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Issue Article

Natalya Sergeevna Rumyanskaya
Institute of Service Sector and Entrepreneurship (branch) DSTU
Ph.D., Associate Professor

Yulia Igorevna Prokhorova
Institute of Service Sector and Entrepreneurship (branch) DSTU
bachelor

Artur Aleksandrovich Blagorodov
Institute of Service Sector and Entrepreneurship (branch) DSTU
master

Vladimir Timofeevich Prokhorov
Institute of Service Sector and Entrepreneurship (branch) DSTU
Doctor of Technical Sciences, Professor,
Shakhty, Russia

Galina Yurievna Volkova
LLC TsPOSN «Ortomoda»
Doctor of Economics, Professor,
Moscow, Russia

THE EFFECTIVENESS OF STRATEGIC HUMAN RESOURCES MANAGEMENT FOR THE SUCCESSFUL IMPLEMENTATION OF PROGRAM DEVELOPMENT OF THE ARCTIC ZONE OF THE RUSSIAN FEDERATION. MESSAGE 3

Abstract: *in the article, the authors analyze the need to manage labor resources for the development of the Arctic zone, since. The Russian Arctic is a strategically significant macro-region of the Russian Federation for a number of reasons, the most significant of which are colossal proven hydrocarbon reserves that can provide the country with fuel, energy and mineral resources for many years; the economic and geopolitical significance of the Northern Sea Route as potentially one of the largest transport arteries for maritime transport; as well as the significant length of the maritime border of the Russian Federation and the need to ensure its security. In the 1990s. The development of the Arctic has taken a back seat among Russian government priorities. However, since the beginning of the 21st century, regulatory legal acts regulating Russia's policy in the Arctic have allow us to talk about an ever-increasing awareness of the critical importance of this region for achieving the goals and objectives of the development of our country as a whole. Currently, we can talk about a large-scale multi-purpose mega project for the development of the Arctic - perhaps the term "redevelopment" would be more accurate.*

The largest projects included in the modern Arctic mega-project are the exploration and development of oil and gas fields (both on land Arctic territories and on the Arctic shelf), as well as the development of the Northern Sea Route. Both of these projects require a significant amount of qualified human resources - this means that the human resources of enterprises and organizations operating in the Arctic territories play an important role in the development of the Russian Arctic. However, for state corporations of the mineral resource complex, transport companies, scientific and educational institutions of the Arctic zone of the Russian Federation (AZ RF), as well as state executive authorities, there is a significant problem of a shortage of highly qualified specialists, capable of

living and working effectively in the extreme natural and climatic conditions of the Arctic. At the same time, there is a clearly expressed need not only for specialists with higher education, but also for workers with secondary specialized education in working specialties.

For 2024, the annual need for specialists was estimated at almost 74 thousand people for the entire Arctic zone of the Russian Federation. The possibilities of meeting the existing demand for personnel "on our own" vary from one Arctic region to another, however, it is obvious that this demand cannot be satisfied only by graduates of universities located in the Arctic Zone of the Russian Federation; Additional resources are required, especially if we are talking about narrow-profile specialists in those specialties for which the universities of the Russian Federation do not provide training at all. The problem remains of the migration outflow of youth from the northern regions to study at universities outside the Arctic Zone of the Russian Federation (after which a significant proportion of young people no longer return to the Arctic, but find employment outside of it), as well as the migration outflow of graduates from northern universities, seeking employment opportunities in other regions of the country. The underdeveloped intellectual infrastructure of the Arctic regions provokes an outflow of population.

***Key words**: forecasting, strategizing, additional resources, Arctic zone, Northern Sea Route, personnel, training, need, graduates, specialists, reproduction, profiles, redevelopment, demand.*

***Language**: English*

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Introduction

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The conceptual approach involves the preliminary development of a research concept, that is, a set of key provisions that determine the general direction and continuity of research. A concept is a certain way of interpreting any actions or actions. In this regard, in order to eliminate, or prevent, or to reduce the migration of qualified personnel from the Arctic zone of the Russian Federation, including from strongholds, it is necessary to implement a series of measures to motivate qualified personnel to show interest in their desire to provide effective and formulated goals and objectives for them , there are all the prerequisites for this, which is confirmed by their effective results of activity in Karelia and the Murmansk region.

The leaders of the Arkhangelsk region can boast of certain successes in reducing the migration of the population and qualified personnel; their decisions, together with federal and regional authorities, were the creation of a cosmodrome, which provoked an understanding among the population that everything in the region is being solved efficiently and for a long time, everything for the population so that guarantee them comfortable living conditions and high wages. Especially, this is being successfully implemented after the completion of the construction of the Arkhangelsk seaport.Based on the results of the research, the following main conclusions can be drawn:

It is shown that the personnel potential of the enterprises of the Arctic Zone of the Russian Federation represents the total labor potential of the Russian Arctic, which, in turn, is one of the key systems of human potential. For this reason, human resource potential must be considered in close connection with labor potential. When analyzing personnel and labor potential, it is necessary to give priority attention to the role of the education system in the reproduction of personnel, since education is a key factor in the formation of personnel and labor potential;

It has been established that successful management of human resources should be based on strategic management tools, which in modern conditions should be based on systemic digital support (databases, analysis of human resources, etc.);

It is shown that insufficient attention is paid to the need to change the state employment policy in the Arctic, which has proven to be insufficiently effective. To a large extent, this policy comes down to attracting additional labor resources, although the existing labor resources may be sufficient in quantitative terms - but they do not have the required qualifications;

It has been revealed that a qualitative intensification of scientific, educational and innovation policy in the region is necessary, promoting, on the one hand, the integration of the Russian Arctic regions into the scientific space of Russia and sustainable and productive scientific contacts with leading scientific institutions of Russia, and on the other hand, the development of "Arctic intellectual service" ;

It is shown that digital transformation can bring significant changes to the employment structure of the Arctic population. The development of remote employment using modern ICT gives residents of the Russian Arctic significantly more employment opportunities anywhere in Russia and the world without the need to leave their place of residence.

Such employees can and should be trained through a distance learning system, the development of which the Arctic regions should pay more attention to;

It has been established that Norway's experience in developing the human resources potential of the Arctic territories reveals the importance of such measures as initiatives to create a competitive local and regional supplier industry for the oil and gas sector; the requirement that 70% of the employed engineering and administrative potential be located in a given region; training programs and programs specifically for the recruitment of young people and government subsidies for the provision of training courses for youth up to 24 years of age and other programs for youth;

It has been shown that the personnel supply system for maritime transport is highly globalized, which poses certain problems for maintaining the level of personnel supply for the sea and river fleet in Russia due to the high gradient of wages towards work on foreign ships for high-quality Russian specialists. The problematic field of staffing for maritime transport in the Arctic and the Far East is complicated by an even more complex demographic situation in the region compared to the average Russian one;

It has been determined that, according to labor potential indices, a number of subjects whose territories are part of the AZ of the Russian Federation are likely to have a relatively stable situation in terms of economic indicators, most of them are above the median (except for the Republic of Karelia and the Krasnoyarsk Territory), as well as in terms of demographic indicators , where only the Republic of Karelia and the Arkhangelsk region were below the median - however, it should be remembered that the demographic situation seems more prosperous than it really is due to the so-called “export of mortality”. To increase the labor potential of the population of the Russian Arctic, it is necessary to concentrate on innovative development, as well as on the development of education and healthcare;

It is shown that the contribution of demographic potential to the labor potential of the Russian Arctic is currently ambiguous. The most serious negative demographic manifestations that undermine the labor potential of the Arctic regions of Russia include the aging of the population and the growing proportion of the population older than working age against the backdrop of continued high mortality in working age. The migration balance of the Arctic regions of Russia is also critical for the labor potential of the Arctic, and we are talking not only about the quantity, but also about the “quality” of migrants, their human capital;

It is shown that one of the most problematic modern trends in the socio-economic development of the Arctic territories is a decrease in the absolute size of the labor force in many Arctic regions, namely in the Republics of Karelia and Komi, the Arkhangelsk and Murmansk regions, as well as the Krasnoyarsk Territory. In the Arctic regions, along with aging, the size of the labor force may also be influenced by the migration outflow of the population, however, this influence will not necessarily be negative, since the population of working age mainly comes to the most successful Arctic regions, and the population of older ages leaves, wishing to spend their old age in more favorable conditions.

It was revealed that the experience of the Soviet Union, as well as foreign Arctic countries, indicates the success of the development of remote regions through a systematic increase in the level of their scientific and innovative potential. Currently, the trends in the number of scientific and innovative personnel (including higher education) directly in the AZ of the Russian Federation indicate an increasing insufficiency of this potential (its personnel component), which cannot ensure the economic and personnel security of the region in the long termand will affect its development;

it is shown that the personnel and demographic situation in the Arctic regions and regions with Arctic territories, associated both with problems of natural reproduction and with the outflow of population (as well as with a significant influx with a positive balance, especially for the most economically successful regions), could be called quite natural and not requiring special measures to support the human resources potential of the Arctic macroregion, however, the author has established that the level of migration (balance) depends not so much on the economy as on integral indicators of the quality of life, as well as the level of scientific and educational development of the regions of the country as a whole;

a reasonable assumption has been made that the most promising approach to the strategic management of staffing in Russia's Arctic policy will be its implementation within the framework of digital management of the personnel system of the entire country, with an emphasis for the Arctic regions on the desire to achieve indicators that determine the quality of life as central to the sustainability of their staffing management in long-term period in conditions of strategic geopolitical turbulence.

Main part

The analysis allows us to make a methodological contribution to the development of Russia’s Arctic personnel policy. An important principle of such a policy must be the need to integrate it into the personnel policy of the country as a whole, otherwise the training and attraction of personnel for the Arctic can lead to imbalances in other regions that also require development. At the same time, taking into account the above proven position that human resources should be considered as a fundamental factor in the strategic development of the Arctic regions of Russia, it should be noted that Russian researchers, for example, note the possibility of using

at least two models of human resource management, namely:

a) a model of a soft management option with an emphasis on "leadership and the effective use of communication";

b) a model of a rigid management option with a focus on planning "quantifiable strategic and operational indicators of human resources management."

Therefore, first of all, it is important to assess the real level of personnel shortages in the Arctic in comparison with national trends.

As is known, the needs of the Arctic regions for personnel practically "lie" on the trend line, that is, the needs of the regions of the Arctic Zone of the Russian Federation for personnel are not much different from the all-Russian pattern. Thus, it would seem that there are no special problems with Arctic personnel, based on the processes common to Russia.

A different situation for the Arctic regions appears with regard to the representation of the Arctic and Northern regions in the picture of the relationship between the level of GRP and the number of vacancies. High GRP in a number of Arctic regions (Murmansk region, Yamalo-Nenets Autonomous Okrug and Nenets Autonomous Okrug) does not lead to a significant increase in personnel requirements, which is largely the effect of the high share of the mining industry.

