

A Study on the Northern Sea Route and its Economic Feasibility

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Table of Contents

1. Abstract.....	p. 3
2. Introduction.....	p. 4
3. Literature Review.....	p.4
4. Definition of the Northern Sea Route and Its Development Through the Years...	p. 6
-Definition of the Northern Sea Route (NSR).....	p.6
-NSR's Development Through the Years.....	p. 5
5. Temperature Changes and Ice Conditions along NSR.....	p. 6
6. Shipping Economic Factors.....	p. 7
-Advantages.....	p. 8
<i>Shorter Distance/Voyage Time</i>	p. 8
<i>Less CO2 Global Emission</i>	p. 8
-Disadvantages.....	p. 8
<i>Little or No Technological Support</i>	p. 9
<i>High Cost for the Qualified NSR Vessels</i>	p.9
<i>Transportation Fees</i>	p. 9
<i>Time-Consuming Procedures to be Followed when NSR is used</i>	p. 9
<i>Russian NSR Fees</i>	p. 10
<i>Operating Costs</i>	p. 11
<i>Environmental Consequences</i>	p. 11
7. Limitations/Suggestions for Future Research.....	p. 11
8. Conclusion.....	p. 11
9. References.....	p. 13

Abstract

Future predictions support that Suez Canal will not be able to compensate the increasing size of ships that are used for trade between Asia and Europe. Relevant studies (Verny & Grigentin, 2009) also indicate that the economic growth of China is moving from the Southeast to the North. Therefore, alternative routes need to be considered in order to minimize transportation costs and satisfy demand of the traded containerized products between Northern Europe and Northern China. One of those alternative routes is considered to be Northern Sea Route (NSR). This research paper, thus, examines the economic feasibility of this route taking into account both the advantages and disadvantages that this route has to offer.

1. Introduction

The economic aspect of globalization began right after World War II when the demand for merchandised trade across natural and national borders grew stronger. This caused intercontinental exchanges between the countries. One of the greatest geographical changes came with the opening of Suez and Panama canals in 1869 and 1914 respectively. However, as the container traffic grew rapidly in the four last decades the demand for greater capacity of the international commercial network increased. Relevant studies indicate that in the future the volume of containerized cargo between Asia and Europe will be increased more than 600% (Verny & Grigentin, 2009, p. 109). Based on this, it is possible that this trade route will reach its capacity limitations for the container ships in the near future since, despite its expansion in 2015, the Suez Canal might not be able to compensate the increasing size of container ships.

Another reason why Suez Canal will probably cease to be the most preferred shipping route in the near future is because of the predictions that indicate that the economic growth of China is moving from the Southeast to the North because Asian mother ships start to indicate a preference for the Northern China instead of the Southeast Asia (Verny & Grigentin, 2009). Therefore, alternative routes need to be considered in order to satisfy demand of the traded containerized products between Northern Europe and Northern China. One of the alternative shipping routes is Northern Sea Route (NSR) which has seen little use but now demands further study.

This research paper, therefore, will explore whether the usage of NSR is economically feasible and pertinent for the liner vessels. More specifically, this paper is going to take into account both the positive and the negative aspects of the progress of Arctic exploration and commercial exploitation in order to avoid unnecessary risks regarding both the economic and the environmental issues that might arise.

2. Literature Review

Many studies have looked into NSR from economic, environmental and technical aspects since all of them expect a rise in the number of ships passing through NSR in the near future. Galic et al. (2015) in their research claim that due to the climate change, the reduction of ice cap in the Arctic Sea makes navigation in NSR easier. Liu & Kronbak (2010) claim that NSR has gained great attention in the recent years due to the fact that it saves up to 40% of sailing distance between Yokohama and Rotterdam compared to the traditional Suez Canal route. In their case study, Liu & Kronbak (2010) claim that the NSR is “profitable, especially when it is navigable for longer periods of time” (p. 444). Lee & Song (2014) also agree with the economic feasibility of the NSR since, in their study, they claim that the NSR has favorable economic effects in terms of distance and time. However, as they finally add, their research has an important limitation; the lack of consideration of the NSR toll fees imposed by Russia’s breaking-ice services.

