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# Factors of technological development of the Northern Sea Route

Iu Guzov<sup>1</sup>, N Polyakov<sup>2,5</sup>, V Titov<sup>3</sup> and A Vashchuk<sup>4</sup>

<sup>1</sup>Department of Statistics Accounting and Audit, Faculty of Economics, Saint-Petersburg State University, Russia

<sup>2</sup>Department of Economics Research and Development, Faculty of Economics, Saint-Petersburg State University, Russia

<sup>3</sup>Department of Credit theory and Financial management, Faculty of Economics, Saint-Petersburg State University, Russia

<sup>4</sup>Department of European Studies, St. Petersburg State University

<sup>5</sup>Ningbo University of Technology, China

E-mail: n.polyakov@spbu.ru

**Abstract.** The article is devoted to the issues of technological development of the Northern sea route (NSR). The purpose of the study is to justify the need to create conditions for the technological development of the shipping line, which is a priority, large-scale and commercial project of Russia that provides economic growth of the Arctic regions and the Russian Federation itself. To make NSR the effective in near future, it is necessary to focus on the development of the Arctic icebreaker fleet, satellite communications, emergency rescue facilities, port fleet and digital technologies. As a result of research authors consider factors of technological development as elements of the driving force of the NSR project and an ecosystem of technological innovations that ensures the constant functioning of the shipping artery. The authors deem the following areas as key factors of the NSR's technological development:

1. Formation of innovation-territorial clusters of enterprises focused on projects for the development of the Arctic Zone of the Russian Federation (AZRF).
2. Creation of special economic zones (SEZ) of technical and innovative type in the administrative centers of the Arctic regions.
3. Stimulating demand for innovative technologies.
4. Building a system of effective international cooperation.
5. Tax incentives for business in the Russian Arctic.

Main conclusions of the research. Technological innovations' usage in development of the NSR will speed up the process of creating an effective and reliable engineering infrastructure, ensure the uninterrupted movement of ships, will give a powerful push and an extra boost to the sectors of Russian economy (shipbuilding, radio electronics, new materials, oil and gas equipment, etc.) and, as a result, it will create favorable conditions for public - private investment inflow in these industries and for the economy of Arctic regions.

## 1. Introduction

The purpose of the study is to justify the need of necessary creation of conditions for the technological development of Northern Sea Route. NSR is a overriding, large-scale, commercial Russian project, which provides economic growth not only of Arctic regions, but also all of Russian Federation.



The economic development plans of Russian Federation are inextricably linked with the development of the Arctic. And the reason for this is not only in the concentration of large mineral reserves. Thus, according to Russian scientists, the Arctic zone of the Russian Federation (AZRF) contains an overwhelming share of all – Russian resources: oil – 60%, gas – 60 to 90%, gold – 40%, chromium and manganese – 90%, platinum – 40%, ore diamonds and vermiculite-90%, and other resources [1]. The estimated value of explored and potential mineral reserves in Russian Arctic may exceed 30 trillion USD, where more than half is the cost of energy resources [2].

The Northern Sea Route (NSR) is a key factor in economic development. A world-class shipping highway that runs along the Northern coast of Russian Federation. Passage is carried out on the seas of the Arctic ocean: Barents, Kara, Laptev, East Siberian, Chukchi, Bering seas. The artery connects European and far Eastern ports in a single transport system. Prospects for the development of the NSR are causally related to the development of the resource base of the AZRF, natural and climatic conditions, technological capabilities for creating engineering infrastructure and ensuring the functioning of the main waterway. The introduction of technological innovations in the development of the NSR will speed up the process of creating an effective and reliable engineering infrastructure, ensure the uninterrupted shipping, give a powerful push and an extra boost to the sectors of the national economy (shipbuilding, radio electronics, new materials, oil and gas equipment, etc.) and, as a result, create favorable conditions for the inflow of public-private investment in these sectors and the economy of the Arctic regions.

