sterility of space technologies can, on the other hand, provide the development of the green economy in the Arctic.

Keywords: *ocean, Arctic, subglacial oceans, space, methodology for exploring the oceans.*

Thor Heyerdahl wrote: “Man hoisted sail before he saddled a horse. He poled and paddled along rivers and navigated the open seas before he traveled on wheel along a road. Watercraft were the first of all vehicles. By hoisting sail or merely traveling with the current, early man was able to settle the islands. Territories that could be reached overland only by generations of gradual transmigration for those who had to confront obstacles like swamps and lifeless tundra, naked mountains and impenetrable jungles, glaciers and deserts could be reached in weeks by casual drift or by navigation. Watercraft were man’s first major tool for his conquest of the world.” [1, T. Heyerdahl, p. 3]. Ocean developed in man a craving for wandering and knowledge of the unknown. It has been established long ago that in order to understand the nature of the Earth and neighboring planets, it is necessary to consider all the phenomena of solar system as a whole. Studying the Earth, man in a certain way studies the history of the entire Universe. Human mind has never reconciled and will never reconcile with the existence of the unknown. To explore the unknown and explain the incomprehensible, a person does not stop at any difficulties.

Humanitarian thought can make a significant contribution to the process of oceans exploration. Within the framework of the article, we will start from descriptive works [2, Scholtz G. et al.¹] and turn to methodological aspects of the issue.

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To date, about 580 inhabitants of our planet have flown into space. A total of 13 people have visited the moon. Only three people have conquered the maximum ocean depth in the Mariana Trench. But no one has seen the real North Pole until now: the ocean bed under a solid ice cover. No one dared to descend to the bottom of the top of the world to a depth of 4300 meters under an ice dome of 2.5 meters. This was done only by a Russian expedition led by the outstanding polar explorer Artur Nikolaevich Chilingarov. The landing of a deep-sea vehicle on the bottom of the Arctic Ocean near the North Pole can be classified as a geographical discovery. No one in the entire history of mankind has come into direct contact with open space, which could not but affect the mental state of cosmonaut A.N. Leonov. None of the people have ever been at such a depth, and even under the ice of the North Pole. All this was taken into account by the organizer of the expedition. "It was a victory of human mind, will, courage, daring, aspirations to comprehend the unknown, which had not been conquered before. It was a leap of trust" [3, Sagalevich A.M., p. 266]. Into the "second space".

The exploration of the ocean as a "second space" is increasingly attracting the attention of the international scientific community. Fabien Cousteau, the grandson of legendary ocean explorer Jacques Cousteau, wants to build the equivalent of the International Space Station (ISS), but on the ocean floor deep below the surface, as CNN reports. "Ocean exploration is 1000 times more important than space exploration for our survival, for our trajectory into the future," Cousteau told CNN. "It's our life support system. It is the very reason why we exist in the first place." Space exploration gets vastly more funding than its oceanic counterpart, according to CNN, despite the fact that humans have only explored about five percent of Earth's oceans and mapped only 20 percent².

Claude Jean Riffaud writes that a parallel can be drawn between work underwater and in space. "They are related to the life support of a person in unusual conditions. The oceanaut, like the astronaut, is isolated in his capsule, he is threatened by lots of dangers. The first one is separated from the usual terrestrial world by the endless space, the second — by a gigantic layer of water, and the huge hydrostatic pressure is no less dangerous than the vacuum. It takes about the same time for return from the Moon to the Earth and for transition from pressure at a depth of 250 meters to normal earth pressure." But the history of ocean exploration has its own peculiarities. "A person has long had the opportunity to explore the underwater world, with certain restrictions" [4, Riffaud, p. 110–111].

For a long time, space exploration seemed to be a matter of manned astronautics. Humans can inhabit near-Earth space in orbitals, the Moon, maybe even Mars. But it's a divergence of humanity. Distant worlds are only open to robots. So is the ocean. Humans can explore the shelf, but

¹ Zaucha J., Gee K. Maritime Spatial Planning: Past, Present, Future. Springer Nature, 2019. 496 p. https://doi.org/10.1007/978-3-319-98696-8_2 (accessed 02 September 2020).

² Tangermann V. Check out This Amazing Design for an Underwater «Space Station». Ocean exploration is 1,000 times more important than space exploration». *Futurism*. URL: <https://futurism.com/check-out-this-amazing-design-for-an-underwater-space-station> (accessed 02 September 2020).

great depths are a task for automata. The pioneering heroes are being replaced by robots. Thus, the Russian autonomous vehicle "Vityaz" made an expedition to measure the real depth of the Mariana Trench. As a result, its sensors recorded a depth of 10,028 meters. The duration of the underwater expedition, during which the "Vityaz" carried out mapping, photo and video filming, was about three hours. The apparatus functioned in a completely autonomous mode, the specialists just observed the progress of the operation. Full autonomous operation distinguishes the "Vityaz" apparatus from Japanese and American underwater devices that are engaged in scientific research in the area³.

