Features and prospects of development of transit container transportation on the Northern sea route

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Abstract Due to the congestion of the main transit container corridors, there is an urgent need for the development of alternative container lines. This trend prompted us to conduct a study of an alternative sea corridor to the Suez Canal. In this paper, we have considered the features and prospects for the development of transit container transportation along the Northern Sea Route. We analyzed many factors that influenced the complexity of transportation by the Northern Sea route, such as severe weather conditions, undeveloped infrastructure, and others. We studied the geography of the Northern Sea Route, the natural conditions along its entire length, and identified the main ports along the route. We conducted a comparative analysis between the Northern Sea Route and its main competitor, the Suez Canal. We found out that there are prospects for the development of the Northern Sea Route and its economic benefits over competitors. We were convinced that the Northern Sea Route is a strategically important project for Russia. We reviewed the transport strategy for the development of the Northern Sea Route until 2030. They presented forecasts for the development of the Northern Sea Route. They gave an example of an experimental flight of a Maersk vessel passing along the Northern Sea Route. Based on our research, we were able to make forecasts for the development of transit container traffic along the Northern Sea Route.

1. Introduction

Prior to the coronavirus (COVID-19) pandemic, maritime transport was considered one of the most cost-effective and mass-market modes of transport with more than 80% of all global cargo flows accounted for by sea. For the further development of sea container transportation, it is necessary to explore new routes for cargo delivery. This route is the Northern Sea Route, perhaps the most discussed transport corridor in recent times.

The Northern Sea Route runs along the Arctic Ocean, along the Siberian coast of Russia, connecting all the northern ports, river mouths, into one single shipping hub. From the west, the NSR is bounded by Cape Desire, and from the east by the Coastal Strait.

It is important to note that the length of the NSR is 5,600 kilometres.

Many experts predict an increase in the volume of cargo transportation along the Northern Sea Route, but for the development of this direction, it is necessary to create a modern infrastructure. For Russia, the development of the Northern Sea Route is a strategically important task, as the Northern Sea Route unites about 70% of the Russian space.
2. Features of transit traffic by the Northern Sea Route

One of the main features of cargo transportation by the northern sea route is its climate, all the seas that are part of the NSR are characterized by extremely severe weather conditions. The average temperature in summer usually does not rise above +7 degrees Celsius, and the temperature in winter sometimes drops to -35 degrees Celsius.

In addition to the very cold temperature, the NSR has another feature, it is an ice layer throughout its entire length, and although in summer in some places the ice cover goes away for 2-3 months, but there are places where the ice will remain all year round. But every year, due to global warming, the summer period increases, which is the prospect of the development of the NSR [1].

In recent years, Russia has taken the development of the Arctic quite seriously. This development will be impossible without modern port infrastructure, now the main strategic ports along the length of the NSR are:

- Pevek;
- Tiksi;
- Providence Bay;
- Igarka;
- Dudinka;
- Dixon.

In the last few years, the Government of the Russian Federation has been actively implementing an economic project to convert the port of Petropavlovsk-Kamchatsky into a major hub port of the Northern Sea Route. The port of Petropavlovsk-Kamchatsky occupies a very favorable position in its region, with the presence of modern infrastructure, it can become an important transport hub between northern Europe and the east coast of the Pacific Ocean. In addition, the port of Petropavlovsk-Kamchatsky has a number of advantages, such as:

- year-round navigation;
- non-freezing bay;
- ability to sort and accumulate cargo [2].

Figure 1 shows the main transport corridors along the Northern Sea Route.
3. Competitors of the Northern Sea Route

The main competitor in the global shipping market for the Northern Sea Route is the Suez Canal. Its length is 193 km, and it is one of the busiest arteries in the world. Due to the increase in the size of ships, the Suez Canal ceases to cope with the load and its main problem today is the limitations on the size of ships that it can accept, which leads to the need to reload cargo from large vessels to the vessels of the Suez Canal Administration. In turn, this affects the time and financial costs. Therefore, the main problem of the Suez Canal is low capacity with growing demand for its services. This opens up growth opportunities for the Northern Sea Route.

The main role of the Northern Sea Route, like the Suez Canal, is to optimize transport routes between the Asia-Pacific region and Europe, but compared to the Southern Suez Canal, the Northern Sea Route has a number of advantages, and also because of the fairly recent start of its development, it has much more prospects in the future. Let's take a closer look at them.

