

PART I

Potential Arctic Shipping

2. Potential Arctic Shipping: Change, Benefit, Risk

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INTRODUCTION

The 1970s saw the worldwide spread of the concepts of globalization and regionalization boost world trade, while revolutionizing transportation through containerization and intermodalism. Following decades of adaptation and diffusion since the emergence of containerization, the global maritime container-shipping network has become a reality this century (Frémont 2007, Rodrigue and Notteboom 2010). Notably, the area of shipping has grown remarkably, now handling more than 90% of global trade. Due to the continuous dependence of world trade on shipping, the functions of ports and their logistics facilities have dramatically changed (Lee and Ducruet 2008:163). However, major commercial shipping routes have remained intact as no major geo-political change that would impact control of maritime resources has been made since the twentieth century.

At the beginning of the second decade of the twenty-first century, global warming directly affects our livelihood and environment. Climate change and global warming have brought new issues to the Arctic, including a large-scale ice meltdown, but they also present a new opportunity, namely a new shipping route through the Arctic which may replace the current international commercial shipping routes built around the Suez and Panama Canals. For example, the Northern Sea Route (NSR) connecting the North Atlantic and the northern Pacific through the Arctic Sea is emerging as one of the most expedient international shipping routes. The number and frequency of ships passing through the NSR have recently increased and more vessels are expected to use the route in the near future,¹ generating tremendous benefits. If the NSR becomes commercialized, it could allow shippers to bypass nearly 5,000 nautical miles and save on weekly shipping time in comparison to the existing routes via the Suez Canal. According to Lee et al. (2011), East Asian countries will enjoy immense economic benefits if they use the NSR in their commercial trade with northern Europe without paying Russian ice breaking fees² and countries in northeast Asia in particular, such as Korea, China, and Japan, will reap larger benefits from the NSR than other Asian countries. Within this context, some questions arise: how can this route be used cooperatively by Arctic states, especially Russia, and by non-Arctic states? How can the inevitable risks of shipping

through this route be mitigated to reduce environmental impact? First, we need to clarify whether the NSR is, in fact, logistically superior to other land transport modes including the Trans Siberian Railway. It is also important to estimate the amount of cargo that will be transported through the NSR. Answering these questions requires analysis of the economic potential of using the NSR based on real data and consideration of the main obstacles and risks of operating the route.

This chapter aims to clarify the main obstacles in operating the NSR and suggests means for its commercial operation, crucially through cooperation between Russia and the East Asian states. The discussion presented here first analyzes previous studies to ascertain the logistical viability of the NSR compared to other logistics routes to the North Pacific, demonstrating reasons for East Asian states to use the route and outlining obstacles in their commercialization of the route. Based on these analyses, the study seeks ways to eliminate those obstacles and mitigate risks, especially through multilateral cooperation among East Asian countries. By presenting the future system of port competition in East Asia, the conclusion offers suggestions on addressing the obstacles progressively through bilateral and multilateral cooperation between, Russia, Korea, other East Asian countries, and among Arctic and non-Arctic states.

THE COMPETITIVENESS OF THE NSR AND RAILWAY

Lee (2011) compared the Suez Canal Route (SCR) and the Northern Sea Route (NSR) by calculating time and cost saving effects between Europe and East Asia. However, the relative competitiveness of the NSR and the region's railways has not yet been examined. The comprehensive commercial railway system of the region includes the Baikal Amur Mainline (BAM), the Trans Siberian Railway (TSR), the Trans Manzhouli Railway (TMR), the Trans Mongolia Railway (TMGR) and the Trans China Railway (TCR), presented on the map below (see Figure 2.1). The BAM is linked to the commercial seaport of Vanino with Taishet by 4,300 km of rail and each of the BAM, TMR, TMGR and TCR railways are able to make use of the TSR to connect to Europe via Taishet, Zabaikalsk, Naushki and Omsk. With 9,289 km of electrified double track line linking Vladivostok to Moscow, the TSR is the key railway route connecting the Asia-Pacific region and Europe.

The rail gauge of BAM, TSR and TMGR is 1,520 mm, which is also used in the former Soviet Republics that now comprise the Commonwealth of Independent States (CIS), in the Baltic states, and in Finland. However, the TMR and TMGR use the standard gauge of 1,435 mm. Cargo shipped on the TMR must be reloaded in Zabaykalsk and transferred to the TCR in Dostyk. This off-loading and transfer,



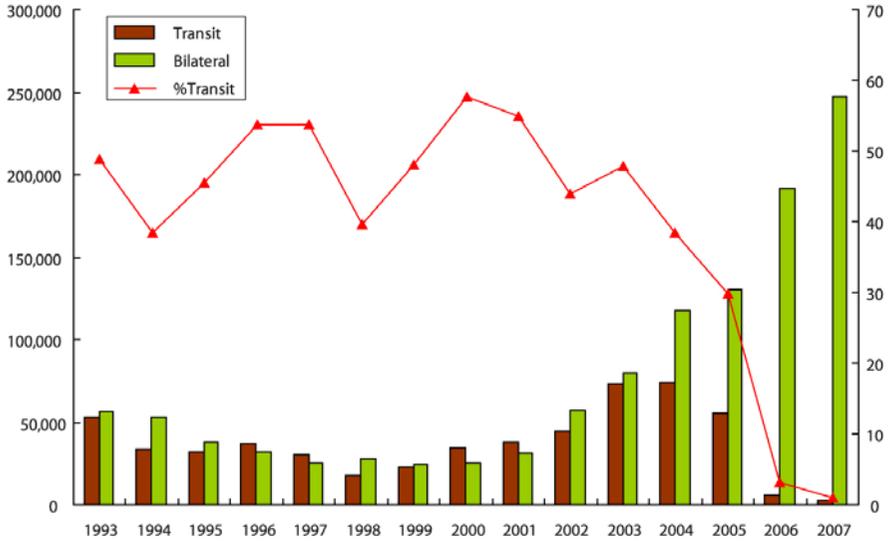
Economic Research Institute for Northeast Asia, Niigata, Japan, 2007

Figure 2.1. Trans-Siberian Land Bridge Network

combined with customs requirements at border crossing points, introduces potentially major problems for freight transportation across the region.

Though the railway is the shortest route to connect Europe and Asia, when block trains (those comprised entirely of cargo container cars) were operated, the journey time was even further decreased. It currently takes 14.5 days to transport goods from Vostochny in the Far East to Berlin in Germany. This duration is much shorter than using the SCR for 25.7 days and using the NSR for 17.9 days from Busan to Brehemen, even while considering the 1.5 days necessary for good to travel from Busan to Vostochny. After 1998, the transit volume of the TSR increased consistently before declining due to a rail fuel increase in 2005 and a further sharp decline in 2008 caused by the global financial crisis. That volume, however, has been recovered. International transport of containers on the TSR in quarters 1 through 3 of 2010 was at 280,271 TEU up over 48% from same period of 2009, including transit volume 18,058 TEU at more than 70% (see Figure 2.2).

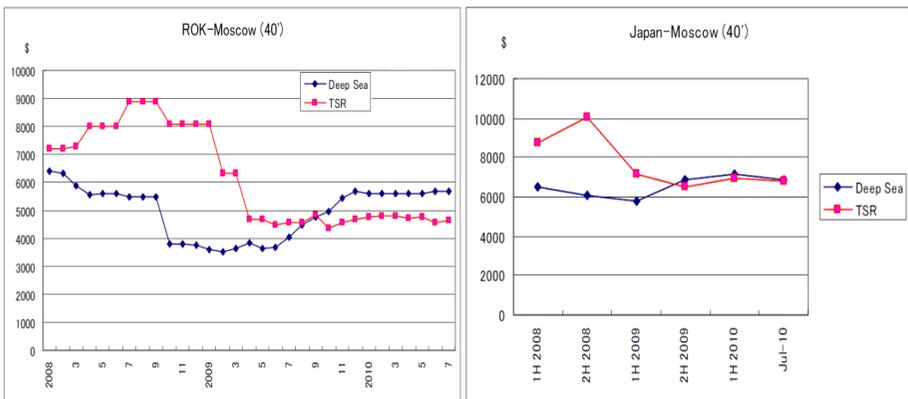
Economic competitiveness is the factor that has so far most recommended the TSR for commercial transport. Sea rates between East Asia and Europe dropped sharply in autumn of 2008 while TSR charges remained high. The Russian Railways held optimistic views that customers would not leave even if rail fees were raised since market demand would be strong. While Russian



Source: Hisako Tsuji (2008)

Figure 2.2. Transit vs. Bilateral volume of TSR

agents were flustered, the TSR rate was reduced by 42% during the period of January to April 2009. In 2010 TSR charges stayed relatively low and sea rates increased gradually. The TSR rate continues to be lower than that of the sea route in 2010 but has fluctuated more than the rates of sea routes (see Figure 2.3).



Source: Hisako Tsuji (2010)

Figure 2.3. Comparison of charges of TSR vs. sea route from ROK and Japan

Block trains service is mainly diversified from the Far East to Russia and Uzbekistan, between Europe and the Commonwealth of Independent States and so on. However, a block train from Europe is small scaled and cargo traffic is unstable. A block train between the Baltic and the CIS is more stable. Table 2.1 shows that block train service does not connect Europe and Asia, excepting Vostochny-Moscow.

Table 2.1. Block Train on TSR (2007)

Name	Route	Countries
Ost Wind	Berlin–Warsaw–Minsk –Moscow–Kazakhstan	German, Poland, Belarus, Russia, Kazakhstan
West Wind	Malaszewicze–Berlin	Poland, German
Czardas	Budapest–Moscow	Hungary, Russia
Mongolian Vector	Brest–Ulaanbaatar /Hohot–Duisburg	Belarus, Mongol, German
Baltic Transit	Baltic countries–Kazakhstan	Baltic, Kazakhstan
Northern Lights	Finland–Moscow	Finland, Moscow
Mercury	Kaliningrad/Klaidpeda–Moscow	Russia, Lithuania
Viking	Scandinavia–Lithuania–Ukraine	Scandinavia, Lithuania, Ukraine
Kazakhstan Vector	Brest–Almaty–Tashkent	Belarus, Kazakhstan
	Vostochny–Buslovskaya	Russia
	Vostochny–Lokot–Almaty	Russia, Kazakhstan
	Vostochny–Taganrog	Russia
	Vostochny–Brest–Malasevice	Russia, Belarus, Poland
	Vostochny–Moscow	Russia

Source: KRRI (2007)

Currently, the TSR is capable of shipping 130 million tons of cargo per year, including about 500,000-600,000 TEU of import/export cargo and 250,000-300,000 TEU of international transit cargo. Once the modernization of the TSR is complete, and if the BAM railway is used, this figure may increase to 1 million TEU per annum. Russia has released A Strategy of Developing the Railways of the Russian Federation Up to 2030 to meet the demand of the country for an adequate transport system. A new 20,550 km line will be built and the total investment will be 13,747.0 billion rub including 5,929 billion rub from JSC Russian Railways. Demands on the TSR have fluctuated and the line's service is restricted to a relatively small area that does not cover the entire route from Europe to East Asia with a capacity of just 1 million TEU, less than the capacity of the sea route.

THE COMPETITIVENESS OF THE NSR BETWEEN EAST ASIA AND THE EUROPEAN UNION

According to Lee's report (2011)³, transport costs and transit times were significantly affected or reduced when cargo was shipped between Asia and Europe through the NSR. We have conducted a 68-question stated preference (SP) survey in order to predict the expected market shares using the Suez Canal Route and the NSR. The SP surveying is a method that provides better transport estimates by asking respondents to select choices or to prioritize options in a specific future scenario. The survey presents five scenarios, spreading out the shipping costs of the NSR by 120%, 110%, 100%, 80% and 70% of the costs for the existing Suez Canal Route and the SP survey design enlarged the sample of the survey from Korean logistics companies to include Chinese and Japanese logistics companies. In order to capture a wider range of responses, this survey will include shipping liners as well as the original respondents, unlike previous studies that limited their samples to forwarders and logistic companies. In this way, we were able to collect 14 more respondents in Japan and 11 more in China.

According to Table 2.2, below, Chinese respondents currently prefer the SCR to the NSR, but in a scenario where the NSR is 10 days faster and the ocean freight is equivalent with the SCR, more than half of Chinese respondents chose the SCR. In contrast, Korean and Japanese respondents show a different pattern, preferring the NSR to the SCR in greater numbers than the Chinese companies. Chinese companies are hesitant to change to shipping via the NSR, for reasons explained by their usual transportation

Table 2.2. The NSR Shares by Scenario in 3 Countries

Scenario	NSR Cost	NSR Time	NSR Shares In Korea	NSR Shares In Japan	NSR Shares In China	NSR Shares In 3 countries
			(2011)	(2012)		
①	120%	30days	1%	2%	3%	3%
②	110%	30days	5%	6%	5%	8%
③	100%	30days	20%	20%	11%	21%
④	80%	30days	86%	79%	38%	72%
⑤	70%	30days	97%	94%	57%	89%
⑥	120%	25days	10%	12%	6%	13%
⑦	110%	25days	34%	36%	12%	31%

⑧	100%	25days	72%	69%	24%	59%
⑨	80%	25days	98%	97%	60%	93%
⑩	70%	25days	100%	99%	77%	98%
⑪	120%	20days	52%	57%	14%	44%
⑫	110%	20days	84%	84%	26%	72%
⑬	100%	20days	96%	95%	43%	89%
⑭	80%	20days	100%	100%	79%	99%
⑮	70%	20days	100%	100%	89%	100%

routes in China, the system uses diverse transportations such as TSR, TCR, TMGR, and TMR, while in Korea and Japan the predominant logistics system is primarily based on marine transportation.

As mentioned in the previous section and shown in Figure 2.4, the TSR's over-land route does not impact the viability of the NSR and the TSR service area are scarcely duplicated. However, taking a conservative approach, the capacity of the TSR is estimated at 1 million TEU.

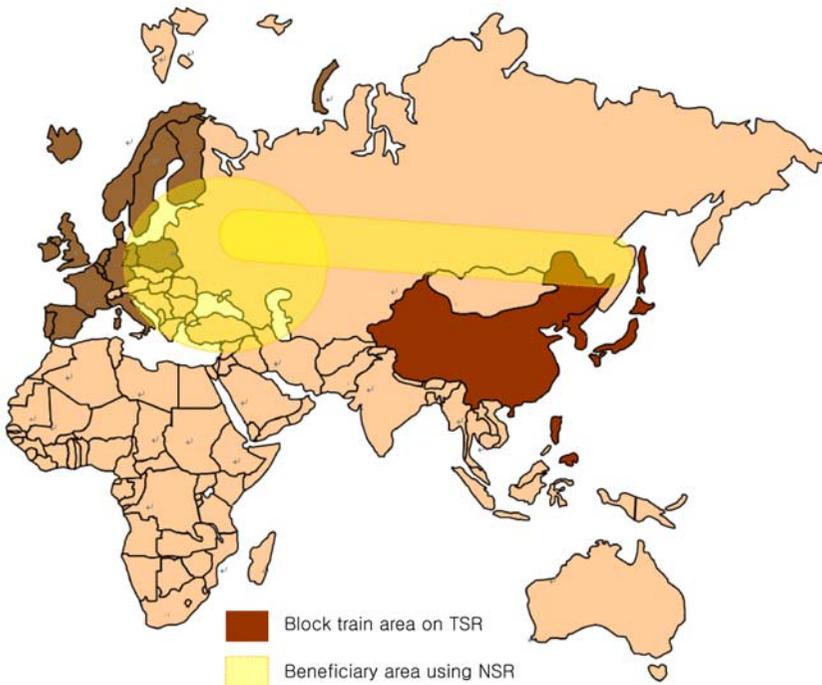


Figure 2.4. The NSR area and TSR area

Using the data from Lloyd's Marine Intelligence Unit (LMIU), which is based on the calculation of multiplying container traffic between ports by vessel capacity and frequency, we are able to estimate the weight of origin and destination (O/D) of traffic volumes. The attainable weight of container traffic that can bring distance-saving effects to target countries⁴ via the NSR is about 6%. We can also get the forecasted container traffic volumes of six Asian countries by adjusting real GDP growth rate of each country on actual performed traffic data in 2010. Multiplying these data by each weight of traffic O/D of target European countries, we may calculate the final traffic volume that can be converted into the NSR.