Factors of technological development should be considered as an element of the driving force of the NSR project and the creation of an ecosystem of technological innovations that ensure the smooth functioning of the shipping artery.

In accordance to the may decrees of the Russian President, NSR was set a target for cargo traffic by 2024 – 80 million tons. At the end of 2018, the volume of cargo transportation amounted to about 20 million tons per year, which is a record value for the entire history of Arctic development. In 2019, at a meeting of the Arctic forum, “ROSATOM” Government Corporation representatives, which is NSR infrastructure provider, announced plans for cargo traffic in 2019 – 26 million tons (the planned values for 2019 have been reached after 11 months), in 2024 – 92.6 million tons, by 2030 this figure may reach a value of 110-120 million tons. Most of these volumes are occupied by hydrocarbon flows (coal, oil, liquefied gas, condensate) and this trend will continue. In 2018, this volume of traffic amounted to 15 million tons (an increase of more than 2.5 times compared to 2017). According to the forecasts of the Russian Government, the volume of cargo transportation will reach 65 million tons by 2024, with a growth potential of 95 million tons by 2030, and by 2035, the volume can be increased to 130-160 million tons of cargo.

Major projects in oil and gas sector are connected with the sea highway. The largest shipper is “NOVATEK” with the project of the “Yamal SPG” gas liquefaction plant. It will be based on the resources of the “Yuzhno-Tambeyskoye” field. Another promising large – scale “Arctic SPG-2” project will be based on the “Utrennee” field of the Gydan Peninsula. At the end of 6 months of 2019, the company loaded 126 gas tankers. NOVATEK is developing the Western direction, but year-round deliveries of liquefied gas in the Eastern direction are planned by 2025 [3,12,13]. The company “Gazpromneft” is also a major shipper in the NSR. This route is used by the company to transport oil from the “Novoportovskoye” field in Yamal. The shipment is carried out from the Arctic Gate oil loading terminal. The use of innovative technologies and innovative solutions allows the company to ship oil all year round. The largest oil company “Rosneft” has the largest license areas of the AZRF offshore fields, which will significantly increase the cargo turnover of the NSR. International business is interested in developing the resource base of the AZRF and, accordingly, the NSR. Despite the sanctions pressure exerted on the Russian energy sector by foreign countries, such companies as “Total”, “CNPC”, “CNOOC”, “Saudi Aramco”, “Saibu Gas Co.”, and “Japan Arctic LNG” are taking part and planning to participate more in new oil and gas projects in the Arctic.

The competitiveness of the waterway is obvious, it is, first of all, the length of the route. The NSR is much shorter than the traditional southern direction (the distance from the Kara gate to the Bay of

Providence is about 5,600 kilometers; from Saint Petersburg to Vladivostok-14,280 km. In moving in this direction through the Suez Canal, it is necessary to overcome 23,200 km), which allows you to significantly reduce the cost of transporting goods and, as a result, companies will receive economic benefits. The NSR is a safe route, since the main part of the route passes in the waters of the Northern Russian seas; although it runs in a difficult ice environment, the vessels pass in harsh natural and climatic conditions, especially during the autumn, winter and spring navigation periods. In the Eastern part of the NSR, in contrast to the Western part, intensive shipping is observed in the summer and autumn period and lasts for 5 months (from July 1 to November 30).

A complicated system of NSR depends on a huge number of subjective and objective conditions. Exogenous conditions should include the external environment, and, above all, the situation on world energy markets. Today and in the long term, the route is dominated and will continue to be dominated by the transportation of oil and liquefied gas, as well as minerals that are extracted and produced in the AZRF [4]. These shipments are mainly for export purposes (96% of cargo traffic on the NSR is transportation of minerals). According to the results of statistical observation in the AZRF, there is an increase in business activity of enterprises and industrial production turnover (Table #1), which may also be associated with the loading of NSR.