As the results of the authors' research have shown, the regions of the Arctic and North that are most prosperous in terms of wages are below the trend line, that is, where wages are high, there are not as many available vacancies as one might expect. The exception is the Murmansk region. Thus, the real severity of the personnel problem in the Russian Arctic, based on the general indicators of personnel needs, is not so obvious.

The so-called subsidization or non-subsidization of a region can say little. The list of constituent entities of the Russian Federation that are not recipients of subsidies to equalize budgetary security in 2022 was approved by Order of the Ministry of Finance dated November 11, 2021 No. 49. In 2022, the list included 23 constituent entities of the Russian Federation, exactly 10 more than last year. These are: the Republic of Tatarstan, Krasnoyarsk and Perm territories, Belgorod, Vologda, Irkutsk, Kaluga, Leningrad, Lipetsk, Moscow, Murmansk, Nizhny Novgorod, Samara, Sakhalin, Sverdlovsk, Tula, Tyumen and Yaroslavl regions, the cities of Moscow and St. Petersburg, as well as Nenets, Khanty-Mansiysk (Ugra) and Yamalo-Nenets Autonomous Okrugs. It is not surprising that many territories from this list occupy leading positions in the ranking of regions in terms of quality of life. The remaining 62 constituent entities of the Russian Federation, respectively, will receive subsidies to equalize budgetary security in 2022. One of the most subsidized regions is Yakutia, although the region has a very high level of GRP per capita. Maintaining a high population in the North is a difficult task.

The first reason: the Arctic is a large area with complex communications.

The second reason: infrastructure, which does not exist or is insufficient for the current population, which leads to an increase in the cost of almost any economic activity.

The third reason: the cost of maintaining the population in the North. It must be resolved so that the costs of developing the riches of the Arctic do not become even higher, because the complexity of the Russian social space of the Arctic reduces the degree of development of the territories.

The governor of the Murmansk region A. Chibis also speaks about the importance of quality of life in the region. "The region's income has doubled over three years: we have the opportunity to invest this money in improving the quality of life. In all northern regions there is such a trend - people are leaving for a more favorable climate. It is impossible to turn the Arctic into a territory for shift workers; on the contrary, it is necessary to slow down the departure, reverse the trend, this is one of the important tasks. Thanks, among other things, to our additional income and investments in quality of life, in 2021 we achieved a reduction in the outflow of population from the region by 8%." At the same time, the high level of influence of investments in human capital on socio-economic development is confirmed by calculations based on models, which integrates the formulation of development goals and applied solutions to achieve them. At the same time, In general, it is obvious that the principles of human capital management in the Arctic should differ from region to region. There are significant differences in this regard between the Murmansk and Arkhangelsk regions, the Republic of Karelia, the Komi Republic, as well as the Nenets Autonomous Okrug, the Yamalo-Nenets Autonomous Okrug, Norilsk, the Yakut Arctic territories and Chukotka.

In connection with the above, it is advisable to consider the general pattern of influence on the migration situation in the Arctic regions of various indicators of society and the economy, collected together in the Rosstat collection "Regions of Russia. Socio-economic indicators".

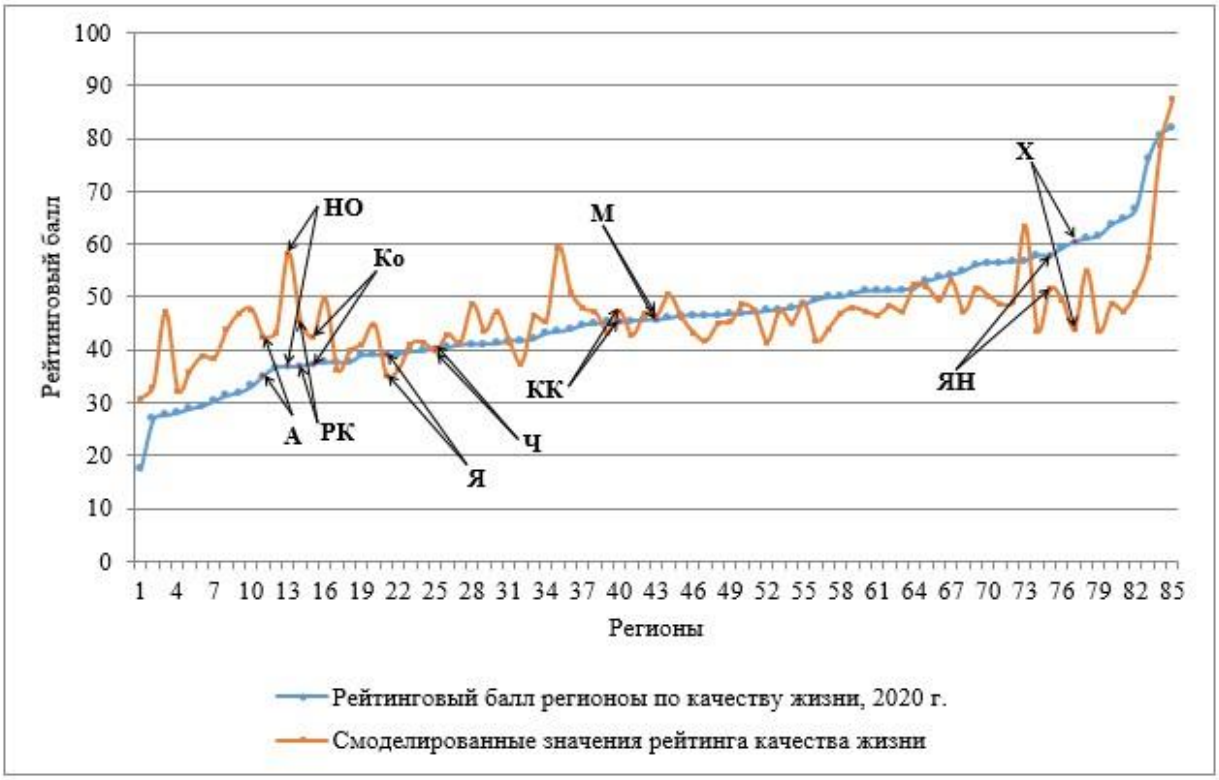
As research results have shown, the relative value of the migration balance is determined both by the integrative indicator of the quality of life rating and, what is especially interesting, by the inverse "concentration" of mid-level medical workers in the regions. In all likelihood, this dependence is largely due to the relatively low concentration of medical workers relative to the vast Arctic expanses with low population densities. It can also be assumed that the higher the "concentration" of health workers, the less people get sick and are treated in inpatient settings

(hospitals, sanatoriums, etc.), which, in turn, is an indicator of the level of general health of the population. Note that the number of indicators was quite extensive, but purely economic ones were not taken into account.

From the measurement results it is clear that the quality of life is positively determined by the magnitude of economic development (GRP per capita, the average January temperature, as well as the saturation of the region with scientific and educational potential. From our point of view, this conclusion is especially important for the Arctic regions of the Russian Federation.

Next, we compare the obtained rating values for 2020 with the values determined by its methodology, paying special attention to the Arctic regions of the Russian Federation.

As can be seen from Figure 1, it is the Arctic regions that have the greatest differences between the calculated rating value and its real value in accordance with the methodology. The calculated rating of the Nenets Autonomous Okrug (especially) as well as the Arkhangelsk region, the Komi Republic and the Republic of Karelia turned out to be higher than the real one, and the calculated rating of the most economically prosperous Arctic region - the Yamal-Nenets Autonomous Okrug - was lower than the real one. In the latter case, this is due to the fact that there are few scientific personnel in the region, and in the first cases, the calculated value is “pushed up” by high rates of saturation of personnel in the scientific and educational sphere of the western territories and Arctic regions.



Picture 1.Rating score of the regions and modeled values of the quality of life rating (highlighting the Arctic and sub-Arctic regions).

To clarify the significance and relevance of the ASI rating, it is advisable to give the places of the Arctic and sub-Arctic regions in the quality of life ratings, in the RIA rating:

15th: Yamalo-Nenets Autonomous Okrug 58.483;

38th: Murmansk region 49.113;

44th: Krasnoyarsk region 48.063;

59th: Chukotka Autonomous Okrug 42.933;

65th: Komi Republic 41.250;

70s: Republic of Sakha (Yakutia)	39.230;
71st: Republic of Karelia	39.150;
72nd: Arkhangelsk region	37.428;
73rd: Nenets Autonomous Okrug	37.191.

Thus, the ratings are slightly different, but these differences are not significant. Both ratings coincide quite well in assessing the situation with the quality of life in the Arctic.

It can be concluded that ensuring the quality of life, which should be built both on a successful economy and on a high level of healthcare, as well as the development of the scientific and educational sphere, should be a policy priority in the field of personnel support for the Arctic development of the Russian Federation.

In general, the core of Russia's Arctic policy is to maximize the use of the resources of the macroregion and its transit potential in the coming decades. This is a natural stage in the development of the country's natural resources; the Russian economy is largely dependent on resource imports; in the Yamal-Nenets Autonomous Okrug, for example, 80% of the country's natural gas is produced and there is no way to abandon the economic use of the Arctic or even slow down its development. In the context of the most severe aggravation of the geopolitical situation in the last 30 years, it is impossible to expect Russia to comply with modern environmental imperatives in relation to the Arctic. Moreover, Arctic resources will most likely be sold in the coming decades to China, India, and other Eastern countries that are relatively loyal to the source of minerals and are heavily dependent on their supplies.

The fact that people are leaving the Arctic is a natural process, moreover, actively stimulated by the state. Is migration from a macro region an indicator of a personnel crisis? This issue seems difficult, since the emphasis on the mining and, to no less extent, transport industries does not give reason to hope that other industries will need personnel. However, demographic impoverishment leads to an increase in the costs of attracting personnel in precisely these industries, since the mono-oriented economy of the macroregion reduces its overall development.

In addition, a simple question arises: if migration is caused by purely economic reasons related to the lack of demand for personnel and natural issues of personnel transformation, then it is not necessary to raise the question of personnel problems in the Russian Arctic at all. At the same time, the general weakness of the economy, reflected in the low GRP per capita, does not threaten the Arctic - there this level is quite high, as are wages (even if the level of their gradient, directed in the community of Russian regions to the North, may be insufficient).

The conducted research, a broad measurement of indicators influencing migration, demonstrates that, in general, it is its values, along with the quality of life, that make it the most important parameter for managing the staffing of Russia's Arctic policy. High values of migration indicators are associated with problems of ensuring the quality of life in the Arctic, which, in turn, are reflected and interconnected with indicators of the scientific and educational potential of the region and the level of healthcare.