In 2007, the main countries using the TSR to move cargo between Europe and Asia were China, shipping a volume of 235,188 TEU with a 48% share, Korea shipping a volume of 206,264 TEU with a 43% share, and Japan shipping a volume of 43,688 TEU with a share of 9% (Lukov 2008). These 2007 amounts have been subtracted from the traffic of the three countries, arriving in Europe with 1 million TEU. Because some of the TSR traffic is already excluded by some target countries and ports, although this can be seen as a strict assumption, the volume shipped between the ports of Bussan and Vostochny would be considerable when using the TSR.

As shown in Table 2.3, 13 million TEU of cargo traffic was estimated between targeted countries in 2010 with a growth to 48 million TEU in 2030.

Table 2.3. Container Traffic forecast by targeted countries considering TSR

Unit: 1,000 TEU

	China	Korea	Japan	Taiwan	China (SAR HK)	Philippines	Total
2010	9,563	321	561	401	2,319	9	13,175
2015	14,691	909	705	509	2,931	12	19,757
2020	21,402	1,210	892	682	3,919	16	28,121
2025	29,500	1,396	910	791	4,655	20	37,271
2030	39,075	1,580	923	904	5,449	24	47,955
2010~2030	7.3%	8.3%	2.5%	4.1%	4.4%	4.9%	6.5%

The timesaving effects of cargo routes via the NSR depend to a great extent on the length of the ice-class section on the Arctic and on how long the NSR can be open. There have been no available data for the opening period of the NSR from year to year. However, Arctic Marine Shipping Assessment (2009), forecasts that it would open about 90 to 100 days by 2080. Moreover, Ragner (2008) proposes the possi-

bility that in 100 years the Arctic Sea would be open for 170 days at maximum, as the technology evolves. Mark Serreze, director of the US-based National Snow and Ice Data Center also predicted that Arctic ice would completely melt away by 2030 if current trends hold. With these predictions, in our scenarios we proposed three possible durations of opening of the Arctic for shipping: for three months in 2015, for six months in 2020, and for nine months in 2025. We took the prospective that the NSR would be fully commercialized by 2030.

We calculated and included into these scenarios the expected time saved using the routes to Europe from each of six Asian countries, and estimated the container traffic share of the NSR, as seen in Table 2.4. The container traffic is forecasted to reach about 0.3 million in 2015 and around 12 million TEU in 2030 under the condition that the sailing cost through the NSR will stay at the same level as the cost of the SCR. The share of the NSR would also be 1.5% in 2015 and 25.1% in 2030.

Table 2.4. Container Traffic forecast using the NSR

Unit: 1,000 TEU

NSR Cost	Container Traffic Forecast				Share			
	2015	2020	2025	2030	2015	2020	2025	2030
120%	54	425	1,402	3,015	0,3%	1,5%	3,8%	6,3%
110%	128	1,017	3,138	6,452	0,6%	3,6%	8,4%	13,5%
100%	305	2,168	6,081	12,047	1,5%	7,7%	16,3%	25,1%
80%	1,311	6,357	15,193	27,975	6,6%	22,6%	40,8%	58,3%
70%	2,185	8,746	19,420	34,731	11,1%	31,1%	52,1%	72,4%

WHAT ARE THE MAIN OBSTACLES AND RISKS?

The economic benefits of the NSR compared with the SCR and the TSR is clear, though the route still poses a number of obstacles and risks for commercial shipping. In order to validate the viability of the route, the obstacles must first be defined and solutions found to overcome them.

The problem of environmental pollution of the NSR. The Arctic area is valuable to the entire world and when the NSR is opened for commercial shipping, this area may become polluted. In this respect, Arctic states and non-Arctic states have a conflict of interest. Currently, International Maritime Organization (IMO) guidelines specifically address environmental protection and maritime safety in the Arctic in a document entitled Guidelines for Ships Operating in Polar Waters

(2009)⁵. The 2009 Guidelines are largely aimed at ensuring safe shipping by recommending construction and design standards for new “Polar Class” ships,⁶ and suggesting various types of equipment, personal survival, and crewing measures applicable to all ships engaged in international voyages in Arctic waters.⁷ In addition, shipbuilding using new technology may solve the potential problems of greenhouse gases and oil spills caused by shipping in the NSR. One important option may be an LNG-fueled ice class ship. Many shipbuilding companies are trying to commercialize this ship because it goes a long way to solve the problems of bunker fuel oil supply and environmental regulations. However, the LNG-fueled ice class ship cannot totally protect the environment of the Arctic while being flexible enough to cope with commercialized shipping. Reasonable scientific evaluations of the pollution situation will be helpful for us to make corresponding laws and regulations in an international organization like IMO.

The ice-breaking fee imposed by Russia. In order to make the price of the NSR more competitive than the price of the SCR, it will be necessary to keep the ice-breaking fee at a reasonable level and for the international community to engage in discussions with Russia on this issue on a continuing basis. A key issue to be negotiated with Russia is the ice-breaking fee and the outcome of these ongoing talks will determine whether or not the NSR will become a popular shipping route. In this context Korea, Russia, and the East Asian countries should discuss and decide on an appropriate toll fee for the Arctic routes.

The cargo imbalance between East Asia and the European Union. Import cargo moving across the two regions is not matched in volume. In 2007, the total container trade between the EU and Asia was 27.7 million TEU. Container trade shipped from Asia to the EU was 17.7 million TEU and trade shipped from the EU to Asia was 10.0 million TEU. Because logistics costs have increased many shipping companies anchor at North African and Middle Eastern ports to fill an unbalanced flow in the SCR, but this obstacle remains when commercial shippers access the NSR. The first step in overcoming this problem would be to find target cargo which is trade balanced such as iron, steel and organic chemicals. Additionally, in order to ultimately mitigate costs it will be necessary to develop industrial parks and new cities in heretofore-undeveloped regions like Far Eastern Russia, nearby the NSR.

The deficiency of relay ports and supporting facilities for them in the coastal region of the NSR. Passage through the NSR covers between 2,200~2,900 nautical miles, depending on the point of origin, and is difficult to sail safely without supporting services along the way, including mid-point fueling, supporting ship equipment, ship maintenance and repair services and so on. To solve the problem of the unbalanced ship-

ping trade relay ports must be constructed on the mid-point so that loading and unloading may occur frequently, while current supporting facilities are simultaneously maintained, repaired, and improved. Recently, the Russian government began constructing a nuclear power plant to surmount an electricity shortage for the coastal ports of the NSR. After the first phase of these plants is completed in 2014, seven or eight additional plants will be planned, aiding the function of the coastal ports in the NSR.⁸ The joint participation in activities of this kind by the countries that would use the NSR is much needed.

The lack of a comprehensive shipping management system. The NSR is a difficult route with a harsh marine environment, volatile snowstorms, and obstructing icebergs. A shipping management system that collects and makes available information on weather situations, navigation information, waterway status reports, port operations, and other supporting information is necessary to promote shipping operations on the NSR. The Arctic coastal states should be prepared to respond to maritime emergencies, including search and rescue in response to major accidents at sea, such as vessel damage and oil spills. In addition, agreement between Russia and the U.S. on traffic separation and monitoring in the Bering Strait⁹ is an important step toward addressing safety and security in the Arctic. Even though piracy problems will likely be minimal due to the harsh climate, insurance costs will increase if risks cannot be managed on the NSR.

The lack of unified politics, policies, and laws. The NSR traverses multiple states in the Arctic coastal area, including Russia and Canada. The range of environmental protection standards set by each country require that the eventual use of the NSR necessitates multilateral diplomatic cooperation between the Arctic states and the non-Arctic states. A framework international cooperation is needed. As an initiating step, an informal dialogue like the annual North Pacific Arctic Conference may contribute to cooperation between Arctic and non-Arctic states. A subsequent step would be a governmental cooperation framework to discuss more sensitive political issues.

The lack of a comprehensive information database of the NSR. The viability of the NSR as a shipping route is related to the world's warming climate. Although many countries have investigated the Arctic situation in consideration of the NSR as a commercial route, the information is limited and is not shared. If an international cooperation framework were set up a comprehensive database of information on the NSR would be possible and would benefit associated countries. The Arctic coastal states could facilitate approval of foreign scientific research within their exclusive economic zones, creating an NSR information platform through cooperation among North Pacific countries. Successful multilateral polar

science and research programs should be supported and given access to non-security and non-commercial data from national sources.

To fully commercialize the NSR, we need to overcome the obstacles and reduce risks as mentioned above. However, all obstacles and risks are related to the gradual changing of the Arctic environment and the policies of Arctic coastal countries, notably Russia. Opening the NSR to commercial shipping is an international issue that cannot be solved quickly and simply. Therefore, a framework of international cooperation is needed to move forward gradually and appropriately. Commercial shipping has already begun along short distances from East Siberia to East Asia (Destination-Arctic shipping). This type of shipping is used to obtain natural resources in conjunction with continuous pilot shipping between Asia and Europe through the Arctic Sea. In this context, Lasserre (2011) observed that gateway traffic rather than transit (trans-shipment) traffic was the engine of the NSR shipping growth, suggesting that the NSR would profit local communities and natural resource extraction plants situated along the coastline. This information is based on a survey done for Global 142 shipping company, the results of which propose that the NSR should be initially opened only partially because it needs more time to develop in the global shipping market. Following this period of development, a fully opened NSR will allow general commercial (container) shipping. At the same time, intra-Arctic shipping from Russian region to Russian region could be promoted. These steps will resolve many obstacles and will manage risks, as mentioned above, by making use of technological advances and the establishment of international governance over the NSR. Trans-Arctic shipping will be a busy enterprise and will promote commercial trade between East Asia and the EU.

BILATERAL (MULTILATERAL-) COOPERATION AMONG COUNTRIES RELATED TO THE NSR

Measures for protecting the environment, the determination of an appropriate toll fee, the development of a comprehensive shipping management system, the ratification reasonable international laws, development of supporting multilateral institutions, and the construction of a comprehensive information database must be realized before the NSR can be fully commercialized. Communication between Arctic and non-Arctic states should be initiated as soon as possible. In particular, East Asian countries should discuss the obstacles and join Russia in multilateral shipping agreements. In bilateral meetings, participants should propose solutions to overcome obstacles and the means to carry out these solutions in cooperative ways. In addition, the countries and Russia should

discuss ways to promote the route to the international shipping community. For the promotion and development of Russian ports nearby the route, participants will have to collaborate on port development, upgrading the capacity of ports nearby the shipping route and reinforcing multi-mode logistics systems. Far East Russian ports have the potential to be excellent relay ports for the route in terms of supporting supplies for vessels and connecting into land logistics.

Several agreements related to the Arctic Sea route have been updated by the IMO, and the Arctic states have a particular influence over their implementation. Therefore, the opinions of non-Arctic states should reflect on the agreements in terms of mutual benefit and rational decision. Ultimately, in order to commercialize the NSR, several legal steps must be taken: (1) the removal of political, economic and regional obstacles through cooperation among Korea, China, and Japan, (2) a joint settlement of the current management system, (3) cooperation between Korea, China, and Japan and Russia. Russia's attention to joint cooperation for Arctic problems is required through Russia's participation in the ongoing meeting of logistics ministers of Korea, China, and Japan. The relevant ministers from Korea, China, Japan, and Russia should be jointly prepared to promote the commercialized NSR. Russia will need to be engaged in collaboration of natural, economic and technological issues in related to Arctic shipping and must reach an agreement with the U.S. on the Bering Strait seaboard line treaty.

PROSPECTS OF PORT COMPETITION IN EAST ASIA AFTER THE NSR IS COMMERCIALIZED

Little has been offered about the foreseeable changes in the existing East Asian port system in the advent of the NSR opening. The world is still debating the commercialization of the NSR. In this situation, it is difficult to forecast the changes that might affect the East Asia port system after the NSR opens, but these issues must be dealt with as soon as possible.

In order to best identify potential hub ports for handling future NSR traffic, several factors must be considered, including the current situation of the East Asian port system and existing port systems around the world situated at the entrance of major shipping routes. In terms of location, trans-shipment hubs are often located near and within mass freight corridors. For instance, some trans-shipment hubs have developed in the vicinity of the Suez and Panama Canals as well as strategic passages such as the Gibraltar and Malacca straits. At the Panama Canal, for example, there has been intense development of container

ports. However, the local market alone is too small to handle the traffic volume at port terminals where global players have invested (for example, Balboa, Coco Solo, Cristobal).

Smaller ports nearby serve as feeder ports, which connect to their respective interior areas. The location patterns of these trans-shipment hubs are relatively simple as demonstrated by Zohil and Prijon (1999), based on the Mediterranean case where there is a linear relationship between the distance to and from the shipping route and the volume of trans-shipped cargo. In the Caribbean, trans-shipment traffic is more important at the center of the region (e.g. Jamaica) than at Panamanian ports because hub ports handle containers not only for Panama-related traffic but also for other shipping routes (for example, between North and South America). As noted by Rodrigue and Notteboom (2010: 21), “the creation of intermediate hubs does not occur in all port systems, but around specific regions ideally suited for maritime hub-and-spoke distribution patterns, thanks to geographical, nautical and market-related advantages”.

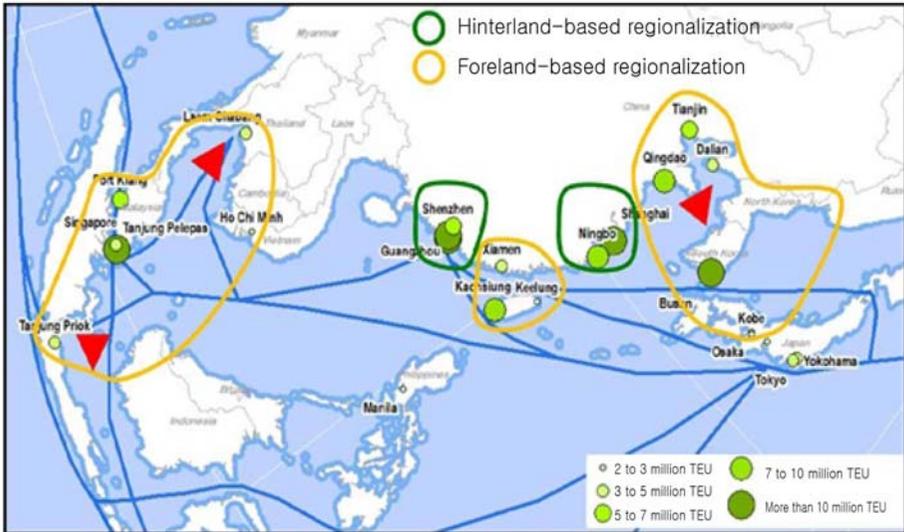
In taking up the specific East Asian cases of Busan, Singapore, and Kaohsiung, Rodrigue and Notteboom (2010) underline that these are more specialized and more focused on near-shore areas than Hong Kong and Shanghai are, which are more oriented toward interior (gateway) traffic (see Figure 2.5).