Lee & Kim (2015) emphasize those economic barriers and make a step further by discussing about the environmental dangers that the shipping companies would face if they chose the NSR. Lindstad et al. (2016) researched the costs, emissions and climate impact of trade by the NSR. Their overall results indicate that there are no general climate benefits of utilizing the NSR even with cleaner fuels, since the additional impact of emissions in Arctic more than offsets the effect of shorter voyages (p. 30).

Zhuravel & Smirnov (2015) conclude that a lot of research for environmental purposes has to be done prior to the start of NSR commercial exploitation as a major international transit route due to the fragile Arctic environment. Pierre & Olivier (2015) claim that the option of NSR for bulk shipping remains “risky” due to extreme weather conditions and high possibility of marine pollution. Overall, the majority of the studies (Verny & Grigentin (2009), Galic et al, (2015), Zhang et al. (2016), Zhuravel & Smirnov (2015), etc.) fully support the argument that extensive environmental research and various investments into appropriate infrastructure need to be done in the overall Arctic area in order for the NSR to be established as a major route.

3. Definition of the Northern Sea Route and its Development through the Years

3.1 Definition of the Northern Sea Route

The Northern Sea Route (NSR) is a navigation route between the Atlantic Ocean and the Pacific Ocean along the northern coast of USSR and within Russia’s Exclusive Economic Zone (EEZ) (See Fig. 1).

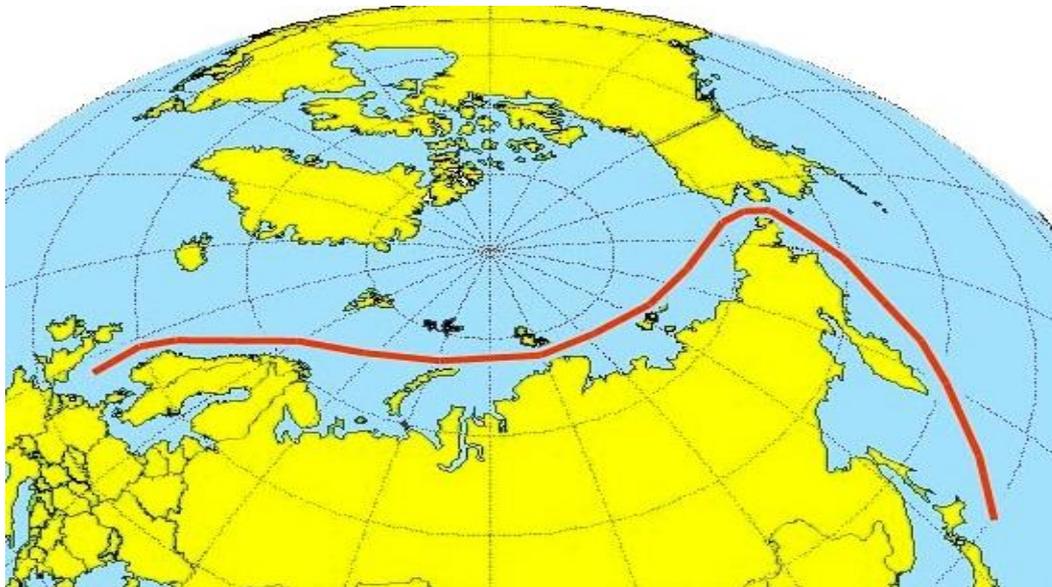


Fig 1: Northern Sea Route (NSR) depicted by the red line¹

The distance of the NSR is considered to be 2.100-2.900 nautical miles approximately. Estimates vary because the route is not a single passageway but it comprises all possible routes between the Atlantic Ocean and the Pacific Ocean. The major factor regarding the choice of the specific route at time is the distribution of sea ice. Regardless of that, NSR is considered to be the shortest connection between Northeast Asia and Northern Europe and it is primarily an internal Russian shipping route that has seen little usage since one of the highest transit volumes (208,600 tons in 2003) accounts for only 7% of the total global shipment that year.