Conceptually, it is also necessary to form a digital personnel twin of the Arctic macro region, built into what is in the future a digital twin of the personnel system of the Russian economy as a whole. At the same time, we agree on the significant influence of institutional conditions that contribute to the increase in the quality characteristics of human resources. All of the above allows us to hope for the possibility of forming some optimal model of the population of a macro-region and the employment of its population by industry (note that a similar approach is presented in works devoted to the strategic development of territories, which declare the need for harmonization of industry and regional strategies, although some researchers generally exclude staffing from consideration when assessing the prospects for the development of regional mineral resource centers. In some regions, it is quite possible to rely on a rotational system with remotely provided experience economy services. At the same time, you will still have to spend money on healthcare, sports, and infrastructure. It can develop according to three main scenarios, namely:

scenario one – Arctic resources are developed more intensively than indicated in the strategic plans;

scenario two – resource development proceeds according to plans;

scenario three – there is some stagnation in the demand for resources (it may be associated with geopolitical turbulence);

For each scenario, it is advisable to have its own modeling, linked, however, in general to the personnel needs of the country. Arctic specialists need to be trained widely, providing opportunities for practice in the Arctic for almost all specialties, attracting workers throughout the country from school. The Arctic region is of enormous importance for the world in general and for the Arctic states in particular, not only due to its strategic location, which allows large trade flows to pass through it in a warming climate, but also due to its significant oil and gas reserves - a study by the US Geological Survey, completed in 2008, showed

that estimates of conventional oil reserves in the region range from 44 to 157 billion barrels, conventional natural gas - from 22 to 85 trillion. m3; There are also reserves of shale oil, shale gas, heavy oil, gas hydrates, etc. A very significant part of these reserves are located in the Russian Arctic, including the Russian part of the Arctic continental shelf - for example, this is where 70% of all undiscovered gas reserves in the Arctic are located. A number of Russian researchers provide their estimates of hydrocarbon reserves in the Russian Arctic (including estimates of recoverable reserves). Currently, hydrocarbon production on the Russian Arctic continental shelf is carried out only at the Prirazlomnoye field, although it is adjacent to a number of promising fields, in particular, the Shtokman gas condensate field (GCF). Active plans to develop this latter field were developed in the 2000s. however, in 2012, this process was suspended for a number of reasons, including the fact that the "shale boom" in the United States made the development of the Shtokman gas and condensate field unprofitable. However, hydrocarbon reserves on the Russian Arctic continental shelf remain of the highest strategic importance. Speaking about the prospects for the development of hydrocarbon reserves of the Arctic continental shelf of Russia from the point of view of human resources, it should be noted the Strategy for the socio-economic development of the Murmansk region, adopted back in 2010 - this document, along with the "traditional" rotational method of developing the resources of the North, relied on "deserted" technologies (about such technologies in different industries). This approach had much in common with the Norwegian experience, when projects for the development of the Arctic continental shelf were developed within the framework of the Norwegian Technology Strategy for the 21st Century Indeed, Norway (as well as Russia, Canada and the USA) can get an "increase" in its hydrocarbon reserves through the exploration and involvement in the development of natural gas fields located on the Arctic shelf. In recent years, Norway has been extremely active in this direction; One of the most important priorities is to promote the technological frontier in various areas of the oil and gas industry, since exploration and production in the extreme conditions of the Arctic pose new challenges for the sector that require innovative technological solutions. Technologies, that can "unlock" (make technologically accessible) new volumes of oil or natural gas or increase the efficiency of production processes are prime candidates for research, practical development and industrial implementation. This section of the article examines the most important challenges to the technological development of the oil and gas sector on the Norwegian Arctic continental shelf and specific innovative technological solutions associated with "unmanned" technologies used by the largest Norwegian oil and gas company Equinor (formerly Statoil ASA) to automate technological processes. The key objective of the study is to identify the potential reduction/increase in demand for personnel in certain specialties, taking into account digitalization and the development of technological responses to those or other challenges to the development of the oil and gas industry in the Arctic continental shelf. Statoil was founded in 1972. It became the largest oil company in the Scandinavian countries. Currently, the company has more than 21 thousand employees and operates in more than 30 countries, being one of the largest offshore operators, as well as one of the largest sellers of crude oil. The company's total revenue for 2021 was $90.9 billion. During 2021, the company produced 2.08 million boe of oil and gas daily. Technological development – including digitalization in its various aspects – is one of the company's pronounced priorities. It can make a company's work smarter, more efficient, safer for people and more environmentally friendly. This can be achieved through the use of sensor technologies, cloud solutions and large volumes of data; applying digital technologies to improve the efficiency of specific work processes; analysis of accumulated data sets using machine learning to make better decisions on the exploration of new fields. Having analyzed data on various technological solutions introduced by the company in recent years, we have identified those that, in our opinion, will have the greatest impact on the volume and structure of employment (as well as the need for personnel in certain specialties) during the development of hydrocarbon reserves in specific conditions of the Arctic continental shelf. Autonomous, independently powered, remotely operated systems can support and significantly improve the efficiency of a variety of routine subsea operations in the oil and gas sector. Such systems can communicate with a shore-based Support Center using a 4G mobile broadband signal transmitted through a surface-mounted buoy equipped with a 4G transmitter and receiver. By securely transmitting remotely controlled system data and transmitting high-definition video in real time via satellite or high-speed terrestrial network, the operator has full control over the system and all its instruments - also in real time. Back in the 1990s. Some of the labor of general workers in oil production was replaced by machines - in particular, hydraulic machines appeared, the main task of which was initially to connect drill pipes. Currently, these machines are gradually being replaced by more reliable and efficient electric robots. Robotization of this operation has changed the need for a worker directly on the platform - now a human handyman controls robotic handymen from a control room, rather than working directly on the well site, assembling pipes by hand. This resulted in significantly less risk for workers and reduced the number of accidents. Today, "handyman" robots

presented on the oil and gas equipment market provide the opportunity to fully automate the drilling process. This is possible thanks to high-resolution cameras with fast image processing. The robot has a number of built-in tools that allow it to perform all tasks during the drilling process that would otherwise require manual intervention by an operator. Robots improve the safety of the human crew and the rig as a whole. According to Equinor, the entire range of operations on the rig deck (both manual and remotely controlled) can be performed by just four robots developed by the Norwegian company Robotic Drilling Systems (RDS). These robots are dynamic in performing their tasks and have no need for micromanagement. This reduces the need for human labor in the red zone on oil platforms - and therefore reduces the risk of accidents. Under optimal conditions, four robots perform tasks at approximately the same speed as human performers; under non-optimal conditions, they are ahead of humans. The development of the Valemon deposit is one of the special projects which Equinor is currently operating on the Norwegian continental shelf. The field, whose hydrocarbon reserves are estimated at approximately 192 million barrels of oil equivalent, is located in the North Sea approximately 160 km west of Bergen and is being developed using a separate platform. Due to the presence of high pressure and high temperature conditions in certain parts of the field, Valmont is a complex field. The most innovative aspect of the development of this field is the design of the platform - it is a stationary platform on which no maintenance personnel or technical specialists are expected to be present. It is the first offshore platform in Norway to be controlled entirely remotely by operators onshore (in Bergen). Back in the first half of the 2000s, Statoil began to develop such a promising area as automated control of the well drilling process. In 2005, the first version of the DrillTronics system appeared; in 2008 it was field tested on the Statfjord C platform; In 2014, DrillTronics was fully deployed on this Statfjord C platform and successfully participated in the drilling of multiple wells, reducing the average time spent drilling one well, improving drilling safety and automating many repetitive process steps. Work on the development of automated control of the well drilling process is actively continuing at the present time. Equinor engineers were involved in the development and field testing of a wireless intelligent post-drilling well completion system, which allows long-term monitoring and control to improve production management by wirelessly connecting the user from a desktop computer to the downhole component of the system. Equinor and Microsoft have entered into a strategic partnership agreement. As part of the agreement, Equinor will provide industry knowledge and business needs to support Microsoft in developing new solutions for the oil and gas industry. Microsoft, for its part, is providing expertise to accelerate the development of Equinor's IT infrastructure and the company's new data centers. The partnership with Microsoft enables Equinor to accelerate the development of fit-for-purpose IT services within the energy industry and enables a faster transition to the cloud. Effective use of the cloud is a prerequisite for transforming the energy industry towards a digital future. In less than a year, Equinor adopted the Microsoft Azure cloud. In parallel with the digital transformation of its activities, Equinor is actively increasing the volume of digital skills, knowledge and competencies among its personnel, having already conducted more than 150 thousand digital training sessions. In total, the digitalization of the company's various activities on the Norwegian continental shelf is expected to reach approximately $3 billion by 2035. The growth in available sources of information in the oil and gas industry requires new efficient methods of accessing data from end users, whose ability to analyze data lies in basis for making business decisions. Data analytics can suffer from end users' insufficient ability to effectively integrate data distributed across many different sources. Current centralized approaches, in which IT translates the requirements of domain experts into upload-transform-load processes in order to integrate data and apply a predefined set of analytical reporting tools, are too heavy and inflexible. To support interactive data exploration directly by subject matter experts without the participation of IT specialists, a more flexible and modular information systems architecture is needed. At Equinor, such a system is the Optique platform, which significantly reduces the time and cost of accessing data, automating the process of converting an information request into a search for relevant data. At Equinor, the Optique platform integrates multiple large and complex data sources and allows geoscientists and geoscientists to query detailed subsurface information directly into existing expert client tools, as well as web portals to easily disseminate information from a central location throughout the enterprise.

Equinor (then Statoil) established a new onshore integrated operations center (IOC) in 2018 that will help improve safety, increase value-added generation and reduce emissions from installations on the Norwegian continental shelf. “The creation of the center contributes significantly to our ambition to become a global leader in digital technology. This will enable us to optimize production and better anticipate support needs, ensuring optimally efficient and safe operations at our producing fields. The center will be important in advancing work to improve workflow on the Norwegian continental shelf and delivering added value to Statoil, our partners and society,” said company CEO Eldar Sætre. The Bergen center integrates the company's technical support centers and condition monitoring centers located in various parts of Norway. The Integrated Operations Center aims to

make data available in a more user-friendly format, supporting the organization of offshore operations through better decision support. IOC will help ensure that field production is optimally efficient at every point in time, eliminating bottlenecks through diagnostic monitoring of current conditions. Instruments are currently being developed that will transmit real-time data from offshore sensors. These tools will help you conduct a detailed analysis of the mining process and equipment activities at the installations. One of the center's important goals is to identify and prevent operational failures.

digitalization of work processes. Many areas of the complex hydrocarbon production process involve repetitive, manual tasks. Digital solutions can reduce the time spent on non-value-added tasks (such as searching for data or moving information from one system to another);

advanced analytics. The oil and gas industry generates large volumes of data. As of August 2021, Statoil/Equinor data centers stored 28 petabytes. Using data analytics and machine learning, understanding of many important issues can be improved;

robotics and remote control. Taking into account the trends of recent years, it seems possible to safely say that in the near future, an increasing expansion of the use of robotics and remotely controlled technological solutions for various physical and mechanical processes is expected. Automated drilling, drone inspection and completely unmanned fields are just a few examples of how digital solutions can be used to improve employee safety, add value and reduce a company's carbon footprint.