What is so interesting about the Arctic in this respect? What could be a subglacial oceans methodology? The Arctic allows you to touch the mystery of life origin on other ice worlds.

A recent analysis of images of the automatic interplanetary probe New Horizons, taken by scientists at the University of California, showed that immediately after formation, Pluto could be so warm that an ocean of liquid water existed on its surface. The giant Sputnik Planitia glacier is located exactly in the *anti-charon* zone. It is placed in area that is opposite to the section of Pluto's surface where Charon (Pluto's satellite), tied by tidal forces, always stands directly overhead. This could happen only if Pluto's inner rocky core and its outer ice crust are not connected to each other by frictional force due to the existence of an ocean with liquid water under the ice crust. Could this ocean be inhabited? According to astrobiologists, liquid water is a fundamentally necessary factor for the existence of life, along with the molecules of organic substances and the flow of energy. All these conditions may be available on Pluto and other worlds with internal oceans, such as Europa and Enceladus [5, Stern A., p. 355–357]. Half the mass of Charon's inner core is water ice. It is known that during the satellite formation, its core was hot, making water ice liquid. Ice freezing caused internal expansions, resulting in a huge tectonic belt. The northern and southern hemispheres of Charon are separated by a huge complex of valleys and rocks, which stretches for more than 1,500 km at an acute angle from the equator from southwest to northeast.

Pluto is not the first ocean world. Astronomers hope to explore giant pools of liquid water on the moons of Saturn and Jupiter. Perhaps the most famous of these is Enceladus, one of Saturn's moons. In 2004, the interplanetary station "Cassini" discovered huge water geysers up to 250 kilometers high above its south pole, which became important evidence of existence of a global ocean under the solid surface. According to estimates, its depth reaches 45 kilometers, which is four times deeper than the Mariana Trench. The thickness of the ice layer over the ocean is from 18 to 22 kilometers (although ice at the south pole is believed to be much thinner: from 2 to 5 kilometers).

Another famous example of the ocean world is Europa, a small moon of Jupiter with a radius four times smaller than the Earth's (by the way, this is the smallest of the planet's moons dis-

³ Noveyshiyy rossiyskiy glubokovodnyy apparat «Vityaz» opustilsya na dno Marianskoy vpadiny [The newest Russian deep-sea vehicle "Vityaz" sank to the bottom of the Mariana Trench]. URL: <https://www.militarynews.ru/story.asp?rid=1&nid=531602&lang=RU> (accessed 02 September 2020).

covered by Galileo). Scientists suggest that a salty ocean is hidden under its icy surface, the depth of which should be one tenth of the entire radius of a celestial body. The volume of water in the “European Ocean” is two to three times greater than in the World Ocean on Earth, and it is preserved in liquid form due to tidal forces. This fairly common mechanism for heating celestial bodies without using the energy of the Sun or internal radioactivity works this way: when a moon orbiting Jupiter comes close to a gas giant, the gravity of the latter flattens it slightly, and it stretches along the direction of the planet. Then, when the celestial body moves away from Jupiter, Europa again takes on a spherical shape. Such regular deformations promote mixing and heating of the subsoil, which prevents the subglacial ocean from freezing, and also creates partially melted “pockets” throughout the entire outer shell of Europa ⁴.

Triton was born in the Kuiper Belt, a ring of ice rocks orbiting the Sun outside the planets. Early in their lives, Neptune and Uranus engaged in an intricate dance that transported them and the Kuiper belt to their present locations. This cosmic accident also allowed Neptune to capture at least one Kuiper belt object, Triton, as the moon. The surface of Triton probably felt the first bursts of activity during this violent takeover. Tidal heating caused by energy dissipation during this takeover and slow circulation of its orbit probably caused geological activity at the surface. The ice may have moved or melted, and its internal structure may have been slightly affected. But this event alone, happened billions of years ago, is not enough to preserve the freshness of Triton’s surface. Something else must be heating its interior today to create a liquid ocean. On Europa, the variable gravity tug of Jupiter and its moons may help preserve the ocean, but Triton is Neptune’s only large moon. Instead, Triton’s orbital tilt could lead to formation of a liquid ocean. Although the Moon is always turned with one side to its planet, its orbital retrograde motion occurs above and below the equator of Neptune, which allows its poles to experience the changing seasons, and the giant planet’s gravitational action effects Triton’s inner surface ⁵.