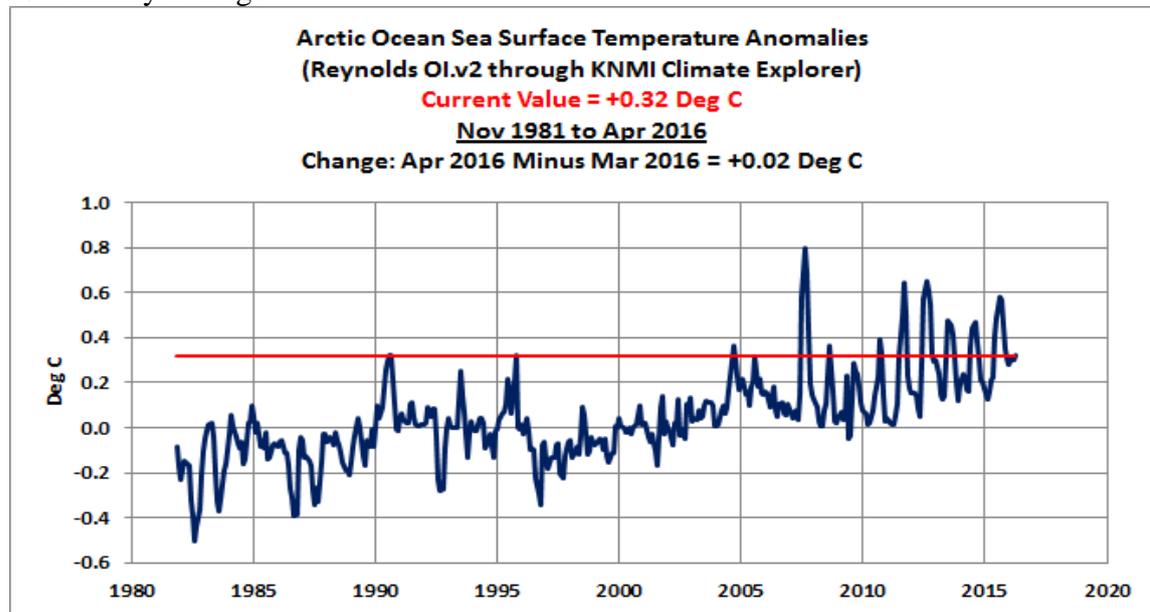
3.2. Northern Sea Route’s Development through the Years

¹ Figure retrieved from: <http://barentsobserver.com/en/sections/articles/preparing-next-years-northern-sea-route-season>

Russian's national security system historically prevented international ships passing through the NSR until October 1987 when Gorbachev, in his speech in Murmansk, declared that the NSR would be opened to foreign ships. In 1991, "Regulations for Navigation on the Seaways of the Northern Sea Route", a document which regulates shipping through the Northern Sea Route without any discrimination on the vessel's nationality, was approved. Because of the USSR dissolution that opened this sea to international trade, future predictions claim that there will be an increase of cargo volumes in the future years. However even careful predictions based on actual statistics, tests and plans are uncertain since the future of the shipping activity in the NSR is completely depended upon Russia's economic and political situation and the environmental changes that might take place in the near future.

4. Temperature Changes and Ice Conditions along the Northern Sea Route

The dramatic change of the environmental temperatures is one of the greatest factors that will determine the amount of NSR usage in the near future. A history of Arctic temperature changes from 1880 to 2016 is shown in Fig. 2². The blue line represents the average temperature for the time period 1980 – 2016. As one can notice, in the 1980's the temperature was relatively cold. The beginning of the 1990's however signified a warmer period in the Arctic Ocean Sea since the temperature was raised by about 0.2 °C. More specifically, there was a relatively warm period from 1990 until 1995 and cold period from 1996-2004. As the high volatility of the blue line shows for the years 2007-2016 the temperature was constantly more than 3.0 °C above the 20th century average.