**Table 1.** Turnover of companies, based in Arctic Zone, thousand rubles\*

	2016	2017	2018	2019
Arctic Zone of the Russian Federation	4 764 495 054	5 570 764 783	6 919 015 253	5 775 806 885
<i>Reference: Russian Federation</i>	<i>112 002 268 928</i>	<i>122 213 694 495</i>	<i>144 029 840 496</i>	<i>149 854 058 966</i>

\*Statistical information on the socio-economic development of the Arctic zone of the Russian Federation. [Electronic resource]. URL: [http://www.gks.ru/free\\_doc/new\\_site/region\\_stat/calendar1-2020.htm](http://www.gks.ru/free_doc/new_site/region_stat/calendar1-2020.htm) (accessed 10.06.2020)

## 2. Methods

In the medium term, geopolitical and geo-economic factors may have a certain impact on the NSR [4,5,6]. Internal factors of influence should include the government policy in the organizational and legislative sphere. Key areas of industrial development of the Arctic shelf; innovative technologies in the use of natural resources; the formation of transport infrastructure; national security and the environment are among the state priorities set out in the government program and strategy for the development of the AZRF. The Ministry of the Russian Federation for the Far East and the Arctic has prepared a document defining the strategy for the development of the Russian Arctic until 2035, where measures for acceleration of economy and social sphere development in the Arctic territories are an important element. In addition, a draft law on a special economic regime in the AZRF has been prepared. State priorities are related to the development of the shipbuilding industry. First of all, the icebreaker fleet. These are new icebreaker construction projects. (Arctic-type icebreakers). Projects for the construction of these ships were included in the state funding Program, so they are in the list of priority tasks for economic development. A unique project of domestic icebreaking is the project for the construction of a nuclear icebreaker "Lider" with two reactor installations with a capacity of 315 MW each, which is able to provide year-round wiring of ships and tankers. Such factors as pilotage of the route, port infrastructure, organization of rescue and navigation control services, hydrometeorological monitoring, cargo insurance, etc. are extremely important for the NSR [7,8]. The factor analysis of cargo flows conducted by Russian scientists [4] has shown that the actions of various conditions (scenarios) have a very contradictory effect on the situation with the NSR. Climate change, namely the effects of global warming, can the experts provide free passage to vessels of a class Arc7 (icebreaking capability up to 1.5 m). In the case of cooling the thickness of the ice cover can reach 2-3 meters, which will make some adjustments in the organization of ice maintenance, and build new, more powerful icebreakers and ice-class tankers.

According to “ROSATOM” company, for the effective functioning of the NSR in the near future, it is necessary to focus on creating favorable conditions: this requires infrastructure support for the megaproject, "including the Arctic icebreaker fleet, satellite communications, emergency preparedness facilities, the port fleet and digital shipping services" [19].

### 3. Research result

The following areas should be considered as key factors of the NSR's technological development:

1. Formation of innovation-territorial clusters of enterprises focused on projects for the development of the Russian Arctic.
2. Creation of SEZ of technical and innovative type in the administrative centers of the Arctic regions.
3. Stimulating demand for innovative technologies.
4. Building a system of effective international cooperation.
5. Tax incentives for business in the Russian Arctic.

### 4. Discussion

#### 4.1. Formation of innovation and territorial clusters

Modernization of the NSR infrastructure should be associated with the construction of a kind of North-Eastern "technological arc" - the territory where new engineering and transport technologies will be introduced [9-11]. These tasks can be solved in the short term by innovative territorial clusters in the administrative centers of the Arctic regions, which unite enterprises and organizations of the same scientific and production chain, including scientific organizations and educational institutions. However, according to statistical observations, the internal R&D costs of Arctic business are insignificant (less than 0.5% of the national indicator), which is rather due to the small number of enterprises registered in the Arctic regions (Table #2). However, compared to 2017, the cost of technological innovations increased sharply in 2018 (from 7.890 billion rubles to 20.780 billion rubles). This may be due to the development plans of the Arctic development by major resource companies and their projects for the development of hard-to-recover reserves, which in turn involves the search for new solutions and technologies in the development of deposits and ways to deliver minerals.