The advent of the NSR may cause important changes in this pattern causing a loss of trans-shipment traffic at Southeast Asian ports, notably in Singapore, and increase of traffic at Northeast Asian ports, notably Busan. This situation raises two questions: How will Busan and Gwangyang be able to attract and handle additional trans-shipment traffic? And, is there an opportunity for Korea to play the role of main hub at the entrance to the NSR?

This following discussion concentrates on neighboring ports and countries that may potentially act as competitors to Northeast Asian trans-shipment markets in regard to NSR-related cargo flows.

Option 1: Korean ports

Based on the aforementioned literature, an intermediate hub mixing trans-shipment flows and interior (gateway) flows has a better chance of sustaining and increasing its position in the maritime network than a pure trans-shipment hub or a pure gateway port. This is the case of Busan, which is not only a hub port for many North Chinese and Japanese ports but also a gateway for Korea. Busan has strengthened its position in the network (Rodrigue and Notteboom 2010, Ducret et al., 2010, and Lee and Kim 2009) despite rising competition from



Source: Rodrigue and Notteboom (2010), p. 27

Figure 2.5. Intermediate hubs and foreland-based regionalization in East Asia

Chinese ports, which actually remain dominated by gateway functions, not sea-to-sea trans-shipment. On the other hand, Japan has abandoned its role as hub port in the region due to lack of space for further port expansion, and due to environmentalist pressures to preserve coastlines. Korea, notably, Busan, has several advantages over Japan in the perspective of the NSR. These include:

1. ***Experience and expertise in the activities of trans-shipment.*** Busan's old and new ports are experienced in trans-shipment so is the "twin hub" Gwangyang.
2. ***Loyalty of main transport players.*** Korean ports have proven their efficiency with global players willing to distribute their cargo regionally. They also possess their own global port operators and shipping lines.
3. ***Technological advances.*** Korea constantly updates infrastructures and facilities dedicated to container handling at a level at which Chinese and Japanese ports are not likely to be able to compete.

While these reasons recommend Korea, and its Busan and Gwangyang ports as entry points for the NSR, these ports may have limited capacity. In such a case, some possible options may be considered:

for example, a dedicated NSR trans-shipment terminal within Korea may shift existing gateway flows towards secondary gateway ports on the south coast (e.g. Masan, Ulsan, Pohang) or the west coast (Inchon, Pyongtaek, Gunsan) in order not to increase shipping time to/from Korea, and concentrating NSR-related flows at Busan or Gwangyang. Another option is a dedicated NSR trans-shipment terminal offshore, thereby transferring know-how and equipment within the territory. Ulleungdo appears to be a good option for pure trans-shipment flows to/from the NSR (shorter distance). Another option would be Jeju Island, but in all cases the project would bear difficult negotiations with local communities and environmental associations due to their respective tourist and natural values.

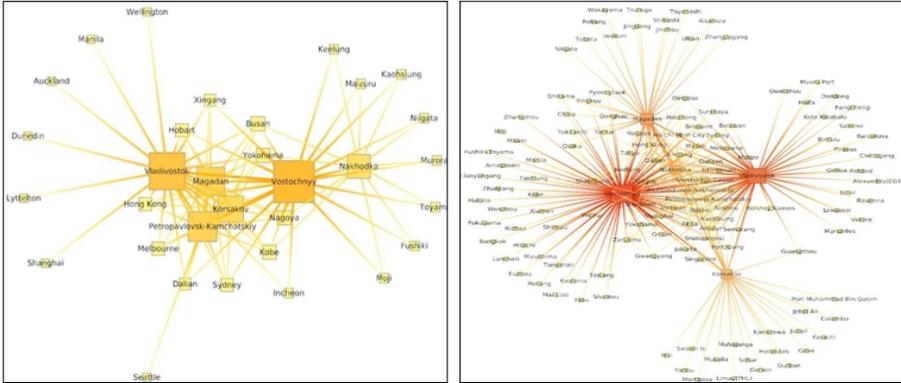
Option 2: Russian Far-East ports

The option of the Russian Far East ports seems logical with regard to two main criteria:

1. The Russian Far East ports are better located than Korean ports in regard to the NSR due to the shorter distance to/from the main route
2. The Russian Far East ports are potentially connected to land-based logistics systems linking Europe and Asia (TSR);

Successful hub ports have the ability to couple gateway flows and trans-shipment flows. However, major obstacles remain, since those ports still have a limited cargo base and suffer from cumbersome procedures in customs. Establishing brand new terminals would not solve all these problems. Another problem is the lack of funds from the Russian government, and the fact that a trans-shipment hub within Russian boundaries might be seen as serving the nation's interest rather than the pure economic interests of shippers and forwarders. Compared with Korean ports, the Russian Far East ports do not have the experience and knowledge of hub activities.

One positive element lies in the recent traffic evolution of the Russian Far East ports. This element is directly translated into an expansion of their maritime connections. In Figure 2.6, we propose to look at the current position of the Russian Far East ports in the maritime (liner shipping) network based only on their connections to other ports. In both 1996 and 2006 we see that Vostochny and Vladivostok have the highest number of connections to other ports, followed by Magadan, Korsakov, and Nakhodka. Although the majority of their connections in 1996 were local, i.e., within Asia (except for Vladivostok



Source: Cesar (2010)

Figure 2.6. Liner shipping connections of the Russian Far East ports between 1996 and 2006

connecting Oceania), by 2006 these ports had become “global” by extending their connections to the Mediterranean, Africa, and the Middle East. They multiplied their links within Asia as well, notably with Chinese and Southeast Asian ports.

Yet, the Russian Far East ports still have a low capacity and nautical accessibility, the basic requirements of any large trans-shipment hub. Presently they remain gateway ports serving their adjacent regions, although cargo flows to and from China by land transport have grown rapidly in recent years. The option to develop a hub port in North Korea at Rajin seems impossible, given the current political situation of the country.

Option 3: Japanese ports

As noted in recent reviews of the situation of Japanese ports, the Japanese government is aware of having lost rank in the global port system over previous decades. To regain their position would call for the launch of new hub ports to compete with Busan. However, there remain serious reservations about the benefits and feasibility of such plans. The Japanese port system is scattered along the coast to serve major urban concentrations (Tokyo, Nagoya and Osaka), so that a hub port project would not benefit the whole port system but only singular locations. Dividing the hub function among two or more locations may not be a solution. Creating a brand new hub port only for NSR cargo at a remote location in Japan might not be a reasonable option as it would be too specialized in trans-shipment functions and therefore too risky with regard to competition from existing hub ports such as Busan and Gwangyang. Therefore, Japan’s investment in an NSR hub would be to further expand

existing gateway ports such as Tokyo or Osaka, thereby contradicting previous environmental policies.

Option 4: Multi-hub configuration

Another option for establishing hub ports in East Asia for NSR cargo distribution would be to make use of more than one trans-shipment hub. Geographically, there could be complementarities between several hubs, as in the Mediterranean, Caribbean, and Middle East contexts where several hubs compete for transshipment cargo. Main shipping lines and terminal operators has dedicated transshipment hubs to deploy their services. Although successful hub ports seem to be located along the line of least deviation, this criterion is not sufficient and other factors include the presence of free zones (e.g., Tangier Med in Morocco) and the coupling with interior area services (e.g., Valencia in Spain). Each hub develops specific services while competing on pure transshipment flows. Functionally, some hubs may exert pure transshipment while others may be better suited for relay or interlining services. Perhaps, Busan could be a pure transshipment hub while some other ports such as Shanghai and Tokyo might become relay or interlining hubs so as to combine NSR cargo with other trade routes with North America and South Asia. Based on the example of the Busan-Gwangyang twin-hub strategy, this strategy could also lower high pressure on the single hub in terms of congestion and cargo volume.

In this scenario, Busan functions as a single hub port for the NSR, and Shanghai and Tokyo (or Kobe) become interlining hub ports. In accessing the NSR, Far East ports like Vladivostok and Vostochny become relay and gateway ports. Korsakov Port in Sakhalin, Petropavlovsk Port in Kamchatka and Provideniya Port in the Bering Strait will be pure relay ports, as shown in Figure 2.7.

CONCLUSION

Global warming and the progressive lifting of technical constraints on navigation together will usher in an era of commercial shipping in NSR in the near future. Increasing sea trade volume from globalization and international specialization reinforces the advantages of the NSR. Another reason to utilize the NSR comes from the fact that the entire industrialized world has pushed for the exploration of the untapped natural resources in the Arctic Sea area and non-Arctic states are sure to increase their interest in the Arctic Sea routes. Against this backdrop, this study has comprehensively estimated benefits of the Arctic Sea routes, the SCR and the TSR, revising the route traffic estimation con-

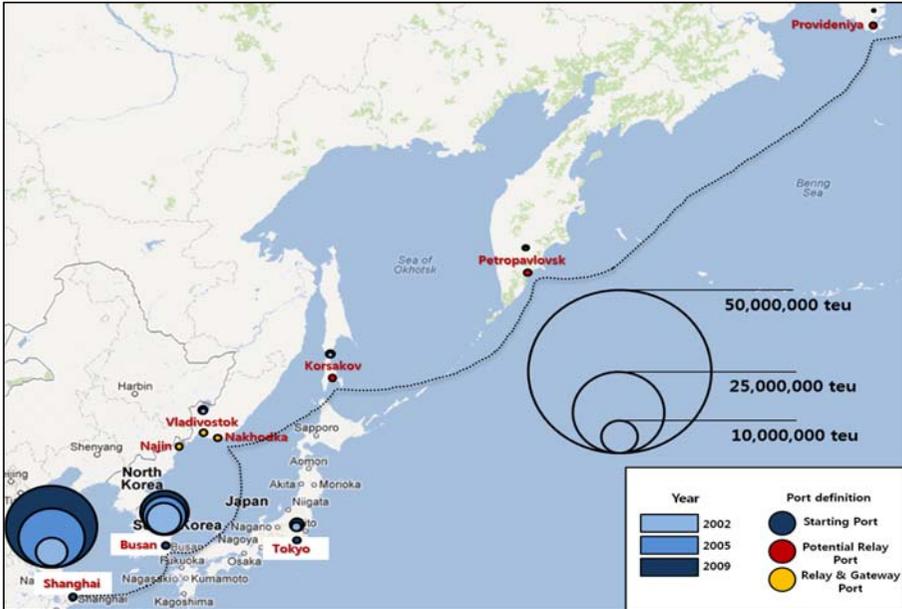


Figure 2.7. Potential hub ports after the NSR opening in East Asia

ducted by the study in the previous year. Moreover, it confirmed competitiveness of the NSR compared with the TSR and suggested the following directions to promote the opening of the NSR:

1. It is necessary to eliminate the obstacles to commercializing the NSR and to approach the issue step by step. For that purpose, destination-Arctic shipping, intra-Arctic shipping and trans-Arctic shipping have to be commercialized sequentially. Destination-Arctic shipping based on mineral resources must be invigorated in order to link the Russian coast and countries that consume Russian resources. As discussed above, this type of shipping is already in the commercialization stage. If destination-Arctic shipping is to be developed, intra-Arctic shipping must be developed simultaneously. As more of the Russian Arctic coastal region is developed, intra-Arctic shipping will be more invigorated, in turn building trans-Arctic shipping. If Arctic shipping is successfully developed in stages, development of transit-Arctic shipping between East Asia and Europe will be a reality soon. However, this eventuality is only possible when environmental destruction and other risks accompanied by development are well addressed. As a result, it becomes clear that stakeholders of the NSR need to prepare the roadmap for NSR commercialization.

2. Technical efforts are required to manage risks and overcome economic challenges and possible air and water pollution generated by shipping in order

to make the route viable. Advances in eco-friendly technologies, including LNG-fueled ships, can solve environmental problems. ‘Block-shipping’, that is, two or three ships sailing together on the same route when an icebreaker is used, can be an option in short term. The development of ice class ships, which can navigate ice flows without needing ice-breaking services, can reduce the costs of ship production and commercialize relevant technology. In addition, Russia is developing nuclear power plant crafts to support Arctic region ports. These sources of electric power will improve the function of ports as relaying points and will help to save costs, maintain safety and stability, and protect the coastal environment and atmosphere.

3. There is a need to improve the economic feasibility of the NSR and to balance the imports and exports between East Asia and Europe. If imports and exports are unbalanced, economic feasibility is difficult to achieve due to increased shipping costs. At the same time, costs resulting from using the Russian coastal route and icebreakers need to be calculated. Shipping costs could be reduced by increasing freight demand through the development of the coastal region, especially the Russian Far East region, and through the development of a large number of assistive ports. Consequentially, it is necessary to improve the economic environment including the free trade agreement among Korea, Japan, China and the EU as well as additional costs, such as insurance fees, by managing unexpected risks.

4. The NSR governance needs to be established. In order to build a governance structure for the NSR, dialogue and cooperation should continue on important issues, including toll hikes between Korea, Japan, China and Russia, boundary demarcation in the Bering Sea between Russia and the United States, environmental problems between coastal states and Korea, Japan, and China, and disputes over common use of the NSR between coastal states and non-coastal states. Tangible progress was already made in building the multimodal transport system between Korea, Japan, China and Russia with the Great Tumen Initiative, which pushes up the cargo demand and freight in the Far East. Furthermore, a cooperation system between East Asian countries and Russia started to float, for example, a system on shipping, port management, and regional development between Korea and Russia. Based on this cooperation, the nations involved will need to increase their communication opportunities through the NPAC and to build a governance system through discussion with international organizations.

5. The port and logistics infrastructure needs to be developed according to port environmental changes in East Asia. It is necessary to enlarge and improve the infrastructure and facilities of Busan, Gwangyang, Shanghai, and Tokyo since they could become starting ports of the NSR. Simultaneous

development and maintenance of infrastructure and facilities should follow at ports in the Russian Far East region, Kamchatka Peninsula and Arctic coastal region as they can act as relay ports. If their role, which would be decided through competition, turns out to be appropriate to their size and location, it would become possible to build the global logistics hub linking East Asia, the EU, Canada, and the United States in the same context of the phased NSR development.

Because the area is one of the last repositories of natural resources and most vulnerable to environmental impacts, research on sailing route commercialization that takes into account the interactions between technology and governance should be done to determine the sustainable usage of the Arctic Sea. For our planet and our future, the NSR should be commercialized under the slogan, “With protecting environment, cautious conversation and investigation, more cooperative implementation.”

