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Article



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ON THE IMPORTANCE OF HUMAN CAPITAL AS A KEY ASSET IN THE ECONOMIC DEVELOPMENT OF ARCTIC TERRITORIES

Abstract: In this article, the authors analyzed the demographic and socioeconomic situation in the Arctic zone of the Russian Federation. They examined prevailing demographic trends, key economic and social development indicators, the labor market situation in the regions of the Russian Arctic zone, challenges in providing the region with the necessary skilled labor, and selected public health indicators. Conclusions were drawn regarding the divergent demographic development vectors of Russia's northern territories, the prevalence of negative migration processes, and the need to preserve and further develop human capital, the size and quality of which are determined by the extent of investment in education and healthcare. Based on the results of this analysis, it can be concluded that to address the diverse and complex challenges of reviving the Russian Arctic, it is essential to preserve and further develop the region's human capital as the primary driver of innovative economic and social progress.

Key words: The Arctic zone of the Russian Federation, demography, socio-economic development, human capital, labor resources, education, healthcare, northern territories.

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Introduction

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In August 2025, the Russian Government approved a new version of the state program "Socioeconomic Development of the Arctic Zone of

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the Russian Federation" (AZRF)—the key mechanism for implementing Russian Arctic policy, outlining its main goals, objectives, and strategic priorities. Implementing these goals will be impossible without preserving and developing the fundamental resource of the modern economy—people. The socioeconomic aspects and challenges of their lives are particularly evident in the Arctic expanses, which our country is developing not for the first time, but at a new stage of technological and organizational development. Enhanced economic activity in the region is a critical national objective, which can only be optimally achieved through the use of the latest technology and innovation. This requires coordinated efforts at the federal and regional levels, including the development and implementation of state programs for Russian Arctic entities. Therefore, an analysis and objective assessment of the region's human potential are essential and relevant. According to the modern development paradigm, investments in human capital yield higher dividends than investments in other factors of production.

The goal of implementing the State Program is to increase the level of socio-economic development in the Arctic Zone of the Russian Federation, and one of the main tasks is to improve the quality of life and security of the population against the backdrop of significant differences within and between polar regions, as well as between indigenous and non-indigenous populations, including in terms of demographic indicators.

Demographic profile.

Demographic potential is the basis of human capital, characterizing the reproduction of the population and determined by the indicators of natural and migration movement of the population, average life expectancy and their dynamics. Since 2025, the Arctic Zone of the Russian Federation has been identified as an independent object of statistical observation, the section "Indicators of the socio-economic development of the Arctic Zone of the Russian Federation and national security" has been included in the Federal Statistical Work Plan. Judging by the available data, in recent years there have been multidirectional trends and vectors of demographic development in the region. According to Rosstat, in 2024 the population of the Arctic Zone of the Russian Federation decreased by 6,579 thousand people (in 2015 by 13.4 thousand people) (Table 1), this happened in the majority of the studied subjects, the most in the Murmansk (-4,552 thousand) and Arkhangelsk regions (-2,112 thousand); The Yamalo-Nenets Autonomous Okrug (YNAO) demonstrated the most significant population growth (+1,945 thousand). The decrease in the total population occurred primarily due to negative net migration throughout the Arctic Zone of the Russian Federation (Table 2). The decline was particularly severe in the Murmansk and Arkhangelsk Oblasts, Krasnoyarsk Krai, and the Yamalo-Nenets Autonomous Okrug; the Sakha Republic (Yakutia), Chukotka Autonomous Okrug (ChAO), and Nenets Autonomous Okrug (NAO) suffered the least in this regard.

Table 1. The permanent population of the land territories of the Arctic Zone of the Russian Federation as of January 1 (people)

Territories	2024	2025	Territories	2024	2025
Arctic Zone of the Russian Federation	2,378,234	2,371,655	UrbanNovaya Zemlya District	3,024	2,934
Komi Republic	81,442	80,061	Novodvinsk urban district	38906	38,735
Vorkuta urban district	81,442	80,061	Severodvinsk urban district	186 138	185,042
Republic of Sakha (Yakutia)	26 107	26,190	Mezensky municipal district	9 241	9,049
Allaikhovsky municipality burning area	2,682	2,718	Onega municipal district	31,456	30,762
Anabar national (Dolgano-Evenki) municipality burning area	3,431	3,500	Primorsky municipal district	25,787	25,639
Bulunsky municipal-district	8,366	8,404	Murmansk Oblast	762 173	757 621
Nizhnekolymsky municipal-central district	4,386	4,366	NAO	43,838	43,937

