The European Proceedings of
Social & Behavioural Sciences
EpSBS

ISSN: 2357-1330

https://doi.org/10.15405/epsbs.2019.12.05.123

MTSDT 2019

Modern Tools for Sustainable Development of Territories. Special Topic: Project Management in the Regions of Russia

INTERNATIONAL LOGISTICS NORTHERN SEA ROUITE HUBS INFRASTRUCTURE

E. R. Schislyaeva (a), S. E. Barykin (b)*, E. A. Kovalenko (c), S. M. Schislyaev (d)
*Corresponding author

(a) St. Petersburg State Marine Technical University, Lotsmanskaya Ulitsa, 10, Sankt-Peterburg, Russia, schislyaeva@corp.smtu.ru
(b) St. Petersburg State Marine Technical University, Lotsmanskaya Ulitsa, 10, Sankt-Peterburg, Russia, sbe@list.ru
(c) St. Petersburg State Marine Technical University, Lotsmanskaya Ulitsa, 10, Sankt-Peterburg, Russia, kovalenko_1994@mail.ru
(d) Saint Petersburg scientific center RAS, 5 Universitetskaya Nab, Sankt-Peterburg, 199034, Russia, elenabalashova@mail.ru

Abstract

The article uncovers the value of Northern Sea Route (NSR) for the Russian Federation and focuses on study of its prospective development as an international transportation corridor. The aim of this research is to estimate the development potential of the Northern Sea Route as a set of international logistics hubs. The possibility of development of the consistent logistics system to unify all available resources of the Russian Federation in Arctic section for attraction of maximal number of partners and customers is discussed. The purpose of the study is to develop the approach that gives possibility to obtain precise estimations of economic advantages of the North Sea Route in compare with the New Silk Route under the conditions when the actual data is absent. The straw poll (SP) conducted by China Commerce & Logistics Corporation CJSC gave the data that may be used for calculation of expected proportions of use of the New Silk Route (ESR) and the North Sea Route (NSR). The straw poll is a method that gives possibility to obtain more precise estimations. It could be proved that the concept of NSR is elaborated from the point of view of competitive advantages of potentially profitable for Russia traffic artery connecting Europe and East Asia.

Keywords: Intensification of cargo traffic, international infrastructure, logistics hubs, Northern Sea Route, transportation system.

https://doi.org/10.15405/epsbs.2019.12.05.123
Corresponding Author: S. E. Barykin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

The infrastructure of the Northern Sea Route could involve the variety of hubs' port logistics dealing with thousands of daily transfers based on a multimodal transport. A crucial challenge in hub port logistics is to avoid delays in the global supply chain and to ensure deliveries on time by means of optimizing logistics networks. Multi-agent modelling and simulation of a hub port logistics being described from the container management point of view are disclosed in (Zouhaier, Kebair, Serin, & Ben Said, 2013). Two main objectives are examined by Zouhaier et al. (2013). The first one is to assist planning for container handling and transportation in a terminal. The second one is to obtain the tasks synchronization that are performed by machines to minimize shifts and to reduce the waiting time. Complex hub systems are studied in the context of terminal in which multiple transport modes receive and distribute freight to various destinations (Maione, 2008). The hubs could be defined as interchange places in a transport system network where seaways, railways, and motorways intersect. Its role is to provide a platform for the containers transshipment from one mode to another. There could be selected three operations types in a terminal as follows: both the port operations (loading, unloading and berthing of container ship) and the operations of reception and delivery by different modes of transport, as well as the storage activities and containers treatment.

The Northern Sea Route forming the consistent transportation system with the Arctic seas is a transport route through the waters of the Arctic Ocean. Development of the Northern Sea Route influences the function of the Arctic region economic complexes and economy of the country as a whole. Role of the Northern Sea Route depends on several reasonable factors connected with extension of the Northern coastlines, transnational and geopolitical value of the sea navigation in the Arctic zone.

Issues of using the sea route as the international transportation corridor to maximize the positive effects are solved by the Arctic economy. For formalization of cargo traffic planning in the conditions of intensification of the Northern Sea Route use and providing all-year navigation cycle it is necessary to set up the conceptual framework of the logistics hubs development. The Arctic economy takes part in solution of several logistics issues such as providing of travel security of sea transport, servicing of ships, communication centers as well as centers and terminals for cargo processing.

Creation of logistics decisions for the NSR that allow upgrading the transportation system, optimize the use of sea route and strengthen control over security are one of the priorities of Russia's economic development (The North seaway development conception project, 2014).

Efficiency of cargo traffic via the Northern Sea Route is driven by higher costs of competing ways of shipment of goods, equipment and energy source materials to the northern parts of Russia. Looking forward, for development of new deposits of Yamal, Timan-Pechora province, Barents and Kara seas is influenced by the Northern Sea Route itself because of the low cost of logistics component providing the functioning of industrial facilities and infrastructure.