**Table 2.** Internal R&D expenditures\*

	2016	2017	2018	2019
Arctic Zone of the Russian Federation	4 396,2	3 545,2	4 749,6	4 896,5
<i>Reference: Russian Federation</i>	<i>943 815,2</i>	<i>1 019 152,4</i>	<i>1 028 226,1</i>	<i>1 134 779,0</i>

\*Statistical information on the socio-economic development of the Arctic zone of the Russian Federation. [Electronic resource]. URL: [http://www.gks.ru/free\\_doc/new\\_site/region\\_stat/calendar1-2020.htm](http://www.gks.ru/free_doc/new_site/region_stat/calendar1-2020.htm) (accessed 10.06.2020)

It is also necessary to note the production complex, which is located in Russian Arctic, where there is a slight increase in the number of advanced technologies used (3% compared to 2018). In 2019, there is a significant increase in the volume of innovative goods, works and services, which amounted to 129,812 million rubles (52,286. 6 million rubles in 2018).

In accordance with the Methodological recommendations for the implementation of cluster policy in the subjects of the Russian Federation, the key task of clusters is to "ensure high rates of economic growth and economic diversification by increasing the competitiveness of enterprises, suppliers of equipment, components, specialized production and service services, research and educational organizations that form territorial production clusters". For effective and uninterrupted functioning of the NSR, clusters of enterprises in the shipbuilding industry come to the fore, including its most important element – icebreaking; information and telecommunications technologies; radio electronics

and instrumentation; nuclear and radiation technologies. An important place is given to the environment and comprehensive safety of the NSR from natural and man-made emergencies [20].

Clusters of enterprises focused on the development of the Arctic can be in different parts of the country. For example, marine robotics and radio electronics companies are in Saint Petersburg and Zelenograd. Enterprises of the shipbuilding cluster are in major industrial centers of Russia, etc.

#### *4.2. Special economic zones of technical and innovative type.*

It is advisable to develop cluster construction within SEZs. The country already has accumulated experience in organizing business activities within the SEZ. The idea of creating these territories was to stimulate the activities of economic entities in priority areas of economic development of backward regions. These are industrial production, innovative technologies, port facilities and tourism. Initially, it was planned to create and develop SEZs in weak subsidized regions of Russia. Their main task was to stimulate the country's economic potential. However, this status is held by economically developed regions, and in terms of innovative development – leaders among the Federal subjects. This is due to the main criteria for obtaining the status of "special economic zone": stable economic development and implementation of major investment projects in the region. For the Arctic regions, where large investment projects are being implemented with the participation of both private businesses and state-owned companies, there is a good opportunity to get this status. It is necessary to distinguish the following subjects of the Russian Federation where SEZs of technical and innovative type are possible: Murmansk region, Arkhangelsk region, Nenets Autonomous district, Chukotka Autonomous district, Yamalo-Nenets Autonomous district, Republic of Sakha (Yakutia), Krasnoyarsk territory. The creation of SEZs in the port and industrial centers of the Russian Arctic further encourages small innovative businesses and activates large enterprises in the implementation of infrastructure projects.

The functioning of clusters in the Arctic will not only speed up the modernization of the NSR, but also achieve the target indicators of socio-economic development of the subjects of the Russian Federation, namely, ensure the growth of the gross regional product; increase the share of Russian-made radio-electronic equipment and high-tech innovative goods, works (services); increase the level of illumination of the Arctic seas.