In 2019, only 660 vessels passed through the waters of the NSR. For example, this is the average amount of time that passes through the Suez Canal in 10 days. In total, about 24,000 ships pass through the Suez Canal every year. Such a huge number of cargo ships often entails downtime during the passage of the Suez Canal, sometimes ships stand from 3 to 7 days waiting for their turn to pass.

Compared to the Suez Canal, the volume of traffic along the Northern Sea Route is not significant and amounted to 27 million 593 thousand 76 thousand tons as of November 29, 2019, which is almost 70% higher than in the same period last year.

At the same time, the volume of transit cargo traffic showed an increase and amounted to about 40% (697,277 thousand tons compared to 491,342 thousand tons in the comparable period of 2018).

The total tonnage of ships passing through the Suez Canal in 2019 was 1.17 billion tons.

The Suez Canal can be traversed in an average of 24 hours. Approximately 48 vessels pass through the NSR in a day, and the NSR can be crossed in 7-15 days under favorable external conditions and must be accompanied by a Russian icebreaker [3].

Through the NSR, navigation is possible only 5-7 months a year, unlike the Suez Canal, where navigation is possible all year round.

For the transition from China to Europe via the Suez Canal, an average of 35 days and 875 tons of fuel oil are needed, compared to the Northern Sea Route, where the figures will be 25 days and 625 tons of fuel oil [3].

A passage through the Suez Canal costs $ 250.000. The NSR does not have direct fees for the passage itself. However, the fee for icebreaking support costs about $ 300.000. It is also worth including such a line of expenses as an additional insurance premium due to piracy in the Gulf of Aden and the Red Sea. That's another $ 120.000. Insurance for passage on the NSR costs $ 70.000 [3].

For comparison, let's give an example of the cost of sending a ship from the port of Yokohama to the port of Kirkines, through the Northern Sea Route, the duration of the journey will be 44 days and $ 500.000 for maintenance, when through the Suez Canal the journey will take 44 days and cost $ 1.000.000, respectively [3].

We also need to compare the distance and time of delivery of various goods through the Suez Canal and the NSR.

The way of the container ship from Murmansk to Japan will be: through the Suez Canal – 12291 miles and 37 days, and through the NSR-6010 miles and 18 days, total savings – 19 days and 6281 miles.

Cargo delivery from Rotterdam to Asian ports (Japan, Republic of Korea, China): through the Suez Canal-an average of 10.600 miles and 33 days, through the NSR 7610 miles and 23 days, total savings – 10 days [3].

The above figures show us that, in theory, the passage through the NSR is cheaper and faster than that through the Suez Canal. However, all these advantages are offset by a number of factors:

- high risks due to outdated infrastructure, poor quality of services;
- lack of icebreaker fleet to escort in the right place and at the right time to avoid the threat of ice compression;
NSR can only be used by vessels with enhanced protection measures against ice and hummocks [4].

The conclusions of section 2 are presented in Table 1.

**Table 1. Comparison of routes through the NSR and through the Suez Canal.**

|                  | The Suez canal     | Northern Sea Route |
|------------------|--------------------|--------------------|
| Distance         | 10,600 miles       | 7,610 miles        |
| Travel time      | 44 days            | 33 days            |
| The cost of the route | 1,000,000 $       | 500,000 $         |
| Pirates          | Yes                | No                 |
| Navigation       | All year round     | 6-7 months         |
| Climatic conditions | Suitable for all loads | Not suitable for many loads |

4. **Prospects for the development of the Northern Sea Route**

Russia invests huge efforts and funds in the development of the NSR, this is clearly demonstrated by the transport strategy for the period up to 2030 on the development of the Northern Sea Route. The following are the main provisions of measures for the goals, objectives and stages of implementation of the Transport Strategy of the Russian Federation for the period up to 2030:

1. Development of the Northern Sea Route:
   - construction of 3 universal nuclear icebreakers of the Russian Maritime Register of Shipping class Icebreaker 9 A2 with a shaft capacity of about 60 MW;
   - construction of 3 diesel-electric icebreakers of the Russian Maritime Register of Shipping Icebreaker 8 AUT2 class with a capacity of about 25 MW on propeller shafts;
   - construction of 2 linear icebreakers of the LK-16 class of the Russian Maritime Register of Shipping Icebreaker 6 AUT1-ICS with two full-turn steering columns with a capacity of 2 x 8 MW [5];
   - construction of 3 hydrographic pilot vessels of the Russian Maritime Register of Shipping KM* Arc 7 class;
   - construction of three shallow-draft pilotage vessels of the Russian Maritime Register of Shipping Ice 3 class.