Nowadays, the main ship routes are going through the Suez Canal and the Mediterranean Sea, but even considering the high quality of the process organization when their pass-through system is overloaded waiting in queues may take over two days.

The Northern Sea Route is the shortest way between East Asia and Europe. It covers the territory of the Arctic Ocean seas, such as Barents, Laptev, Chukchi and so on. The major ports of the NSR are

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Murmansk, Arkhangelsk, Naryan Mar, Sabetta, Dudinka, Igarka, Dickson and Pevek. Furthermore, the Dudinka port comprises a border between the Eastern and Western sectors of Arctics. The international value of the Northern Sea Route is very high. The NSR is capable not only make a transportation of goods quicker, but also to significantly reduce of entrepreneurs' costs for passage of the ship.

2. Problem Statement

The aim of this research is to estimate the development potential of the Northern Sea Route as a set of international logistics hubs.

It is worth to interpret logistics hub as logistics parks, multimodal complexes for processing, checking and control of large volumes of cargo. In this case, the goods in logistics hubs are not only stored and handled but also assigned to the routes (Newspaper Transport of Russia – Keys to the Arctic, 2019).

Now the interactive logistics system for the Northern Sea Route is under development. The main goal of this system is to unify all available resources of the Russian Federation in the Arctic section for attraction of maximal number of partners and customers. It is worth to interpret logistics system as a combination of elements that are integrated together as one to control the system's material flows: from raw materials shipment to transportation of the different consolidated cargo to its end consumer. This system has feedbacks that perform certain controlling and accounting functions as well as operations in the logistics area. In the Northern Sea Route context the logistics system is a set of seaways and ports in the Arctic zone that comprise the transportation corridor for Russia, Asia, Europe and the USA (Shcherbakov, 2009).

Turnover raise of goods shipping traffic inside the country between the Far East and North-Western Russia as well as provision of connection of arterial waterways of Asia and Europe under control of the Russian Federation is a top priority task for Russia that can be fulfilled by development and optimization of the NSR's logistic system.

3. Research Questions

One of the most representative routes that, as was proved before, allows saving on the shipping distance via the NSR, is the route from Yokohama, Japan, to Rotterdam in Europe. In this study the certain countries that may benefit because of the shorter distance via the NSR will be discussed (Lee, 2013).

First, for this purpose Europe was conditionally classified into three geographical regions. There are nine Scandinavian countries along the Baltic Sea: Norway, Sweden, Finland, Russia, Estonia, Latvia, Lithuania, Poland, Denmark; and seven countries in Northern Europe: Iceland, Germany, the Netherlands, Belgium, UK and France. Also, the representative ports of three countries on the Iberian Peninsula and the west of the Mediterranean Sea: Portugal, Spain and Italy were analyzed. As for Asia, the analysis included eight large ports in China, Korea, Japan, Taiwan, Hong Kong, the Philippines, Cambodia, Thailand, Singapore and Indonesia. In other words, the North-Western region in Europe and the right-coast Asian countries were chosen for the discussion (Vemy, 2009).

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The shipping distances between the chosen countries sea ports and the Suez Canal may be measured by the Netpas software developed for professional measurement of shipping routes. Nevertheless, up to now there are some difficulties with the Northern Sea Route distance measurement because commercial use of the NSR was not fully started yet. Up to now we have the following measurements: 3184 NM is the distance between the westernmost part of the route (Murmansk) and its easternmost port (Provideniya). Thus, if we will additionally take into account the distance between European ports and Murmansk and between Provideniya and Asian ports from Netpas software, we may obtain the general idea of the NSR's logistics extension with possibility to choose the optimal and economically profitable route for the majority of the world countries.

Using the abovementioned system of optimal route calculation it is possible to derive the value of saving effect in the world logistics. For example, the route from China may be built in a way that reduces shipment distance to region along the Baltic Sea and the eight major ports in Northern Europe. Busan, Korea, may derive benefit from the reduction of distance to Lisbon, Portugal, and Japan also may get a positive result while shipping to Valencia, Spain (Liu & Kronbak, 2015) (Table 01).

Table 01. Distance reduction as per routes via the NSR Measurement unit is nautical mile