Summarizing the experience presented above, we can assess the prospects for staffing Russia's development of hydrocarbons on the Arctic shelf as follows. It seems appropriate that Russia's preparation for the development of hydrocarbon deposits on the Arctic continental shelf should have the development of "unmanned technologies" as one of its priorities. These technologies, coupled with the digitalization of work processes in general, will improve the safety of industry workers and partially mitigate the impact of extreme Arctic conditions on work processes, however, for their successful implementation it will be necessary to anticipate some structural changes in the needs of oil and gas production in personnel of various specialties.

Trends in recent years allow us to speak with a fair degree of confidence about the displacement of human personnel who provided monitoring and control of the condition of various objects during the development of oil and gas resources of the Arctic continental shelf, by complex intelligent systems that monitor and control in real time due to the continuous receipt of operational data from a variety of sensors and sensors. At the same time, the role of personnel capable of acting as operators and dispatchers of such systems is increasing. Moreover, there is an increasing need for IT personnel capable of developing such systems, including those involving the Internet of Things, cloud analytics, artificial intelligence and machine learning on high-resolution data. The direct participation of human resources as performers of technological processes is reduced to a minimum, but at the same time the need for personnel who set the initial algorithms for such processes and carry out remote control over their progress and troubleshooting if necessary increases. The infrastructure of the Arctic transport system, its modernization and development are defined as strategic priorities of the state policy of the Russian Federation in the Arctic. A key element of the Arctic transport system is the Northern Sea Route (NSR). According to Federal Law No. 132 of July 28, 2012, the NSR water area is understood as "... the water space adjacent to the northern coast of the Russian Federation, covering internal sea waters, the territorial sea, the contiguous zone and exclusive economic zone of the Russian Federation and limited from the east by the maritime demarcation line with the United States of America and the parallel of Cape Dezhnev in the Bering Strait, from the west by the meridian of Cape Zhelaniya to the Novaya Zemlya archipelago, the eastern coastline of the Novaya Zemlya archipelago and the western borders of the Matochkin Shar straits , Kara Gate, Yugorsky Shar" (Article 5). In addition to the water area directly related to the NSR, it is adjacent to the vast territory of Russia with such large rivers as the Northern Dvina, Pechora, Ob, Yenisei, Lena, Yana, Indigirka, Kolyma. These river highways form a single system of waterways, connected in the north by sea. The Northern Sea Route is one of the main, and in many ways the only, transport corridor for the movement of goods in the Arctic regions of Russia. Developed logistics is extremely necessary for the large-scale development of Arctic resources and the socio-economic growth of the Arctic macroregion. The history of the desire of Russia, and before the USSR, to develop this route can be dated back to the Kara expeditions in the 1920s, and then the founding of the Directorate "Glavsevmorput" under the government of the USSR (in terms of its status, responsibilities and rights, this Directorate was equal to the ministry) in 1932. It seems logical to count the development of the NSR precisely from 1932, since, in addition to the founding of the Glavsevmorput Directorate, it was in that year that the NSR was crossed in one navigation by a Soviet expedition.

Since the 1930s. Polar aviation was actively developing, a new icebreaker fleet was being built, the Northern Navy was being created and developed, ports and polar stations were being built, geological and hydrographic surveys were carried out. In the period after the Great Patriotic War, a number of large oil and gas fields were discovered in the Soviet Arctic. In the 1980s proposals for a transition from "local"

development of the Arctic to comprehensive socio-economic development of the Arctic territories once again increased the importance of the Northern Sea Route and raised the question of the need to ensure its year-round operation. However, the collapse of the USSR significantly slowed down the development of the Northern Sea Route, reducing the scope of its functioning to individual random flights by the end of the 1990s.

A new wave of interest, including commercial interest, in the NSR is associated with climate change that has directly affected the Arctic. According to the National Snow and Ice Data Center in Colorado (NSIDC), in July 2018, the Arctic was covered with 5.7 million km2 of ice, and in the first two weeks of August, the area of ice cover decreased by 65 thousand km2 every day. First of all, global warming is most actively manifested in the Arctic, which is gradually losing permafrost and glaciers in area, warming up twice as fast as the rest of the planet. Scientists at Newcastle University in northern England estimate that the ice has been retreating by about 10% every 10 years over the past 30 years. This is also reflected in shipping - according to experts, by 2030, the waterways of the Northern Sea Route will be ice-free 6 months a year, and then ships can sail year-round without the need for icebreakers. At the same time, already now, from approximately July to October, with the help of experienced pilots and icebreaker support, commercial vessels can sail in the Arctic seas, although previously only powerful nuclear icebreakers could do this. Statistics on cargo transportation along the NSR confirm the theses defined above - if in 2010 their volume did not even reach 1 million tons, by 2018 it increased by an order of magnitude - to 10.7 million tons, and by 2021 it almost doubled to 18 million. t. In 2025, the annual volume of transportation, according to planned contracts, should increase to 75 million tons. As for the commodity structure of transportation, in 2018 the following distribution took place: 8399 thousand tons of liquefied gas (LNG), 7810.5 thousand tons of oil, 805.4 thousand. tons of condensate, 290.8 thousand tons of coal, 43 thousand tons of ore, 2340.1 thousand tons of general cargo. According to the Federal Agency for Maritime and River Transport of Russia, the volume of cargo transportation is increasing due to the fact that it is provided by real economic needs - transportation of LNG, coal, increased gas and oil production, northern delivery through the Arkhangelsk transport hub. In 2019, the tonnage of transportation along the Northern Sea Route amounted to 31 million tons, and in 2020 - 32 million tons. The main growth since 2018 has been observed in liquefied natural gas. If in 2018 its volume in transportation along the NSR was just over 8 million tons (before that its share in transportation was very small), then in 2020–2021 it approached 20 million tons. From 2014 to 2017, growth was mainly driven by oil.

The lion's share of LNG supplies in 2022 was carried out to Europe, only a small part of liquefied gas went to Asia (only in September and October 2022 did deliveries to Asia equal supplies to Europe). LNG went to Europe mainly to the ports of France, Belgium, the Netherlands, Spain and the UK. LNG supplies to Asia were carried out mainly to China and to a much lesser extent to Japan and Taiwan. Oil and condensate are transported mainly from the Novoportovskoye field. Iron ore accounted for 78% of the volume of transit traffic along the NSR. In 2022, the volume of transit traffic along the NSR exceeded 1 million tons (previously it reached such values in 2011–2012), while more than 90% of them were carried out from west to east, and not from east to west. It should be noted that this excess has always occurred in the last decade, i.e. China and other Asian countries are still weakly involved in the development of the NSR. The Northern Sea Route remains, as before, essentially an internal Russian transport artery. However, statements by the Chinese side about their intention to direct up to 15% of foreign trade in the next 10–15 years (which is more than $350 billion) through the NSR suggest a significant increase in the efficiency of using this route. China already ranks second after Russia in cargo transportation along the Northern Sea Route.

In accordance with the master plan for the implementation of the “Strategy for the development of the Arctic zone of Russia and ensuring national security for the period until 2035,” mechanisms for accelerated economic and social development of the Arctic territories and a regulatory legal framework for the functioning of the special economic regime of the Arctic zone should be developed in 2020-2025.

Already at this first stage, it is planned to use a certain new model for the implementation of economic projects on the continental shelf, actively develop the Northern Sea Route, build a number of ships, modernize the energy infrastructure of the Russian Arctic (including ensuring the transition from diesel fuel to LNG), stimulate scientific research as part of the creation of a state system for monitoring and preventing the negative consequences of permafrost degradation; intensify international cooperation, including scientific and technical cooperation, in the development of the Arctic.

The second stage of the Strategy implementation covers 2025-2030 and is designed to ensure a significant increase in the competitiveness of the Russian Arctic economy through the introduction of a new special economic regime and investment. Year-round navigation in the Arctic should be ensured, taking into account the new fleet of ships, a communication infrastructure of the Northern Sea Route and the Arctic as a whole should be created within the framework of a highly elliptical space

system for "obtaining hydrometeorological data of high temporal resolution for the polar region of the Earth"; New technologies must be created and put into operation, including robotic, unmanned and portable equipment, ensuring both an increase in labor productivity and an increase in the safety of production activities.

At the third stage of the Strategy implementation (2031-2035), it is actually planned to complete the transformation of the region's economy with the formation of a highly efficient, environmentally friendly, transport-supported industrial complex of the Northern Sea Route, ensuring profitable oil and gas production (including offshore), processing (LNG, petrochemicals) and transportation (NSR, pipelines) of products to external markets and domestic consumers with minimal negative impact on the environment. Among the most important national tasks for the period until 2025, outlined in 2018 by the President of Russia, is the task of achieving 80 million tons of cargo transportation along the Northern Sea Route. However, in 2035, only 10 million tons are "strategically reserved" for transit cargo. This somewhat contradicts the idea of the Russian Arctic as a future transport corridor of global importance. Transport development of the Arctic is of great importance for the transportation of oil and gas products. In addition, the development of transport is of great importance for ensuring food security in the Arctic macroregion, including from the point of view of the sustainable development of modern agriculture and the formation of sustainable food systems. The Strategy for the Development of the Arctic Zone of Russia and Ensuring National Security until 2035 sets the task of organizing training and retraining of personnel in terms of personnel needs of the Northern Sea Route. The most in demand are "specialties for manufacturing and mechanical engineering, mining, and various types of engineers. Also in demand areas of activity are: social, transport, education and communications." The emergence of new technical and technological complexes related to the development of the Northern Sea Route will obviously require retraining of personnel and the search for new qualified personnel, for which A.P. Isaev and I.A. Fomina proposes the development and active use of professional standards for various specializations, which become the main tool for regulating the balance of graduates and their employment. A separate acute problem is the training of highly qualified researchers to create an up-to-date fundamental and practical knowledge base on these technologies. The strategy provides for the formation of a cluster of scientific and educational centers, ensuring the development and application of new progressive technologies; A number of priority research areas have already been identified at the Strategy level. Additional research will also be required to increase NSR freight traffic. It is appropriate to recall here that at the initial stage of development of the NSR, during the existence of the "Glavsevmorput", under the head of this organization there was a division whose tasks were the selection and distribution of personnel, "all specialized and administrative and management departments, research and development" were accountable to him. -construction organizations, interdepartmental bureau of long-term ice forecasts, etc." The training of personnel for the development of the Soviet Arctic was actively carried out by the Hydrographic Institute, which opened in April 1935, and in 1945. transformed into the Leningrad Higher Arctic Maritime School, as well as a number of polytechnic schools in the country. In the 1950s at the level of the leadership of the USSR, a decision was made on the advisability of abandoning the mobilization approach to the development of the North and emphasizing policy in this area on efforts to secure the population and qualified personnel, and since the 1960s. this desire was actively realized. However, in the 1990s. "The economic and social situation in the Russian Arctic has sharply worsened. The state and local governments were unable to cope with a series of problems. Sea ports and infrastructure were left to the mercy of fate"; There was a colossal outflow of personnel to the "mainland." Now, according to the government plan for the development of emergency services, staffing the successful functioning of emergency services is allocated to a separate group of tasks, within the framework of which the Ministry of Eastern Development, together with the Rosatom Corporation, should study the personnel needs of shipowners transporting goods along the NSR, and on their basis calculate the state order for personnel training; for their part, the Ministry of Education and Science and the Ministry of Education must ensure the training of the necessary personnel.

