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Development of Logistics Hubs in Case of Intensification of International Cargo Traffic via the Northern Sea Route

Elena Schislyaeva
Vice-Rector for Educational Activities
St. Petersburg State Marine Technical University
St. Petersburg, Russia
schislyaeva@corp.smtu.ru

Sergey Barykin
Department of International Economic Relations
St. Petersburg State Marine Technical University
St. Petersburg, Russia
sbe@list.ru

Egor Kovalenko
Department of Economics
St. Petersburg State Marine Technical University
St. Petersburg, Russia
kovalenko_1994@mail.ru

Sergey Schislyaev
Saint Petersburg scientific center RAS
St. Petersburg State Marine Technical University
St. Petersburg, 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 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 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—Northern Sea Route, logistics system, transportation corridor, Arctic economics, navigation, shipbuilding, sea logistics, cargo traffic, atomic icebreakers.

I. INTRODUCTION

From the logistics point of view the Northern Sea Route is a transport route through the waters of the Arctic Ocean, which forms the consistent transportation system with the Arctic seas.

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 [13].

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 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.

II. MATERIALS AND METHOD

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 [14].

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 [12]. 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.

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.

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.

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.

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.

TABLE I. 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***
Russia	St Petersburg	3.325	3.317	3.223	2.986	2.961	2.024	1.505	1.505	3.706	4.464
Poland	Gdynia	3.325	3.317	3.223	2.986	2.961	2.024	1.505	1.505	3.706	4.464
Sweden	Gothenburg	3.325	3.317	3.223	2.986	2.961	2.024	1.505	1.505	3.706	4.464
Norway	Oslo	3.356	3.348	3.254	3.016	2.992	2.055	1.536	1.536	3.737	4.495
Denmark	Aarhus	3.325	3.317	3.223	2.986	2.961	2.024	1.505	1.505	3.706	4.464
Finland	Helsinki	3.325	3.317	3.223	2.986	2.961	2.024	1.505	1.505	3.706	4.464
Estonia	Tallinn	3.325	3.317	3.223	2.986	2.961	2.024	1.505	1.505	3.716	4.464
Latvia	Riga	3.325	3.317	3.223	2.986	2.961	2.024	1.505	1.505	3.716	4.464
Lithuania	Klaipeda	3.325	3.317	3.223	2.986	2.961	2.024	1.505	1.505	3.716	4.464
Iceland	Reykjavik	3.397	3.389	3.295	3.057	3.033	2.096	1.577	1.577	3.787	4.536
Germany	Bremen/ Bremerhaven	2.992	2.984	2.890	2.652	2.628	1.690	1.172	1.172	3.373	4.131
Netherlands	Rotterdam	2.701	2.693	2.599	2.361	2.337	1.400	881	881	3.082	3.840
Belgium	Antwerp	2.629	2.621	2.527	2.289	2.265	1.328	809	809	3.010	3.768
UK	Felixstowe	2.621	2.614	2.519	2.282	2.257	1.320	801	801	3.002	3.760
Ireland	Dublin	2.487	2.479	2.385	2.147	2.123	1.185	667	667	2.868	3.626
France	Le Havre	2.343	2.336	2.241	2.004	1.980	1.042	524	524	2.725	3.483
Portugal	Lisbon	682	675	580	343	319	-619	-1.138	-1.138	1.063	1.822

Source: Netpas program 2015

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 II. 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
Russia	St Petersburg	1.959	1.535	1.199	-362	-403	-446	-1.208	-218
Poland	Gdynia	1.959	1.535	1.199	-362	-403	-446	-1.208	-218
Sweden	Gothenburg	1.959	1.535	1.199	-362	-403	-446	-1.208	-218
Norway	Oslo	1.990	1.566	1.230	-331	-372	-415	-1.177	-187
Denmark	Aarhus	1.959	1.535	1.199	-362	-403	-446	-1.208	-218
Finland	Helsinki	1.959	1.535	1.199	-362	-403	-446	-1.208	-218
Estonia	Tallinn	1.959	1.535	1.199	-362	-403	-446	-1.208	-218
Latvia	Riga	1.959	1.535	1.199	-362	-403	-446	-1.208	-218
Lithuania	Klaipeda	1.959	1.535	1.199	-362	-403	-446	-1.208	-218
Iceland	Reykjavik	2.031	1.607	1.271	-290	-331	-374	-1.136	-146
Germany	Bremen/ Bremerhaven	1.625	1.202	865	-696	-736	-779	-1.541	-552
Netherlands	Rotterdam	1.335	911	575	-986	-1.027	-1.070	-1.832	-842
Belgium	Antwerp	1.263	839	503	-1.058	-1.099	-1.142	-1.904	-914
UK	Felixstowe	1.255	832	495	-1.066	-1.107	-1.150	-1.912	-922
Ireland	Dublin	1.121	697	360	-1.200	-1.241	-1.284	-2.046	-1.056
France	Le Havre	977	554	217	-1.344	-1.385	-1.427	-2.190	-1.200
Portugal	Lisbon	-684	-1.107	-1.444	-3.005	-3.046	-3.088	-3.851	-3.400
Spain	Valencia	-1.886	-2.309	-2.646	-4.207	-4.248	-4.291	-5.053	-3.524
Italy	Gioia Tauro	-3.230	-3.653	-3.990	-5.551	-5.592	-5.634	-6.396	-5.407