COUNTRIES		China								Korea	Japan
		Dalian	Tianjin	Qingdao	Shanghai	Ningbo	Xiamen	Shenzhen	Guangzhou	Busan	Tokyo
Belgium	Antwerp	2629	2621	2527	2289	2265	1328	809	809	3010	3768
Denmark	Aarhus	3325	3317	3223	2986	2961	2024	1505	1505	3706	4464
Estonia	Tallinn	3325	3317	3223	2986	2961	2024	1505	1505	3716	4464
Finland	Helsinki	3325	3317	3223	2986	2961	2024	1505	1505	3706	4464
France	Le Havre	2343	2336	2241	2004	1980	1042	524	524	2725	3483
Germany	Bremen/ Bremerhaven	2992	2984	2890	2652	2628	1690	1172	1172	3373	4131
Iceland	Reykjavik	3397	3389	3295	3057	3033	2096	1577	1577	3787	4536
Ireland	Dublin	2487	2479	2385	2147	2123	1185	667	667	2868	3626
Latvia	Riga	3325	3317	3223	2986	2961	2024	1505	1505	3716	4464
Netherlands	Rotterdam	2701	2693	2599	2361	2337	1400	881	881	3082	3840
Norway	Oslo	3356	3348	3254	3016	2992	2055	1536	1536	3737	4495
Poland	Gdynia	3325	3317	3223	2986	2961	2024	1505	1505	3706	4464
Portugal	Lisbon	682	675	580	343	319	-619	-1138	-1138	1063	1822
Russia	St Petersburg	3325	3317	3223	2986	2961	2024	1505	1505	3706	4464
Sweden	Gothenburg	3325	3317	3223	2986	2961	2024	1505	1505	3706	4464
UK	Felixstowe	2621	2614	2519	2282	2257	1320	801	801	3002	3760

Source: Netpas Distance Program, 2018.

Besides the regions of Korea, China and Japan, the other beneficiaries will be such countries as: Taiwan, Hong Kong and the Philippines. The countries listed may in the same manner create their short routes of shipment to the regions along the Baltic Sea and countries of northern part of Europe. Also it is worth to mention that location of ports in such countries as Viet Nam, Cambodia, Thailand, Singapore and Indonesia has no any influence on the route distance in case if it will be necessary to visit them (Table 02).

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Table 02. Distance reduction as per routes via the NSR Measurement unit is nautical mile (continuation)

Category		Taiwan Kaohsiung	Hong Kong	Philippines Manila	Vietnam Ho Chi Minh	Cambodia Sihanoukville	Thailand Lame Chabang	Singapore	Indonesia Tanjung Priok
Belgium	Antwerp	1263	839	503	-1058	-1099	-1142	-1904	-914
Denmark	Aarhus	1959	1535	1199	-362	-403	-446	-1208	-218
Estonia	Tallinn	1959	1535	1199	-362	-403	-446	-1208	-218
Finland	Helsinki	1959	1535	1199	-362	-403	-446	-1208	-218
France	Le Havre	977	554	217	-1344	-1385	-1427	-2190	-1200
Germany	Bremen/ Bremerhaven	1625	1202	865	-696	-736	-779	-1541	-552
Iceland	Reykjavik	2031	1607	1271	-290	-331	-374	-1136	-146
Ireland	Dublin	1121	697	360	-1200	-1241	-1284	-2046	-1056
Italy	Gioia Tauro	-3230	-3653	-3990	-5551	-5592	-5634	-6396	-5407
Latvia	Riga	1959	1535	1199	-362	-403	-446	-1208	-218
Netherlands	Rotterdam	1335	911	575	-986	-1027	-1070	-1832	-842
Norway	Oslo	1990	1566	1230	-331	-372	-415	-1177	-187
Poland	Gdynia	1959	1535	1199	-362	-403	-446	-1208	-218
Portugal	Lisbon	-684	-1107	-1444	-3005	-3046	-3088	-3851	-3400
Russia	St Petersburg	1959	1535	1199	-362	-403	-446	-1208	-218
Spain	Valencia	-1886	-2309	-2646	-4207	-4248	-4291	-5053	-3524
Sweden	Gothenburg	1959	1535	1199	-362	-403	-446	-1208	-218
UK	Felixstowe	1255	832	495	-1066	-1107	-1150	-1912	-922

Source: Netpas Distance Program, 2018.

4. Purpose of the Study

The purpose of the study is to develop the approach that gives possibility to obtain precise estimations of economic advantages of the North Sea Route in compare with the New Silk Route under the conditions when the actual data is absent.

There are also conflicting opinions that distance saving effect not necessarily guarantees reduction of shipment time. Main reason of this is the fact that vessel speed may be sufficiently reduced in icebound part of the Arctic waters. Thus, calculations should use 18 nautical miles per hour as an average economical speed of the cargo container ship on the route. If it is necessary to enter some adjustments for more precise calculation of transportation savings, you need to take into account the average speed of sailing in iced locations as less than 3 nautical miles per hour. Besides, if on the base of global heating data we assume that the Arctic waters will be opened for operation for three months and allow to move via the NSR, it is possible to take the 700 nautical miles as the permanent icy section. Under condition of route functioning for six months, it is possible to use 300 nautical miles and if it is possible to function the whole year correction for icing is not necessary. Based on this assumption we may estimate the effects of shipment time reduction as shown in Table 03. Moreover, all Chinese ports will not have cost-efficient effect in case if the NSR is accessible only for three months. Besides, for Korea the time saving effect will be minimal: less than one day for the Baltic Sea and North European countries. In case of Japan one or two days may be saved if shipment directed to the countries situated at the northern side of Europe (Lee, Song, & Oh, 2011).