The staffing of ports connected to the NSR is extremely important. It is currently "the weakest point in the Arctic shipping system." According to the representative of the Legislative Assembly of the Primorsky Territory L. Talabaeva, "for the international transport corridor within the Northern Sea Route to become an impetus for development for the Far Eastern region... At the initial stage, up to two thousand sailors will be required to work on high-tech ships, gas carriers that will have to work in difficult conditions of the Arctic on the Northern Sea Route. To prepare them, we will need highly qualified teachers and a qualified educational base, which is being created with the participation of the state. There is also a shortage of personnel at shipbuilding and ship repair yards." The shortage of such personnel may worsen significantly in the coming years, given the fact that that it is planned to build additional ships to transport investors' products along the Northern Sea Route, and for such construction, in turn, it is planned to create new shipbuilding centers (for example,

Rosatom and the United Shipbuilding Corporation are preparing to locate a cooperative shipyard for large-tonnage shipbuilding in the Leningrad region on Kotlin Island). The authors note that the construction of new Arctic ports will lead to the fact that "the total length of the berthing front can be tens of kilometers. To implement such large-scale projects, polytechnic education in courses in the design and construction of water transport infrastructure will be a key task for universities and design organizations." Official estimates of the personnel needs of the NSR have not yet been developed - according to the government plan for the development of the NSR, the Ministry of Eastern Development and Rosatom must submit them only by the end of 2023. However, it is possible to calculate estimates (which, of course, are only very preliminary, "rough" in nature) based on a comparison of the cargo turnover of sea ports of the Russian Arctic with some foreign ports. The cargo turnover of Russian seaports in January-November 2022 increased by 0.6% compared to the same period last year and amounted to 768.2 million tons. The cargo turnover of the Arctic seaports "amounted to 89.9 million tons (+3.7%), of which the volume of dry cargo transshipment amounted to 26.8 million tons (-0.1%), liquid cargo - 63.1 million tons (+5.4%). Cargo turnover of the ports of Murmansk amounted to 51.2 million tons (+1.7%), Sabetta - 25.9 million tons (+2.1%), Varandey - 5.4 million. tons (+27.9%) and Arkhangelsk – 2.2 million tons (27.7%)." A large OECD survey study found that on average there are 800 jobs per million tonnes of port throughput - a finding based on a comparison of more than 150 studies of individual ports, with two-thirds of these studies producing estimates ranging from 200 to 1,500 workers places for 1 million tons of cargo. However, as noted by D.V. Martynov, "This number includes jobs associated with the port, both directly and indirectly, and should be interpreted with caution as it is based on port impact studies that use different definitions of ports and apply different methodologies." According to another OECD study, which looked at 560 regions in 10 European countries, an increase in port capacity of 1 million. t leads to an increase in employment in the port region by 300 people for every million of the region's labor force (and subsequently up to 7,500 people, if we take into account not only direct, but also indirect employment in the port sector). At Russian Arctic ports, employment rates relative to cargo turnover are likely to be somewhat lower than these average figures if the share of liquid cargo continues to be significant - the need for personnel to handle it is relatively small, since the majority of such cargo is loaded and unloaded via pipelines.

Training of personnel for the Northern Sea Route (as well as other areas of intellectual development of the Russian Arctic) is specialized for the North-Eastern Federal University named after M.K. Ammosov in Yakutsk (established in 2007) and for the Northern (Arctic) Federal University named after M.V. Lomonosov in Arkhangelsk (established in 2009), which implement, among other things, "programs on hydraulic, industrial and civil construction, construction of roads and airfields, new building materials and technologies for the North, etc." However, of course, the training of personnel necessary for emergency medical services is not limited to these two universities. An analysis of Russian university enrollments made it possible to identify more than 10 universities, leading the training of specialists in the bachelor's degree "Hydraulic Construction" and the specialty "Hydraulic Construction of High-Responsibility Structures" are polytechnic and technical universities, and construction and transport universities. It should also be mentioned that since 2016, the National Arctic Scientific and Educational Consortium has been operating, uniting 14 scientific and educational organizations, including federal universities, for cooperation in the field of training personnel for Arctic projects (mainly in master's programs in areas related to hydraulic engineering construction of ports and structures inland waterways), including for the Northern Sea Route. However, the requirements for staffing EMS are not limited to professional specializations alone - psychological preparation (psychological endurance, the ability to act competently in emergency situations and survive in difficult climatic conditions) and health indicators (for working in the extreme climatic conditions of the Far North) are also important. To identify and attract such workers, career guidance and special internship programs can be extremely useful - such as, for example, the cadet program of the Federal State Budgetary Educational Institution of Higher Education "State University of the Sea and River Fleet named after Admiral S. O. Makarov." Some experts believe that the training of Arctic personnel should begin in secondary educational institutions (through, for example, career guidance not only by employees of such educational institutions, but also enterprise specialists; a particularly significant synergistic effect can be achieved with the involvement of representatives of leading state corporations, resource extraction, manufacturing and transport companies operating in the Arctic). Maritime transport and its infrastructure play an extremely important role in the development of the Russian Arctic; further strategic prospects for the development of the Russian Arctic are associated with it. Russia has ambitious plans to develop its maritime trade, while there are obvious personnel problems in maritime transport, which, naturally, cannot develop without adequate staffing, including the most important "layer" of managerial and scientific and technological personnel. The development of the Northern Sea Route as one of the new transport arteries of global importance is closely

related to the solution of personnel problems in maritime transport in Russia and the Arctic as a whole. The outflow of specialists from Russia for maritime transport is on a significant scale, which, however, is difficult to accurately assess, since, for example, most of the Russian sailors work under a foreign flag. There are problems with university education, employment, wages, labor safety, retraining, career guidance - in all areas of the industry's personnel system. In general, the pace of development of the Russian fleet and its needs is outpacing the capabilities of the educational system and encountering demographic difficulties. Reducing the need for personnel through automation and digitalization, the development of unmanned maritime transport only increases the requirements for the qualifications of specialists, which makes solving personnel problems in maritime transport even more difficult. Currently, Russian maritime transport is showing good growth rates following the growth of port transshipments. At the same time, in the context of a significant increase in Russia's maritime trade turnover, the issue of providing maritime transport with its own personnel acquires the scale of a national security problem. This issue is important not only for Russia - the creation of a sustainable shipping sector is important for the development and growth of the global economy as a whole. Despite the current global economic downturn, demand for transport services will continue to grow over time. but the provision of this demand with a qualitatively and quantitatively adequate supply of human resources is by no means guaranteed. Certification and supervision of seafarers are regulated by the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, adopted in 1978 (amended in 1995, 2006 and 2012 as part of the so-called Manila Amendments). Currently, more than 1.5 million people work in the maritime transport sector. If the global economy continues to grow, more trained and skilled workers will be needed. Related activities such as shipbuilding, ship repair and ship recycling will also have increasing human resource requirements. If the global fleet grows by 70% between 2015 and 2030 (as generally predicted based on growth trends over the past five decades), the number of naval officers is expected to increase from 500 thousand to approximately 850 thousand, if In this case, half of the current naval officers will retire, and a total of 600 thousand new officers will need to be recruited and trained during this period. This corresponds to the annual need for officers of about 40 thousand people.

It is no exaggeration to say that the safety and security of life at sea, the protection of the marine environment and more than 90% of world trade depend on the competence of seafarers, largely determined by their level and quality of education and training. Indeed, according to the literature on the subject, many maritime disasters were caused by mistakes that could have been easily avoided. According to statistics, 75–96% of maritime accidents are due to human error.

The “cost” of such an error can vary significantly for different cargoes. Thus, about 50% of the world's oil is produced by sea. Considering that throughout the history of the transportation of petroleum products, numerous accidents have already been recorded, some of which led to real environmental disasters, the International Maritime Organization has developed a new set of strict rules and regulations to ensure safety. The new specialized curriculum lists learning objectives and target competencies to be achieved upon completion of the course. Safe and reliable transport is essential to the smooth functioning of global trade.

According to Gosmorrechnadzor, there has been a critical increase in accidents at sea: from 2014 to 2017, their frequency doubled, from 45 to 84 cases, for merchant ships - from 36 to 49. The number of very serious accidents increased 8 times! - from 1 to 8, for merchant ships - from 0 to 5. The most difficult situation is in the fishing fleet - the number of accidents has increased from 9 to 35. At the same time, however, the accidents of ships are very rarely to blame for their age, 90% of accidents are human factor. It turns out that the reason for 90% of accidents lies in the fact that small (mostly) shipping companies operating on very old ships with low salaries cannot attract highly qualified workers; they are unattractive for an experienced sailor. The most qualified personnel go to foreign companies, often under the flags of other countries.