Source: Netpas program 2015

III. RESULTS

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 3. 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.

TABLE III. 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*
Russia	St Petersburg	-0.4	-0.4	-0.6	-1.2	-1.2	-3.4	-4.6	-4.6	0.5	2.2
Poland	Gdynia	-0.4	-0.4	-0.6	-1.2	-1.2	-3.4	-4.6	-4.6	0.5	2.2
Sweden	Gothenburg	-0.4	-0.4	-0.6	-1.2	-1.2	-3.4	-4.6	-4.6	0.5	2.2
Norway	Oslo	-0.3	-0.4	-0.6	-1.1	-1.2	-3.3	-4.6	-4.6	0.5	2.2
Denmark	Aarhus	-0.4	-0.4	-0.6	-1.2	-1.2	-3.4	-4.6	-4.6	0.5	2.2
Finland	Helsinki	-0.4	-0.4	-0.6	-1.2	-1.2	-3.4	-4.6	-4.6	0.5	2.2
Estonia	Tallinn	-0.4	-0.4	-0.6	-1.2	-1.2	-3.4	-4.6	-4.6	0.5	2.2
Latvia	Riga	-0.4	-0.4	-0.6	-1.2	-1.2	-3.4	-4.6	-4.6	0.5	2.2
Lithuania	Klaipeda	-0.4	-0.4	-0.6	-1.2	-1.2	-3.4	-4.6	-4.5	0.5	2.2

Category		China								Korea	Japan
		Dalian	*Tianjin*	*Qingdao*	*Shanghai*	*Ningbo*	*Xiamen*	*Shenzhen*	*Guangzhou*	*Busan*	*Tokyo*
Iceland	Reykjavik	-0.2	-0.3	-0.5	-1.0	-1.1	-3.3	-4.5	-4.5	0.7	2.4
Germany	Bremen/ Bremerhaven	-1.2	-1.2	-1.4	-2.0	-2.0	-4.2	-5.4	-5.4	-0.3	1.5
Netherlands	Rotterdam	-1.8	-1.9	-2.1	-2.6	-2.7	-4.9	-6.1	-6.1	-1.0	0.8
Belgium	Antwerp	-2.0	-2.0	-2.3	-2.8	-2.9	-5.0	-62	-6.2	-1.1	0.6
UK	Felixstowe	-2.0	-2.0	-2.3	-2.8	-2.9	-5.0	-6.2	-6.2	-1.1	0.6
Ireland	Dublin	-2.3	-2.4	-2.6	-3.1	-3.2	-5.4	-6.6	-6.6	-1.5	0.3
France	Le Havre	-2.7	-2.7	-2.9	-3.5	-3.5	-5.7	-6.9	-6.9	-1.8	-0.0
Portugal	Lisbon	-9.3	-9.3	-9.5	-10.1	-10.1	-12.3	-15.5	-13.5	-8.4	-5.7
Spain	Valencia	-9.3	-9.3	-9.5	-10.1	-10.1	-12.3	-13.5	-13.5	-8.1	-6.7
Italy	Gioia Tauro	-12.4	-12.4	-12.7	13.2	-13.3	-15.4	-16.6	-16.6	-11.5	-9.8