2. Development of the Northern Sea Route:
   - modernization of berths and port facilities in Dixon, Tiksi, Pevek for the purpose of basing emergency rescue and hydrographic vessels, storage of property of emergency rescue groups (ASG), oil spill response (OSR), bunkering of vessels with fuel, water, replenishment of ship stocks and repair [12];
   - construction and modernization of coastal navigation equipment (SNO);
   - implementation of area survey of the bottom relief of the Arctic seas along the routes of transportation of hydrocarbon raw materials;
   - development of the basic production infrastructure for the creation of publishing originals of navigational charts, manuals and manuals for navigation;
   - creation of onshore production and technological complexes for the repair of navigation equipment in Arkhangelsk, Tiksi, Zeleny Mys, Pevek.

3. Construction of new ports and transshipment complexes for the integrated development of new territories and deposits:
   - development of the oil handling complex in Kozmino Bay (Vostochny port) to increase capacity by 15 million tons;
   - development of production capacities up to 8 million tons of coal of JSC "Daltransugol" (Vanino port);
   - construction of the seaport of Sabetta (Yamal Peninsula) with a capacity of 30.7 million tons, including LNG-25 million tons, GC-2.2 million tons, oil-3.5 million tons;
- construction of a seaport for transshipment of LNG and GC in the area of Teriberskaya Bay (Murmansk region);
- construction of a specialized coal transshipment complex in Muchke Bay (Vanino Port) with a capacity of 45 million tons;
- construction of a coal port in the area of Cape Izylmetyev (Shakhtersk port, Sakhalin Region) with a capacity of 10 million tons [4].

Thus from the text of the Transport strategy there is a clear understanding that SMEs will play an important role in the development of navigation in Russia that will improve as the quality of services in the field of freight transport, and in the future on the basis of the Northern sea route an international transport corridor.

Two groups of factors are important as prospects for the development of the Northern Sea Route. The most important thing is the development of the infrastructure of the Arctic territories, which in turn will lead to an increase in oil and gas production on the Arctic shelf. It is oil and gas that should become the main cargo transported along the Northern Sea Route [6].

An equally important factor may be the transformation of the NSR into an international transit corridor, which will open a new route of cargo transportation between the countries of Asia and Europe [13].

However, the prospects for the development of the NSR face a number of circumstances:
- compliance with the delivery schedule is more important than speed;
- cost savings due to traffic volumes;
- transportation via the NSR is possible only on the route from the starting point to the final point, unlike transportation through the Strait of Malacca, which allows calling at dozens of intermediate ports;
- established supply chain of most of the world's largest shipping companies and a network of counterparties along the route through the Suez Canal [14].

The analysis of the situation allowed us to identify a number of reasons that hinder the development of the NSR:
1) "narrowness" of the niche for transportation;
2) established traditions and principles of maritime transport organization;
3) the absence of large shipping companies that act as transit organizers;
4) lack of modern port terminals [7].

To strengthen Russia's position in the maritime transport market, it will be necessary to provide the NSR with the status of a world transport corridor that meets all the standards of world shipping. In order for the NSR to be perceived not as exotic, it is necessary to increase the cargo flow to 1% of the global sea traffic, which will amount to more than 90 million tons.

Major world powers are not yet ready to consider the NSR as a cost-effective route. However, a well-designed policy for the development of competitive advantages, as well as the attraction of foreign capital for the joint construction of infrastructure, and further reduction of transportation tariffs can raise the importance of the NSR as the most profitable world sea route [8].

5. Forecasts for the development of transit container traffic along the Northern Sea Route
One of the most important segments of the market, for the development of which it is necessary to make efforts, is the transportation of transit containers along the NSR. According to experts, by 2030, if the necessary conditions are created, it is possible to redistribute the transit of container cargo between such countries as Japan, China and South Korea with European countries up to 6 million tons.