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Table 03. NSR navigation time reduction Measurement unit: days; period is 3 months

Category		China								Korea	Japan
		Dalian	Tianjin	Qingdao	Shanghai	Ningbo	Xiamen	Shenzhen	Guangzhou	Busan	Tokyo
Belgium	Antwerp	-2	-2	-2.3	-2.8	-2.85	-5	-62	-6.19	-1.1	0.6
Denmark	Aarhus	-0.38	-0.38	-0.6	-1.19	-1.19	-3.38	-4.55	-4.55	0.5	2.19
Estonia	Tallinn	-0.38	-0.38	-0.6	-1.19	-1.19	-3.38	-4.55	-4.55	0.5	2.19
Finland	Helsinki	-0.38	-0.38	-0.6	-1.19	-1.19	-3.38	-4.55	-4.55	0.5	2.19
France	Le Havre	-2.65	-2.65	-2.85	-3.5	-3.5	-5.65	-6.85	-6.85	-1.8	0
Germany	Bremen/ Bremerhaven	-1.19	-1.19	-1.38	-2	-2	-4.19	-5.38	-5.38	-0.3	1.5
Iceland	Reykjavik	-0.19	-0.3	-0.5	-1	-1.1	-3.3	-4.5	-4.5	0.65	2.38
Ireland	Dublin	-2.3	-2.38	-2.6	-3.1	-3.19	-5.38	-6.6	-6.6	-1.5	0.3
Italy	Gioia Tauro	-12.38	-12.38	-12.65	13.19	-13.3	-15.38	-16.6	-16.6	-11.5	-9.8
Latvia	Riga	-0.38	-0.38	-0.6	-1.19	-1.19	-3.38	-4.55	-4.55	0.5	2.19
Netherlands	Rotterdam	-1.8	-1.85	-2.1	-2.6	-2.65	-4.85	-6.1	-6.1	-1	0.8
Norway	Oslo	-0.3	-0.38	-0.6	-1.1	-1.19	-3.3	-4.55	-4.55	0.5	2.19
Poland	Gdynia	-0.38	-0.38	-0.6	-1.19	-1.19	-3.38	-4.55	-4.55	0.5	2.19
Portugal	Lisbon	-9.3	-9.3	-9.5	-10.1	-10.1	-12.3	-15.5	-13.5	-8.38	-5.65
Russia	St Petersburg	-0.38	-0.38	-0.6	-1.19	-1.19	-3.38	-4.55	-4.55	0.5	2.19
Spain	Valencia	-9.3	-9.3	-9.5	-10.1	-10.1	-12.3	-13.5	-13.5	-8.1	-6.65
Sweden	Gothenburg	-0.38	-0.38	-0.6	-1.19	-1.19	-3.38	-4.55	-4.55	0.5	2.19
UK	Felixstowe	-2	-2	-2.3	-2.8	-2.85	-5	-6.19	-6.19	-1.1	0.6

Source: Netpas Distance Program, 2018.

Similarly, Taiwan, Hong Kong and the Philippines do not get any advantage from the time saving effect via the NSR if the Arctic waters are open for a 3-month period (Table 04).

Table 04. NSR navigation time reduction (continuation) Measurement unit: days; period is 3 months

Category		Taiwan Kaohsiung	Hong Kong	Philippines Manila	Vietnam Ho Chi Minh	Cambodia Sihanoukville	Thailand Lame Chabang	Singapore	Indonesia Tanjung Priok
Spain	**Valencia**	**-12.5**	**-13.38**	**-14.19**	**-17.8**	**-17.85**	**-18.0**	**-19.8**	**-18.6**
Portugal	Lisbon	-9.65	-10.65	-11.38	-15.1	-15.19	-15.3	-17.0	-15.8
France	Le Havre	-5.8	-6.8	-7.6	-11.19	-11.3	-11.38	-13.19	-11.85
Ireland	Dublin	-5.5	-6.5	-7.3	-10.85	-11.0	-11.1	-12.8	-11.6
Belgium	Antwerp	-5.19	-6.19	-6.85	-10.6	-10.6	-10.65	-12.5	-11.3
UK	Felixstowe	-5.19	-6.19	-7.0	-10.6	-10.65	-10.8	-12.5	-11.3
Netherlands	Rotterdam	-5.0	-6.0	-6.8	-10.38	-10.5	-10.6	-12.3	-11.1
Germany	Bremen/ Bremerhaven	-4.3	-5.3	-6.1	-9.65	-9.8	-9.85	-11.65	-10.38
Russia	St Petersburg	-3.55	-4.5	-5.3	-8.85	-9.0	-9.1	-10.85	-9.65
Poland	Gdynia	-3.55	-4.5	-5.3	-8.85	-9.0	-9.1	-10.85	-9.65
Sweden	Gothenburg	-3.55	-4.5	-5.3	-8.85	-9.0	-9.1	-10.85	-9.65
Denmark	Aarhus	-3.55	-4.5	-5.3	-8.85	-9.0	-9.1	-10.85	-9.65
Finland	Helsinki	-3.55	-4.5	-5.3	-8.85	-9.0	-9.1	-10.85	-9.65
Estonia	Tallinn	-3.55	-4.5	-5.3	-8.85	-9.0	-9.1	-10.85	-9.65
Latvia	Riga	-3.55	-4.5	-5.3	-8.85	-9.0	-9.1	-10.85	-9.65
Norway	Oslo	-3.5	-4.5	-5.3	-8.85	-9.0	-9.1	-10.8	-9.6
Iceland	Reykjavik	-3.38	-4.38	-5.19	-8.8	-8.85	-9.0	-10.65	-9.5
Italy	Gioia Tauro	-15.6	-16.6	-17.3	-21.0	-21.0	-21.1	-22.85	-21.65