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Ustyansky municipal-district	7 242	7 202	ChAO	50 157	49,822
Krasnoyarsk Krai	227,546	227 220	Yamalo-Nenets Autonomous Okrug	534 104	536,049
Norilsk urban district	178 106	178,654	Republic of Karelia ⁶	27809	27267
Taimyr Dolgano-Nenets municipality district	32,871	32,290	Belomorsky municipal district	17,034	16,663
Turukhansky municipal district	16,569	16,276	Loukhsky municipal district	12,056	11,771
Arkhangelsk Oblast without the Nenets Autonomous Okrug	652 867	650 755	Kemsky municipal district	15,753	15,496
Urban district "Arkhangelsk	358 315	358,594			

In most Arctic Zone regions, the birth rate exceeded the death rate in 2024 (Table 2), with the Nenets Autonomous Okrug, the Sakha Republic (Yakutia), and the Yamalo-Nenets Autonomous Okrug ranking 3rd, 8th, and 11th in the Russian Federation in terms of birth rate, respectively. The demographic dependency ratio in the Arctic Zone

regions did not exceed the Russian average—764 people aged 0–15 and 60 years and older per 1,000 people of working age, with the exception of the Arkhangelsk Region, excluding the Nenets Autonomous Okrug.

Table 2. Demographic indicators of the Arctic Zone of the Russian Federation subjects in 2024

Territories	Natural coefficient Population growth	Migration rate	growth	Demographic dependency ratio	Migration increase, people
Arctic Zone of the Russian Federation	3.1	-5.9		..	-14021
Komi Republic*	0.9	-18.0		725	-1451
Sakha Republic (Yakutia)	7.0	-3.8		701	-99
Krasnoyarsk Krai	7.3	-8.8		726	-1990
Arkhangelsk Oblast without the Nenets Autonomous Okrug	-0.5	-2.8		812	-1811
Murmansk Oblast	-0.3	-5.7		674	-4343
NAO	9.6	-7.3		736	-320
ChAO	3.6	-1.0		582	-516
Yamalo-Nenets Autonomous Okrug	10.1	-69.8		536	-3491
Republic Karelia*	-2.8	-16.0		811	..

In the Arctic Zone of the Russian Federation, life expectancy at birth has generally increased in recent years, in line with the national positive trend, and in 2024 it amounted to 71.36 years, but was lower than the national average (71.87 years). This level was exceeded only in the Yamalo-Nenets Autonomous Okrug (72.13 years), with a similar figure in the Nenets Autonomous Okrug (71.08), while the largest

lag, as in the previous period (2014–2015), was demonstrated by the Chukotka Autonomous Okrug (64.42 years), which ranks second from the bottom among Russian regions after the Republic of Tyva. This figure is also low in the Republic of Karelia (69.78 years). The average age of residents in the Arctic Zone of the Russian Federation is lower than the national average (40.7 years), with the exception

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of the Chukotka Autonomous Okrug (41.5 years), and the proportion of children and individuals of working age is higher (except for the Arkhangelsk Region, in the latter case).

Low life expectancy and depopulation in the Russian North, which have been observed in recent decades and which reduce the region's demographic security, are associated not only with extremely harsh natural and climatic conditions, which lead to high morbidity and mortality rates, but also with a low quality of life due to the insufficient development of the healthcare system, including the availability of high-quality medical services.

Standard and quality of life

Standard of living refers primarily to income; quality of life also includes longevity and educational attainment as generalized health characteristics, objective indicators of the quality of medical and educational services, and the implementation of national programs in the relevant areas. Gross regional product (GRP) is a key indicator of socio-economic development; in per capita terms, it is higher than the Russian average in all territories of the Arctic Zone of the Russian Federation, except for the Arkhangelsk Region without the Nenets Autonomous Okrug. The leaders are the Nenets Autonomous Okrug, Yamalo-Nenets Autonomous Okrug, and Chukotka Autonomous Okrug, where this indicator exceeds the average for the constituent entities of the Russian Federation by 11.2, 7.6, and 2.9 times, respectively. The share of GRP produced in the Arctic Zone of the Russian Federation in the total GRP of the constituent