This problem is directly reflected and most acutely manifested in the regions of the Arctic and Far East that are rapidly developing in terms of transport, remote from central Russia and having harsh climatic conditions. Since the beginning of the new millennium, the cargo turnover of Russian seaports has increased almost 5 times, its maximum value was in 2019 - 840.3 million tons. The throughput capacity of Russian ports has increased 2.5 times over 15 years: from approximately 452 million tons in 2004 to 1.13 billion tons in 2019. By 2025, this figure should reach 1.3 billion tons. Growth has been uniform throughout the two decades. Only in the pandemic year of 2020, cargo turnover decreased slightly - by only 2.3% compared to the same period last year, amounting to 820.8 million tons (Figure 2):

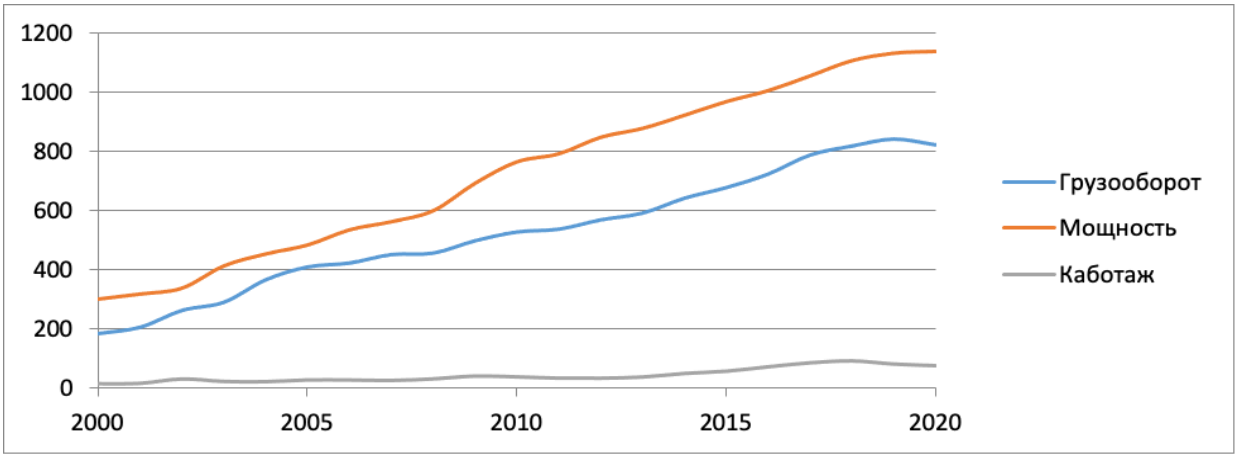


Figure 2. Freight turnover, throughput and volume of cargo turnover of coastal (inland) transportation of sea port facilities in Russia (from 2000 to 2020).

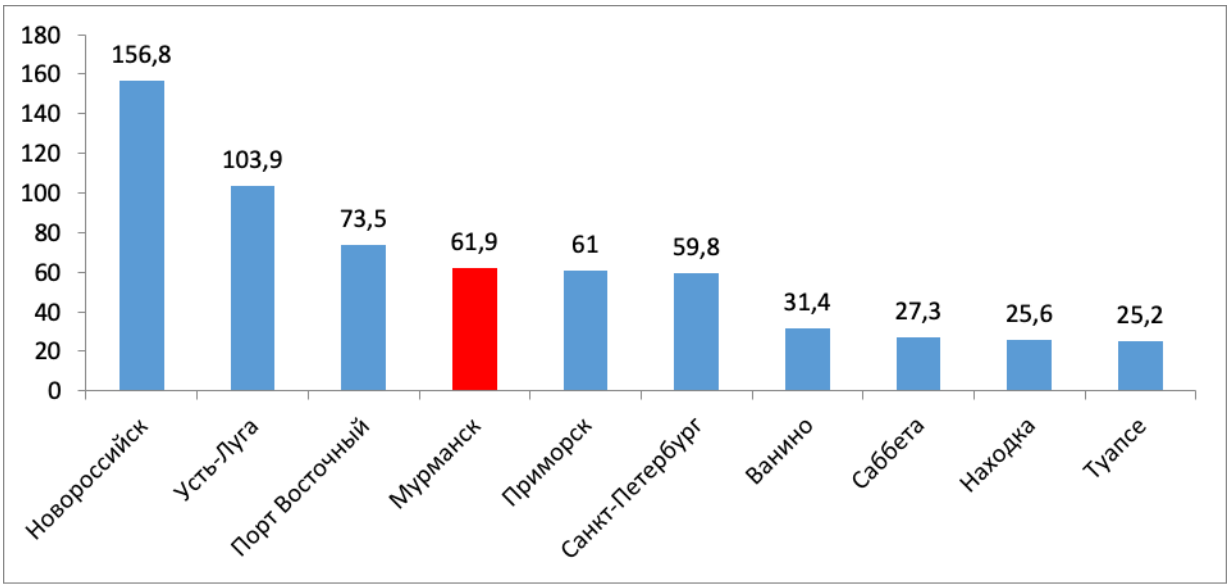


Figure 3. 10 largest Russian ports by cargo turnover, 2019

Murmansk is the largest city in the entire world Arctic and the largest seaport in the Arctic basin; its cargo turnover in comparison with some other Russian seaports is presented in Figure 2. In general, the cargo turnover of the seaports of the Russian Arctic in 2020 amounted to 96.0 million tons (a decrease of 8.4% compared to the previous year 2019), dry cargo - 30 .1 million tons (-4.9%), liquid cargo – 65.0 million tons. The pandemic led to a decrease in cargo turnover in almost all Arctic ports: Murmansk - 56.1 million tons (-9.3%), Sabetta - 27.8 million tons (+0.5%), Varandey - 4.9 million. tons (-31.8%), Arkhangelsk – 3.3 million tons (+22.4%). At the same time, as we noted above, by 2025 it is expected that the throughput capacity of Russian ports will reach 1.3 billion tons. At the end of the last decade (2018)) the Azov-Black Sea basin was in the lead in terms of cargo volume (33.3% of the total volume), the Baltic basin accounted for 30.2% of the total volume, the Far East - 24.6%, the Arctic - 11.3%, the Caspian Sea - 0.6%. The raw material bias of the cargo turnover of Russian ports, however, does not impede the development of container cargo turnover, which, it should be noted, is developed to a lesser extent. Container transshipment in 2018 amounted to 5.1 million TEU.

The development of cargo turnover is associated with an increase in the efficiency and capacity of Russian maritime transport, especially in intensively developing regions. In 2018, cargo transportation by sea under the Russian flag amounted to 23 million tons, and cargo turnover - 45 billion ton-km. The supply of goods to the regions of the Far North and similar areas in 2018 in the total volume of goods shipped amounted to 6.6 million tons (an increase of

124.2%). The volume of passenger transportation by sea in 2018 amounted to 7.5 million people.

In general, at the end of 2019, the cargo turnover of Russian seaports increased by 3%, exceeding 840 million tons, and the capacity of seaports by the beginning of 2020 reached 1.13 billion tons. The cargo turnover of the ports of the Arctic (by 15%) and Far Eastern (by 6.5%) basins increased. At the same time, the volume of cargo transported by sea under the Russian flag has decreased. The decrease by 2018 was 12% (to 32 million tons), which is explained by Rosmorrechflot mainly by the transfer of cargo to land modes of transport after the commissioning of the Kerch Bridge. According to the Central Research Institute of the Maritime Fleet, the maritime transport fleet controlled by Russian companies as of February 2025 includes the fleet of Russian shipping companies registered under the Russian flag of Russia - 1176 ships, with a total deadweight of 7.7 million tons, under foreign flags - 247 ships with a total deadweight of 14, 7 million tons. The total number of vessels in the maritime transport fleet managed by domestic companies is 1,423 vessels, their total deadweight is 22.4 million tons, of which 65.7% of the tonnage operates under foreign flags. Since 2019, the number and tonnage of ships have increased slightly: +2% in number of ships and +3.0% in deadweight. In total, according to the Russian Maritime Register of Shipping, there are 425 shipping companies in Russia, including 71 companies (17%) with sea vessels. Meanwhile, back in 2019, the Russian Ministry of Transport initiated a campaign to transfer the domestic fleet under the Russian flag. It is proposed to oblige the export of up to 50% of cargo by ships registered in the Russian registry, today this is only 12 million tons of cargo per year - and this is less than 2% of maritime exports. At the same time, Gazprom asked the Ministry of Energy to identify cases when it is possible to use ships under foreign flags to carry out certain technical operations in the Arctic. Within the framework of the Northern Sea Route, there is a permitting procedure for the navigation of vessels. In 2018, the Federal State Budgetary Institution "Administration of the Northern Sea Route" issued about 800 permits for ships to navigate within the Northern Sea Route, of which about 100 were foreign. The Arctic basin is thus developing largely thanks to the domestic fleet.

Since the beginning of 2019, Russia has had amendments to the Merchant Shipping Code prohibiting the use of ships under a foreign flag to transport goods (including oil, gas and coal) in the Arctic along the Northern Sea Route, as well as cabotage. These measures were taken by the Russian Ministry of Industry and Trade to support Russian shipbuilding. Gazprom asks the Ministry of Energy for exceptions to this rule in cases where the required type of vessel under the Russian flag is not available at all.

At the same time, as already noted, Russia has created the Russian International Register of ships that sail under foreign flags, but maintain contact with Russia, which is a kind of compromise for the use of "flags of convenience."

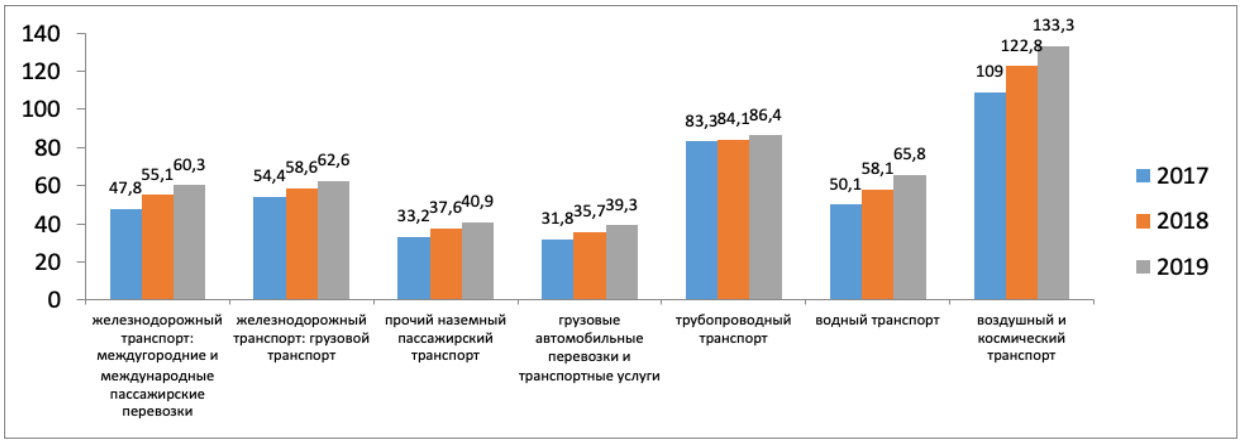
Table 1 shows the number of different types of vessels in Russian maritime transport.

