CENTRE FOR
HIGH NORTH LOGISTICS

Port of Grøtsund and future development of the Northern Sea Route

5.5.2020

Summary

Questions for CHNL:

1) *List the different roles/activities the port of Grøtsund could play in the future development of the NSR. Which of these roles/activities would be most important based on the characteristics of Grøtsund/Tromsø area? What is needed or needs to occur to accomplish these goals?*

- A transshipment terminal for transport of containerized frozen fish and meat products between Norway (and NW Europe) and the Asian Pacific market (Japan, China and South Korea) via the NSR.
- A transshipment terminal for other selected containerized cargo between Norway (and Northern Scandinavia) and NE Asia and onward transport by roadways in Northern Scandinavia; competition with the port of Narvik and Kirkenes
- A transshipment terminal for more general containerized cargo between Central Europe and NE Asia via the NSR; dependent of efficient railway connections from Norway through Finland to Central Europe. Competition from Kirkenes.
- Base for temporary storage or direct transshipment of large project cargo from conventional to high ice-class heavy load carriers for Norwegian and Russian Arctic oil and gas installations and mineral projects.
- Base for Norwegian service and support vessels providing logistical support to oil and gas installations in the Barents Sea and also Norwegian vessels providing offshore services along the NSR.
- Base for logistical services for NW Europe-NE Asia transportation, customs clearance and crew changes
- Service and support base for Norwegian oil and gas installations in the Barents Sea – maintenance, repair and providing spare parts, machinery and equipment. Dependent on continued or increase Norwegian offshore oil and gas development; competition from Hammerfest and Kirkenes.

2) *What type of infrastructure is critical so Grøntsund could take on an active role in NSR development? How important is railway connection to reach this goal?*

- Railway connection to Central Europe is essential to establish Grøtsund as a viable transshipment hub for transit cargo via the NSR.
- Storage area for containers and bulk (project) cargo; storage of refrigerated containers
- Industrial facilities for repair of ship and offshore installations and maintenance services; drydocks
- Sufficient berth space to accommodate several vessels at the same time.
- Cranes with efficient loading and unloading capabilities for containerized goods
- Efficient and innovative container inventory system and customs clearance (e.g. blockchain)
- Good road connections to nearby cities in Northern Scandinavia
- High speed and high volume railway connections to Central Europe
- International airport (near-by)
- Renewable energy sources for all port and industrial facilities
- LNG-bunkering for ships

3) *How much volume per different cargo types could be expected for transshipment at Grøtsund to 2030? Which changes in types and volume of cargo can be expected between 2030-2040?*

- It is not expected that Norwegian vessels will be involved in the transport of Russian natural resources along the NSR nor that Norwegian ports will play any significant role in the transshipment and storage of Russian oil, natural gas and mineral resources.
- The only cargo being considered is: a) project cargo shipped to the Russian Arctic from European destinations; b) project cargo shipped to the Norwegian Barents Sea from European destinations; and c) transit cargo in containers or bulk between NW Europe and NE Asia.
- For the construction of the Yamal LNG plant several shipments with prefabricated LNG modules and other project cargo was shipped to the port of Sabetta in 2016 and 2017. Though the prefabricated LNG modules were all built in China and Indonesia most were shipped on heavy load carriers through the Suez Route to Zeebrugge in Belgium (and in few cases some other European ports) for temporary storage or transshipment before onwards delivery to Sabetta. Grøtsund was considered for the same purpose in 2014

4) *How many port-of-calls could be expected per year at Grøtsund tied to shipping on the NSR (to 2030)? How much increase could be expected between 2030-2040?*

5) *What other types of business activities and facilities would strengthen Grøtsund position regarding NSR?*

- Service and support base for Norwegian oil and gas installations in the Barents Sea – maintenance, repair and providing spare parts, machinery and equipment.
- Base for Norwegian service and support vessels providing logistical support to oil and gas installations in the Barents Sea.
- Logistical base for the Norwegian fleet of SAR vessels and coast guard vessels providing support to offshore operations in the Barents Sea; monitoring and surveillance.
- Maintenance and repair base for Norwegian fishing fleet operating in the Barents Sea and maintenance and repair services for the fishing fleet; servicing Russian fishing vessels could also be a future possibilities as has been the case in Kirkenes.
- Establishment of several logistics and transport companies arranging transport of goods between NW Europe and NE Asia.
- Businesses specializing in advance ship technologies for Arctic operations, including ice class technologies and winterization procedures.

6) *Which repercussions could be expected if Grøtsund plans to take an active role in NSR development?*

- The increase activity of the port in this role may boost social and economic development of region. It may also strength the cooperation of the industry/science/authorities in finding innovative solution for arctic logistics.
- Could lead to active political discussion and regional competition between Grøtsund/Tromsø, Kirkenes and Hammerfest as future hubs for Arctic transit shipping. In particular the construction of a railway connection between Northern Norway through Finland to Central Europe is already providing heated political debate.

Comments

The assignment for CHNL identifies issues that initially suggest the existence of various opportunities for the port of Grøtsund in connection with the development of the NSR. Thus, according to the assignment, the role of the Centre is to characterize the opportunities, highlight the most important of them and describe the arrangements necessary for their successful implementation. CHNL also should give a short-term and long-term forecast for the types and quantity of cargo and the number of ship calls.

We believe that in order to fully answer the questions, it is necessary first to raise and answer the question of the availability of potential opportunities for the port in connection with the development of the NSR. That is why, we described the main cargo flows of the NSR and the prospects for their development.