Source: Netpas program 2015

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 IV. 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
Russia	St Petersburg	-3.6	-4.5	-5.3	-8.9	-9.0	-9.1	-10.9	-9.7
Poland	Gdynia	-3.6	-4.5	-5.3	-8.9	-9.0	-9.1	-10.9	-9.7
Sweden	Gothenburg	-3.6	-4.5	-5.3	-8.9	-9.0	-9.1	-10.9	-9.7
Norway	Oslo	-3.5	-4.5	-5.3	-8.9	-9.0	-9.1	-10.8	-9.6
Denmark	Aarhus	-3.6	-4.5	-5.3	-8.9	-9.0	-9.1	-10.9	-9.7
Finland	Helsinki	-3.6	-4.5	-5.3	-8.9	-9.0	-9.1	-10.9	-9.7
Estonia	Tallinn	-3.6	-4.5	-5.3	-8.9	-9.0	-9.1	-10.9	-9.7
Latvia	Riga	-3.6	-4.5	-5.3	-8.9	-9.0	-9.1	-10.9	-9.7
Lithuania	Klaipeda	-3.6	-4.5	-5.3	-8.9	-9.0	-9.1	-10.9	-9.7
Iceland	Reykjavik	-3.4	-4.4	-5.2	-8.8	-8.9	-9.0	-10.7	-9.5
Germany	Bremen/ Bremerhaven	-4.3	-5.3	-6.1	-9.7	-9.8	-9.9	-11.7	-10.4
Netherlands	Rotterdam	-5.0	-6.0	-6.8	-10.4	-10.5	-10.6	-12.3	-11.1
Belgium	Antwerp	-5.2	-6.2	-6.9	-10.6	-10.6	-10.7	-12.5	-11.3
UK	Felixstowe	-5.2	-6.2	-7.0	-10.6	-10.7	-10.8	-12.5	-11.3
Ireland	Dublin	-5.5	-6.5	-7.3	-10.9	-11.0	-11.1	-12.8	-11.6
France	Le Havre	-5.8	-6.8	-7.6	-11.2	-11.3	-11.4	-13.2	-11.9
Portugal	Lisbon	-9.7	-10.7	-11.4	-15.1	-15.2	-15.3	-17.0	-15.8
Spain	Valencia	-12.5	-13.4	-14.2	-17.8	-17.9	-18.0	-19.8	-18.6
Italy	Gioia Tauro	-15.6	-16.6	-17.3	-21.0	-21.0	-21.1	-22.9	-21.7

Source: Netpas program 2015

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.

TABLE V. 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*
Russia	St Petersburg	7.7	7.7	7.5	6.9	6.9	4.7	3.5	3.5	8.6	10.3
Poland	Gdynia	7.7	7.7	7.5	6.9	6.9	4.7	3.5	3.5	8.6	10.3

Sweden	Gothenburg	7.7	7.7	7.5	6.9	6.9	4.7	3.5	3.5	8.6	10.3

Category		**China**								**Korea**	**Japan**
		Dalian	***Tianjin***	***Qingdao***	***Shanghai***	***Ningbo***	***Xiamen***	***Shenzhen***	***Guangzhou***	***Busan***	***Tokyo***
Norway	Oslo	7.8	7.8	7.5	7.0	6.9	4.8	3.6	3.6	8.7	10.4
Denmark	Aarhus	7.7	7.7	7.5	6.9	6.9	4.7	3.5	3.5	8.6	10.3
Finland	Helsinki	7.7	7.7	7.5	6.9	6.9	4.7	3.5	3.5	8.6	10.3
Estonia	Tallinn	7.7	7.7	7.5	6.9	6.9	4.7	3.5	3.5	8.6	10.3
Latvia	Riga	7.7	7.7	7.5	6.9	6.9	4.7	3.5	3.5	8.6	10.3
Lithuania	Klaipeda	7.7	7.7	7.5	6.9	6.9	4.7	3.5	3.5	8.6	10.3
Iceland	Reykjavik	7.9	7.8	7.6	7.1	7.0	4.9	3.7	3.7	8.8	10.5
Germany	Bremen/ Bremerhaven	6.9	6.9	6.7	6.1	6.1	3.9	2.7	2.7	7.8	9.6
Netherlands	Rotterdam	6.3	6.2	6.0	5.5	5.4	3.2	2.0	2.0	7.1	8.9
Belgium	Antwerp	6.1	6.1	5.8	5.3	5.2	3.1	1.9	1.9	7.0	8.7
UK	Felixstowe	6.1	6.0	5.8	5.3	5.2	3.1	1.9	1.9	6.9	8.7
Ireland	Dublin	5.8	5.7	5.5	5.0	4.9	2.7	1.5	1.5	6.6	8.4
France	Le Havre	5.4	5.4	5.2	4.6	4.6	2.4	1.2	1.2	6.3	8.1
Portugal	Lisbon	1.6	1.6	1.3	0.8	0.7	-1.4	-2.6	-2.6	2.5	4.2
Spain	Valencia	-1.2	-1.2	-1.4	-2.0	-2.0	-4.2	-5.4	-5.4	-0.3	1.4
Italy	Gioia Tauro	-4.3	-4.3	-4.6	-5.1	-5.2	-7.3	-8.5	-8.5	-3.4	-1.7