Source: Netpas Distance Program, 2018.

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eISSN: 2357-1330

However, if we assume that the route through the Arctic waters will be open the whole year, the vessels will be able to sail with speed 18 nautical miles per hour across all sections of the NSR. Under such conditions, all cargo ships starting their route from ports between Dalian and Ningbo may save nearly five–eight days during goods shipment to Northern Europe. Busan, Korea, may reduce the shipment time to France for six–nine days. Japan also may gain eight–ten days due to time saving using the NSR (NHK, 2013) (Table 05).

Table 05. NSR navigation time reduction Measurement unit: days; period is 12 months

Category		China								Korea	Japan
		Dalian	Tianjin	Qingdao	Shanghai	Ningbo	Xiamen	Shenzhen	Guangzhou	Busan	Tokyo
Belgium	Antwerp	6.095	6.095	5.780	5.290	5.190	3.095	1.850	1.850	7.00	8.650
Denmark	Aarhus	7.650	7.650	7.50	6.850	6.850	4.550	3.50	3.50	8.60	10.290
Estonia	Tallinn	7.650	7.650	7.50	6.850	6.850	4.550	3.50	3.50	8.60	10.290
Finland	Helsinki	7.650	7.650	7.50	6.850	6.850	4.550	3.50	3.50	8.60	10.290
France	Le Havre	5.380	5.380	5.190	4.590	4.590	2.380	1.190	1.190	6.290	8.095
Germany	Bremen/ Bremerhaven	6.850	6.850	6.650	6.095	6.095	3.850	2.650	2.650	7.780	9.60
Iceland	Reykjavik	7.850	7.780	7.60	7.095	7.00	4.850	3.550	3.550	8.780	10.50
Ireland	Dublin	5.780	5.650	5.50	5.00	4.850	2.650	1.510	1.510	6.60	8.380
Italy	Gioia Tauro	-4.290	-4.290	-4.590	-5.095	-5.190	-7.290	-8.50	-8.50	-3.380	-1.650
Latvia	Riga	7.650	7.650	7.50	6.850	6.850	4.550	3.50	3.50	8.60	10.290
Netherlands	Rotterdam	6.290	6.190	6.00	5.50	5.380	3.190	2.00	2.00	7.095	8.850
Norway	Oslo	7.780	7.780	7.50	7.00	6.850	4.780	3.550	3.550	8.650	10.380
Poland	Gdynia	7.650	7.650	7.50	6.850	6.850	4.550	3.50	3.50	8.60	10.290
Portugal	Lisbon	1.595	1.595	1.290	0.779	0.650	-1.380	-2.590	-2.590	2.50	4.190
Russia	St Petersburg	7.650	7.650	7.50	6.850	6.850	4.550	3.50	3.50	8.60	10.290
Spain	Valencia	-1.190	-1.190	-1.380	-2.00	-2.00	-4.190	-5.380	-5.380	-0.290	1.380
Sweden	Gothenburg	7.650	7.650	7.50	6.850	6.850	4.550	3.50	3.50	8.60	10.290
UK	Felixstowe	6.095	6.00	5.780	5.290	5.190	3.095	1.850	1.850	6.850	8.650

Source: Netpas Distance Program, 2018.

Taiwan, Hong Kong and the Philippines will have from one up to five days effect for countries situated at the north of Europe (Table 06).

Table 06. NSR navigation time reduction (continuation) Measurement unit: days; period is 12 months

Country		Taiwan Kaohsiung	Hong Kong	Philippines Manila	Vietnam Ho Chi Minh	Cambodia Sihanoukville	Thailand Lame Chabang	Singapore	Indonesia Tanjung Priok
Belgium	Antwerp	2.850	1.850	1.190	-2.380	-2.50	-2.590	-4.380	-3.190
Denmark	Aarhus	4.490	3.550	2.775	-0.779	-0.850	-1.00	-2.775	-1.595
Estonia	Tallinn	4.490	3.550	2.775	-0.779	-0.850	-1.00	-2.775	-1.595
Finland	Helsinki	4.490	3.550	2.775	-0.779	-0.850	-1.00	-2.775	-1.595
France	Le Havre	2.290	1.290	0.50	-3.095	-3.190	-3.290	-5.095	-3.780
Germany	Bremen/ Bremerhaven	3.780	2.775	2.00	-1.595	-1.650	-1.780	-3.550	-2.290
Iceland	Reykjavik	4.550	3.550	2.850	-0.650	-0.779	-0.850	-2.590	-1.380
Ireland	Dublin	2.590	1.595	0.779	-2.775	-2.850	-3.00	-4.550	-3.50
Italy	Gioia Tauro	-7.50	-8.50	-9.190	-12.775	-12.850	-13.00	-14.780	-13.550
Latvia	Riga	4.490	3.550	2.775	-0.779	-0.850	-1.00	-2.775	-1.595