DETAILED REPORT OF CHNL

Introduction

This report briefly discusses the main prerequisites and conditions for realizing potential opportunities of the port of Grøtsund (Norway) related to the development of the Northern Sea Route (NSR). The main provisions of the report are based on an assessment of the last 10 years of the NSR usage for commercial shipping, as well as the announced plans for the NSR development for the future until 2035. We will consider the main reasons and priorities in the development of the NSR, evaluate the existing shipping traffic and the main ongoing projects. Thus, we will define the main functions and significance of the NSR as a new transport line. This will allow us to assess the availability of specific opportunities for the Grøtsund port based on its geographical location, infrastructure and other characteristics.

Role, importance and practices of the NSR 2010-2020

Over the last 10 years, the NSR has received a positive impact for development. The transformation of the NSR has occurred. Until 2010, the NSR was traditionally considered an intra-Russian route, mainly providing for the export of products and the supply of the Norilsk industrial region through the port of Dudinka. Also, the NSR was used for the delivery of supplies to remote settlements of the Russian Arctic (Severnyy Zavoz). Scientific exploration of the Arctic shelf, exploration by oil and gas companies and single voyages related to tourism were also carried out.

In the period 2010-2013, due to a certain deterioration of ice, as well as the availability of free transport capabilities of the nuclear icebreaker fleet and a number of other favorable factors, there was an increase of interest in the NSR as an international transit route from Europe to Asia. There were experimental transit voyages during this period. They showed the technical feasibility of transit passages at a commercial speed, an acceptable level of safety and reliability. Transit traffic will be discussed in details below.

At the same time, planning and implementation of new mining and energy projects in the Arctic region took place with export through the NSR. This direction has become the main driving factor for the development of the NSR infrastructure and the reason for the multiple growth in cargo turnover. From 2011 to 2019, cargo traffic on the NSR increased 10 times from 3.1 million tons to 31.5 million tons.

In May 2018, the President of Russia V.V. Putin signed the Decree “On National Goals and Strategic Tasks for the Development of the Russian Federation for the Period until 2024”, which included paragraph 15-a about the development of the NSR and the increase of its cargo traffic to 80 million tons by 2024. At the moment, this Decree is the central reference point in the formation of the Arctic agenda in Russia.

There are several scenarios for the development of future freight traffic, we will give below the main one. First, consider the current situation. As of March 2020, it is possible to distinguish several key types of traffic that today form shipping traffic on the NSR.

The main types of traffic that form the cargo flow on the NSR

1. Export of minerals from existing projects in the western and eastern directions.

2. Delivery of equipment and supplies for the construction of new terminals and delivery of supplies to remote areas of the NSR.

3. International and intra-Russian transit traffic.

4. Cabotage transportations within the NSR waters including usage of Siberian rivers.

1. Export of minerals from existing projects in the western and eastern directions

The largest project “Yamal LNG” carries out year-round export of LNG from the port of Sabetta to the markets of Europe and the Asia-Pacific region. In 2019, out of 31.5 million tons of the total NSR cargo turnover, the share of LNG exports amounted to 18.3 million tons. Transportation was carried out using temporary transshipment at the port of Honningsvåg or direct voyages to European or Asian ports. In the future, it is planned to implement a shuttle LNG delivery scheme through specially designed offshore transshipment complexes on the Kola Peninsula in Ura-Guba with a capacity of 20.9 million tons per year and on the Kamchatka Peninsula in Bechevinka Bay with a capacity of 21.7 million tons per year. The future LNG cargo flow from “Arctic LNG-2” and “Ob LNG” projects, that are currently under development, will be connected to the same scheme.

Also, from 2018 the port of Sabetta carries out year-round export of gas condensate to Europe. For 12 months of 2019, 40 direct voyages with gas condensate to European ports were completed (Kalundborg, Mongstad, Rotterdam, Slovag, Southwold and Wilhelmshaven).

Besides Sabetta, gas condensate is delivered to Europe from the Pelyatkinskiy gas condensate field through the port of Dudinka. Shipments are year-round, except for the period from mid-May to mid-June. A scheme with offshore transshipment of cargo in the port of Murmansk or direct voyages to Europe is used. In 2019, 7 voyages were made, 2 of them are direct and 5 are with offshore transshipment in the port of Murmansk.

The next major project is the export of oil from the Novoportovskoe field of “Gazpromneft-Yamal” LLC through the stationary ice-resistant shipping terminal “Arctic Gate” located in the area of Cape Kamennyy in the Ob Bay. This project also provides for the shuttle delivery scheme with transshipment through “Umba” floating storage (belonged “RPK Nord” company) in the Kola Bay in the port of Murmansk and further dispatch by conventional vessels to European markets. In 2019, 235 voyages from “Arctic Gate” were made and 7.6 million tons of oil were transported.

Further, it should be noted the export of ore concentrate (Feinstein) and metals from the Norilsk industrial region through the port of Dudinka. Several decades ago, this project led to the construction of the nuclear icebreaker fleet and the organization of year-round navigation in the western part of the NSR. The cargo is delivered from Dudinka to the port of Murmansk for further processing or direct deliveries to Europe. In 2019, 5 specialized container ships from the port of Dudinka completed 70 voyages to Murmansk and 1 voyage to Europe.

Plans for cargo growth

A further increase in the export of mineral resources in order to achieve cargo turnover of 80 million tons by 2024 may have several development options. The relevant ministries and experts put forward various scenarios, but one way or another they are all connected with the growth of export of mineral

raw materials due to the implementation of new projects. In December 2019, the Ministry of Natural Resources of the Russian Federation made a presentation. According to it the main cargo base of the NSR by 2024 will be formed by NOVATEK's projects: “Yamal LNG” and “Arctic LNG-2” (to be launched in 2022) - up to 40 million tons of LNG. Condensate and oil production was estimated at 9.2 million tons (oil from the Novoportovskoe field of “Gazprom Neft” - 7.5 million tons and 1.7 million tons of condensate from LNG projects), the flow of solid minerals from the Norilsk region and cargo to provide deposits’ activities are estimated at 3.2 million tons (total 52.4 million tons).