Notes

1. A 2009 assessment by the Arctic Council counted 6,000 vessels in the Arctic, mostly fishing trawlers and mining barges in the lower reaches. The 41 vessels that traversed it last year shipped 834,931 tons of cargo (Vladimir V. Mikhaylichenko, 2012 North Pacific Arctic Conference Proceedings).
2. According to Lee (2011), if a 8,000TEU vessel transports the container shipment with its 60% capacity, the fee imposed on the shipment amounts to maximum 3.9 million dollars; Approx USD 780 per one fully loaded TEU (Russian Federal Tariff Service issued Order #122-T/1 from June 07, 2011, “Federal Rates Service”).
3. We used the data of Lloyd's Marine Intelligence Unit (LMIU) in order to estimate the future container traffic volume between countries benefitting from the time and cost saving effects by using the NSR. Also, we were able to get the forecasted container traffic volumes of six Asian countries by adjusting real GDP growth rate of each country on actual performed traffic data in 2010. Then, we multiplied the gained data by each weight of traffic O/D of target European countries in order to get the final traffic volume that can be converted into the NSR. Then, we had conducted a SP survey in order to gain the expected shares of using the SCR and NSR in the future.
4. Between Asian countries including China, Korea, Japan, Taiwan, Hongkong and Philippines and European countries including Russia, Poland, Sweden, Norway, Denmark, Finland, Estonia, Latvia, Lithuania, Iceland, Germany, Netherland, Belgiun, UK, Ireland, France, Portugal, Spain, Italy.
5. IMO, Res. A. 1024(26) [Polar Shipping Guidelines].

6. Polar Shipping Guidelines, *supra* note 78, para. 1.1.2 and Part A.
7. *Ibid.*, para. 1.1.1 and 1.1.3.
8. *Морские вести России*, N0.7 (2012), p.8
9. In 1990, Russia and the U.S. agreed on the sea board line treaty in the Bering Strait. Russia has still not ratified the treaty. It remains an international dispute when we use the NSR.

References

- Arctic Council, 2009. Arctic Marine Shipping Assessment 2009 Report
- Bessonov, Gennady. 2010. Trans-Siberian Route: an Effective Transport Link between Europe and Asia, paper presented at International Delegate Conference Making the Intermodal Connection: The Role of Terminals, November 12-13, 2010, Ft. Lauderdale.
- Drewry Maritime Research. 2010. Ship Operating Coast Annual Review and Forecast, Annual Report, 2010/11, October 2010.
- Ducruet, C., Lee, S.W., Ng, K.Y.A., 2010. Centrality and vulnerability in liner shipping networks: Revisiting the Northeast Asian port hierarchy. *Maritime Policy and Management* 37(1): 17-36.
- Frémont, Antoine. 2007. Global maritime networks: The case of Maersk. *Journal of Transport Geography* 15(6): 431-442.
- International Maritime Organization. 2009. Guidelines for Ships Operating in Polar Waters. 26th Assembly, Resolution 1024.
- Kämärä, Alexander. 2010. Russian Port and Railway Sector: Development in 2008-2009. Centre for Maritime Studies, University of Turku.
- Korea Railway Research Institute. 2007. Siberian Land Bridge.
- Lasserre, Frédéric. 2011. Des autoroutes maritimes polaires? Analyse des stratégies des transporteurs maritimes dans l'Arctique (Polar Shipping Seaways? An analysis of strategies from shipping firms in the Arctic) *Cybergeog: European Journal of Geography*: 537.
- Lautso, Kari, Pirjo Venäläinen,, and Hannu Lehto. 2005. Transport connections between the EU and Russia: Current Status and Outlook for the Future. Ministry of Transport and Communications Finland.
- Lee, Sung-Woo. 2011. Benefit of the Northern Sea Route to the North Pacific, paper presented at Korea Maritime-Korea Transport Institute-East-West Center International Conference, August 8-10, 2011, Honolulu.
- Lee, Sung-Woo, J-M Song, Y-S Oh. 2011. Benefit of the Northern Sea Route to the North Pacific. Korea Maritime Institute, Seoul.
- Lee, Sung-Woo and César Ducruet. 2009. Spatial Glocalization in Asia-Pacific Hub Port Cities: A Comparison of Hong Kong and Singapore. *Urban Geography* 30(2): 162-181.
- Lee, Sung-Woo and, Guen-Sub Kim. 2009. Port challenge in Northeast

- Asia: Korea's two-hub port strategy. In Theo E. Notteboom, César Ducruet and Peter W. De Langen (eds.), *Ports in Proximity: Competition and Cooperation among Adjacent Seaports*. Ashgate Publishing.
- Lukov, Boris E. 2008. *The Transsiberian Rail Corridor: Present Situation and Future Prospects*, presented at PROMIT seminar, February 14, 2008, Helsinki.
- Ocean Shipping Consultants. 2006. *Barents Sea Intermodal Service (BASIS)*, Report No. 2-06, August.
- Rodrigue, Jean-Paul and Theo Notteboom. 2010. *Foreland-based Regionalization: Integrating Intermediate Hubs with Port Hinterlands*. *Research in Transportation Economics* 27(1): 19-29.
- Tong, Jian, Haitao Wen, Xuenmei Fan, and Sebastian Kummer. 2010. *Designing and Decision Making of Transport Chains between China and Germany*. *I.J. Intelligent Systems and Applications*.
- Tsuji, Hisako. 2008. *The Trans-Siberian Railway Route: Connecting East Asia and Europe by Rail*, paper presented at WORLDNET Seminar, May 2008, Beijing.
- Tsuji, Hisako. 2010. *The Tide Turns for Trans-Siberian Rail Transport*. UNECE Working Party on Intermodal Transport and Logistics, 53rd Session, October 4-5, 2010, Geneva.
- United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). 1999. *Development of The Trans-Asian Railway*. United Nations. Retrieved from http://www.unescap.org/ttdw/Publications/TIS_pubs/tarns-fulltext_2182.pdf
- Vinokurov, Evgeny, Murat Dzhadrallyev, and Yuriy Shcherbanin. 2009. *The EurAsEC Transport Corridors*. Eurasia Development Bank. Sector Report No.5, April. Eurasian Development Bank: Almaty.
- Zohil, J., Prijon, M. 1999. *The MED rule: The Interdependence of Container Throughput and Transshipment Volumes in the Mediterranean Ports*. *Maritime Policy and Management* 26(2): 175-193.

Comments on Chapter 2: Scientific perspective

Lawson W. Brigham

Chapter 2, (*Potential Arctic Shipping: Benefit, Risk, Cooperation and Change*), is an informative overview of many of the challenges and issues facing future container ship traffic in the Arctic Ocean. He focuses his attention appropriately on use of the Northern Sea Route for trans-Arctic navigation, for it is this route which has been used recently for transport of natural resources out of the Russian Arctic (and from

northern Norway) to global markets in the Pacific. All of these voyages were conducted during a narrow period of time in summer during conditions with minimum ice. There were 34 trans-Arctic voyages along the NSR in a short, summer navigation season in 2011 and an additional 35 voyages transporting more than 1 million tons of cargo were undertaken during summer 2012. By contrast, there were approximately 18,000 voyages using the Suez Canal in 2011 during the year-round navigation season. Many of the risks and challenges that the author highlights in his chapter are the reasons for this stark contrast in use of these waterways as global trade routes. One of the key issues is the length of the economically-viable navigation seasons in a future Arctic Ocean. No one in the global maritime world knows with any certainty the answer to this critical question.

COMPARISON OF THE NSR WITH CONTINENTAL RAIL

I believe it very important that the NSR be compared with rail across the Eurasian continent. The author notes, importantly, that rail is the shortest route to connect Europe and Asia, at least for container cargo. For the transport of natural resources, of course, it may be another matter since those resources originate in northern Europe and the Russian Arctic. Additional links between the southern tier rail lines and the northern resources would have to be developed for full rail service in support of Arctic natural resource development in the region. The author rightly points out the competitiveness of the Trans-Siberian Railway (TSR) is highly influenced by rail fare increases and for many reasons the capacity of the TSR will remain low. One key issue is that the TSR is a year-round operation that could compare more favorably with Arctic shipping if its capacity grew. The greatest advantage of the TSR, if investments were made in building its capacity and infrastructure, is that it could theoretically operate in a seamless, integrated flow of “just in time cargo,” whereas flows in Arctic shipping along the NSR would contend with the vagaries (and potential risks) of Arctic navigation. Again, if Arctic navigation is only seasonal, perhaps during a longer navigation season extended beyond summer, how might the flow of regular container traffic compare with rail operating more efficiently over the course of an entire year? What delays are inherent in the TSR in winter, a key element in this comparison of competitiveness of both rail and sea routes? Should the Russian Federation invest more in this continental rail “bridge” or invest as an alternative in fully developing the NSR?

The promises of the NSR and the TSR, both developed during the Soviet era, remain unfulfilled early in the twenty-first century. However, the promise of the NSR in facilitating the transport of natural resources by

ship out of the Russian Arctic appears economically viable for the decades ahead, especially during extended summer navigation seasons. I believe the Russian Federation will focus on NSR infrastructure investments to ensure the flow of natural resources to global markets, mostly in the Pacific, as an integral component of their national economic wellbeing. The primary focus will be appropriately on bulk carriers and tankers operating along the NSR in extended seasons of navigation, while secondary interest will be on the opportunity to capitalize on any container traffic. Some of that traffic and tonnage could plausibly flow from return voyages from the Pacific to the Russian Arctic and northern Europe. However, the primary driving factor for current expansion of the NSR is to support natural resource development in the Russian Arctic, consistent with the findings of the Arctic Council's Arctic Marine Shipping Assessment (AMSA released in 2009) for major shipping throughout the Arctic.

THE SHIPPING CHALLENGE OF THE ARCTIC OCEAN'S FUTURE SEA ICE COVER

A review of the Arctic sea ice simulations of the Global Climate Models (GCMs) reveals that the Arctic Ocean remains fully or partially ice-covered for 9-10 months each year through the century and beyond. However, we do know that the extent, thickness and character of Arctic sea ice are changing in extraordinary ways. The possibility of an ice-free Arctic Ocean for a brief period of time is plausible even before mid-century, as early as 2030 or perhaps even earlier. This physical change will remove the last vestige of multi-year ice with only seasonal sea ice remaining. While the Arctic Ocean will remain fully or partially ice-covered for much of each year, the ice cover will be entirely first year sea ice with limitations on maximum winter growth in thicknesses (plausibly a maximum of 2.2 to 2.5 m). The sea ice cover will also likely be more mobile which will be another significant challenge for ice navigation, by either ships in convoy under icebreaker escort, or ships sailing as independent icebreaking carriers. For background, Figure 2.8 indicates the main Arctic Ocean marine routes, recognizing the Eurasian Arctic as the region most ice-free during the recent and rapid summer Arctic sea ice retreat.

Several issues remain regarding future sea ice conditions and use of the NSR for trans-Arctic navigation and regular container ship routing. The future conditions will determine what polar class ships will be required to traverse the route in any given season. There will be shorter navigation seasons for lower class ships (PC6 ships) compared to longer navigation seasons of higher class ships (PC3). What will be the length

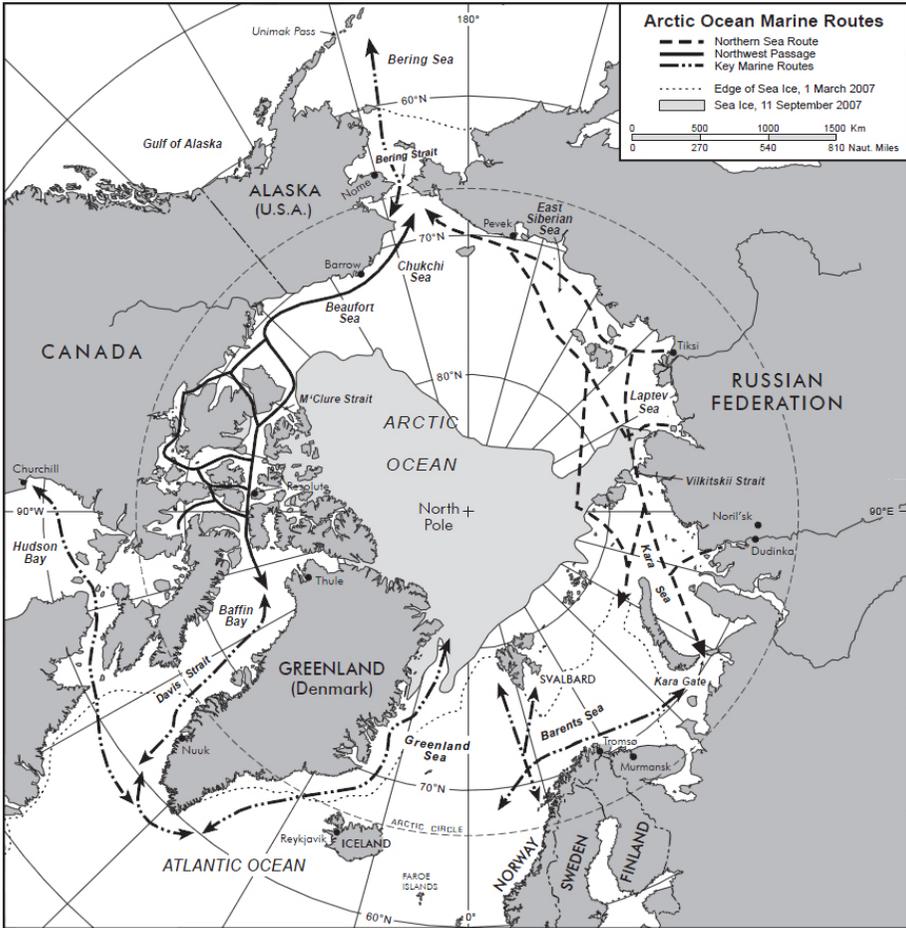


Figure 2.8. Arctic Ocean Marine Routes

of the navigation season, particularly in the autumn, winter, and spring months? What will be the resulting ship speeds, particularly if larger, deeper draft ships will be required to sail north of the islands groups of the Russian maritime Arctic? Ice conditions on more northerly routes will plausibly be more challenging. A key issue is whether all ships will be under constant icebreaker escort during navigation periods other than the summer. Will independently-operated polar class icebreaking carriers be allowed to navigate without icebreaker escort beyond the summer months? What ship speeds might be obtained that will make the NSR competitive, given the prevailing ice conditions in late spring and early autumn? Given the future sea ice simulations of the GCMs, a funda-

mental question remains whether the NSR can be competitive for container traffic if it is used only on a seasonal basis. While it may be technically and operationally plausible to escort large ships through several meter of ice (for more than 2000 nautical miles), will it be economically viable to do so if the resulting ship speeds are not high enough to make up for the distance savings compared to the Suez Canal route (between the EU and Asia)?

PRACTICAL CHALLENGES AND RISKS

Chapter 2 provides an important review of the main obstacles and risks associated with the use of the NSR: an icebreaking fee system, lack of marine infrastructure, a need for an informational NSR database, a need for unified rules and regulations, and, the challenges of attaining adequate environmental and marine safety measures. Many of these challenges (and needs) are consistent with the 17 recommendations in the Arctic Council's Arctic Marine Shipping Assessment (AMSA). AMSA called for a mandatory International Polar Code of Navigation to replace the current, voluntary International Maritime Organization *Guidelines for Ships Operating in Polar Waters*. Ongoing work at IMO has shown the complexities of developing mandatory regulatory measures that would have three key elements: polar ship construction standards (and identified polar ship classes), polar marine safety equipment, and, ice navigator training requirements and enhanced polar expertise in the pilothouse. Defining the risks associated with different ship types operating in ice-covered and ice-free Arctic waters has proven to be a difficult challenge for the IMO committees. The author's call in his chapter for enhanced international collaboration is timely. IMO is likely the right forum for this to happen among the Arctic and non-Arctic states due to the global nature of the maritime industry. Most certainly the Russian Federation should be a supporter and leader for the NSR to be part of an international framework such as a mandatory Polar Code. Bilateral cooperation, also mentioned in the chapter, will be very important for Arctic waterways such as the Bering Strait region where the U.S. and Russia have adjacent exclusive economic zones (EEZs). Both Russia and the U.S. should cooperate regarding the development of new safety and environmental protection strategies for the Bering Strait region. Any proposed measures, such as voluntary ship routing, in this international strait will have to be submitted to the IMO for review and approval.