https://doi.org/10.15405/epsbs.2019.12.05.123
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Netherlands	Rotterdam	3.095	2.095	1.290	-2.290	-2.380	-2.50	-4.190	-3.00
Norway	Oslo	4.590	3.550	2.775	-0.779	-0.850	-1.00	-2.650	-1.510
Poland	Gdynia	4.490	3.550	2.775	-0.779	-0.850	-1.00	-2.775	-1.595
Portugal	Lisbon	-1.595	-2.590	-3.290	-7.00	-7.095	-7.095	-8.850	-7.650
Russia	St Petersburg	4.490	3.550	2.775	-0.779	-0.850	-1.00	-2.775	-1.595
Spain	Valencia	-4.380	-5.290	-6.095	-9.650	-9.780	-9.850	-11.650	-10.50
Sweden	Gothenburg	4.490	3.550	2.775	-0.779	-0.850	-1.00	-2.775	-1.595
UK	Felixstowe	2.850	1.850	1.095	-2.50	-2.590	-2.650	-4.380	-3.190

Source: Netpas Distance Program, 2018.

5. Research Methods

The straw poll (SP) conducted by ChinaMerchants China Commerce & Logistics Corporation CJSC gave the data that may be used for calculation of expected proportions of use of the New Silk Route (ESR) and the North Sea Route (NSR). The straw poll is a method that gives possibility to obtain more precise estimations. That is, respondents are encouraged to choose higher priority options depending on each specific outcome of the events (event scenario), which, in turn, has not yet occurred. In other words, under the conditions when the actual data is absent, the other methods shall be used, such as: traffic volume and capacity for prediction in the process of development of new sea logistics nods.

Advantage of the SP is in possibility for researchers to control the current state of the experiment. None the less, the SP has its own disadvantages that show its limitation as a poll method. Also it is worth to show the presence of certain psychological factors that influence the choice of a particular answer. “Penchant for approval” is the factor that gives respondents the possibility to interpret a questionnaire. The presence of such factor confirms their conscious and unconscious state during answering. Such factor as “Penchant for rationalization” shows how respondents may give artificial answers trying to rationalize their actions. “Bias in answer to the policy” makes respondents think that their answers will influence their decisions and as a result answer respectively. Finally, “biased reaction” makes respondents ignore limitations of facts and react unrealistically. Due to these reasons, to avoid disadvantage of the SP research it is necessary to imagine some hypothetical situation that must correspond to the real conditions, which in turn will lead to the critical poll result that is close to reality (Table 07).

Table 07. Shipment scenarios via the NSR (%)

Cost	Transportation time	% of transportations
120.00%	30	1.00%
110.00%	30	5.00%
100.00%	30	20.00%
80.00%	30	86.00%
70.00%	30	97.00%
120.00%	25	10.00%
110.00%	25	34.00%
100.00%	25	72.00%
80.00%	25	98.00%
70.00%	25	100.00%
120.00%	20	52.00%
110.00%	20	84.00%
100.00%	20	9 6.00%
80.00%	20	100.00%
70.00%	20	100.00%

Source: China Merchants Group, n.d.

https://doi.org/10.15405/epsbs.2019.12.05.123
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eISSN: 2357-1330

Respondents participating in the poll were forwarders and specialists from logistics companies except for liners. Also the poll did not include manufacturing companies as soon as their level of the NSR using now is very low, and this would decrease the accuracy of the poll results.

Factors that were taken into account and set forth above are financial expenses and time. These factors are most important for choice of the shipment route. For the purposes of the poll analysis some factors were excluded, e.g. the following: sea waves in Arctic, port infrastructure, stability of navigation, regularity of transportations, shipboard items delivery methods as well as availability of oil supply bases and port facilities. Exclusion of these factors resulted firstly from labor intensity of the process of transformation of this data into the concrete numbers that in turn complicate the contents of the questionnaire and may negatively impact accuracy of the answers. As for the variants with time variables, it is worth to look upon maximal 10-days saving effects caused by the use of the NSR. Because of this we analyzed three versions of the event outcome (three scenarios): zero time saving effect similar to the current level, five-days saving effect and ten-day saving effect. As for "expenses scenario" the expert advice on asymmetrical elasticity of demand price was analyzed. Thus, we developed five versions of events (scenarios) outcome by distribution expenses for shipment via the NSR for 120, 110, 100, 80 and 70 per cent of cost of existing route via the Suez Canal respectively. At the beginning of the poll the respondents were asked about readiness to use the NSR with variations of cost and time, as well as on the assumption that TEU cost is set up at the level of $1000 ~ 1500 for TEU and the NSR is open for 30 days (Ranger, 2016).