Already in March 2020, the Ministry of Natural Resources of the Russian Federation updated the estimates for the NSR cargo turnover. According to new prognosis, by 2024 the volume of cargo will reach 82 million tons. An additional 5 million tons are declared due to the transport of timber and various supply cargoes. “Rosneft” and “NNK-Taimyrneftegazdobycha” projects in the Sever Bay were also added, providing for the supplies of oil and gas condensate from the Vankor cluster of “Rosneft”, as well as the Payakhskoye field. It is expected that in 2024, from these projects, the NSR will receive 14.9 million tons of oil. Among them Payakhi oil accounts about a third (5 million tons per year). Another 18 million tons of cargo remains in doubt. This refers to Taimyr coal, which “VostokUgol” company plans to mine and transport via the NSR by 2024. These volumes of coal so far are based only on the company’s statement about the availability of mineral resources in this region; actual reserves have not been confirmed. In addition to the export of mineral raw materials, additional volumes will be provided by supply cargo for existing and under construction industries, deliveries to remote Arctic settlements and transit cargo in the amount of 1 million tons per year according to the Ministry of Transport of the Russian Federation.

The estimates were also supplemented with cargo from small projects: 3.5 million tons of coal are expected from “Severnaya Zvezda”, 500 thousand tons of copper concentrate are expected from “KazMinerals”, “Norilsk Nickel” should supply condensate in addition to metals (100 thousand tons per year from the Pelyatkinskiy deposit), and the “daughter” of LUKOIL - “Ritek” - 100 thousand tons of oil from the Sandibinskoye field. The forecast included even insignificant volumes of cargo from Tomtorskiy (rare-earth), Pavlovskiy (lead-zinc) and Maiskiy (gold ore) deposits, as well as 300 thousand tons of coal from the Zyryansk coal mine in Yakutia.

As we can see, the NSR freight traffic figures are constantly being updated, but the main growth is associated with the export of LNG, oil, gas condensate, ore, coal and rare-earth metals. At the same time, there are no plans for a serious increase in transit traffic at the stage until 2024. Nevertheless, the planned implementation of LNG shipments eastward in winter will actually mean the opening of year-round navigation in the eastern sector of the NSR. The functioning of the icebreaker support, hydrographic support and the experience of winter navigation throughout the NSR will create the prerequisites for the formation of the possibility of year-round international transit in the future.

2. Delivery of equipment and supplies for the construction of new terminals and delivery of supplies to remote areas of the NSR

This paragraph can be conveniently divided into 2 subparagraphs. The first is the traditional deliveries of goods to the Northern Territories of Russia. These transportations are carried out annually in the summer-autumn period of time.

Typically, the NSR is used for “Northern delivery” to 4 regions: the Krasnoyarsk region, the Nenets Autonomous okrug, the Republic of Sakha and the Chukotka Autonomous okrug. Northern delivery begins in June and lasts until November. Fuel, products, construction materials and essential goods are delivered to the remote areas. These goods will continue to be transported further along the NSR, but their share in the total cargo flow is insignificant and will only decrease in the future.

The second part relates to the delivery of construction materials, equipment and supplies for the construction of land and sea infrastructure during the development of new deposits. These transportations are not permanent and arise at the initial stage of the project. So, on the example of "Yamal LNG" project, we see an increase in the transportation of general and bulk cargoes to the port of Sabetta at the stage of construction of the coastal infrastructure and LNG plant. The bulk of the cargo was delivered between 2014-2018. Table 1 below is the CHNL database on shipping traffic for the NSR: excerpt on ship calls at the port of Sabetta in the period 2016-2019. So in 2016 there were 159 voyages to Sabetta for the delivery of general cargo, 48 voyages for the delivery of bulk cargoes and 31 voyages of ships carrying heavy cargo. After the construction of the port and the plant is completed, the number of these transportations decreases. Detailed information is provided in Appendix 1 and Figure 1.

Vessel Type	Ships 2016	Voyages 2016	GRT 2016	Ships 2017	Voyages 2017	GRT 2017	Ships 2018	Voyages 2018	GRT 2018	Ships 2019	Voyages 2019	GRT 2019
General cargo	52	159	1673K	38	112	1130K	21	66	536K	20	57	456K
Heavy Load	23	31	664K	14	19	534K						
Bulk	12	48	756K	5	14	227K	2	4	63K	3	6	97K
Dredger	9	9	59K	4	5	39K	2	2	5K	1	1	3K
Barge	5	5	19K									
Module carrier	2	4	93K									
Total	**103**	**256**	**3263K**	**61**	**150**	**1930K**	**25**	**72**	**604K**	**24**	**64**	**556K**

Table 1.