Astronomers analyzed the data obtained by the Dawn spacecraft between 2015 and 2018. The results suggest that there is a salty ocean beneath the surface of Ceres. It is also possible that the celestial body was geologically active not so long ago. The Dawn spacecraft orbited Ceres, a dwarf planet and the largest known object in the asteroid belt, from 2015 to 2018 until it ran out of fuel. In the final phase of Dawn’s operation, it entered orbit just 35 km above the surface of Ceres. Its goal was to analyze the structure of the Occator crater, since scientists noticed salt deposits on its surface, which were thought to get there from the subsurface ocean. In the first

⁴ Ulasovich K. Na Plutone, okazyvaetsya, est’ drevniy okean vody. Uzhasno interesno, chto tam proiskhodit, – no dlya nachala pridetsya izuchit’ okeany Entselada i Evropy [It turns out that Pluto has an ancient ocean of water. Terribly interesting what is happening there — but first you have to explore the oceans of Enceladus and Europa]. URL: https://meduza.io/feature/2020/06/24/na-plutone-okazyvaetsya-est-drevniy-okean-vody-uzhasno-interesno-chto-tam-proishodit-no-dlya-nachala-pridetsya-izuchit-okeany-entselada-i-evropy?utm_source=twitter&utm_medium=main (accessed 20 September 2020).

⁵ Redd N. T. What lies beneath Triton’s ice. *Astronomy*. URL: https://astronomy.com/magazine/2019/08/what-lies-beneath-tritons-ice?utm_source=asytwitter&utm_medium=social&utm_campaign=asytwitter (accessed 20 September 2020).

phase of the work, astronomers analyzed high-resolution gravity data and images from the spacecraft and discovered that there is a huge reservoir of salt water deep under the Occator crater. Researchers suggest that the impact of a celestial body that created the Occator crater could have caused the rise of salt water to its surface. Then scientists investigated the composition of the hard crust of Ceres. They hypothesized that the dwarf planet experienced a period of cryovolcanic activity that began about nine million years ago and continued until recently. In a separate work, astronomers showed that the hills in the Occator crater could have formed by the freezing of lava flows after the impact of celestial bodies on the surface of Ceres. It means that cryogenic processes are possible not only on Earth and Mars, but also on Ceres. The age of Occator is estimated at about 20 million years, while the age of the light deposits — several million years. Therefore, scientists were inclined to the second hypothesis, according to which water and soda are contained at a greater depth in the form of a saturated liquid solution and rise to the surface due to cryovolcanic activity. The detected gravity anomalies suggest that there is indeed a reservoir of fluid under the crater ⁶.

The gas giant Jupiter was believed to be responsible for the tidal heating of the liquid interior of its moons. In a new study, scientists at the University of Arizona believe that the satellites are able to warm themselves up due to the mutual gravitational influence that exists between them. According to the researchers' new model, Jupiter's influence cannot create tides at the right frequency to resonate with moons, because their oceans are considered too deep. When researchers added the gravitational influence of other moons, they noticed tidal forces approaching the natural frequencies of the satellites. When the tides created by other objects in the Jupiter satellite system match the natural resonance frequency of each moon, then the moon begins to heat more than due to the tides raised by Jupiter alone, and in the most extreme cases it can cause ice melting. According to experts, for moons to experience tidal resonance, their oceans must be tens to hundreds of kilometers – at most a few hundred miles – thick, which is in range of scientists' current estimates. Researchers believe that protecting sub-ice oceans from freezing requires a delicate balance between internal heating and heat loss, and yet there is some evidence that Europa, Ganymede, Callisto, and other moons could be ocean worlds. For example, volcanic activity is observed on the moon Io, which, according to scientists, is one of the consequences of tidal heating. "These tidal resonances were known before this work, but only known for tides due to Jupiter, which can only create this resonance effect if the ocean is really thin (less than 300 meters or under 1,000 feet), which is unlikely," — says the study's lead author Hamish Hay in one of his interviews ⁷.

⁶ Pod poverkhnost'yu Tserery nakhoditsya okean solenoy vody [Beneath the surface of Ceres is an ocean of salt water]. URL: <https://indicator.ru/astronomy/pod-poverkhnostyu-cerery-okean-solenoi-vody-10-08-2020.htm> (accessed 27 September 2020).

⁷ Mace M. Jupiter's Moons Could be Warming Each Other. The gravitational push and pull by Jupiter's moons could account for more warming than the gas giant Jupiter alone. *News of the University of Arizona*. URL: <https://news.arizona.edu/story/jupiters-moons-could-be-warming-each-other> (accessed 27 September 2020).