6. Findings

The analysis shows that the share of the Northern Sea Route expected to be around 20 per cent of the total volume of logistics routes provided that the shipment time using the NSR will remain the same as time spent for transportation via the Suez Canal Route (SCR). It is worth to mention that with the same costs of delivery both via the SCR and the NSR the delivery time via the NSR under certain conditions may be reduced by 5 day period.

6.1. Effect of time factor reduction via the NSR

Thus, in this case the share of transportations via the Northern Route will comprise nearly 72 per cent of the total volume of the world sea logistics transportations. Furthermore, it develops that 96 per cent of respondents will choose the NSR if they will be able to save up to 10 days with the same level of expenses as with the standard routes.

Analysis of expenses at using the Northern Sea Route and the Suez Canal Route (SCR) has certain complications due to the influence of many other factors that may change the transportation cost. Nevertheless, the obtained values shown in preceding section may be used for calculation of time saving while choosing the route.

Effect of time factor reduction via the NSR to a considerable degree depends on the extension of the icy sector and on the vessel used in accordance with its ice class and consequently on the period of unrestricted uses of the NCR. It is necessary to note the lack of publicly available data on the established

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period of the NSR operation. However, according to the Arctic Council (AMSA) (Arctic Council, 2016) it is predicted that by 2040 the NSR will be freely used by the transportation vessels 90–100 days per year unaccompanied by ice-breakers because of the global warming. Mark Serreze from the NSIDC, USA predicted that the Arctic ice will fully melt by 2030 if the current meteorological situation will not change. Moreover, the current extension of the icy cover (as per July 2014) was even lower than at the same period of 2007. In view of this situation three stages of Arctic opening were researched: three months in 2018, six months in 2022 and nine months in 2026 in view of future full scale commercialization of the NSR by 2030. The expected time saving is calculated for the use of routes to Europe from six Asian countries along these routes and estimated share of the use of container traffic ports on the NSR that is clearly illustrated in Tables 05–06.

6.2. The raise of transportation volumes via the NSR

It is also predicted that container transportations will reach the level of nearly 3 million TEU in 2030. The transportation volumes via the NSR accounted for 1.6 per cent in 2015 and is planned to be 64.1 per cent in 2030 provided that cost of transportation via the NSR will remain equal to one via the SCR (Table 08).

Table 08. Prediction of cargo transportation via the NSR (%)

NSR cost	Share	2015	2020	2025	2030
120.00%		0.10%	1.19%	4.59%	9.65%
110.00%		0.29%	5.00%	16.85%	31.59%
100.00%		1.59%	16.00%	40.19%	64.10%
80.00%		13.29%	43.29%	69.65%	94.49%
70.00%		20.19%	47.29%	72.10%	96.38%

Source: China Merchants Group, n. d.; AMSA, n.d.

For further research connected with shipments via the NSR we need to analyze the prime cost of the shipment and take further into consideration the fact that critical problems are connected with both the level of prices for oil and oil products for ships and with the way of ice-breaker assistance tariff calculation. Due to the fact that the Arctic route still is in primary phase of development, any research of various risks cannot give the accurate picture related to the price raise index. Also in future it is necessary to make an assessment of insurance for shipment and continue to explore the issue of reduction of logistics transportation expenses by development of the NSR logistics flows.

7. Conclusion

Year by year area of ice cap in Arctic is reducing, which leads to the boom of navigation along the Northern coast. Now navigation by the ice-class ships is possible for three months and with ice-breaker assistance – for whole year. Thus, an alternative to the permanent logistics route between the Far East and Europe appears. Also, development of the Northern Sea Route is strategically important for relations of Russia, China and East Asia, that will have a positive impact on economical and political relations of both countries.

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7.1. The NSR is effective economically

Sea logistics ramp up as a result of the world globalization and expansion of free trade zone enforces advantages of the NSR. Another reason for using the NSR is that the entire industrialized world is committed to the development of unused natural resources in the Arctic Sea. And this is to say nothing of the most important value of the Northern Sea Route as safe pirate-free and shortcut for container transportations between West and East (Mulherin, 2015).

As a result, we may say that the NSR is effective economically because of reduction of finance and time expenditures. And it is essential not to forget about the fact that charges collected by Russia for travel long the NSR also give positive effect for this country.

7.2. The NSR logistics saves transportation time

The SP gathered the answers from 20 per cent of respondents, Korean, Chinese and European cargo shippers and forwarders. 72 per cent of them confirmed that logistics via the NSR may save about 5 days, and 96 per cent of them said that they will choose the NSR if it will allow them to save up to 10 days.