Additional challenges confront the use of the NSR for trans-Arctic navigation. There are few ports and associated marine infrastructure along the NSR and most of the Arctic Ocean. Of critical importance for the whole of the Arctic marine environment, only between six and seven percent of the region has been charted to international navigation standards.

The lack of comprehensive charting is an important limitation for the NSR and other potential Arctic shipping routes. Although long stretches of the main straits of the NSR and Northwest Passage have been charted, additional charts are needed for alternative routes in both regions. Finally, the large size and draft of modern container ships looms as a significant factor and practical limitation for global shipping and potential Arctic navigation. Maersk Line has recently ordered ten 18,000 TEU container ships (to be built in Korea by Daewoo Shipbuilding Engineering Company, Ltd.) for delivery by 2013-2015. With dimensions of 400 x 59 x 19 m, ships of this new type are even stretching the limits of operation in the Straits of Mallacca! Maersk Line also operates currently the world's largest containerships at 13,000 TEU (the Emma Maersk at 397 x 56 x 15.5 m ships operating since 2006). Ships of this great size do not appear practical for operation along the NSR or anywhere in the Arctic due their extreme draft and overall size. More discussion and evaluation is required to determine what operational and optimal size and draft limitations might be required for polar class container ships operating along the various routes of the NSR. Ship teu capacities will surely be influenced by any design limitations such as shallower drafts required for operations in Arctic waterways and straits of the NSR. My sense is that modestly sized polar class carriers with built-in icebreaking capability to operate independently may be the norm for potential container operations along the NSR.

EAST ASIA PORT COMPETITION RELATIVE TO THE NSR

Chapter 2 reviews in some detail the East Asia port system and the roles of potential hub ports and multi-hub configurations. He makes a good case for the use of more than one transshipment hub to handle NSR cargo distribution. One interesting factor that requires further understanding is how this vast port infrastructure would operate if the NSR is only used seasonally. How would the hub ports adapt to variable (and seasonal) trans-shipment flows? Would any size limitations for container ships operating along the NSR influence the cargo flows within the port system? Also, key ports in East Asia might develop direct ties to select Russian Arctic ports so that if Russian ships carried out bulk cargoes during summer seasons, containers could be carried on return voyages to the Russian Arctic. Combining East Asia hub ports serving NSR cargoes with other global trade route flows would appear to be a sound strategy as suggested by Chapter 2. Again, plausible seasonal shipping traffic flows along the NSR must be considered one op-

tion and the call for a single hub port serving the NSR, such as Busan in South Korea, might better handle potentially variable and seasonal cargo volumes.

SUMMARY AND CONCLUSIONS

The global market connection of Russian Arctic natural resources and greater marine access throughout the Arctic Ocean afforded by regional climate change have provided for opportunities to exercise the NSR system in a “preparatory phase” for commercialization of the route during recent summer operations. Trans-Arctic container shipping possibilities may come later, although some containers could be shipped to the Russian Arctic or even Europe on the return voyages once the main natural resource cargoes have been delivered to their East Asia destinations. Due to the current and projected sea ice conditions for the next two decades, the length of the NSR navigation season remains uncertain. A six-month season is plausible and perhaps economically viable, given the current escort capability of the Russian nuclear icebreaker fleet. More robust economic analyses factoring in a complex of variables are required for the NSR: ice conditions, ship speeds, navigation season lengths, use of northerly routes beyond the island groups of the Russian Arctic, cargo schedules, ice class ship requirements, insurance requirements (and rates), and, operational fees for ice-breaking and ice pilotage. Chapter 2 highlights the complex array of factors influencing trans-Arctic navigation along the NSR and I echo his call for enhanced cooperation between the Arctic and non-Arctic states, particularly at IMO in developing a mandatory International Polar Code of Navigation. The expanding use of the NSR should herald a new era of international cooperation in Arctic marine navigation.

Comments on Chapter 2: Inuit perspective

Udloriak Hanson

For those unfamiliar with how the Inuit people are organized, let me offer a few words of explanation. Inuit Tapiriit Kanatami, or ITK, represents the Inuit people of what we call Inuit Nunangat, and what you would call Arctic Canada. The Inuit Circumpolar Council, or ICC, represents the Inuit of what we call Inuit Nunaat, and what you would call the Inuit circumpolar area. The Inuit circumpolar area includes the Inuit part of Canada, but also includes Greenland and the Inuit home-

lands within Alaska and at the eastern tip of Siberia.

We have worked hard to build up a high level of coherence in our political life, recognizing and accommodating domestic and international political boundaries, without being paralyzed by them. For example, ITK is a member organization of ICC (Canada), and we have intersecting boards of directors. Our time is very limited here and there is much ground to cover so I hope you will forgive me if my remarks are presented in broad brush strokes when there is complexity in Inuit perspectives on this topic.

The title of our session is “Potential Arctic Shipping” and I would like to bring to your attention some of the baseline political and policy considerations that the Canadian Inuit people will bring to bear on any major expansion of shipping in our part of the Arctic. Time will not permit me to be exhaustive or detailed, but I would propose eight key considerations.

Key Consideration 1: Various routes that form the alternate passages of the Northwest Passage pass squarely through Inuit Nunangat. When I say “pass through”, I don’t mean “pass by”. Inuit are a maritime people. Extensive land and marine use occupancy studies have shown that areas used and occupied by Canadian Inuit include larger sea areas than land areas. Arctic sea areas, and the health of arctic seas, remain vital to our identity and to our material well-being and security. The sea provides food, inter-regional and inter-community travel routes, corridors for the import of necessary goods and, similarly, corridors for the export of commodities.

The seas within Inuit Nunangat cover rich geological platforms, still only imperfectly understood, for hydrocarbon exploration and, potentially, production. Any large scale or risk-producing shipping or other use of seas within Inuit Nunangat is not peripheral to us as Inuit people, it is front and center.

Key Consideration 2: Inuit people have not been demographically displaced; we are the strong majority of the permanent populations of both Inuit Nunangat and the Inuit circumpolar Arctic. It is true that in comparison to densely populated areas in other parts of the world we are thin on the ground and on the seas, but our majority is undiminished, and that fact brings with it a whole set of implications for commercial Arctic shipping at both the conceptual and practical levels. We have every intention of sustaining and safeguarding our status as the permanent population of our part of the Arctic.

Key Consideration 3: Inuit people have fundamental rights and expectations under international law, including international human rights instruments. I am sure you are all familiar with the 2007 United Nations Declaration on the Rights of Indigenous Peoples. That Declaration sets out a whole set

of tests to govern the behavior of nation states in their interactions with indigenous peoples, particularly in relation to the authorization of resource development and other commercial activities within traditional indigenous homelands.

An operative requirement for most new resource extraction and related transportation projects is “free, prior and informed consent” on the part of the indigenous peoples affected. Equally important as the substance of existing international laws and instruments, is the reality that indigenous rights and interests are a still expanding part of the international legal and political order. There is no reason to believe that global public opinion will permit a reversal of that trend.

Key Consideration 4: Apart from international law, the rights of Canadian Inuit are very well-rooted in domestic Canadian law. A continuous chain of modern treaties between Inuit people and the Crown, representing the Canadian state, now cover lands and seas stretching from the Alaskan border to northern Labrador. These treaties incorporate much of the Canadian side of the Beaufort Sea and all the waters of the Northwest Passage within the Canadian Arctic archipelago. The terms of these treaties vary somewhat from each other, but characteristically create regulatory and other bodies charged with overseeing resource development planning and development, and the environmental assessment and review of development projects, including related shipping elements. Modern Indigenous treaties also contain provisions for dealing with such development related issues as wildlife management, wildlife compensation, and royalty sharing. These treaties have entrenched status under Canadian Constitutional law.

Key Consideration 5: The organization and work of the Arctic Council provide a good example of how, in the international Arctic, an open, respectful, constructive partnership between States and indigenous peoples is a central factor in how and when progress can be made in the coordination of broad objectives and policies. The role of “permanent participants” at the Arctic Council has been an important innovation, but it also can be said to be an important reflection of some longer-term political realities about the Arctic. For non-Arctic states and interests these realities have tangible consequences. I am sure, for example, that there would be many at the European Union who would be surprised that the ill-informed and hypocritical EU legislation blocking seal product imports would color how others evaluate whether the EU can make a useful contribution to the work of the Council.

Key Consideration 6: The previous key considerations combine to make it very difficult to foresee the viability of approaches to development in the Inuit portions of the Arctic that would ignore or marginalize Inuit rights and interests. Perhaps it cannot be said that Inuit people have an all-purpose,

formalized “veto” over development and related transportation proposals, but it can be said that such proposals face an extremely high set of barriers in the absence of adequate Inuit participation and support.

Key Consideration 7: Representative Inuit organizations, both in Canada and in the wider circumpolar world, have indicated that Inuit seek a balanced, responsible, and diversified approach to development. Three things have to be weighed in that balance. The first is the need for environmental protections to minimize negative environmental impacts of all kinds and, in particular, to mitigate the risks of catastrophic environmental mishaps.

The second is the need to stimulate economic activities at a level that will allow Inuit people and, in particular, young Inuit people, to enjoy genuine and varied opportunities, including adequate employment, to lead rewarding and productive lives and also to allow Inuit regions and communities to build up a much enhanced degree of economic resilience and self-sufficiency.

The third priority is to ensure that a sufficient share of the public wealth generated by resource development, related shipping, and other projects, is applied within Inuit Nunangat to address, reduce, and, eventually, overcome, the very real and very painful gaps in basic well-being between Inuit people and other Canadians. The negative cycle that sees education, health, and housing problems reinforcing each other must be converted into a virtuous cycle that sees progress in one area reinforcing progress in the others and that accepts that economic development, social development, and cultural continuity must go hand in hand.

Key Consideration 8: An optimistic scenario for Arctic development, in its broadest sense, depends very heavily on the forging of creative and in-depth partnerships between Inuit people and other actors. This is true at the highest levels: active Inuit involvement is necessary in international deliberations affecting the future of the Arctic and Arctic policy making within Arctic States at the national and regional levels. It is also true at the level of community development, and the mix of initiatives and supports developed to assist Inuit households and individuals. Partnership is equally compelling in the private sphere. It is in the self-interest of every private sector development company to search out and enter into solid partnerships with Inuit economic development agencies and businesses. Reliable partnerships with Inuit people in today’s world and in the years to come must go well beyond some of the half-hearted, going-through-the-motions, just-for-show efforts Inuit people sometimes have seen in the past. Such things are not only highly probable, but like other Inuit people, I remain confident that they are also very much possible.

Comments on Chapter 2: Russian perspective

Vladimir V. Mikhaylichenko

ARCTIC NAVIGATION IN 2011

In the 2011 navigation period forty-one transit voyages passed through the Northern Sea Route (NSR), including those transporting cargo in ballast for research purposes and transfers. Of these, twenty-six voyages were carrying cargo on tankers (a total of 15 trips, transporting 686,516 tons), bulkers (a total of 3 trips, transporting 109,950 tons), refrigerators (a total of 4 trips, transporting 27,535 tons), and dry cargo vessels (a total of 4 trips, transporting 10,930 tons). In total, 834,931 tons were transported through the route during the 2011 season. The transport of hydrocarbons comprised 82.2% of the total cargo amount. Of the forty-one voyages completed in 2011, twenty-four were on vessels sailing under the flag of the Russian Federation (58%) and 11.3% of Russian flag vessels were carrying cargo. Seventeen voyages were completed by vessels sailing under foreign flags (42%). Foreign vessels comprised 86.9% of total tanker delivery, while Russian tankers accounted for 3.1%.

In comparison with the previous year, turnover in 2011 increased by 5.8 times (145,000 tons in 2010 versus 834,931 tons in 2011). On some days an average of 100 sea and river vessels worked on the NSR in 2011. Most of these vessels were transporting equipment and building materials to oil and gas companies in Baidaratskaya Bay and Ob Bay. The increase in transit occurred due to more numerous shipments of petroleum products. In previous years, the percentage loading of liquid cargo did not exceed 30%. In the future we can expect a significant increase of such traffic on the NSR.

In 2011, the tanker *Vladimir Tikhonov* was the largest vessel ever piloted through the North Sea Route. Several other cargo ships also passed through the route. *Sovcomflot*, a ship owned by JSC Freight One with a deadweight of 162,362 tons carried a cargo of 120,843 tons of gas condensate. The Neste Oil-owned tanker *Palva*, with a deadweight of 74,940 tons and a cargo of 59,313 tons of gas condensate, was piloted through in shortest time, going through the route in just 6.5 days with an average speed of about 14 knots. This voyage was undertaken in the second half of September, the best time for leading, which allowed the Marine Operations Headquarters to choose a navigation route through waters completely clear of ice.

Also in 2011, for the first time in NSR history the tanker *Perseverance*, with a deadweight of 73,788 tons, transported liquid hydrocarbons on three transit routes during one Arctic navigation, completing two routes

from west to east and one route back. *Zapolyarny*, a dry cargo vessel of the highest Arctic class (arc7), owned by JSC Freight One and Norilsk Nickel completed two transit routes without icebreaking assistance. *Zapolyarny* transported a cargo of 9,000 tons of nonferrous metal from Port Dudinka to Port Shanghai returned to Dudinka with 7,000 containers.

ANALYSIS OF SHIPMENT VIA NSR IN 2011

Cargo shipment via the NSR in 2011 was estimated at 3,111 kilotonnes (based on the data from the NSR Administration) including:

- Outbound cargo: 806 kilotonnes, comprising 26% of overall shipment
- Inbound cargo: 1,471 kilotonnes (including inner-coastal traffic via NSR), comprising 47.2% of overall shipment
- Transit cargo: 834.26 kilotonnes, comprising 8% of overall shipment
- Shipment of liquid cargo: 1117.4 kilotonnes, comprising 36% of overall shipment

In adjacent NSR regions that are covered with ice more than six months in 2011 (Article 234 of the Convention on the Law of the Sea) shipments were estimated at 3,900 kilotonnes in the Pechora Sea (the south-eastern part of the Barents Sea), and 4315.3 kilotonnes in the northern part of the Bering Sea.

In 2011 a total of nearly 7.5 million tons of various types of cargo were shipped through the Arctic, including shipments within the NSR boundaries (3,111 kilotonnes) and adjacent regions (4,315.3 kilotonnes). In 2012 shipment within the NSR boundaries may reach 4 million tons, while transit cargo is estimated at half that volume.

Arctic navigation in 2011 showed that cargo ships sailing through the NSR from port of Murmansk to the various ports of Southeast Asia reduced travel time by seven to twenty-two days, compared with sailing through the Suez Canal. This is an important economic advantage of the NSR.

TIME SAVING DURING NAVIGATION VIA NSR FROM EUROPEAN PORTS TO SOUTH ASIAN PORTS, AS COMPARED TO NAVIGATION TO THE SAME PORTS VIA SUEZ CHANNEL

In 2011 the following large vessels (DWT exceeding 20 kilotonnes) navigated the NSR with cargo on board:

Based on the data received from ship owners, the cost per day of the vessels in transit on the NSR, including cost of fuel, is estimated to be approximately \$90,000 USD for tankers with deadweight exceeding 150 kilotonnes. For tankers with deadweights between 50-70 kilotonnes the daily operating costs are between \$40,000-50,000 USD. For bulk carriers with deadweights of 50-75 kilotonnes the cost is approximately \$40,000-50,000 USD. For bulk carriers with deadweights of 20-25 kilotonnes the operating cost is approximately \$25,000 USD.