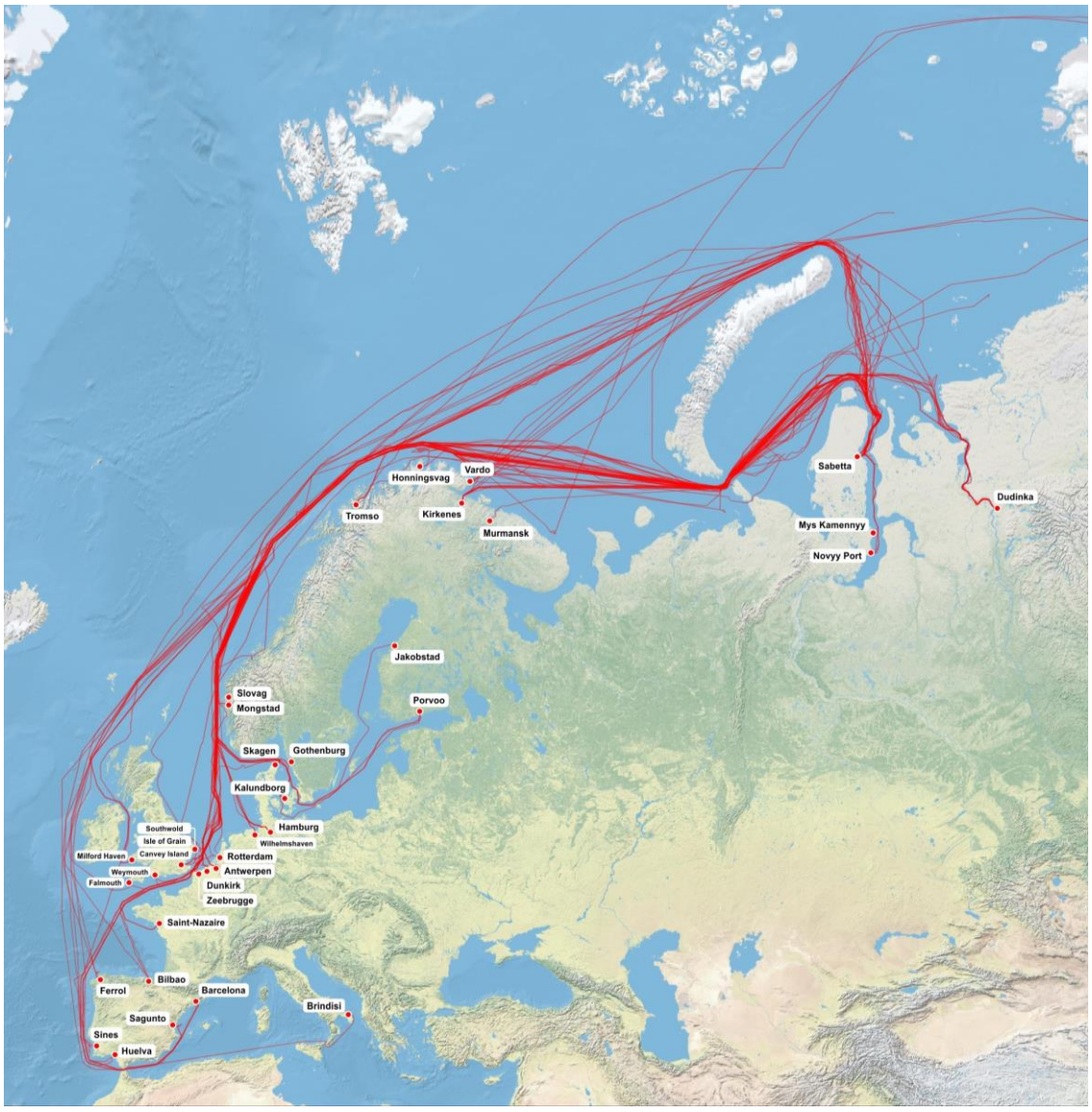


Figure 1. Main links to NSR from Europe ports 2016-2019

3. International and intra-Russian transit traffic

The activation of transit traffic via the NSR began in 2010. Over the past 10 years, in the period 2010-2019, 314 transit passages were made and 5.29 million tons of various cargoes were transported. The five largest transit cargoes include 1,678 thousand tons of oil products, 1,277 thousand tons of gas condensate, 913 thousand tons of iron ore, 240 thousand tons of general cargo and 84 thousand tons of frozen products. In the past 2019, 37 vessels made transit and 697 thousand tons of cargo were transported. This is mainly oil products from west to east - 5 voyages 333 thousand tons; bulk cargo from west to east 3 voyages - 175 thousand tons; and general cargo in a total volume of 169 thousand tons. Among them, 6 transits to the west - 134 thousand tons and 7 transits to the east - 35 thousand tons. According to the data provided by Mikhail Grigoriev in the article “Development of the transit potential of the Northern Sea Route”, from the ports of Norway in the period 2010-2018, 396 thousand tons were sent in transit. Among them 104 thousand tons to China, 76 thousand tons to South Korea, and 217 thousand tons to Japan.

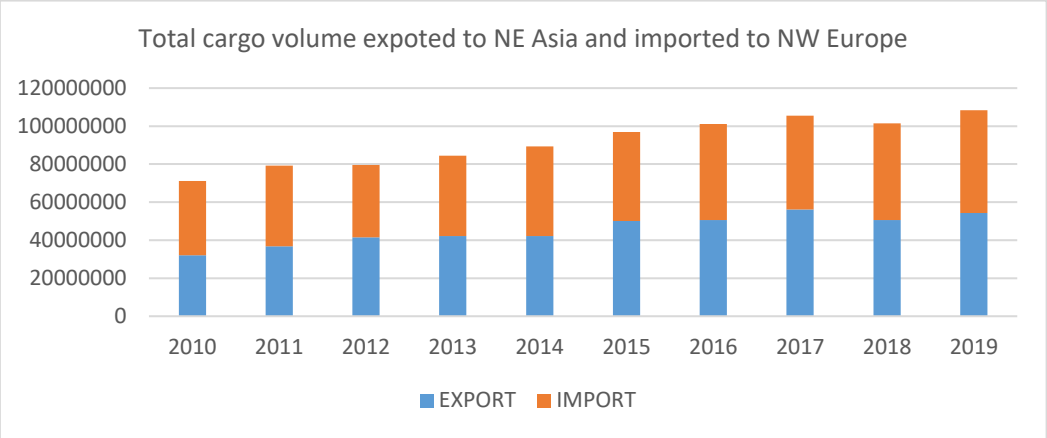
One of the promising areas of transit traffic for the NSR is the transportation of frozen fish products. Summary data in Appendix 2 shows all transits related to fish market via the NSR.