Bob Tisdale

Fig. 2 Arctic Ocean Sea Surface Temperature Anomalies (1980-2016)

This temperature change has greatly affected the Arctic polar ice cap. In Fig.3 the comparison between the oblique views of the Arctic polar ice cap in September 1979 and 2003 show the significant reduction of sea ice in just 24 years. As a result, future predictions indicate a tremendous reduction of ice cap which will open new

² Figure retrieved from: <https://bobtisdale.wordpress.com/2016/05/09/april-2016-sea-surface-temperature-sst-anomaly-update/>

geographical areas for the exploration of natural resources and shipping transportation (Galic, et. Al, 2015, p. 64). This reduction of ice is also expected to increase the number of sailing days ³from 70 days to 125 in 2050, and to 160 days in 2100 (Pierre & Olivier, 2015, p. 344).

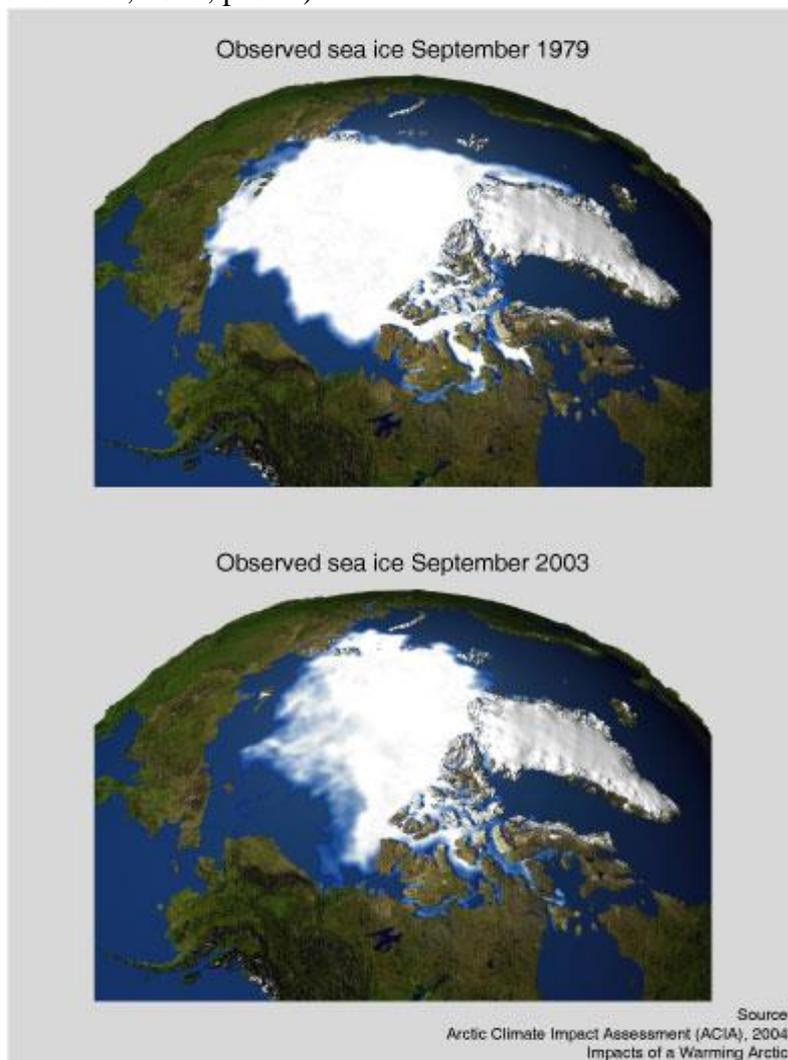


Fig. 4: Arctic Polar Ice Cap in 1979 & 2003

5. Shipping Economic Factors

Shipping Transportation is one of the most important aspects of the international logistic network that contributes to the development of global trade. Especially liner shipping is one of “the most operational modes of sea transportation” since it basically relies on its punctuality and economies of scale (Zhao, Hu & Lin, 2016, p.50). Liner vessels primarily through containerization carry 60% of the goods moved

³ Liu & Kronbak (2010) define the sailing days as “the number of days per year with less than 50% sea ice cover” (p. 436).

internationally by sea annually ⁴. Based on this percentage, one can notice that liner shipping is of extreme importance to the international trade. Therefore, this section is going to analyze the advantages and disadvantages that the liner shipping companies will face due to the NSR usage.