The fee for icebreaking assistance through the NSR, taking in consideration the new flexible tariff, may be equal to the fee for passing through the Suez Canal. The excessive insurance fee for passing through the NSR, accounting for the possibility of ice damage, may be compared with excessive insurance for passing through Gulf of Aden (where the major threat is piracy). The fee for ice pilotage is an additional fee for ships passing through the NSR, but this fee is not very high, costing approximately \$10,000 USD for one voyage. In light of these costs, it is clear that the 10-day time savings of navigating through the NSR may reduce ship-owners' expenses by \$250,000 to \$900,000 USD. However, a serious problem remains affecting economic attractiveness of the NSR. The lack of cargo for return transit from the east to the west would require certain vessels to do return voyages without cargo in ballast. Still, the voyage of the tanker *Perseverance* at the end of August 2011 shows that there is enough cargo for shipment via the NSR! It is necessary to search for this cargo to prove economic effectiveness of shipment through the NSR.

Vessel	Deadweight	Transit route	Duration
1. Tanker <i>Perseverance</i>	73,788 tons	Murmansk (Vitino)–Ningbo (China)	12 days
2. Bulk Carrier <i>Sanco Odisey</i>	74,800 tons	Murmansk – Beilung (China)	18,5 days
3. Bulk Carrier <i>M. Kutuzov</i>	23,500 tons	Murmansk – Gingang (China)	10 days
4. Bulk Carrier <i>Dm. Pozharsky</i>	23,500 tons	Murmansk – Gingang (China)	11 days
5. Tanker <i>Vl. Tikhonov</i>	16,236 tons	Murmansk – Bangkok (Thailand)	7,3 days
6. Tanker <i>Marilee</i>	74,898 tons	Murmansk – Hangzhou (China)	9 days
7. Tanker <i>Sti Heritage</i>	73,957 tons	Murmansk – Bangkok (Thailand)	7 days
8. Tanker <i>Stena Poseidon</i>	74,957 tons	Murmansk – Incheon (South Korea)	22 days
9. Tanker <i>Palva</i>	74,940 tons	Murmansk – Huizhou (China)	16 days
10. Tanker <i>Perseverance</i>	73,788 tons	Onsan, Yosu (South Korea)–Havre (France)	5 days
11. Tanker <i>Mariann</i>	74,999 tons	Murmansk – Incheon (South Korea)	20 days
12. Tanker <i>Affinity</i>	73,541 tons	Murmansk – Huizhou (China)	14,5 days
13. Tanker <i>Perseverance</i>	73,788 tons	Murmansk – Huizhou (China)	8 days

Today the Federal State Unitary Enterprise Atomflot and Directorate of the Partnership are doing this kind of work. Together with our partners in Alaska (the Institute of the North) we are preparing a meeting with certain consignors: Red Dog Mines in Alaska, which transports shipments of zinc concentrate to Europe, and the ports of Dutch Harbor and Adak in the Aleutian Islands which ship frozen fish to Europe.

Red Dog Mine exports over 1 million tons of zinc and lead concentrate per year, usually dispatching part of this concentrate to the European market via the Panama Canal. Surely, shipping between Alaska and Europe may be done much faster through the Northern Sea Route. The distance from the Red Dog Port to the Rotterdam Port through the Northern Sea Route is 4,438 nautical miles, less than half the distance of shipping through the Panama Canal, a route of 10,887 nautical miles. The price for icebreaking assistance on the Northern Sea Route for vessels with cargo of concentrate is approximately equal to the price of sailing through Panama Canal, a cost of \$4.00-4.50 USD per ton of cargo. Red Dog Mine dispatches concentrate 100 days per year, from the end of June until the end of September, a very favorable period for transit through the NSR. At this time of the year a cargo vessel can follow icebreaker at full speed.

CONSTRUCTION OF NEW ICEBREAKERS

By the 2015-2016 season the transit traffic through the NSR may rise to 5 million tons, which would require more than 100 ice-breaking leadings per year. To carry out this work it is necessary to have a sufficient number of icebreakers in permanent readiness. According to the Russian Ministry of Transportation and the State Corporation Rosatom, which has conducted a nuclear icebreaker fleet since 2008, it was necessary to begin construction of the head general icebreaker, a new generation nuclear icebreaker. Otherwise, an “ice pause” in 2016 may inhibit a comprehensive program for the development of LNG on the Yamal Peninsula and transportation of hydrocarbons from offshore fields in the Barents and Pechora seas due to the amortization of two shallow-draft nuclear icebreakers Taimyr and Vaigach, working in estuaries. An “ice pause” would reduce the transit potential of the NSR and would limit the dominance of the Russian Federation in the Arctic zone.

The new icebreaker by Project 22220 is the head general vessel to be working in both shallow and deep NSR routes. It replaces two previous types of icebreakers, *Arcticand Taimyr*. The project development was completed in 2008-2009 and the project was approved by the Rosmorrechflot Technical Board in 2009. The federal target program, Development of Russian Transport System (2010-2015), has provided the production of the head general icebreaker since 2010. However, due to the optimization of

the federal budget in 2010-2011, funding for these purposes has not been allocated. Only in 2012 did the Russian government assign financing of 5 billion rubles to start building one icebreaker and announced its tender offer. The icebreaker is scheduled to be completed in 2017 and two icebreaker sister ships are expected to be delivered in 2020.

The Federal Law “About amendments to certain Legislative Acts of Russian Federation regarding state regulation of commercial navigation on the route in the waters of the Northern Sea Route” (No. 132-ФЗ) was dated on 28 July 2012 . The bill includes the following steps for its implementation:

- Government regulation on the NSR route, historically a single transportation line of the Russian Federation in the Arctic, will be legally fixed.
- The government of the Russian Federation will set NSR borders.
- The Administration of the NSR will be created as a federal government agency with the definition of its functions to replace the existing Department of Rosmorrechflot, significantly raising the status of the Administration.
- New “Regulations for Navigation on the Seaways of the Northern Sea Route,” “Regulations on the Headquarters of Marine Operations,” “Requirements for the Design, Equipment and Supply of Vessels Navigating the Northern Sea Route,” “Regulations on the Ice Pilot for NSR,” etc. will be developed.
- The rates for leading services on the NSR will be approved at the state level.

Development, approval, and implementation of the documents mentioned above must be completed without delay for regular and safe operations on the NSR. The Law was published on July 30, 2012 in the official newspaper *Rossiyskaya Gazeta* and went into effect 180 days after publishing.

ORDER OF NAVIGATION THROUGH THE NORTHERN SEA ROUTE

“The Regulations for navigation on the seaways of the Northern Sea Route” were officially published on July 13, 1991 in the notices to mariners 29. The following documents can be found on the official web site of Ministry of Transport of The Russian Federation (www.morflot.ru): “Commemorative booklet to the owner or master of a vessel,” “Regulation for navigation on the seaways of the Northern Sea Route,” “Regulations

for icebreakers and pilot guiding of vessels through the Northern Sea Route,” “Requirements for the design, equipment and supply of vessels, navigating the Northern Sea Route,”

“Federal rates service order” (no. 122-t/1) dated June 7, 2011 in Moscow, “Procedure of granting permission for the escorting of ships along the Northern Sea Route,” “Declaration of readiness of the ship to navigate in the waters of the Northern Sea Route.”

STEPS NEEDED TO RENDER ASSISTANCE TO A SHIP IN TRANSIT VIA NSR SEAWAYS

To submit application to the Icebreaking Support and Hydrographic Department (NSR Administration) of the Federal Agency for Marine and River Transport, Ministry of Transport of Russia (<http://www.morflot.ru/sev-morput/>), correspondence may be addressed to

Head of NSR Administration: Nikolay MONKO

Tel. +7 495 626-10-64, e-mail: MonkoNA@morflot.ru, www.morflot.ru
125993, Moscow, Petrovka Street, 3/6

To sign a contract for icebreaking services on NSR Seaways with Federal state unitary enterprise *Atomflot* or FESCO JSC Federal state unitary enterprise *Atomflot*, Department of Perspective development and operations, correspondence may be addressed to

Department head: Vladimir ARUTJUNYAN.

Tel. +7 (8152) 553-311, e-mail: arutyunyanvg@rosatomflot.ru,
www.rosatomflot.ru 183017, Murmansk-17, ATOMFLOT

FESCO JSC, Special Fleet department

Department head: Vyacheslav NAGANYUK

Tel. +7 (4232) 52-14-13, e-mail: 63000@63.fesco.ru, www.fesco.ru
690091, Vladivostok, Aleutskaya Street, 15.

PROCEDURES OF GRANTING PERMISSION FOR THE ESCORTING OF SHIPS ALONG THE NSR AND SHIPS PROCEEDING EN ROUTE TOWARD THE NSR FROM SEA WITHOUT CARGO HANDLING IN PORTS OF THE RUSSIAN FEDERATION

1. Submission of applications and declarations about the readiness of ships to navigate the Northern Sea Route.

2. Applications for the escorting of ships along the NSR are submitted to the NSR Administration in accordance with item 3.1 of the “Regulations for Navigation on the Seaways of the Northern Sea Route,” 1990.
3. Procedure of the submission of applications and of the required information is specified in Item 2 of the “Regulations for Icebreaker and Pilot Guiding of Vessels through the NSR” (hereinafter referred to as the Regulations).
4. Applications are submitted by ship owners or masters of ships not later than 15 days before the beginning of traffic in the water area of the NSR. It is recommended to submit applications in advance. The NSR Administration accepts applications for consideration within the time period from 4 months to 15 days before the beginning of traffic in the water area of the NSR.

In addition to applications, to facilitate administrative actions on granting permissions, ship owners and masters of ships should send the NSR Administration declarations according to the attached example signed by master of ship and ship owner.

- Consideration of applications and declarations
- According to Item 2.3 of the Regulations, the NSR Administration considers applications for not longer than 10 days and informs the applicants of the appropriate decision.

After the NSR Administration has considered applications and declarations, permissions in accordance with the set form for the escorting of ships along the NSR are issued or a reasoned refusal is sent to the applicant.

PROCEDURES OF GRANTING PERMISSION FOR SHIPS PROCEEDING TOWARD THE NSR FROM INLAND WATER WAYS AND SEA PORTS OF THE RUSSIAN FEDERATION

- Submission of applications about the readiness of ships to navigate the Northern Sea Route.
- Applications for the escorting of ships along the NSR are submitted to the NSR Administration in accordance with item 3.1 of the “Regulations for Navigation on the Seaways of the Northern

Sea Route,” 1990.

- Procedure of the submission of applications and of the required information is specified in Item 2 of the Regulations for Icebreaker and Pilot Guiding of Vessels through the NSR (hereinafter referred to as the Regulations).
- Applications are submitted by ship owners or masters of ships not later than 15 days before the beginning of traffic in the water area of the NSR. It is recommended to submit applications in advance. The NSR Administration accepts applications for consideration within the time period from 4 months to 15 days before the beginning of traffic in the water area of the NSR.
- Consideration of applications.

In order to determine the compliance of ships with the established requirements, a survey of ships is carried out before they exit to the Northern Sea Route. The survey of ships is administered by sea port masters in accordance with article 79 of the “Code of Commercial Navigation,” Order No. 140 of August 20, 2009 and “the Requirements for the Design, Equipment and Supplies of Vessels Navigating the NSR” each time a ship leaves a sea port proceeding towards the NSR. The NSR Administration may refuse to grant permission for the following reasons: prohibitions or restrictions imposed in compliance with the established legislation, inconsistency with the requirements set for ships navigating the NSR, and the refusal to make agreements for icebreaker escorting if ice conditions and the ice class of the ship require it.

After the NSR Administration has considered applications, either permissions in accordance with the set form for the escorting of ships along the NSR are issued or a reasoned refusal is sent to the applicant. The NSR Administration issues the permission for a calendar period (not more than one year) taking into account the ice class of ship and admissible conditions of navigation in ice. If in the course of the ship’s survey the sea port master detects defects jeopardizing the safe navigation of the ship in the NSR, the sea port master performing the survey may refuse to grant the ship permission to leave the sea port in accordance with article 80 of the “Code of Commercial Navigation”, even if the ship has the permission to navigate in the area of the NSR issued by the NSR Administration.

ORDER OF PRIORITY OF ESCORTING SHIPS ALONG THE NSR

During the navigation period is permissible along the NSR ships are

under the surveillance of the Headquarters of Marine Operations. Observation of ship traffic from west to east allows the Headquarters of Marine Operations to coordinate ship flows, providing ships with a pilot, icebreaker support, and notifying ship masters of ice and hydro-meteorological conditions. Depending on ice conditions, the Headquarters may specify and provide for the following types of escorting: icebreaker escorting or escorting according to the recommended routes to a definite geographic point (Item 1.4 of the *Regulations for Icebreaker and Pilot Guiding of Vessels Through the NSR*).

In accordance with Item 2.12 of the Regulations for Icebreaker and Pilot Guiding of Vessels through the NSR the priority established by the Headquarters of Marine Operations for the date and origin point of icebreaker escorting of ships, as stipulated in agreements for conducted between ship owners and icebreaking fleet operators. In prioritizing the escort of ships, the Headquarters of Marine Operations considers recommended routes to a definite geographic point. One type of escorting is used for ships navigating in ice-free areas of the NSR or for ice class ships enabled to independently proceed along the NSR under certain ice conditions. In the latter case, the escorting priority is not fixed. Ships may depart for the voyage as soon as they are ready to depart after receiving the permission of the NSR Administration or registration of ship for leaving the sea port.

Two new documents are introduced in the specification of documents: "Procedure of Granting Permission for the Escorting of Ships along the NSR" and "Declaration of Readiness of the Ship to Navigate in the Waters of the Northern Sea Route." These documents make access to the NSR for ship owners and masters of ships much easier. For example, Article 1 of the "Procedure" now allows ship masters and owners to submit an application no later than 15 days before the beginning of traffic in the water area of the NSR, previously it was not later than 4 months. In addition, the new "Procedure" allows owners and ship masters to get permission without preliminary examination of the ship if it transits without cargo operations in Russian ports and has submitted declarations to fully satisfy the NSR Administration.

The effective and regular operation of the NSR requires solving major issues to ensure maritime safety and good service for transit vessels. In 2011 the funding for the continued development of mapping, securing reliable operation of the navigation and hydrographic equipment through the NSR, and regular water soundings on the Northern Sea Route allocated from the budget. Seven hydrographic vessels have been involved for the first time in recent years on the route. Several issues still require attention, however, including determining the possibility of bunkering vessels around the NSR, maintaining a supply of fresh water, setting up crew ro-

tation points, and the implementation of emergency and urgent repairs of vessels and their diving inspections. Additionally, ports would need to be opened for non-Russian vessels with the appropriate servicing infrastructure so that foreign ships can take advantage of these same services. Some potential ports on to establish these services for the NSR could be Port Dickson on the West and Port Pevek on the East. These ports are located on the NSR, have deep-water and closed roads, and are suitable for large-capacity vessels. It will also be necessary to restore infrastructure for servicing vessels in the far-eastern Port Providenie, called the “East Gate of the Arctic,” and already opened to foreign vessels.