The NSR allows significantly reducing transportation costs by reduction of the distance and passage time. Here is the calculation of the distance at the example of the transportation of frozen products from Norway to Japan in 2016. The vessel “Winter Bay” left the port of Tromsø on August 6, 2016 and already arrived on September 8 at the port of Osaka. The actual distance passed by the vessel between the ports via the NSR was 6,588 nautical miles. The distance via the Suez Canal is 12,116 nautical miles. The difference is approximately 5,528 miles or 45%. The geographical location of Tromsø port is extremely advantageous for transit traffic. In this case, the passage took 33 days. The average speed of the vessel in the area without ice (beyond the NSR) was 9 knots. At this speed, the voyage via the Suez Canal would take about 56 days. The time savings amounted to 23 days in one direction.

Thus, one of the potential directions for the port of Grøtsund is the accumulation and shipping of frozen fish products to Asia via the NSR. However, there is no clear commercial offer and no clear conditions for the transportation of fish via the NSR. For even greater efficiency of transits with frozen fish, it is important to have return cargo. Theoretically, it could be Russian fish from the Far East.

Seaborne trade between NE Asia and NW Europe

13 NW European countries that have seaports (Belgium, Denmark, Sweden, Ireland, The United Kingdom, Poland, Estonia, Latvia, France, The Netherlands, Germany, Finland, and Lithuania) and three NE Asian countries (China, South Korea, and Japan) were included in a quantitative estimate of the volumes of goods transported by sea between two regions. For all of them the Northern Sea Route is geographically the shortest maritime route for international trade.



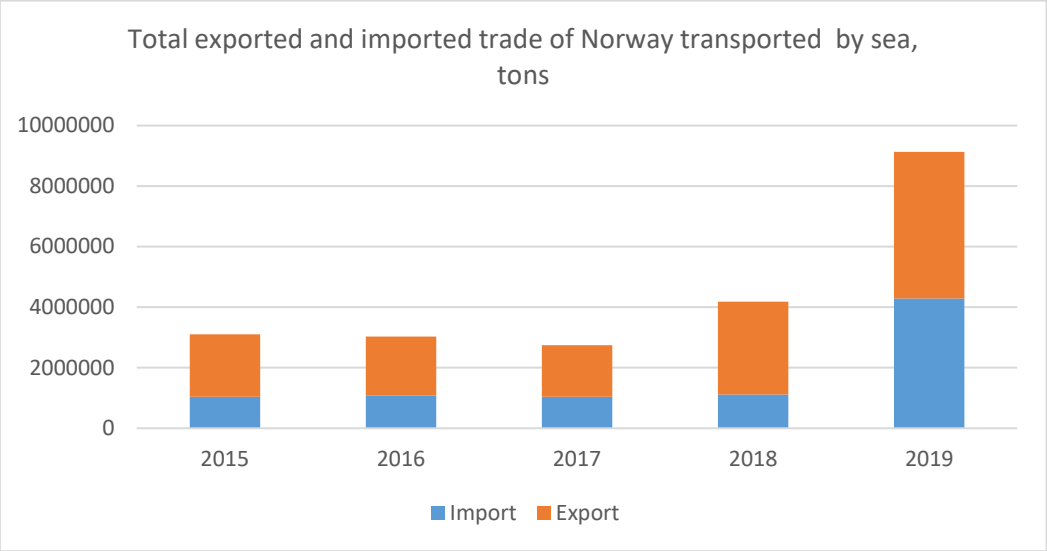
Historical statistics of total trade volume of 99 commodity groups (HS2-HS4 classification) exported and imported by sea between NE Asia and NW Europe show that the total trade volume is growing over the years. In 2019, around 108 mln tons of cargo was transported between two regions, and increase by 6,8% comparing with 2018.

The main 6 commodity groups exported constantly with the biggest volume tonnage to NW Europe from NE Asia during 2015-2019 are: (1) boilers, machinery (incl. nuclear reactors), (2) electrical machinery and equipment, (3) iron and steel, (4) mineral fuels, (5) furniture, and (6) plastic and articles thereof. The seasonality analysis of previous 4 years shows that around 42% of the trade of the biggest 6 commodity groups exported to NW Europe was made from July to December, i.e during the NSR summer navigation season.

The main 6 commodity groups exported constantly with the biggest volume tonnage to NE Asia from NW Europe during 2015-2019 are: (1) mineral fuels, (2) wood and articles of wood, (3) pulp of wood or of other fibrous cellulosic material, (4) plastic and articles thereof, (5) vehicles and parts thereof, and (6) meat and edible meat offal. The seasonality analysis of previous 4 years shows that around 45% of the trade of 6 biggest commodity groups exported to NE Asia is made from July to December, i.e. during the NSR summer navigation season.

Trade between Norway and NE Asia

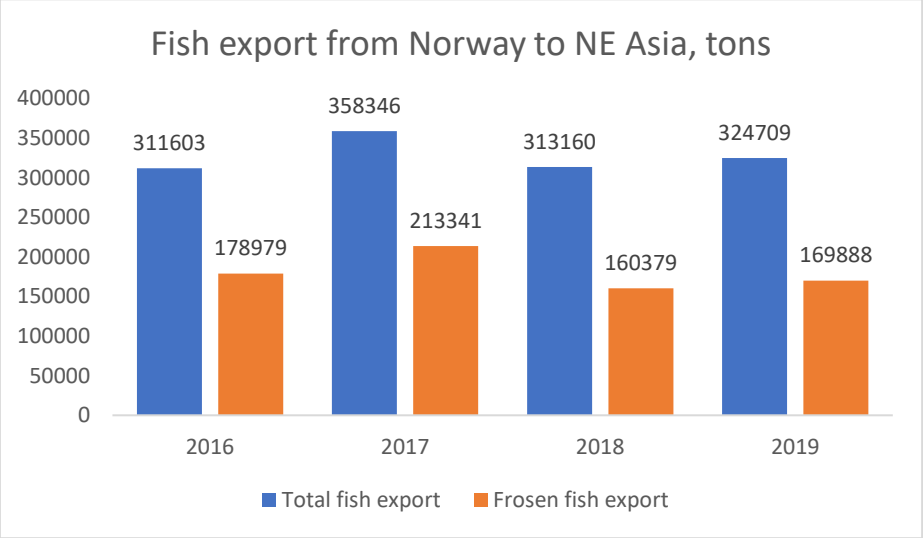
Historical statistics of total trade volume of 64 commodity groups (SITC classification) exported and imported by sea between Norway and NE Asia show that the total trade volume is growing over the years. In 2019, around 9,1 mln tons of cargo was transported between two regions and increase in 118% comparing with 2018.