The developed model involves the creation of an operator company with state participation and a regular (operating for 9 months a year) Arctic container line between the ports of Murmansk and Petropavlovsk-Kamchatsky. The rationale for the creation and development of this line is given in the works of famous Russian scientist V. S. Zbarashchenko [5].
The calculations showed that it is possible to take 10% of the market of import of container cargo from Asia to the Russian Federation and 5% of the market of international transit from Asia to Europe. The total volume of container traffic on the NSR can reach 455 thousand containers (Figure 1). Thus, the NSR will remain a niche route with its competitive advantages [9].

A year ago, the test transportation of a Maersk container ship along the Northern Sea Route along the Busan-Vladivostok-Nakhodka-Bering Strait-Bremerhaven-St. Petersburg route was successfully completed. Almost the entire route passes through Russian territorial waters.

The press service of Maersk stated that this was done to study the potential of container transportation in northern waters [10]. It is known that the Danish ship spent 26 days on the entire journey instead of the standard 34, without taking into account calls to the ports of Vostochny and Busan [11]. This is not surprising, since the Northern Route is shorter than the Southern One by seven thousand nautical miles. Experts at Maersk assure that they are ready to consider the NSR as a commercial alternative to the existing logistics schemes, domestic experts do not doubt that the Danes have estimated the economic benefits of the new project [9].

6. Conclusion
The development of the Arctic region and the Northern Sea Route is a strategically important task for Russia. Although sea container transportation takes a small share in the total cargo flow, but do not forget that the cost of transportation of container cargo per ton is much higher than liquid or bulk cargo. In addition, the creation of an international container corridor along the Northern Sea Route will reduce transport costs and change the port of Petropavlovsk-Kamchatksky into a major international logistics center. In turn, this will allow one to unload the Trans-Siberian Railway, as well as create the necessary conditions for the formation of infrastructure along the coast of the NSR.

Thus, the study showed the prospects of sea container transportation through the Northern Sea Route, but it is necessary to take into account that the full realization of the competitive advantages of the NSR is impossible without creating a product — international container transportation by the Arctic container line. The income received from the sale of this product will serve to return on
investment, develop the infrastructure of the NSR and ensure the profitability of an important and large-scale project.

References
[1] Likhachev A 2018 PortNews, available at: http://portnews.ru/ne-ws/288164/
[2] Gordeev M 2019 Infranews, available at: http://infranews.ru/logisti-ka/54616-doxydy-egipta-ot-tranzita-sudov-cherez-suec-vyrosli-na-5-do-59-mlrd/
[3] Polyakova I 2019 Northern Sea Route: a vector of development Transport of Russia, available at: http://www.transportrussia.ru/.
[4] Yakovlev M 2019 Arctic road of life, available at: http://yourarctic.com/
[5] D.Ivanov D 2020 The ice is broken Rossiyskaya Gazeta, available at: http://rg.ru/.
[6] Peresypkin V 2020 Development of the Northern Sea Route Morskie Vesti, available at: http://morvesti.ru/.
[7] Semushin D 2019 The first Chinese container ship set off to Europe through the Arctic: prospects for the Northern Sea Route, available at: http://www.regnum.ru/.
[8] Bakylin N 2019 Russia and the Northern Sea Route, available at: http://voprosik.net/
[9] 2008 Transport strategy of the Russian Federation for the period up to 2030 No. 1734-r, available at: https://mintrans.gov.ru/documents/3/1009
[10] 2008 Changes to be made to the order of the Government of the Russian Federation No. 1734-r.
[11] Gordeev I 2020 Northern Sea Route and the Suez Canal DeloNovosti, available at: https://delonovosti.ru/analitika/3921-severnyy-morsk-oy-put-i-sueckiy-kanal.html0
[12] Petrakov V and Roy O 2020 Prospects for the use of the Northern Sea Route for transit container transport, available at: https://cybe-rleninka.ru/article/n/perspektivy-ispolzovaniya-severnogo-morskogo-puti-lya-tranzitnyh-konteynerov
[13] Zbarashchenko V S 2020 Strategic transport corridors. “New Silk Road: Business Cooperation and Prospective of Economic Development” available at: https://www.researchgate.net/publication/340553452_International_Transport_Corridors_Impact_on_Territorial_Development
[14] Nikulin V P 2013 The state of Russian maritime transport, Sea news of Russia