#### *4.3. Stimulating demand for innovative technologies.*

Big development plans for Russian Arctic create a demand primarily from government for technological innovations. Government is a customer of high-tech and high-tech projects in the field of mining and transportation of minerals, industrial production, and the construction of an effective energy supply system for the far North. To develop competition in the regions, the Government of the Russian Federation has proposed a mechanism for creating priority markets. The standard for competition development at the regional level defines priority markets as non-resource markets with high export potential and import substitution potential within production and innovation clusters located on the territory of Russia. Such markets could be the markets for scientific and technical products and advanced technologies necessary for the development of the AZRF and the modernization of the NSR. In the plans for socio-economic development of the Arctic regions, it is important to shape the development directions of priority markets, taking into account the specifics of the Northern territories and pressing regional problems. Forecasting of technological development today allows us to simulate future markets of the Russian Arctic in accordance with the methodology of the National Technology Initiative (NTI) on the first plan it is necessary to bring these promising markets associated with Arctic development and mega project NSR as "AeroNet" (the market of unmanned aircraft and space earth systems); "AutoNet" (road transport on the basis of intelligent control systems); "MariNet" (intelligent Maritime transport); "EnergyNet" (the market of smart energy); SafeNet (information and cyberphysical systems security market). The possibility of using alternative energy sources in the Arctic region also seems to be a very original solution [13]. This is wind power. Potentially, wind power plants in the Arctic can provide energy to both remote Northern facilities and the engineering infrastructure of the NSR.



Private businesses are also interested in implementing innovative technologies for their production processes [14,15,17,20]. An interesting example is the project for the construction of the fourth technological line of “Yamal LNG”, which is focused exclusively on Russian-made equipment. For example, a large number of contractors take part in the creation of new-generation icebreakers: large companies of the state Corporation “United Shipbuilding Corporation”(“ОСК”), medium-sized businesses and small innovative firms. Creating favorable conditions for the development of high-tech business in the Arctic regions will stimulate demand for innovation.

#### *4.4. Building a system of effective international cooperation.*

Russia actively cooperates in the Arctic with other countries on various issues of international cooperation. The main intergovernmental cooperation within the framework of the Arctic Council is established in the field of environmental protection and improving the living conditions of Arctic communities. In accordance with the Ottawa Declaration, in addition to the Russian Federation, this organization includes countries such as Canada, the Kingdom of Denmark, Finland, Iceland, Norway, Sweden and the United States. Issues of economic development and national security are separate key tasks of the States that are members of the Arctic Council. However, other countries are also showing great interest in the development of the Arctic. Non-Arctic countries that depend on energy supplies and are interested in developing the NSR. These are countries in the Asia-Pacific region. China is particularly active in using the highway and considers it as part of the "silk road: one belt-one road" project, the so-called "Ice silk road"[9,15]. In 2018, the state Council of China proposed the Arctic policy of the PRC, where the Arctic is considered as a national priority. The Chinese government has defined the main directions of Arctic development: shipping, minerals, fishing, and tourism. Attracting a national partner to the tasks of modernizing the NSR will allow Russia to reach qualitatively new levels of technological development [15,16,18].

#### *4.5. Tax incentives for business in the Russian Arctic.*

To increase investment and boost business, it is necessary to introduce tax incentives for enterprises focused on projects in the AZRF. Especially for companies that implement innovative technologies. These tasks can be solved both within the framework of the SEZ organization of a technical implementation type, and by the example of the development programs of the Far East, which provide preferential income tax rates, reducing coefficients for taxes on extraction of mineral resources, simplified procedures for land plots, with a mandatory condition for the implementation of investment projects for companies [2,17]. The new Arctic development Strategy offers options for tax and administrative incentives for businesses, including tax incentives and favorable scenarios for international companies that have modern technological solutions for building port infrastructure and building a safe navigation system for the NSR in difficult natural and climatic conditions.

Thus, based on the research, we can draw the following conclusion. The introduction of technological innovations in the development of the NSR will speed up the process of creating an effective and reliable engineering infrastructure, ensure the uninterrupted shipping, give a powerful push and additional impulse to the sectors of the national economy (shipbuilding, radio electronics, new materials, oil and gas equipment, etc.) and, as a result, it will create favorable conditions for the inflow of public-private investment in these sectors and the economy of the Arctic regions.

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