The main 6 commodity groups exported constantly with the biggest volume tonnage to Norway from NE Asia during 2015-2019 are: (1) non-metallic mineral manufactures, (2) iron and steel, (3) manufactures of metals, (4) electrical machinery and apparatus), (5) feeding stuff for animals (not cereals), and (6) road vehicles. The seasonality analysis of previous 4 years shows that around 49% of the trade of the biggest 6 commodity groups exported to Norway from NE Asia was made during 3rd and 4th quarters, i.e. during the NSR summer navigation season.

The main 6 commodity groups exported constantly with the biggest volume tonnage to NE Asia from Norway during 2015-2019 are: (1) petroleum, petroleum products, (2) chemical materials and products, (3) gas, natural and manufactured, (4) fish, crustaceans, mollusks and prep. thereof, (5) crude fertilizers and crude minerals, and (6) pulp and waste paper. The seasonality analysis of previous 4 years shows that around 68% of the trade of the biggest 6 commodity groups exported to NE Asia from Norway was made during 3d and 4th quarters, i.e. during the NSR summer navigation season.

The statistics of frozen fish market exported from Norway to NE Asia is considered below.



The seasonality analysis of previous 4 years shows that around 60% of the frozen fish volume exported to NE Asia from Norway was made from July to December, i.e. during the NSR summer navigation season.

The development of year-round international transit traffic can take place only with the implementation of plans to provide the NSR with new icebreakers in order to support existing projects and implement new ones, especially with regard to year-round deliveries of LNG to the east. According to the NSR Infrastructure Development Plan, the construction and commissioning of the 1st nuclear icebreaker of "Leader" type is planned for the end of 2027, and the delivery of the second and third icebreakers is expected at the end of 2030 and 2032 respectively. Thus, international year-round transit can receive technical conditions for development no earlier than 2030, with the timely construction of the icebreaking fleet in order to ensure leading NSR projects.

Current main drivers of seaborne trade between NE Asia - NW Europe

Recent study at CHNL showed that the logistics performance of a country plays the most significant role in traffic growth. Logistics performance of country means the efficiency of customs and border management clearance, the quality of trade and transport infrastructure, the ease of arranging competitively priced shipments, the competence and quality of logistics services—trucking, forwarding, and customs brokerage, the ability to track and trace consignments, the frequency with which shipments reach consignees within scheduled or expected delivery times.

4. Cabotage transportations within the NSR waters including usage of Siberian rivers

An important and promising part of the water transport system of the Northern Sea Route is the Siberian rivers adjacent to the NSR. Basically, goods originate within the mainland - in Tyumen, Surgut, Omsk and then go to the north along the rivers. Among the transported cargoes are general, oil products, crushed stone, reinforced concrete, timber. The most popular is crushed stone, followed by machinery, equipment, building materials, reinforced concrete. There are very few cargos in containers, mainly products. 130 fleet units operate in Lena River Shipping Company. The fleet includes a wide variety of vehicles, of various ice classes - tankers, general, river-sea-type container ships, tugboats, barges, floating cranes and others. The main geography of work: The Ob Bay, Sabetta, Salmanovskoe field, the Yenisey Bay and others, it covers the entire coast of the Northern Sea Route.

Yamburg port (located in the Ob Bay) is one of ports for cargo transshipment from river-sea-type ships to sea-type. The port has a deep channel, a railway approach, an asphalt road and is able to send and receive cargo from any port of the world.

In the south of the rivers that can receive cargo from the Arctic seas, there are a large number of cities with million-plus population that consume a large amount of energy, supplies, and raw materials. Return goods can also be sent from there. So, for example, today, oil products are supplied from Surgut. The refinery supplies oil products to the entire north, in particular Arctic fuel.

Sabetta is worth particular noting as a port for transshipment of goods. Initially, the port of Sabetta experienced a large stage of construction work. Now it is an equipped port, with modern cranes, warehouses for storing goods, an airport, and a checkpoint. There are many cargoes for this port, if we consider Sabetta as a transshipment point for cargo from the rivers. It has already been used for transshipment of cargo from ships to barges. Sabetta is becoming a more traditional port, moving away from exclusively specialized purposes.

These transportations will always be limited by summer navigation period and therefore are inferior in terms of efficiency to the railway. Nevertheless, such delivery schemes can be successfully used for project cargo in the summer.

The total number of voyages associated with the NSR including import, export, transit and cabotage transportation in 2019, according to the CHNL database, amounted to 2694 voyages. Internal traffic of the NSR (when the exit port and the port of call are inside the NSR) in 2019 amounted to 557 voyages, which is about 20% of the total number. But the total GRT parameter for all voyages in this type of

transportation is only 2.1 million tons. This is just over 2% of the total GRT total parameter for all transportations to the NSR, which is equal to 97 million tons. 49 companies and 109 vessels participated in cabotage shipments on the NSR. The largest number of voyages - 153 - were made by 20 vessels of the Lena River Shipping Company. Among the transportation directions, the most frequent ones were - 75 between the port of Pevek and Zelenyy Mys.