5.1 Advantages

Shorter Distance/Voyage Time

One of the great advantages that the NSR has over the Suez Canal is the shorter distance. More specifically, the NSR is 40% shorter (12,038 km) than the Suez Canal (20,742km) between Rotterdam and Yokohama which will result in up to 7 days off the shipping time (Schofield (2009), p.132, Lee & Kim (2015), p. 265). Thus, the shorter shipping time and distance between the ports will result in profit increase for the shipping companies. However, it should be noted that in relation to the Asian countries that use the NSR, only Japan China and Korea will benefit due to their location in regards to this alternative shipping route. This is apparent by the fact that the distance from Shanghai-China, Bussan-Seoul and Tokyo-Japan to Oslo-Norway is shortened by 5585 km, 6913 km, and 8324 km respectively (Lee & Kim, 2015, p.265). This is not true however when the NSR is used from Ho Chi Minh City-Vietnam and Singapore to Oslo-Norway since the distance is longer than the SCR by 613 km and 2179 km respectively. Therefore, one should keep in mind that the advantage of shorter distance/voyage time is heavily dependent upon the choice of destination since for some parts Suez Canal might be an economically wiser choice.

Less CO2 Global Emission

Another advantage that the NSR could offer is related with the environmental issues. More specifically, as a result of the shorter distance between some regions, the bunker consumption will be reduced. Therefore, less CO2 will be emitted in the environment.

5.2 Disadvantages

The economic and environmental advantages of the NSR usage are of great importance; however, the consequences of the NSR's geographical location might outnumber those advantages. More specifically, while the ice free season in the Arctic Sea was increased tremendously in the past decades, it is apparent that shipping along the NSR cannot be year-round as is shipping though SCR since thick sea ice covers the most of the Arctic Ocean. Those harsh weather conditions make it very difficult for people to settle down in the area near the Arctic Ocean. More specifically, about 2500 nautical miles of Siberian coast between Bering Strait and the port of Murmansk are nearly inhabited; therefore, no stopovers are available for the ships. As Zhuravel & Smirnov (2015) claim this "insufficiency of infrastructure" regarding the transportation and logistics is "probably the most serious challenge" because regular container lines cannot be optimized since they cannot access a network of developed communication lines in the hinterlands of port cities through NSR (p. 100). Another problem of that the insufficiency of infrastructure can cause is the limited choice of cargo transportation. VERNY & GRIGENTIN (2009) inform us, at the moment only certain

⁴ Data Retrieved from (<http://www.worldshipping.org/about-the-industry/how-liner-shipping-works>)

types of cargoes “indifferent to the long period of isolation” can be successfully transferred through NSR.

Little or No Technical Support

Another disadvantage that is related with the uninhabited area of Siberia is that there is little or no response to technical problems that the ships might face due to hazards associated with extreme climatic conditions. The most frequent types of ship damage are hull fracture and damage to propellers, shafts and steering gear. The lack of technical support for the ships will cause higher insurance premiums for the ship owners. Thus, the machinery and hull insurance as well as the cargo insurance will be at a very higher cost. Even if the conditions improve the extra cost will be added to the client who wishes his/her goods to be transferred in a perfect condition.

High Cost for the Qualified NSR Vessels

Even if the NSR might be “ice-free” during certain months of the year, it is not entirely clear of ice but just enough to travel through. Due to this, only special ships build for extreme conditions are qualified to pass through NSR. According to MOHQ (Russian Marine Operations Headquarters) the ships that are allowed to sail along the NSR are those that belong in 1B Class and above. According to Lloyd’s Register, ships that are classified in Class IL Super can navigate in extremely difficult ice-conditions. Also ships that are classified in 1A Class and 1B Class can sail in “difficult ice conditions” and “moderately difficult ice-conditions” while the ships that are classified in 1C Class can only handle “easy ice-conditions”. The common characteristics that those ships that belong in the categories described above share are thicker hulls, several forms of rudder and propeller protection, more watertight bulkheads and finally, heating arrangements for fuel tanks and ballast tanks. Any ship that aims to travel the NSR must do so with an ice-breaker and receive further permission from the MOHQ. As Pierre & Olivier (2015) inform us, the Arctic ice is at minimum in September and covers 5-8 million square kilometers which means the 40-60% of the entire Arctic sea (p.340). Thus, during September an 1A Class vessel can pass through NSR without resorting to any ice-breaker provided that ice thickness is under 0.8 m.