entities of the Russian Federation is steadily growing: from 2022 to 2024, it increased by 0.3% to 5.3%. The share of the added value of high-tech and knowledge-intensive sectors of the economy in the GRP of the Arctic Zone of the Russian Federation reached 7.1%, while the share of knowledge-intensive innovative goods and services decreased during the same period. Per capita income of the population, due to regional coefficients and wage supplements for work in the Far North regions, is higher in the Arctic Zone of the Russian Federation than the Russian average, with the exception of Krasnoyarsk Krai, where the sectoral structure of gross added value is dominated by manufacturing rather than mining (Table 3). At the same time, the share of the population with incomes below the subsistence minimum established in the constituent entity of the Russian Federation exceeds the Russian average (13.4%) in the Komi Republic (16.7%), Arkhangelsk Oblast excluding the Nenets Autonomous Okrug (14.3%), Krasnoyarsk Krai (18.4%) and the Sakha Republic (Yakutia) (19.8%). The problems of low income in northern regions threaten to undermine the achievement of a range of state Arctic policy objectives. The Gini coefficient exceeds the national average (0.412) in the Nenets and Yamalo-Nenets Autonomous Okrugs. Overall unemployment is significantly lower than the national average in the Yamalo-Nenets and Chukotka Autonomous Okrugs, which are among the country's leaders in labor force participation and employment rates.

Table 3. Social and economic indicators of the Arctic Zone of the Russian Federation subjects, 2024

	Graduation of skilled workers and employees / mid-level / senior specialists, thousand people.	Morbidity, people per 1000 people population	Average per capita cash income per month, rubles.	Employment rate, %	Unemployment rate, %
Russian Federation	198.6/469.1/1161.1	785.3	30744	65.7	5.5
Komi Republic	1.9/ 2.9 / 4.8	1121.2	31527	64.6	8.7
Arkhangelsk Oblast without the Nenets Autonomous Okrug	2.6 / 3.5 / 5.8	1002.2	31043	61.7	7.1
NAO	0.1 / 0.2 / ..	1380.7	69956	67.1	8.5
Murmansk Oblast	1.0/ 2.4 / 3.2	875.8	36115	68.8	7.7
Yamalo-Nenets Autonomous Okrug	0.8/ 1.6 / 0.2	1180.4	67521	75.1	2.6
Krasnoyarsk Krai	4.2/ 9.5 / 18.9	783.1	28030	64.3	6.1
Republic of Sakha (Yakutia)	2.4/ 4.1 / 4.7	1043.8	38933	64.5	7.2
ChAO	-/ 0.1 / 0.1	1289.4	63909	79.6	3.5
Republic of Karelia	1.0 / 2.2 / 3.0	1126.2	25744	62.2	9.2

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The real sector of the Russian Arctic economy is primarily represented by the defense industry, mining, and enterprises related to transport infrastructure and the Northern Sea Route. In the sectoral structure of gross value added, mineral extraction ranks first everywhere except in Krasnoyarsk Krai; the share of manufacturing is also high in the Komi Republic, Arkhangelsk Oblast, and Murmansk Oblast.

During the new development of the Arctic Zone of the Russian Federation, the system of secondary, higher, and continuing education for adults will play a central role in the formation of human capital, allowing future specialists to master blue-collar jobs during the intermediate stage of training. However, in line with the national trend, the region currently produces predominantly specialists with higher education (Table 3). The composition of the employed population in the Arctic by level of vocational education in 2024 was as follows: the highest share of the employed population with higher education was in the Yamalo-Nenets Autonomous Okrug (41.2% versus the Russian average of 33.5%), and the lowest was in the Komi Republic (25.8%). Arkhangelsk Oblast, excluding the Nenets Autonomous Okrug, leads in secondary vocational education of the workforce (56.3%), followed by the Nenets Autonomous Okrug (54.8%), and the Chukotka Autonomous Okrug (36.0%), which is almost 10% lower than the Russian average (45.1%). The highest share of unemployed people with university education is in the Yamalo-Nenets Autonomous Okrug (26.0% versus the Russian Federation average of 20.5%), and the lowest is in the Nenets Autonomous Okrug (4.3%). In order to create a modern educational, scientific, and innovative infrastructure, strengthen regional educational institutions and their ties with the economy and social sphere, and develop a competitive human resource potential corresponding to the objectives of resuming full-fledged economic activity in the Russian Arctic, the following federal universities operate in the field of higher education: Siberian (Krasnoyarsk), Northern (Arctic) University named after M.V. Lomonosov (Arkhangelsk), Far Eastern (Vladivostok), and North-Eastern University named after M.K. Ammosov (Yakutsk). In April 2025, Murmansk Arctic State University, the largest higher education institution in the region, became one of the regional flagship universities. Its mission is to accumulate regional, domestic, and international scientific and educational potential to effectively support the development of the Arctic Zone of the Russian Federation in terms of human resources and scientific research. The flagship universities have a total of approximately 20 branches and include institutes and colleges, thus ensuring not only continuous but also accessible education for residents of various categories of settlements.