Most of the projects on the NSR described above are directly linked or even depend on the availability of icebreaker fleet services. Therefore, one of the important aspects of work planning at the NSR is the provision of icebreaking services. In Appendix 3 we present the planned layout of icebreaker fleet positioning by 2035.

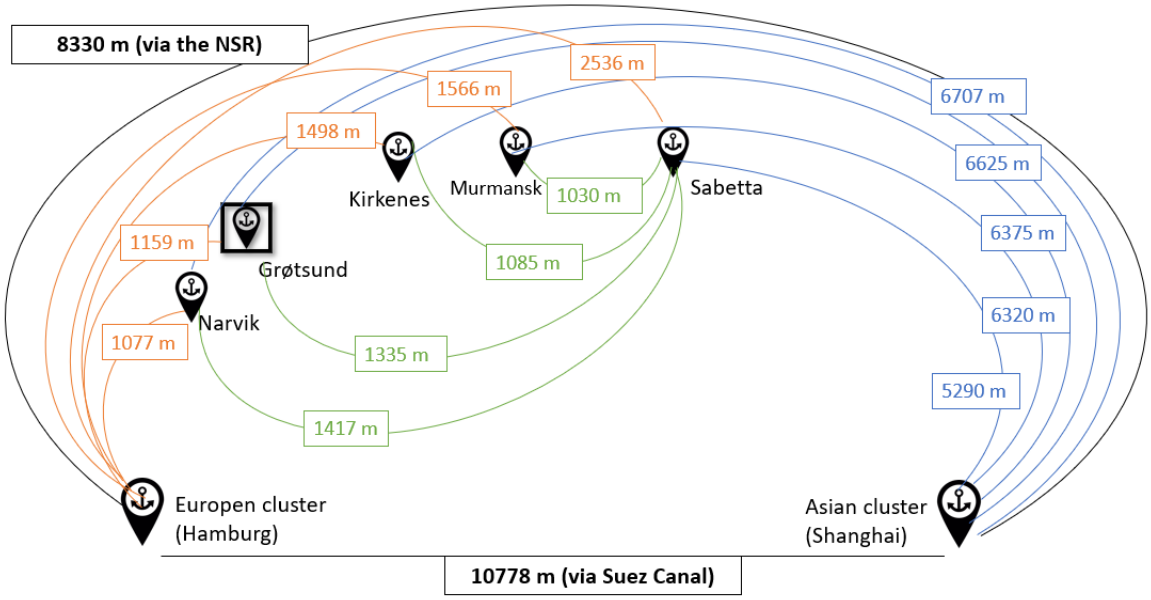


Figure 2. Distance between ports (in nautical miles)

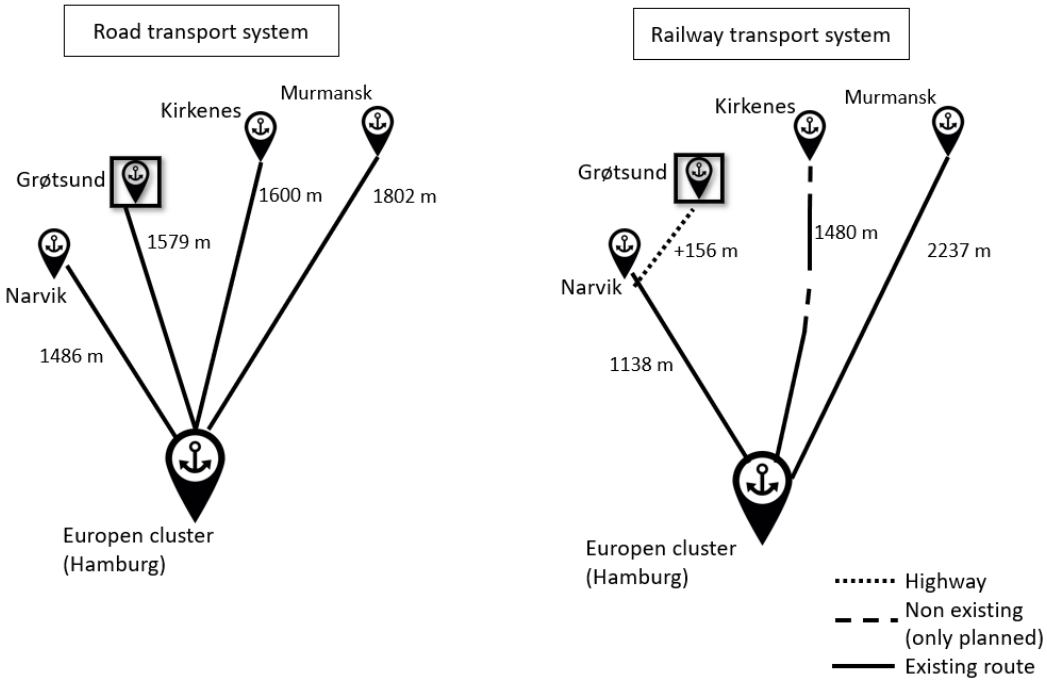


Figure 3. Road and railway network of Northern region (distance in miles)

Main conclusions

Based on the currently available traffic, as well as the expected development of the NSR, we cannot clearly say that the port of Grøtsund has distinct prospects and advantages for development in connection with the NSR. Accordingly, it is impossible to give answers about the quantity and types of cargo, as well as the number of estimated ship calls.