Table 1. Maritime transport: number of sea vessels as of the end of 2021

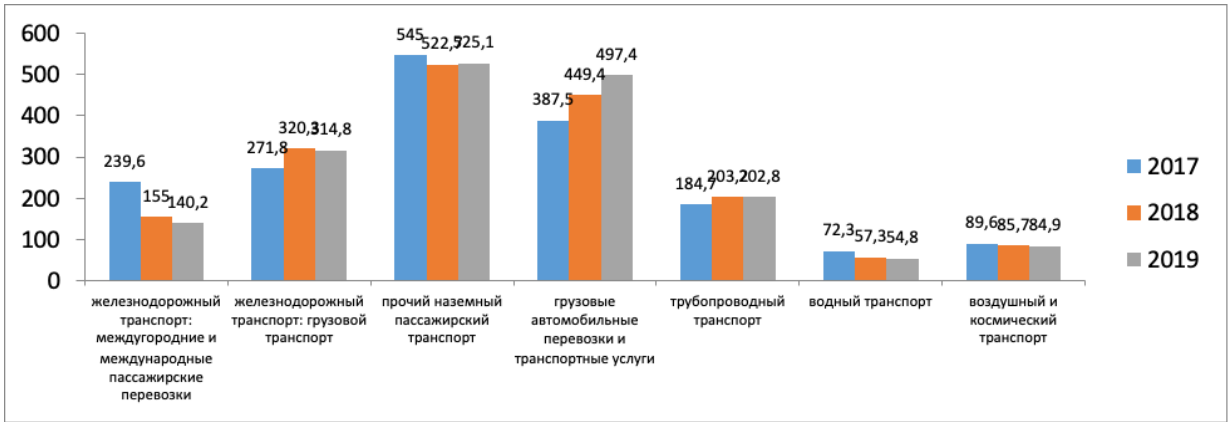
	2005	2010	2018	2019	2020	2021
All sea vessels	3574	2779	2760	2718	2717	2726
Including						
Oil tankers	310	311	430	407	397	397
Other liquids	20	22	18	18	19	17
Oil and oil ore carriers	44	32	24	18	15	14
Ore and bulk carriers	31	20	13	12	9	6
For general cargo	811	620	533	505	545	541
Cargo-passenger	9	9	13	15	16	12
Container, barge carriers, dock carriers	13	8	10	10	10	11
Fishing bases and fishing vessels	84	38	26	22	20	20
Fishing	1455	932	843	820	818	832

Passenger and passenger non-berths	51	47	42	39	38	37
Support vessels serving vessels	27	36	42	49	46	45
Tugs	272	312	338	370	363	369
Dredgers	16	16	14	17	15	14
Icebreakers	26	34	31	33	32	32
Research	77	73	75	74	72	68
Others	328	269	308	309	302	311

From the data in Table 3 it can be seen that for all types of ships there was a decrease in their number (despite the fact that the process of updating the ship fleet is underway with an increase in its tonnage). At the same time, the number of workers in water transport in Russia is declining, and wages in the industry are growing (Figure 4).



A)



B)

Figure 4. Salaries (in rubles) of specialists in various transport sectors of Russia (A) and their number (B) in 2018–2021.

At the same time, there is a growing need for the development of domestic maritime transport, which is also associated with an increase in the throughput and cargo turnover of Russian ports. The Russian port industry consists of more than 900 complexes in 67 seaports of the country, their total capacity exceeds 1 billion tons. By 2025, according to the Comprehensive Plan for the Modernization and Expansion of Trunk Infrastructure, the throughput of Russian seaports will increase by 338 million tons. In our country, sea transport ensures the transportation of about 60% of export cargo. Thus, the growth of port

cargo turnover in the context of the growing importance of national security issues in Russia will inevitably lead to an increase in the need for domestic maritime transport and its personnel, but the number of this personnel has been declining in recent years. An important aspect of national maritime policy is the development of a training system for seafarers. Twenty years ago, problems with personnel appeared: the number of qualified sailors has decreased, the motivation of young people to master maritime professions has decreased, the scale of maritime production has decreased, many specialists in maritime affairs have retrained and gone to work in other economic sectors.

The industrial education system currently has five subordinate universities, including 24 branches. About 6,000 people work at universities, of which the teaching staff of universities is 3,000 people, including 350 doctors of science and 1,030 candidates of science. The graduation rate of specialists in 2017 amounted to 10,964 specialists. By the beginning of 2022, a total of about 55,000 people were studying in higher (HE) and secondary vocational education (SVE) programs, of which 33,700 people were studying on a budgetary basis.

Based on the results of the 2022 admissions campaign, 4,400 people were admitted to study at the expense of the federal budget: under secondary vocational education programs. – in swimming specialties; 85 people – in coastal specialties. in HE programs: 3940 people. – in swimming specialties; 785 people – in coastal specialties. To implement work of an organizational and educational nature, the Maritime Federal Resource Center for Additional Education of Children (MFRC DEC) was created in 2020.

The main thing in the process of training specialists is the formulation of industry standards. Thus, in 2021, 13 industry-specific profs were developed. standards. For swimming specialties of higher education, three federal state educational standards of the 3rd generation, 60 exemplary programs for training and advanced training of crew members of inland navigation vessels have been approved. More than 6 thousand people work at universities, almost 3 thousand are professors and teachers (1.3 thousand - with academic degrees of Candidate of Sciences and above). A reserve of management personnel is formed annually. For 2021, in addition to universities, institutions subordinate to Rosmorrechflot included 4 enterprises and 38 other organizations (8 seaport administrations, 15 inland waterway basin administrations, 10 other organizations).

Thus, if we proceed from the current number of workers in Russian maritime transport (about 50 thousand people), then with the average possible work experience of a professional specialist being 30–35 years, the current output of maritime transport specialists is 5–7 times higher than the future needs of Russian maritime transport . This suggests that not all graduates are employed in their specialty and go to work in Russian maritime transport.

The strategy for the development of maritime activities notes both the lack of its own personnel and “the insufficient level of provision of scientific and pedagogical personnel, the development of the laboratory, educational and methodological base of educational organizations that train specialists for the field of maritime activities.

The shortage of workers in the industry in the middle of the last decade was estimated at 13 thousand people. At the same time, the total number of seafarer passport holders in Russia is estimated at 168 thousand people, of whom at least two thirds work under the flags of other states. The peculiarity of maritime education is that a diploma from any country is recognized in the navy of a foreign state. A crew member of a foreign ship receives from 4 to 8 thousand dollars a month. Flags of convenience: Panama, Cyprus, for their owners fees and taxes are minimal. On domestic ships, earnings are several times lower. It is proposed to solve the problem field comprehensively through career guidance. However, this work can also be done for foreign companies. Moscow State University named after Admiral G.I. Nevelskogo, the only one in Russia, trains personnel in personnel management in the maritime industry. Personnel marketing usually begins with an analysis of the external environment. As a rule, businesses prefer to hire a ready-made specialist from outside, reducing the cost of training young people. At the same time, a feature of the global labor market in the maritime industry is cheap labor from Asian countries, which competes through social dumping.

There are difficulties in implementing the Bologna process in Russia. The fact is that secondary education in the European Union takes 12 years, the last years are devoted to career guidance. Thus, in reality, a European bachelor’s degree lasts 5 years, and until 2011, a bachelor’s degree in Russia was almost equal to a specialist’s degree. As a result, the middle management level in Russia suffers, since, according to established requirements, bachelor's degree graduates are equal to graduates of colleges and technical schools. In this regard, we can conclude that the current two-level system “bachelor - master” is not able to meet the personnel needs for engineers and middle managers, or rather, creates obstacles for this. In this regard, it is possible to propose a modernized structure of higher education within the framework of the Bologna system. It is proposed to strengthen practical, technological training in bachelor's degrees, while maintaining the basics of management, and divide master's programs into 2 profiles: engineering and technology and management. PAO Sovcomflot, wholly owned by

Russia, has, unlike many non-state companies, a sufficiently qualified workforce with good salaries.

Cadets and trainees of maritime universities undergo sailing practice on ships of the Sovcomflot group of companies, and the most promising graduates are selected for further work. At the same time, in 2020, 166 cadets from maritime universities and 21 trainee sailors and motor mechanics completed sailing practice on the company's ships. If the number of employees of an enterprise is divided by the approximate number of years of professional activity, the result will be (35–40), that is, the number of young people is far from sufficient for simple personnel reproduction. The Sovcomflot group of companies works with personnel, promotes the professional development of personnel, obtaining additional education, studying modern technologies, and training employees in master's and postgraduate programs. Optimizing ship personnel by reducing the number of ship crew members has a negative impact on the safety of navigation. The legal requirements for crew composition are not met, which often happens on small ships with crews of less than 15 people, and even more often with crews of less than 8. The change in the personnel needs of Russian maritime transport over the past 15 years can be traced by changes in the ship and personnel composition of Sovcomflot. . Currently there are 146 vessels with a total deadweight of 12.6 million tons. As of December 31, 2022, the fleet of the Sovcomflot group of companies includes 144 vessels with a total deadweight of 12.44 million tons, the number of personnel is about 7.8 thousand (53 people per vessel and 619 per 1 million deadweight tons). In 2012, the fleet included 157 vessels with a total deadweight of 12 million tons with a staff of more than 9.3 thousand people. (59 people per vessel and 775 per 1 million deadweight tons). As of 01/01/2006, the fleet consisted of 50 vessels with a total deadweight of 3.95 million tons, the total number of personnel was about 3 thousand people. (60 people per ship and 759 per 1 million deadweight tons). Thus, there is a clear tendency to save human resources with an increase in the deadweight of individual vessels. All this makes it difficult to solve personnel problems in maritime transport in the interests of Russia and, in general, poses challenges and threats to its security. There are problems in the scientific organization of labor. Often, seafarers unofficially admit that there is a double recording of working time on ships: one - real, the second - for regulatory authorities. It is very important that from the beginning of 2000 to the present, the number of accidents due to fatigue of navigators has been increasing. The most surprising thing is that the introduction of conventions, designed to improve safety, increased the paperwork load of seafarers and worsened the situation. This was mainly due to poor labor organization. In 2020, the number of inland navigation vessels was 30.4 thousand, their average age was 37 years, and their total deadweight was 9.7 million tons. The systems managed by FSUE "Rosmorport" are kept in good technical condition, certified by the relevant authority and effectively perform their functions. The strategy for the development of sea port infrastructure until 2035 involves a significant strengthening of the industry's human resources potential. There will be a shift to on-demand learning. It is expected that specialists from the educational sector will be involved in the process of planning the development of the industry. The Comprehensive Plan for the Modernization and Expansion of Trunk Infrastructure for the Period until 2025 also pays great attention to personnel issues. The relatively good personnel situation at FSUE "Rosmorport" is explained by the growth of cargo turnover in Russian ports and the organization's assets. Thus, the income of FSUE "Rosmorport" from port dues in 2019 amounted to 19,759.3 million rubles, the target was met at 102%. According to the current program of the FSUE "Rosmorport" event, a lot of attention is paid to personnel. It is planned to introduce professional standards as they are approved by the Russian Ministry of Labor on the basis of the Plan for organizing their application at the enterprise (the entire period from 2019 to 2025). It is important to increase labor productivity and quality of services, which is impossible without improving the qualifications of personnel, events for the exchange of experience among employees, including all-Russian and international ones, internships for students of specialized educational organizations in departments and branches of the enterprise.