Time-Consuming Procedures to be followed when NSR is used

Ship companies that intent to send their ships through NSR should obtain official permission by submitting a request at least 4 months in advance to the NSRA in Moscow. The shipping companies should also send a copy of this request to the NSRA representatives in Murmansk or in Vladivostok, depending on the area of entry in NSR. This procedure comes in contrast with a much easier and less time-consuming procedure of transiting in the Suez Canal since the request for entering the Suez Canal should reach the Suez Canal port officers 4 days in advance and if the request is accepted then the Masters of the vessel should transmit the following information to their agents 2 days prior to the vessel’s arrival (Suez Canal Rules of Navigation)⁵.

Liu & Kronbak (2010) inform us that in order for the shipping company to arrange a transit through the NSR, the following information should be included in the request:

⁵ Suez Canal Rules of Navigation, Suez Canal Authority website: www.Suezcanal.gov.e.g.

i) name of vessel, ii) gross/net tonnage and displacement of the ship, iii) the ship's principal dimensions (i.e. length,/breadth/draft), the engine output, speed, age and propeller material and design, iv) type of bow construction (bulbous or knife), v) ship's class including ice class, name of society and date of last examination, vi) expected date of voyage, vii) presence of certificate of insurance or other financial security with respect to civil liability for environmental pollution damage, viii) purpose of the voyager (cargo transport-state port of loading/discharging), ix) owners preferred place of inspection by the administration's inspector (p.438).

The vessel that is about to transit through the NSR should also be inspected for ice worthiness by MSC or FESCO. The costs related with the delivery of the vessel to the port where a MSC or FESCO agent resides are covered by the ship owner. As Liu & Kronbak (2010) inform us after the ship passes the inspection, a permission for leading through the seaway of NSR will be given (p. 438). Then the MOHQ will determine the date and route of the ship because the MOHQ is the service provider for any authorized usage of NSR.

Russian NSR fees

The Russian ice-breaking fee depends on the ship size, the voyage route and the level of support required. This fee also includes guiding by reconnaissance aircraft, hydrographic and meteorological services and the use of communication services. The cost of the fee is reliant on the size of the vessel (i.e. the larger the vessel, the lower per tonnage tariff). It also dependant on the route that the vessel is going to follow through NSR since NSR has been divided into 3 routes (and therefore, different tariff regions).

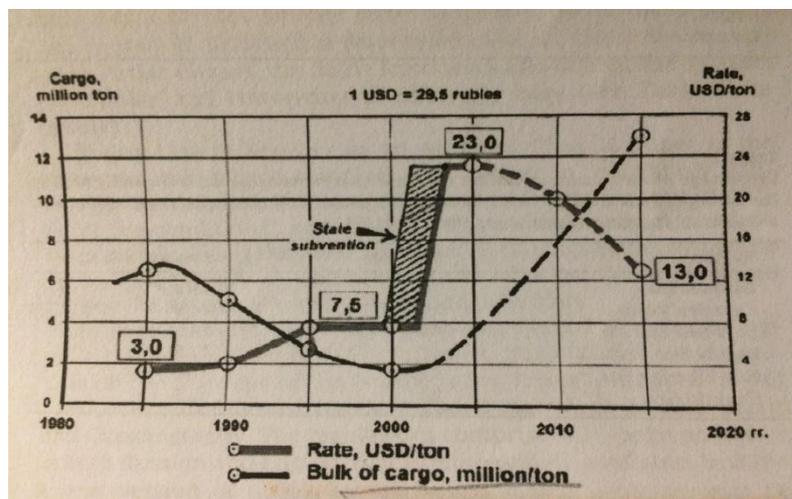


Fig 4: Cargo Volume Along the NSR⁶

For the diagram above, one can notice that in the early 1990's when the cargo volume along the NSR was around 4 million tons/year, the average ice-breaking fees were 2-4 USD per ton of cargo. In the late 1990's when the cargo volume declined to 2.5 million tons/year the rate increased to 7.5 USD per tonnage. It is important to note that during this period the Russian government annually granted additional subsidies