When the tides created by other objects in the Jupiter satellite system match the natural resonance frequency of each moon, then the moon begins to heat more than due to the tides raised by Jupiter alone, and in the most extreme cases it can cause ice melting. According to experts, for moons to experience tidal resonance, their oceans must be tens to hundreds of kilometers – at most a few hundred miles – thick, which is in range of scientists' current estimates. Nevertheless, there are some reservations to the researchers' conclusions. Their model assumes that tidal resonances never get too extreme, Hay said. He and his team want to return to this variable in the model and see what happens when they lift that constraint. Hay is hoping that future studies will be able to infer the true depth of the oceans within these moons. Warm deep oceans are the main hope of those seeking extraterrestrial life in the solar system. None of the ice worlds have been properly studied, but astronomers already have many specific plans for research missions⁸.

The Arctic can become a testing ground for such missions.

For example, the American space agency NASA is planning a mission to Jupiter's satellite Europe in order to search for life in the oceanic worlds. Engineers at NASA Jet Propulsion Laboratory in Pasadena have created the Buoyant Rover for Under-Ice Exploration (BRUIE), which is currently being tested in Antarctica. A three-foot (1 meter) floating all-terrain vehicle equipped with two wheels for rolling under the ice can take pictures and collect data in an important area where water and ice meet⁹.

From the above, **the methodology of subglacial oceans** is the following: Based on the universality of the scientific method, what is suitable for space can be applied to study our planet. We can talk about the equivalence of space and Arctic technologies. By studying Arctic Ocean, we are exploring all possible subglacial oceans. For example, one of the activities of the robotics departments can be reoriented towards the development of robots for autonomous exploration of the Arctic. Subsequently, they can be used in outer space in the study of sub-ice oceans of other celestial bodies.

This research touches upon the essence and origin of life, possibility of its occurrence in a closed hydrospace. A group of researchers from the Free University of Berlin have found data indicating the existence of life in the subglacial ocean of Enceladus. Traces of organic compounds in plumes that burst from the moon surface may be the building blocks of amino acids, the precursors of terrestrial life forms. It is not known if amino acids are needed to build alien lifeform, but finding the molecules that form amino acids is an important piece of the puzzle.

The plumes are ejected from the surface of Enceladus after mixing with water from the moon's giant sub-ice ocean, and then the material is ejected in the form of water vapor and ice

⁸ Hay Hamish C.F.C., Trinh A., Matsuyama I. Powering the Galilean Satellites with Moon-Moon Tides. *Geophysical Research Letters*. 2020. Volume 47. Iss. 15. DOI: <https://doi.org/10.1029/2020GL088317>. URL: <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2020GL088317> (accessed 27 September 2020).

⁹ Samuelson A. Aquatic Rover Goes for a Drive Under the Ice. *Jet Propulsion Laboratory California Institute of Technology*. URL: <https://www.jpl.nasa.gov/news/news.php?feature=7543> (accessed 27 September 2020).

grains. NASA's Cassini spacecraft was able to analyze it using an onboard mass spectrometer. The news appeared after another group of researchers suggested in 2018 that complex organic molecules float on the surface of Enceladus's vast subsurface ocean. In June, a team from the Washington University discovered that the ocean is nutrient-rich and livable.

In the Earth's ocean, plankton is the basis of life: where phytoplankton (photosynthesizing unicellular algae) appears in the mass, life begins. It releases oxygen, which the oceans produce more than all forests in the world. In the northern seas, the appearance of phytoplankton is tied to the appearance of the sun after a long polar night. Cold seas are more saturated with oxygen than warm ones (the solubility of gases in water increases with decreasing temperature). The presence of a sufficient amount of oxygen and food leads to explosive outbreaks of abundance, because the plankton biomass in the northern seas can be unimaginably huge [6, Semenov A., p. 15].

This is the difference between the terrestrial arctic seas from the subglacial oceans on other celestial bodies. It is obvious that anoxic life is possible there, as in the deep oases of the Earth's ocean. Such oases are usually located along rift ridges.

Space technology is generally sterile. Researchers are seeking sterility in order not to pollute other planets. This means that space technologies are environmentally friendly. This is very important for such a sensitive region as the Arctic.