TARIFF POLICY OF THE NSR

The new tariff (the FTS of Russia No. 122-t/1 of June 7, 2011) for the services of icebreakers on the NSR is flexible and allows for the application of tariffs below the limit, significantly increasing the attractiveness of the NSR for ship owners and operators, including foreign ones and those engaged in transit navigation. The previous rates virtually locked the NSR, since the rates were prohibitively four to six times higher than the rates of the Suez Canal. As a result of flexible tariff policy, more than 834,931 tons of cargo were carried in transit in 2011, which is an absolute record in the history of the NSR.

The leading of vessels in order to ensure delivery on the NSR is more active now and the transportation of equipment for the construction of pipelines in the Arctic and scientific research, including work on the delimitation of the Russian Arctic Shelf, is more frequent. Four nuclear icebreakers and one diesel icebreaker currently perform proper ice breaking support in the NSR. There is also new advanced cargo traffic in the NSR, including the carriage of frozen fish from far east to the western Russian ports and transportation of petroleum products produced at the Arctic fields. Large tankers with a cargo of oil products undertake round trips from east to west and back.

According to the governmental order of the Russian Federation from July 3, 1995 (No. 239), “About Measures on Streamlining State Regulations of Prices (Tariffs),” on the basis of the references from Rosatom, the state corporation on atomic energy, and the report of the Board of FST of Russia from June 7, 2011 (No.33), provisions have been made to set maximum tariffs for icebreaking fleet services on NSR Seaways. Additionally, under the recommendations of these documents, the establishment of tariffs for icebreaking fleet services on NSR Seaways can be applied at the level or below the maximum tariff.

SUMMARY

To increase the economic attractiveness of NSR cargo traffic, the tariff for icebreaking leading on the route must remain equal to or less than the 10-15% tariff for using the Suez Canal. It will be necessary to promptly negotiate “Regulations for Navigation on the Seaways of the Northern Sea Route,” “Regulations on the Headquarters of Marine Operations,” “Requirements for the Design, Equipment and Supply of Vessels Navigating the Northern Sea Route,” “Regulations on the Ice Pilot for NSR”, etc., and make these documents simple and understandable for all ship owners, including foreigners. Additionally, it will be necessary to increase the amount of back cargo in order to decrease number of ballast voyages through the NSR.

Today the Federal State Unitary Enterprise Atomflot and the Directorate of the Partnership are doing this kind of work. Together with our partners in Alaska (the Institute of the North) we are preparing a meeting with consignors, for example, Red Dog Mines, and the Ports of Dutch Harbor and Adak, to build a new double-draft icebreaker to be completed in 2017. This new icebreaker will help to eliminate the expense of engaging an icebreaking fleet for transit vessel leading. In order to make the NSR a viable route it will be necessary to outfit new deep-water routes to provide for the safety of navigation for large capacity vessels (with the draft over 15 meters) and to restore or build new infrastructures for servicing vessels on the route and to open ports for servicing foreign vessels.

Comments on Chapter 2: European perspective

Jerome Verny

There is real potential for Arctic shipping along the North Sea Route (NSR) thanks to new transport services options like integration between the NSR and the Trans-Siberian Railway (TSR). Traveling from Shanghai to Rotterdam, an average transit time along this route is twelve to eighteen days, versus one or two days by air and an additional twenty eight days necessary on route through the Suez Canal. When shipping via the NSR, transporting 1 TEU (equivalent to 14 metric tons) between Shanghai and Rotterdam is approximately double the expense of shipping through the Suez Canal. Though both options are cheaper than shipping by air freight, the total shipping cost depends on the value of the product, the cost of logistic services, time constraints, the season,

the shippers and logistics providers' strategies, and the reliability versus efficiency relationship. As Chapter 2 suggests, with global warming and the melting of polar ice, a new itinerary can be imagined permitting maritime transport between the markets of northeastern Asia and northwestern Europe via the NSR, passing through the Arctic Ocean and utilizing the TSR.

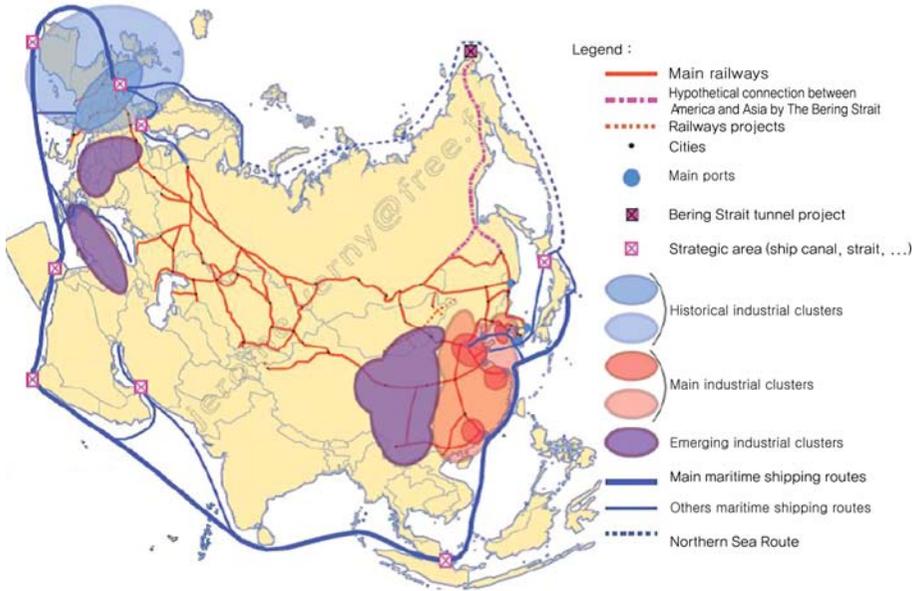
Several factors justify renewed interest in the NSR. For example, the NSR presents advantages linked to its geography. In the map below, it is clear that the shortest distances between the industrial clusters in northeastern Asia and the European consumer market are connected by the NSR and the TSR.

This map also highlights the Bering Strait tunnel project, a potential international commercial route viable in the long term. I included this route in the map because I believe there will be more discussion about this project in the near future. The Kremlin wants to complete the extension of the rail network to the tip of Siberia by 2030. But the new geography of places and flows also depends on the relocation of industrial clusters towards eastern and central Europe and towards western China. The offshoring, versus backshoring, of the industrial clusters is correlated with the new value added logistics strategy. This new economic geography can explain the renewal of research works on the NSR and the TSR. The development of the NSR could depend on the reliability of the TSR, an intermodal system, and a new supply chain organization. It is imperative to analyze the prospective link between the NSR and the TSR as The author tries to do.

As Chapter 2 presents, the NSR poses new accessibility challenges for north-east Asian countries, but also does for Europe. Murmansk and Indiga are the two ports that will supply Eastern Europe, the new economic center of the continent, from the NSR. But these Russian ports must prepare for the evolution of a new geography of freight flows (see Figure 2.9). Port authorities need to invest, in the near future, in new terminals, in new handling tools, and more. At the same time, they will need to optimize their land accessibility using new inland transport infrastructures. However, building transport infrastructures is not enough. It is also necessary to develop good organization across infrastructures.

One example, of course, are dry ports. There may be well developed infrastructures, but dry ports are developed only if we can integrate them and optimize organization of freight flows through an understanding of the evolution of supply chain management. Logistic platforms on dry ports add value to each product (for example, postponement, in order to minimize the transshipments costs between rail and road). The optimal location of dry ports will be strategic in the success to link the NSR with eastern Europe. In order to promote inland ac-

cessibility, opportunities for northeast Asian and European countries and to develop intermodalism, the European Union and Russia need to develop plans for cooperation on the NSR as soon as possible.



source : Jerome Verny

Figure 2.9. New geography of freight flows

References

Baykasoglu A., Kaplanoglu, V., 2008. Application of activity-based costing to a land transportation company: a case study. *International Journal of Production Economics* 116(2), pp. 308-324.

Brooks, M. & Frost, J., 2012 (in press). Providing freight services to remote arctic communities: Are there lessons for parctitioners from services to Greenland and Canada’s northeast?, *Research in Transportation Business & Management*.

Drewry, 2008. *Container forecast*. London: Publications of Drewry Shipping Consultants Limited.

Global Insight, 2011. *Trends in the world economy and trade*. Waltham: Publications of Global Insight.

Hong, N., 2012. The melting arctic and its impact on China’s maritime transport, *Research in Transportation Economics* 35(1), pp. 50-57.

- HWI, 2006. Maritime trade and transport logistics. Hamburg: HWI Publications.
- Lasserre, F., 2011. Des autoroutes maritimes polaires?, *Cybergeo*, European journal of geography, article 537.
- Notteboom, T., Rodrigue, J-P., 2008. Containerization, box logistics and global supply chains: The integration of ports and liner shipping networks. *Maritime Economics and Logistics* 10, pp. 152-174.
- Quinet, E., Vickerman, R., 2004. Principles of transport economics. Cheltenham: Edward Elgar Publishing.
- United Nations, 2005. Regional shipping and port development strategies. New York: Publications of UN.
- Verny, J. & Grigentin, C., 2009. Container shipping on the Northern Sea Route, *International Journal of Production Economics* 122(1), pp. 107-117.
- Verny, J., 2007. The importance of decoupling between freight transport and economic growth: The role of distances. *European Journal of Transport and Infrastructure Research* 7(2), pp. 113-128.
- World Trade Organization, 2008. International trade statistics 2008. Geneva: WTO Publications.

Comments on Chapter 2: Chinese perspective

Xu Hua

In Chapter 2, six major obstacles of Arctic shipping are presented. The first of them is the ice breaking fee imposed by Russia, which lessens the attractiveness of the NSR and prevents more carriers from sailing on it. I will consider this cost as one of the three determinants of the economic potential of the NSR. Another determinant is the sea ice extent along the NSR. As the author mentions, the estimated ice-free duration of the NSR in the long-run varies widely among different researchers, so it is uncertain how long the NSR will be navigable during a year. Although it is clear that in September sea ice is no longer a barrier to the NSR, the sea ice extent in August and October is uncertain and likely change to a great extent on a year-to-year basis. For example, in 2011 the NSR was totally ice-free at the end of July, while in 2008 the sea ice east of the Taymyr Peninsular, which blocked the NSR, did not melt until September. If a ship need to pass though the NSR in August and October, backup from an icebreaker will be indispensable to maneuver through the changing sea ice. The last determinant is the bunker price. If other conditions remain unchanged, the fuel

cost saved by shipping through the NSR will rise (or fall) when the bunker price is higher (or lower). So, the above three determinants—the ice breaking fee, the sea ice extent, and the bunker price—determine how long the most economical duration will be in which ships pass through the NSR with icebreaker escort. When the ice breaking fee is low but the bunker price is high, for example, it may be economical to expand the navigational duration by more intensive use of icebreakers even if the NSR is blocked by sea ice.

The prime difference between the author's work and mine is that I specifically focus on Asia-Europe container lines that use the NSR as a seasonal alternative route. Because the schedule of an ocean-going container line is fixed, usually a weekly service is provided in spite of the distance. That is to say, the total transit time of an Asia-Europe line via the traditional Suez Canal Route (SCR) is unchanged when the ship goes through the NSR. The only difference between the SCR and the NSR is that ships can steam more slowly on the NSR, and in turn the fuel cost can be saved considerably.

An Asia-Europe line can use the NSR as an alternative route seasonally. As we have observed, the NSR has been totally open throughout September since 2008. If a ship from an Asia-Europe line passes through the NSR instead of the SCR in September, it can be free from icebreaker escort. However, while the NSR is blocked by sea ice in August and October, ships can still choose the NSR in these months if the ice breaking fee is low enough or the ice condition is light enough for ships to pass. There is the trade-off between the ice breaking fee and the fuel cost, leading to overall savings. Below is a model that quantifies this trade-off.

The fuel cost model. The fuel cost per round is determined by the fuel consumption rate, the transit time per round, and the bunker price:

$$F = FP \cdot BHP = FP \cdot m \cdot V^3$$

F - fuel consumption rate (t/h)

FP - fuel consumption rate of unit power (t/h/kW)

BHP - brake horsepower of the engine (kW), which is cubic proportional to the speed.

V - speed (knot)

m - proportional factor

Furthermore, the speed is related to the distance and transit time:

$$V_i = L_i / T_i$$

V_i - average speed in leg i of the route (knot)

L_i - distance of leg i of the route (n mile)

T_i - transit time of leg i of the route (h)

Thus, the fuel cost per round can be written as:

$$CF = PF \cdot \sum_{i=1}^I F_i \cdot T_i = PF \cdot FP \cdot m \cdot \sum_{i=1}^I L_i V_i^2 = K \cdot \sum_{i=1}^I L_i V_i^2$$

where $K \equiv PF \cdot FP \cdot m$

CF - fuel cost per round (\$)

PF - bunker price (\$/t)

I - number of legs of the route

We assume that there is a typical weekly Asia-Europe line, on which eight ships are assigned with a total transit time per round of fifty-six days and call at four ports in East Asia and Western Europe each, with staying one day at each port. The voyage time on sea, therefore, is forty-eight days. This line can be divided into four legs if it uses the SCR: two intra-regional legs (that is, in East Asia and West Europe) and two inter-regional legs (eastbound and westbound ocean-going SCR legs). Similarly, the line can be divided into six legs if it uses the NSR: two intra-regional legs, two inter-regional non-ice legs (eastbound and westbound NSR legs which consist of ice-free water segments), two inter-regional ice legs (eastbound and westbound NSR legs which consist of ice water segments). Each leg of the line is shown in Figure 2.10.