⁶ Graph was taken by <http://www.nordregio.se/en/Metameny/About-Nordregio/Journal-of-Nordregio/2008/Journal-of-Nordregio-no-3-2008/Potentials-for-Trans-Arctic-Shipping/>

to help maintain the icebreakers and their fleet. In 2003 however, the state stopped issuing those subsidies and as a result, the rate was increased to an average of 23 USD per tonnage in order to maintain the icebreakers. According to the ice-breaking fee research that Liu and Kronbak (2010) did, 1 TEU (24 tons of cargo) will cost USD 979.2 which is extremely high when it is added to other cost components.

Operating Costs

Apart from the ice-breaking fee, additional cost components that might occur during the NSR voyage are: i) Route recommendation based on meteorological and ice forecasts (e.g. 1 day forecast costs 231 USD whereas the 3 day forecast is 231 USD), ii) the salary of the Russian helmsman is 33 USD per day if the vessel does not have a qualified one for ice navigation, iii) maps, guidebooks, tide tables, signals book, etc. can cost up to 900 USD for each route, iv) special vessel steerage can be applied by local authorities at the ports for safety reasons, v) the bunker-filling fee is 6.30 USD per ton and the bunker itself is priced at world market rates, vi) supply of fresh water en route ranges between 1-12 USD per ton depending on the location and the water's quality (Liu & Kronbak, 2010, p. 440).

Environmental Consequences

Even though one might argue that the shorter distance of NSR will reduce the vessel's freight emissions, in reality, using NSR might be dangerous for the peculiar Arctic environment. As Lindstad (2016) argues, "there are no general climate benefits of utilizing the NSR" (p. 30). This can be explained mainly by three reasons. Firstly, the vessels that can be used for the NSR are generally smaller than those used in SCR. This implies that additional voyages are required to transport a certain amount of cargo. Secondly, on the surface of NSR there will be some remaining sea ice which will increase the power that a vessel needs in order to pass through the remaining sea ice. Last but not least, it is important to highlight the fact that the real challenge of the amount of vessels' emissions is not the percentage in comparison with the other routes but the fact that it will be emitted in sensitive areas prone to large impact.

6. Limitations/Suggestions for Future Research

Since the NSR is relatively new, measurements about various risks have not been performed accurately. Therefore, an important limitation of this study is that there is no concrete information about the future of the Arctic sea. Also this research is focused only on liner vessels. Future studies should investigate the advantages and disadvantages that the NSR has to offer to other types of shipping services (i.e. tramp service). Future studies should focus on the estimation of the shipping insurance costs both for the vessel and the cargo.

7. Conclusion

To sum up, this research paper focused mainly the advantages and disadvantages that the usage of NSR will have upon the shipping companies. More specifically while NSR has a strength in "quantitative factors" (i.e. transport distance and time), it has a weakness in all "the qualitative factors" (i.e. cost and safety). Similarly to what Lee & Kim (2015) and Verny & Grigentin (2009) have proposed, this research essay comes to the conclusion that despite the shorter distance for specific geographical areas (40%), the capital and operating costs can make the NSR economically unfeasible in

comparison with the year-round SCR. Based on the above analysis NSR appears to be poorly adapted to regular traffic. It is also important to note that even though the shorter sailing distance through NSR will reduce the global CO₂ emission, it will also increase the chances of local emissions, risk of oil spills, etc. on the fragile Arctic environment. Therefore, safety reasons can impose an economic and physical obstacle since shipping companies need more financial resources in order to train and equip crews in order to enhance voyaging safety. Thus, one can assume that NSR is not going to be transformed into a main trade route in the immediate future. Despite this, the technical difficulties are not significant enough to prevent companies for future usage of NSR. Since it is expected that the ice will retreat and the water in the Arctic region will rise, the demand for the NSR usage for business purposes will also rise. However, as major studies have indicated (i.e. Zhuravel & Smirnov, 2015), this research essay comes to the conclusion that a lot of work needs to be done prior to the usage of NSR as a major international transit route between Asia and Europe.

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