At present, there is practically no Russian commercial fleet as such. There are Sovcomflot structures (less than 10 thousand employees), and two or three other large companies with a stable personnel situation. The remaining Russian companies are, for the most part, small firms with two or three obsolete ships. The personnel shortage is only partially filled by employees from Belarus and Ukraine, but in general, mostly pensioners work in Russian companies and on research vessels. There is an acute problem of personnel shortage in many categories of specialties. This problem is especially noticeable among enlisted personnel on ships of the icebreaking and service fleets.

The bulk of deliveries to and from Russia come from foreign fleets, which leads to colossal budget losses. Charterers do not take the risks of transport on old ships, so they turn to foreign ones. At the same time, a foreign flag does not provide sailors with the protection of Russian legislation, to say nothing of qualified personnel work. The USSR had a huge fleet. Now the domestic fleet is registered more in foreign jurisdictions. At the same time, ship owners support the requirements of the ministry only if the requirements for the use of the Russian flag are reduced. Shippers themselves note that they are confident that they will have to export products

through other countries. The level of direct and indirect influence of the transport industry in the Arctic and Far East on the economy is significantly higher than the Russian average. The transport industry as a whole has a higher level of wages compared to the regional average, which ensures the operation of a "personnel pump" that acts on both residents of the region and migrants, attracting and retaining the most active in the port industry and directly related areas and able-bodied workers. Trade and services related to the port industry are developing. However, there is also the effect of redistribution of resources and personnel in favor of the transport sector, as a result of which the development of the region as a whole can lead to certain imbalances, giving negative effects on the construction sector, the social sphere, foreign trade and hindering the innovative development of the region. An important addition to the description of the situation is the fact that the industries directly related to the region's science, which is quite developed compared to the average Russian level (mineral resources development, fishing), find themselves isolated from the transport industry, which is leading in terms of level and pace of development, which generally affects one of the most important indicators of the region's development – its level of innovation. the reproduction of maritime transport personnel depends on the personnel needs of the relevant labor market, the number of youth cohorts ready to study at universities and other vocational education organizations, and the capabilities of the educational system to accept and graduate trained personnel; these circumstances form the basis of the problem field for maritime transport personnel in Russia in general and the Arctic in particular, including the uncertainty of long-term plans for the development of maritime transport, a demographic situation unfavorable for personnel reproduction in general, as well as problems of the organizations themselves engaged in training the relevant personnel;

- The personnel supply system for maritime transport is highly globalized, which poses certain problems for maintaining the level of personnel supply for the maritime and river fleet in Russia in general and the Arctic in particular due to the high gradient of wages towards work on foreign ships for high-quality Russian specialists. The problematic field of personnel support for maritime transport in the Arctic and the Far East is aggravated by the even more complex demographic situation in the region compared to the average Russian one, i.e., a relatively low proportion of young people with a high educational migration to the central regions of the country and the development of other types of population migration, not giving the region the opportunity for rapid innovative development due to the permanent shortage of personnel in recent decades. At the same time, the progressive development of port capacities and cargo turnover in the region is mainly associated with an increase in the need for low-skilled labor, since this cargo turnover is largely associated with the transshipment of Russian coal. In addition, the problems of maritime transport in the region are complicated by the uncertainty of the prospects for its development, as well as in Russia as a whole, tied to the situation in the commodity markets. In recent years, there has been a trend towards a decrease in the quality of personnel training for maritime transport, determined through such an indicator as the accident rate, which indirectly reflects not so much the state of the personnel training system as a whole, but the quality of the training (and teaching) contingent itself; this phenomenon is associated with the outflow of personnel most capable of maritime activities to other industries; and the quality of the student (and teaching) population itself; this phenomenon is associated with the outflow of personnel most capable of maritime activities to other industries;

There are general trends in optimizing personnel requirements in the domestic fleet by increasing the deadweight of ships and the level of automation of their management, to a limited extent (for the transportation of export cargo, first of all, this can provide significant benefits) contributing to the solution of personnel problems in maritime transport. However, without a long-term program to improve the efficiency of maritime transport management and the adjustment of this trend to the raw materials transportation sector, the positive effect on the personnel system will be very limited.

Thus, with the number of professional seafarers in the country being approximately 160 thousand, it can be argued that organizations are preparing workers "more than" exceeding the required number for simple reproduction in a scenario of no growth in personnel needs in terms of the number of workers. Perhaps an adjustment should be made taking into account the share of only swimming specialties, it will be approximately 62% of the graduation rate, that is, 6.2 thousand people of potential future sailing personnel, which, given their expected service life in the fleet, is not even 40, but 30–35 years, will also ensure easy reproduction. At the same time, no one anywhere measures the drain of personnel to other areas of the national economy, which complicates our measurements of the personnel system.

- formation of a system for strategic planning of the personnel needs of Russian maritime transport, based on long-term forecasts for the development of exports, construction and acquisition of ships, expansion of port capacities, preparation of relevant strategic and program documents;
- increasing the level of scientific support for personnel training, as well as the intensity of scientific activity in the field of maritime transport on the basis of relevant universities and research centers;

- increasing the flexibility of the personnel training system for maritime transport (for example, in the Arctic and the Far East, increasing the level of interaction between leading universities in the region, up to their merger with the possibility of any students receiving maritime specialties as additional ones);
- increasing the level of attraction of schoolchildren from the interior regions of the country into maritime professions through early career guidance with benefits for studying at specialized universities;
- increasing the level of digitalization of the educational process, developing distance educational, educational, and career-oriented programs;
- the formation of career guidance and pre-university training programs for migrants promising in maritime professions (relevant for the Arctic and the Far East), attracting promising foreigners to work on Russian ships;
- introduction of a system of restrictive measures for Russians to work for foreign maritime transport companies immediately after graduating from universities;
- increasing automation of control, increasing the deadweight of Russian ships, which may lead to a decrease in personnel requirements for maritime transport.

The economic effect of the implementation of the proposed management solutions is to increase the efficiency of the process of training and working with them, which will contribute to solving the strategic problems facing the maritime transport industry. We can expect a reduction in accident rates by 3–5 times, optimization of costs for training specialists, ensuring growth in income from the port industry and its development as a whole; One can also expect an indirect effect on the economic efficiency of maritime transport by improving the quality of its human resources. The personnel problems of Russian maritime transport are obvious. From a structural point of view, each link of the relevant personnel system has problems. At the same time, the personnel system that provides a particular industry depends on the demand for services or goods in this industry. That is, If it is planned to ensure the development of the Russian maritime industry due to the growth of income from it, then the personnel problem, it seems, should be solved "by itself."

In addition, the general demographic dynamics directly in the Arctic and the Far East have negative trends. Programs to attract personnel to the Arctic and Far East show only relatively weak success. There is no necessary wage gradient in the region. The need for personnel is mainly in the port industry - for the provision of stevedoring services in the coal industry. This mainly requires low-skilled personnel. Staffing of shipbuilding and ship repair enterprises remains problematic. In general, the development of maritime transport under the Russian flag can be ensured by foreign ships, but this is not profitable for foreigners. Therefore, no one will voluntarily go to Russian sea transport. At the same time, not displaying the Russian flag is unsafe for possible sanctions. Thus, solving the problems of staffing Russian maritime transport in the Arctic and the Far East is in the context of the need for comprehensive solutions to the personnel problem in the Arctic and the Far East as a whole. The only prospect for solving the problem is to increase the tonnage of ships, increase the level of digitalization - automation of the process of managing them, which will lead to a decrease in the number of personnel in maritime transport and will open up opportunities for increasing wages.

References:

1. Beloborodova, N.A. (2012). Personnel strategy of the region: theoretical approaches to defining the concept. *Baikal Research Journal*. 2012, no. 5, p.14.
2. Zaikov, K.S., Kondratov, N.A., Kuprikov, N.M., & Kuprikov, M.Yu. (2021). Analysis of trends in the training of highly qualified personnel in the interests of strategic development of the Arctic zone of the Russian Federation. *Economic and social changes: facts, trends, forecast*. 2021, Vol. 14. No. 1, pp. 125-140.
3. Zelenkov, M.Yu. (2019). Transport and logistics system of the Northern Sea Route: prospects, problems and ways to solve them. *Arctic: ecology and economics*. 2019, no. 4, pp. 131-140.
4. Ignatiev, V.P., Bogushevich, A.P., & Daramaeva, A.A. (2019). Personnel training for the Arctic zone of the Republic of Sakha (Yakutia). *Professional education in the modern world.* 2019, Vol. 9. No. 4, pp. 3265-3274.
5. Isaev, A.P., & Fomina, I.A. (2018). Priority projects for the development of the Arctic zone. Restoration of the Northern Sea Route. *Management consulting.* 2018, no. 8, pp. 98-105. DOI: 10.22394/1726-1139-2018-8-96-105.
6. Kiselenko, A.N., Malashchuk, P.A., & Sundukov, E.Yu. (2019). Assessing the compliance of the carrying and throughput

capacities of transport routes of the European and Sub-Ural North of Russia with the needs of the Arctic transport system. *Problems of territory development*. 2019, no. 3 (101), pp. 33-48.

7. Kornyakov, K.A. (2018). Personnel problems of Arctic development. *Finance and credit*. 2018, Vol. 24. No. 4 (772), pp. 929-938.
8. Korczak, E. A. (2017). State policy in the sphere of living standards in the regions of the North and Arctic of the Russian Federation. *ECO*. 2017, No. 10 (520), pp. 110-123.
9. Korchak, E.A. (2020). Long-term dynamics of the social space of the Arctic territories of Russia. *Arctic and North*. 2020, no. 38, pp. 123-142.
10. Popova, L.A., & Terentyeva, M.A. (2014). Labor potential of the Russian North. *Arctic and North*. 2014, no. 4, pp. 51-69.
11. Simakova, A.V., Stepus, I.S., & Pitukhin, E.A. (2019). Education system and personnel needs of the Arctic regions of Russia: professional perspective. *Perspectives of science and education*. 2019, no. 5 (41), pp. 492-502.
12. Stepus, I.S., & Simakova, A.V. (1887). Migration flows of university graduates to work in the Arctic zone of Russia: quantitative and qualitative aspects. *Regional Economics: Theory and Practice.* 2018, No. 10 (457), pp. 1872-1887.