Many of the robotic gliders and floating sensor stations currently monitoring the world's oceans are effectively treated as disposable devices. "This is because the research community has a limited number of both ships and funding to retrieve drones after they've accomplished their mission of beaming data back home. That's not only a waste of money, but may also contribute to a growing assortment of abandoned lithium-ion batteries polluting the ocean with their leaking toxic materials," said Yi Chao, president and CEO of the Seatrec startup. Seatrec's energy-harvesting system works by taking advantage of how certain substances transition from solid-to-liquid phase and liquid-to-gas phase when they heat up. The company's technology uses pressure changes resulting from such phase changes to generate electricity. The startup is working to adapt its system to work with autonomous underwater gliders. To make the phase changes happen, Seatrec's solution taps the temperature differences between warmer water at the ocean surface and colder water at the ocean depths. "Even a relatively simple robotic probe can generate additional electricity by changing its buoyancy to either float at the surface or sink down into the colder depths."¹⁰ This fits well with the green economy and the use of renewable energy sources.

Among all the possible applications, startup founder Yi Chao is particularly excited about the prospect of Seatrec's renewable power technology enabling underwater drones and floaters to collect oceanographic data for much longer periods of time. He spent most of two decades working at NASA Jet Propulsion Laboratory (JPL) in Pasadena, California, where he helped develop a satellite designed to monitor the Earth's oceans. He and the JPL engineering team that devel-

¹⁰ Ibid.

oped Seatrec's core technology believe that swarms of underwater drones can provide a continuous monitoring network to truly begin understanding the oceans in depth ¹¹.

The unity of world science is manifested in the project for the study of subglacial oceans. The efforts of all countries within the Arctic Circle can be united. Finally, a kind of *dream project* arises. Such a project does not bring immediate benefits, but its development significantly promotes science and technology, attracts young, promising personnel who are in love with the Arctic, and engages young people to the field of scientific research. It develops a cosmic worldview, allows considering the Universe as a whole, because the Earth is one of the many worlds covered by the ocean.

In conclusion, we must recall why it is important to refer to methodology. It is known that the construction of methods dates back to the late 19th – early 20th centuries ¹². In conclusion, we must recall why it is important to refer to methodology. It is known that the construction of methods dates back to the late 19th – early 20th centuries. V.M. Rozin identifies a number of features characteristic of this trend. "Generally, methods are understood as methods of correct thinking, and the criteria for correctness can be different (consistency, creation of conditions for further development of thinking, the possibility of building new knowledge). Methods are created by methodologists, but based on already emerging patterns of thinking, which are described and analyzed from a certain angle of view. Methods are addressed to certain audiences (in particular, scientists), who impose certain requirements on the content and form of these methods. We get *a specific methodology of research* ¹³. According to G.P. Shchedrovitsky, *methodology* is the doctrine of thinking and action. From thinking according to the schemes of two or many knowledge, the task of *configuring knowledge* follows quite naturally. "Collective forms of methodological thinking contribute to the fact that methodological thought is constructed in such a way as to prepare the conditions for the next new thought. Modern methodology sees its purpose in restructuring and reforming unsatisfactory forms and ways of thinking and in building ways of thinking that allow solving fundamentally new problems and tasks. Methodological thinking is open to criticism, it waits for it, exposes its thoughts for discussion to interested subjects. The third main characteristic is the reliance in solving methodological problems and tasks on modern intellectual technologies and the scientific study of thinking" [7, V.M. Rozin, p. 98].

From the above, our proposal for the methodology of subglacial oceans is following:

1. Based on the universality of the scientific method, what is suitable for space can be applied to study our planet. We can talk about the equivalence of space and Arctic technologies. By studying Arctic Ocean, we are exploring all possible subglacial oceans.

¹¹ Ibid.

¹² Rozin V.M. Rekonstruktsiya «Logiko-filosofskogo traktata» L. Vitgenshteyna [Reconstruction of the "Logical-Philosophical Treatise" by L. Wittgenstein]. URL: http://www.e-notabene.ru/fr/article_571.html#4 (accessed 27 September 2020).

¹³ Ibid.

2. We propose to reorient some of the functionality of the robotics departments to develop robots for autonomous exploration of the Arctic. Subsequently, they can be used in outer space in the study of both subglacial oceans and other celestial bodies.
3. This research touches upon the essence and origin of life, possibility of its occurrence in a closed hydrospace. This concerns the kinship of all living creatures in space.
4. Space technologies are usually sterile. Researchers are seeking sterility in order not to pollute other planets. This means that space technologies are environmentally friendly. This is very important for such a sensitive region as the Arctic.
5. This issue reveals the unity of world science. The efforts of all countries within the Arctic Circle can be united.
6. A kind of dream project arises. Such a project does not bring immediate benefits, but its development significantly promotes science and technology, attracts young, promising personnel who are in love with the Arctic, and engages young people to the field of scientific research. It develops a cosmic worldview, allows considering the Universe as a whole, because the Earth is one of the many worlds covered by the ocean.

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