Based on the review of the main existing and promising projects at the NSR, several possible work directions were identified for the port of Grøtsund. The geographical location and characteristics of the port have many advantages. The depths at the berth and the vast areas for storage and transshipment of cargo indicate the potential for handling of project cargo, including heavy and bulky ones, for example, blades for windmills. The relative proximity of the port to the NSR and new Arctic projects allows to position the port as a supply base for the development of new projects in the Arctic. It is important remoteness from residential areas and the possibility of round-the-clock work, the availability of roads, airports, deep-water berths and ice-free waters. An additional benefit would be the availability of a railway.

Nevertheless, we suppose that the existing capabilities of the port allow to participate and compete with other ports that claim to be supply bases in the construction of the infrastructure of large projects in the Arctic. The specific port parameters and the necessary infrastructure will depend on customer requirements, i.e. from specific activities, types of cargoes and timeframe. In general, the port of Grøtsund already has sufficient arrangements to be positioned for such purposes. The location of the port in comparison with other European ports makes it possible to deliver large volumes of cargo in a short time.

To review the example of freight transportations during the supply deliveries to Sabetta port while its construction, plant and terminals, we enclose extracts from the CHNL database of shipping traffic from Europe to the NSR related to these goals.

It should be separately pointed out the prospects for organizing seasonal multimodal export-import transportation of project cargoes through the port of Sabetta or other ports of the NSR, followed by transshipment to river vessels or barges and delivery to the cities of central Russia via the Siberian river system.

The even more obvious prospects that we have identified are related to the accumulation and shipping of frozen fish products to the countries of the Asia-Pacific region by transit via the NSR. Here it is necessary to determine the possibilities of accumulation of large cargo lots and take into account the seasonality of delivery. This issue takes time to gather information and elaborate. The greatest economic efficiency of such transportation occurs when return cargo is available.

As for the export of raw materials from the Russian Arctic, we do not see potential opportunities here. Most projects have well-established delivery schemes through Russian ports. Earlier, ideas were considered several times and even detailed calculations were carried out on the possibility of opening a container line from Europe to Asia, where the port of Murmansk or the port of Kirkenes (if there is a railway to Europe) could become a hub in the western part. Theoretically, the port of Grøtsund could also be considered for such a role. We do not study such possibilities in details, since the whole idea of transit container traffic is based on one so far unconfirmed assumption that it is possible to switch 5-10% of container cargo going to Europe from China and other Asian countries. Such projects will become more relevant in practice, if in the future specific cargo owners interested in the NSR begin to appear. It should be noted the experience of COSCO company, which for several years in the summer-autumn navigation season has been trying to build a seasonal transit line, but the volume of traffic today is insignificant.

Appendix 1. (Additional Excel file.)

Appendix 2.

Year	Vessel name	Vessel type	Departure	Arrival	Cargo (t)
2011	Kommynary Nikolaeva	Refrigerator	P.-Kamchatskiy	St. Petersburg	24 000
	Captain Prykha	Refrigerator	Vladivostok	St. Petersburg	
	Reinfrost	Refrigerator	P.-Kamchatskiy	St. Petersburg	
	Bereg Nadezhdy	Refrigerator	P.-Kamchatskiy	St. Petersburg	
	Kommynary Nikolaeva	Refrigerator	west	east	ballast
	Captain Prykha	Refrigerator	west	east	ballast
2012	Skyfrost	Refrigerator	St. Petersburg	P.-Kamchatskiy	8 265
2013	Kamchatka Harvest	Refrigerator	P.-Kamchatskiy	Alesund	ballast
2014	Odoevsk	Trawler	west	east	ballast
2015	Winter Bay	Refrigerator	Tromso	Osaka	1 938
	Garmoniya	Refrigerator	Nakhodka	Murmansk	2 806
	Garmoniya	Refrigerator	Murmansk	Nakhodka	ballast
	Winter Bay	Refrigerator	P.-Kamchatskiy	St. Petersburg	1 842
	Volk Arktiki	Fishing	P.-Kamchatskiy	Murmansk	ballast
2016	Winter Bay	Refrigerator	Tromso	Osaka	1 625
	Winter Bay	Refrigerator	P.-Kamchatskiy	St. Petersburg	1 874
2017	Volk Arktiki	Fishing	Murmansk	Vladivostok	No info
	Odissey-1	Fishing	P.-Kamchatskiy	Murmansk	No info
	Sunny Lina	Refrigerator	Kaliningrad	Nakhodka	No info
	Garmoniya	Refrigerator	Arkhangelsk	Anadyr	No info
	Winter Bay	Refrigerator	Reykjavik	Osaka	No info
	Winter Bay	Refrigerator	P.-Kamchatskiy	St. Petersburg	1 800
	Garmoniya	Refrigerator	Ossora	Arkhangelsk	3 000
2018	Progress	Refrigerator	Anadyr	Arkhangelsk	2 800
	Progress	Refrigerator	Arkhangelsk	P.-Kamchatskiy	No info
	Jupiter	Fishing	Arkhangelsk	P.-Kamchatskiy	No info
	Venta Maersk	Container	Busan	St. Petersburg	17 000
2019	Simfoniya	Refrigerator	Ossora	Arkhangelsk	2 645
	Garmoniya	Refrigerator	Ossora	Arkhangelsk	2 815
	Simfoniya	Refrigerator	Arkhangelsk	Ossora	ballast
	Garmoniya	Refrigerator	Arkhangelsk	Vladivostok	38
	Alsey	Fishing	Arkhangelsk	P.-Kamchatskiy	ballast
	Tanango	Fishing	Vladivostok	Murmansk	ballast
	Crown Sapphire	Refrigerator	P.-Kamchatskiy	St. Petersburg	7 350
	Rashkov	Fishing	P.-Kamchatskiy	Murmansk	No info
	Sevmorput	Container	P.-Kamchatskiy	St. Petersburg	5 000

Appendix 3. (Map in PDF)