Arctic universities are increasing the number of students admitted to state-funded places, with

engineering programs accounting for the majority of these, generally higher than the national average. However, approximately 20% of graduates find employment outside the Arctic Zone of the Russian Federation, and expanding cooperation between universities and businesses in the training and subsequent employment of graduates is a pressing issue. The region's largest employers are currently experiencing a shortage of qualified CNC machine operators, lathe operators, milling machine operators, and electric welders. There is an objective need to train specialists in shipbuilding, mechanical engineering, and instrument engineering, shipbuilding economics and management, and other fields. Targeted training (in specialties and areas of training identified by the state or leading regional employers), along with additional vocational education and advanced training, can address the Arctic's most pressing human capital needs. Health is the most pressing issue in human capital development in the Arctic Zone of the Russian Federation. Health indicators in the Arctic are inferior to those in Russia as a whole: life expectancy in the region is lower (53 years, according to some expert estimates), and morbidity rates, especially for parasitic and cancerous diseases, are significantly higher (with the exception of Krasnoyarsk Krai). This highlights the need to train medical personnel for the Arctic with these specific needs in mind. There is also a pressing need to develop pharmacological therapies for thermal management that could increase survival rates when exposed to low temperatures, as well as vaccines against infections that existed tens of thousands of years ago, as the permafrost thaws.

In 2024, in accordance with an order from the Russian Ministry of Health, the Arctic Scientific and Educational Cluster of federal healthcare institutions was established to improve the quality of medical personnel training for polar regions. It includes I.I. Mechnikov Northwestern State University (St. Petersburg) and Northern State Medical University (Arkhangelsk). The Northern Cluster specializes in Arctic medicine, and its main objective is to improve the quality of personnel training and the efficiency of universities, as well as develop research activities. Increased student and faculty mobility is also planned. Improving healthcare requires accelerated development of mobile and satellite communications, expanding the fleet of medical helicopters, and upgrading medical infrastructure. These measures, along with improved disease prevention and the promotion of a healthy lifestyle, can significantly improve the health of northerners.

Conclusion

Today, Russia occupies a global leadership position in the development of Arctic projects: infrastructure (the Northern Sea Route, road, air, and rail routes), oil and gas, mining (the Bovanenkovo-

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Ukhta-Torzhok gas pipeline, etc.), industrial (shipbuilding and mechanical engineering), and information technology. The territory of the Russian Arctic will continue to grow: the authorities of Karelia have justified the inclusion of two territorial units (the Segezha District and the city of Kostomuksha) in the Arctic Zone of the Russian Federation. Russia's revenue from the exploitation of Arctic resources is also gradually increasing: LNG exports in the first quarter of 2025, compared to the same period in 2024, more than doubled in real terms and increased almost 2.5 times in value, with a significant portion of this growth coming from the Yamal Liquefied Natural Gas Plant (Yamal LNG). Also in Yamal (and in Greenland), scientists from the Ural Branch of the Russian Academy of Sciences, together with the French Academy of Sciences, will carry out a project to conduct a large-scale study of the impact of climate change on Arctic fauna in order to preserve biodiversity in the Arctic.

Given the harsh meteorological and geophysical conditions, the challenging environmental situation in high-latitude territories, and the impact of Western sanctions, the implementation of economic and infrastructure projects in the Arctic during this new phase of its development will be determined by the potential of domestic science and industry and their ability to create competitive products. In turn, the realization of these opportunities is closely linked to the quantity and quality of human potential, whose development index, according to the UN Development Programme, is below the Russian

average in most regions of the Arctic Zone. The utilization of all other development resources depends on human capital; without healthy, educated people provided with decent work, it will be impossible to develop the real sectors of the economy in the Arctic. This means measures must be taken to stabilize the demographic situation, increase the attractiveness of the region as a place of permanent residence, and develop indigenous social innovation technologies, including in medicine and education.

An analysis of human development data in the Arctic reveals diverse processes: one key trend is increased migration and, consequently, population decline in many regions, despite a higher natural population growth rate than in the Russian Federation as a whole. Data on socioeconomic development also paints a mixed picture: on the one hand, high nominal incomes, their relatively even distribution, and a high employment rate with low unemployment; on the other, a shortage of specialists at various levels of professional training for the region's economy and social sphere. Given the above, it can be concluded that a reversal of the negative trends in sociodemographic development is likely. This, given the challenging natural and climatic conditions and significant territorial disparities, is only possible through improving well-being and quality of life, improving the environment, promoting the development of traditional activities, and creating optimal conditions for the personal and professional fulfillment of northerners.

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