Source: Netpas program 2015

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

TABLE VI. 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**
Russia	St Petersburg	4.5	3.6	2.8	-0.8	-0.9	-1.0	-2.8	-1.6
Poland	Gdynia	4.5	3.6	2.8	-0.8	-0.9	-1.0	-2.8	-1.6
Sweden	Gothenburg	4.5	3.6	2.8	-0.8	-0.9	-1.0	-2.8	-1.6
Norway	Oslo	4.6	3.6	2.8	-0.8	-0.9	-1.0	-2.7	-1.5
Denmark	Aarhus	4.5	3.6	2.8	-0.8	-0.9	-1.0	-2.8	-1.6
Finland	Helsinki	4.5	3.6	2.8	-0.8	-0.9	-1.0	-2.8	-1.6
Estonia	Tallinn	4.5	3.6	2.8	-0.8	-0.9	-1.0	-2.8	-1.6
Latvia	Riga	4.5	3.6	2.8	-0.8	-0.9	-1.0	-2.8	-1.6
Lithuania	Klaipeda	4.5	3.6	2.8	-0.8	-0.9	-1.0	-2.8	-1.6
Iceland	Reykjavik	4.7	3.7	2.9	-0.7	-0.8	-0.9	-2.6	-1.4
Germany	Bremen/ Bremerhaven	3.8	2.8	2.0	-1.6	-1.7	-1.8	-3.6	-2.3
Netherlands	Rotterdam	3.1	2.1	1.3	-2.3	-2.4	-2.5	-4.2	-3.0
Belgium	Antwerp	2.9	1.9	1.2	-2.4	-2.5	-2.6	-4.4	-3.2
UK	Felixstowe	2.9	1.9	1.1	-2.5	-2.6	-2.7	-4.4	-3.2
Ireland	Dublin	2.6	1.6	0.8	-2.8	-2.9	-3.0	-4.7	-3.5
France	Le Havre	2.3	1.3	0.5	-3.1	-3.2	-3.3	-5.1	-3.8
Portugal	Lisbon	-1.6	-2.6	-3.3	-7.0	-7.1	-7.1	-8.9	-7.7
Spain	Valencia	-4.4	-5.3	-6.1	-9.7	-9.8	-9.9	-11.7	-10.5
Italy	Gioia Tauro	-7.5	-8.5	-9.2	-12.8	-12.9	-13.0	-14.8	-13.6

Source: Netpas program 2015

IV. DISCUSSION

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

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.

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. Table below shows results of the SP analysis. 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.

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 encouraged to choose higher priority options depending on 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. 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.

TABLE VII. SHIPMENT SCENARIOS VIA THE NSR (%)

Cost via NSR	Transportation time via NSR	% of transportations via NSR
120%	30days	1%
110%	30days	5%
100%	30days	20%
80%	30days	86%
70%	30days	97%
120%	25days	10%
110%	25days	34%
100%	25days	72%
80%	25days	98%
70%	25days	100%
120%	20days	52%
110%	20days	84%
100%	20days	96%
80%	20days	100%
70%	20days	100%

Source: ChinaMerchants China Commerce & Logistics Corporation CJSC 2018

V. PERSPECTIVES

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 period of the NSR operation. However, according to the Arctic Council (AMSA) (2015) 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 5–6. 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 VIII. PREDICTION of cargo transportation via the NSR (%)

NSR cost	Share	2015	2020	2025	2030
120%		0.1%	1.2%	4.6%	9.7%
110%		0.3%	5.0%	16.9%	31.6%
100%		1.6%	16.0%	40.2%	64.1%
80%		13.3%	43.3%	69.7%	94.5%
70%		20.2%	47.3%	72.1%	96.4%

Source: ChinaMerchants China Commerce & Logistics Corporation CJSC 2018; AMSA (2015)

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.

VI. 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.

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.

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.

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.

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.

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