In this context most important thing is the necessity to calculate the relevant level of payment for passage to implement the NSR as a public commercial shipment route. Besides, it is expected that the level of CO will be decreased to protect the environment and obtain the profitable economic effect, if payment for ice-breakers will remain on the level satisfying for contractors.

7.3. There could be suggested five proposals concerning enhancement of the NSR effectiveness

To summarize this research, it is logical to make the following proposals concerning enhancement of the NSR effectiveness: First, it is necessary to have a good approach to calculation and fixing the prices for passage in the framework of the NCR commercial use. Second, it is necessary to make alterations to regulatory environment, i.e. to UNCLOS (UN Convention on the Law of the Sea) and to the Polar Code as well as to the system of amendments related to the NSR. Third, it is necessary to develop the shipping facilities suitable for the NSR as soon as possible. Fourth, it is necessary to provide all economic ties in the framework of the new global co-operation to activate the NSR use in the global logistics scale by creation of logistics hubs. Fifth, it is necessary to develop a program for training of sailors to be ready for the NSR conditions.

Therefore, this research has addressed issue of how to make the NSR commercialization feasible from containerized cargo standpoint. However, it becomes evident that the use of this route has a number of weak points and limitations. Because of forever changing economic situation any results obtained from analysis shown in this study may be altered. Expenses may vary depending upon the transportation costs. Other factors may change as a function of uncontrollable external factors, such as oil prices, demand and offer of ship-owners, political situation, effective environment protection policy, technology level, etc. Because of this some difficulties in analyzing and providing the accurate results were revealed. The

conducted poll was limited from the respondents' number point of view and its sensitiveness to the time and logistics expenses varies depending upon the companies' location.

The analysis concerned only two variables: time and expenses. In reality, there may be other factors, such as regularity of transportations and port infrastructure, which actually influence decisions of shippers and forwarders.

Acknowledgments

We express our gratitude and deep appreciation to Vladimir V. Shcherbakov, Doctor of Economics, Professor, to the head of the scientific school of logistics at the St. Petersburg State University of Economics, for the valuable advice and comments on the article.

References

AMSA. (n.d.). Australian Maritime Safety Authority (Australian Government). Retrieved from https://www.amsa.gov.au/

Arctic Council. (2016). Arctic Marine Shipping Assessment November 25, 2016 Report.

China Merchants Group. (n.d.). Retrieved from http://www.cmhk.com/main/a/2016/a26 /a30448_30530.shtml

Lee, S. W. (2013). Benefit and risk of the northern sea route to the north pacific. In Myron H. Nordquist, John Norton Moore, Aldo Chircop, and Ronan Long (Eds), *The Regulation of Continental Shelf Development: Rethinking International Standards* (pp. 310-318). Leiden, Boston: Martinus Nijhoff Piblishers.

Lee, S. W., Song, J. M., & Oh, Y. S. (2011). Shipping &Port Condition Changes and Throughput Prospects with Opening of the Northern Sea Route. Korea Maritime Institute, Seoul, No. 4, 2011.

Liu, M., & Kronbak, J. (2015). The potential economic viability of using the Northern Sea Route (NSR) as an alternative route between Asia and Europe. *Journal of Transport Geography, 18*(3), 434-444.

Maione, G. (2008). Discrete-event dynamic systems modelling distributed multiagent. Control of intermodal container terminals. In P. Pecherková, M. Flídr, and J. Duník (Eds.), Robotics, Automation and Control (pp. 39-58). Vienna, Austria: InTech. https://doi.org/10.5772/5827

Mulherin, N. D. (2015). The Northern Sea Route: Its development and evolving state of operations in 2020s. *CRREL Report, 96*(3), 84-91.

Netpas Distance Program. (2018). Fridtj of Nansens Institute (FNI) December, 2018. Retrieved from https://portal.netpas.net/information/bunkerPrice.php

Newspaper Transport of Russia – Keys to the Arctic (2019) Retrieved June 25, 2019, from http://press.rzd.ru/smi/public/ru?STRUCTURE_ID=2&layer_id=5050&id=3 06946

NHK. (2013). Read Asia: Development of the Arctic ocean new route, the logistics of the world will change, 2013.

Ranger, C. L. (2016). *The Northern Sea Route, Norden Association's Yearbook*. Stockholm: Rosatomflot. Retrieved from http://www.rosatomflot.ru

Shcherbakov, V. V. (2009). *The basics of logistics: a textbook for high schools*. St. Petersburg: Peter.

The North Seaway development conception project. (2014). Retrieved June 25, 2019, from https://helion-ltd.ru/role/

Vemy, J. (2009). Container shipping on the Northern Sea Route, International Transport Forum, 2009.

Zouhaier, H., Kebair, F., Serin, F., & Ben Said, L. (2013). Multi-agent modeling and simulation of a hub port logistics. In *2013 International Conference on Control, Decision and Information Technologies (CoDIT)* (pp. 671-676). Hammamet, Tunisia: IEEE. https://doi.org/10.1109/CoDIT.2013.6689623