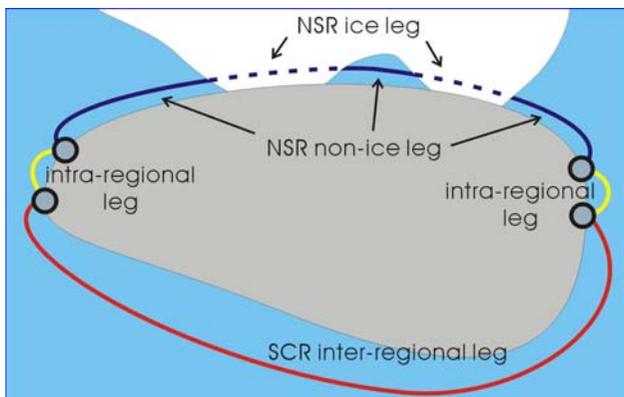


Figure 2.10. Legs of NSR and SCR

The speed of ships via the SCR is:

$$V_S = (L_A + L_E + L_{SE} + L_{SW})/48/24$$

V_S - speed in all legs of the SCR (knot)

L_A - distance of the intra-regional leg in East Asia (n mile)

L_E - distance of the intra-regional leg in West Europe (n mile)

L_{SE} - distance of the eastbound inter-regional leg of the SCR (n mile)

L_{SW} - distance of the westbound inter-regional leg of the SCR (n mile)

The fuel cost of a ship sailing on the eastbound and westbound SCR voyages are:

$$CF_S = K \cdot (L_A + L_E + L_{SE} + L_{SW}) \cdot V_S^2 = K \cdot (L_A + L_E + L_{SE} + L_{SW})^3 / 1152^2$$

$$CF_{SE} = K \cdot L_{SE} \cdot V_S^2 = K \cdot L_{SE} \cdot (L_A + L_E + L_{SE} + L_{SW})^2 / 1152^2$$

$$CF_{SW} = K \cdot L_{SW} \cdot V_S^2 = K \cdot L_{SW} \cdot (L_A + L_E + L_{SE} + L_{SW})^2 / 1152^2$$

CF_{SE} - fuel cost on the eastbound inter-regional leg of the SCR (\$)

CF_{SW} - fuel cost on the westbound inter-regional leg of the SCR (\$)

Similarly, the fuel cost of a ship sailing on the eastbound NSR voyage is:

$$CF_{NE} = K \cdot (L_{NNE} V_{NNE}^2 + L_{NIE} V_{NIE}^2)$$

CF_{NE} - fuel cost on the eastbound NSR voyage (\$)

LN_{NE} - distance of the eastbound non-ice leg of the NSR (n mile)

LN_{IE} - distance of the eastbound ice leg of the NSR (n mile)

VN_{NE} - speed in the eastbound non-ice leg of the NSR (knot)

VN_{IE} - speed in the eastbound ice leg of the NSR (knot)

In fact, VN_{IE} is the average speed of an icebreaker cutting a way through an ice field, and is based on data from practice. According to the assumption that the transit time is fixed via the NSR, we can draw a constraint condition. After all, we can add the ice breaking fee to the fuel cost as the object function to be optimized:

$$\min\{C_{NE}\} = \min\{CF_{NE} + BF_{NE}\} = \min\{K \cdot (L_{NNE} V_{NNE}^2 + L_{NIE} V_{NIE}^2) + BF_{NE}\}$$

$$\text{s.t. } L_{NNE}/V_{NNE} + L_{NIE}/V_{NIE} = L_{SE}/V_S = 1152 \cdot L_{SE} / (L_A + L_E + L_{SE} + L_{SW})$$

$$L_{NNE} + L_{NIE} \geq L_{NE}^*$$

C_{NE} - sum of the fuel cost and the ice breaking fee of the eastbound NSR voyage (\$)

BF_{NE} - ice breaking fee of the eastbound NSR voyage (\$), a function of the distance of the ice leg. It goes higher when LNIE is larger, which implies that the worse the ice condition is, the more ice breaking service is needed.

L_{NE}^* - minimum distance of the entire eastbound inter-regional leg of the NSR (n mile)

It should be noted that LNNE and LNIE are variables because the exact route of the NSR can be varied due to different ice condition. In most circumstances, if a ship wants to pass through a shorter ice leg to save on the ice breaking fee, it has to pass a longer non-ice leg, as Figure 2.11 shows.

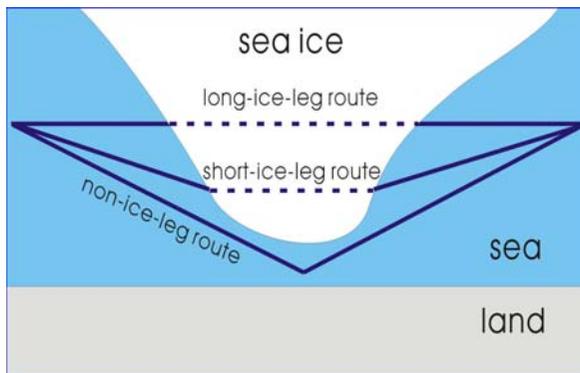


Figure 2.11. Trade-off between non-ice leg and ice leg

The approach for westbound NSR voyage is symmetrical. We can see that when the NSR is totally open in September, LNIE and BFNE both equal to zero and LNNE equals to L_{NE}^* , so C_{NE} reduces as:

$$C_{NE} = K \cdot L_{NNE} V_{NNE}^2 = K \cdot L_{NE}^{*3} (L_A + L_E + L_{SE} + L_{SW})^2 / L_{SE}^2 / 1152^2$$

After all, through the above approach, we can calculate C_{NE}^* and C_{NW}^* , the optimal cost of the eastbound and westbound NSR voyages respectively, including the fuel cost and the ice breaking fee. Compare them with the fuel cost on the SCR:

$$R_E \equiv C_{NE}^*/CF_{SE}$$

$$R_W \equiv C_{NW}^*/CF_{SW}$$

When R_E is bigger than 1, it indicates that the NSR is more economical than the SCR, and a ship on the eastbound voyage of an Asia-Europe line has an incentive to choose the NSR as an alternative route rather than remain on the SCR. For a westbound voyage the situation is the same. Because of the seasonal fluctuation of the sea ice extent, the distance of the ice legs LNIE and LNIW can vary widely. Therefore, for an Asia-Europe line the alternative route of the NSR is seasonal (see Figure 2.12). Furthermore, the bunker price and the ice breaking fee also influence the result. If the ice breaking fee is higher, a ship is more likely to remain on the SCR. However, the effect of the bunker price is not so explicit.



Figure 2.12. Seasonal costs comparison between the SCR and the NSR

Comments on Chapter 2: Japanese Perspective

Ryuichi Shibasaki

My comments mainly consist of three parts. First, I will summarize recent responses to arctic shipping delivered from several bodies in Japan including the Japanese government, media, other organizations, and researchers. Secondly, I would like to provide a kind of worldwide per-

spective for potential arctic shipping from the viewpoint of the Panama Canal and Suez Canal as potential competitors. Since I am now engaged in a Japan International Corporative Agency (JICA) project to improve management capacity of the Suez Canal Authority (SCA) as a specialist on demand analysis and the forecast of maritime shipping, I will give a few comments from that perspective. Additionally, I am a researcher who specializes in developing simulation models for worldwide intermodal freight flow. From that perspective I will comment on the possibility of developing a model which includes arctic shipping and related issues.

RESPONSES TO ARCTIC SHIPPING IN JAPAN

Until recently, Arctic shipping was rarely featured in Japanese media but interest is steadily increasing. For example, Asahi-Shimbun (which is one of the most popular newspapers in Japan) recently ran an article on Arctic shipping over its first and second pages (Asahi-Shimbun 2012), addressing how shipping distance will be saved and how much ice-breaking vessels will cost. Related business papers and journals also sometimes feature arctic shipping (for example, *Zasshi Kaiun* (Maritime Shipping Journal), January 2010).

Since more than thirty vessels passed through the Arctic last summer, Japanese government attention to the North Sea Route is rapidly increasing and they are starting to gather information through various channels. For example, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Japan launched an internal study meeting on Arctic shipping on August 3, 2012 which was attended by leaders from all related departments in the ministry including Maritime Bureau, Ports and Harbors Bureau, Hokkaido Bureau, Coast Guard, and Metrological Agency (MLIT of Japan 2012).

Since Japan is located at the east end of the Far East, the Arctic route would not only save shipping distance to northern Europe but there is also potential for a Japanese port to serve as a hub as a gateway for Arctic shipping. For example, the port of Tomakomai, which is the biggest port in the Hokkaido region, had a seminar on the potential of Arctic shipping and the possibility for port of Tomakomai becoming a gateway for the arctic shipping, in collaboration with the IAPH project team, discussed below.

The Ocean Policy Research Foundation launched a “Japan-Arctic Sea Talk” in 2010, and published policy recommendations in Japan for a sustainable utilization of the Arctic Sea (Ocean Policy Research Foundation 2012). There are nine recommendations including “to appropriately re-

spond for a potential change in logistics expected with the development of the North Sea Route,” in which recommendation it is pointed out that the Japanese response for potential logistics change is far behind Korea, considering the activities of Korea Maritime Institute (KMI) and Korea Transit Institute (KOTI).

The International Association of Ports and Harbors (IAPH) organized a project team (Port Planning and Development Committee) and launched research on the effect of the Arctic Sea routes navigability on port industry last year. In the project team, two Japanese experts, Dr. Furuichi (JICA expert), and Dr. Otsuka, who presented at last year’s North Pacific Arctic Conference, play a key role. They delivered a mid-term report at the recent International Association of Ports and Harbors (IAPH) conference (May 2012) on the potential of the Arctic Sea Routes by showing trial calculation results of how much shipping cost can be saved by utilizing the NSR (Furuichi, Otsuka, and Tomakomai Port Authority 2012).

ARCTIC SHIPPING AS A COMPETITOR FOR THE PANAMA AND SUEZ CANAL

The Panama Canal is now implementing its expansion project to be completed in 2014. Before the project was approved in a national referendum in 2006, the Panama Canal Authority (PCA) made various studies on future demand to pass through the Panama Canal after expansion. All the reports are still available in its website <http://www.pancanal.com/eng/plan/temas/>. Among them, the Arctic marine transport is seen as a potential competitor, although its main competitor is Northern Western Passage (NWP), not the NSR (Panama Canal Authority 2005). Since the major focus of the PCA studies was to determine whether the expansion project of the Panama Canal is viable or not from a financial viewpoint, especially in the worst case scenario, the NWP and NSR were apparently deemed just as one of various risk factors. At any rate, it is not too much to say that the NSR and NWP are potentially strong competitors for the Panama Canal, even though they will not be realized in the near future.

As for the Suez Canal, the NSR is the more threatening competitor due to its geographical condition. As many researchers have pointed out, more than 40% of the shipping distance between North Europe and Far East Asia can be saved by utilizing the NSR. Because vessels that can benefit by utilizing the NSR are limited from both viewpoints of vessel type (e.g. vessels in regular service such as containership may find it difficult to utilize the NSR because it cannot be used throughout

the year) and regional combination (e.g. for many tankers connecting Middle East and Europe, the NSR will not be a strong competitor), it will take more time until the potential of the NSR as a competitor becomes clear. However, the SCA already recognizes it as a strong future competitor. We are going to analyze the degree to which the NSR will be able to compete, in our ongoing project to forecast future demand of the Suez Canal.

POTENTIAL FOR DEMAND FORECASTING MODEL AND RELATED DISCUSSIONS

I have developed an international intermodal freight flow model considering both maritime and land shipping network all over the world (National Institute for Land and Infrastructure Management of Japan 2010, Shibasaki and Watanabe 2010, Shibasaki and Watanabe 2012). The model can predict a flow pattern of maritime container shipping and land cargo transport by inputting cargo shipping demand on a regional basis and related policies on logistics infrastructure. I also attempted a risk simulation by using the model on a scenario in which the Singapore-Malacca Strait is blockaded due to some reason. The result was that the impacts to Malaysian ports such as Port of Tanjung Pelepas and Klang are significant compared with those to Port of Singapore and Indonesian ports (Shibasaki 2010). In this model, in addition to all major trunk routes for maritime container shipping including a service between Europe and Far East Asia, the Trans-Siberian Railway (TSR) is also already incorporated, although validation and calibration of the model when TSR is included is still inadequate. I would like to develop a model that includes both the NSR and TSR in order to evaluate the impacts of the NSR on the worldwide cargo shipping market and global logistics infrastructure such as the Suez Canal and Panama Canal, after sufficient verification of the model.

There are two possible problems when developing a model to include the NSR. First, my model does not include maritime bulk shipping at the moment. There is no real technical problem in developing a route choice model for maritime bulk shipping; therefore, in the ongoing project for the Suez Canal, it will be included. A more important problem (or in other words, a discussion point) is how to evaluate the significant characteristics of the NSR, i.e., seasonal differences of availability. This cannot be easily incorporated into the model developed on a regular shipping basis. A new approach will be required.

References

- Asahi-Shimbun: article on 2012.7.16 (in Japanese)
- Masahiko Furuichi, Natsuhiko Otsuka, and Tomakomai Port Authority. 2012. Effects of the Arctic Sea Routes (NSR and NWP) Navigability on Port Industry, IAPH Port Planning and Development Committee (PPDC) Project, presented at IAPH 2012 Mid-term Conference, Jerusalem, Israel, May 2012.
- Ministry of Land, Infrastructure, Transport and Tourism of Japan. 2012. On launching an internal study meeting in the Ministry on the arctic shipping. http://www.mlit.go.jp/report/press/sogo11_hh_000018.html (in Japanese)
- National Institute for Land and Infrastructure Management of Japan. 2010. Impacts of Trade and Transport Policy on International Cargo Shipping and Economic Activities, submitted to Maritime Expert Group (MEG), the 33rd Transportation Working (TPT-WG), Asia-Pacific Economic Corporation (APEC), Tokyo, Japan, 2010.
- Ocean Policy Research Foundation. 2012. Japan-Arctic Sea Talk, Policy Recommendations in Japan for a Sustainable Utilization of the Arctic Sea. http://www.sof.or.jp/jp/report/pdf/12_06_02.pdf (in Japanese)
- Port of Tomakomai. 2012. On a symposium on Northern Sea Route on March 15, 2012. <http://www.jptmk.com/modules/bulletin0/index.php?page=article&storyid=471>(in Japanese)
- Panama Canal Authority. 2005. Future of marine transport in the Arctic. <http://www.pancanal.com/esp/plan/estudios/0301.html>
- Shibasaki, Ryuichi. 2010. A cost minimization model of a large-scale international maritime container shipping network regarding characteristics of ports, TRB 90th Annual Meeting Compendium of Papers DVD, Transportation Research Board, Washington, D.C.
- Shibasaki, Ryuichi and Tomihiro Watanabe. 2012. Large-scale simulation model of international maritime container shipping considering shippers' and carriers' behavior. The 9th World Congress of Regional Science Association International, Timisoara, Romania.
- Shibasaki, Ryuichi and Tomihiro Watanabe. 2010. Risk Assessment of Blockade of the Malacca Strait using International Cargo Simulation Model. Annual Conference of International Association for Maritime Economists, Lisbon, Portugal.
- Zasshi Kaiun (Maritime Shipping Journal): January 2010. (in Japanese)

Comments on Chapter 2: Korean perspective

Seo-Hang Lee

For the last several years, the Arctic's sea ice cover has undergone an historic transformation due to climate change. Ice in the region is thinning and there is reduction of it in all seasons, including loss of multi-year ice in the central Arctic Ocean. These changes allow increases in marine access throughout the Arctic Ocean and potential longer seasons of navigation and possibly trans-Arctic voyage in the summer.¹ These changes also make the Northern Sea Route (NSR), the Arctic sea route along the Russian coast of Siberia, one of the most feasible international shipping routes connecting Europe and East Asia.

Previously, no non-Russian ships traversed the NSR, but during the summer seasons since 2004, merchant, research, and expedition vessels have journeyed through the NSR and that volume is set to increase. For instance, the 34 vessels that traversed the route last year shipped 820,000 tonnes of cargo. The official Russian forecast suggests that this year's figure will be 1.5 million tonnes. By 2020, according to American estimates, the figure will rise to 64 million tonnes, making the transit traffic in the NSR more regular. Last September, shortly before the end of the NSR's four-to-five month season, Mr. Putin, then the Prime Minister of Russia, predicted that the NSR would one day rival the Suez Canal.²

The Arctic sea routes, notably the NSR and the Northwest Passage, could bring significant economic benefits. For example, the NSR, transiting the coast of Siberia between North Atlantic and North Pacific, would trim about 5,000 nautical miles and a week's sailing time from the use of the Suez Canal and the Malacca Straits. Taking the Northwest Passage, which weaves between Canada's high Arctic islands, could reduce the distance by 15%. This would mean a shorter journey time, or alternatively allow ships to go more slowly, saving on bunker fuel, the price of which rose by one third last year. The Arctic passages are also free of the piracy that is rampant in some other parts of the world, costing shipping companies an estimated \$7 billion USD to \$12 billion USD a year in insurance premiums, ransoms and disruption.³

These potential savings in time and money are the main reasons why Korea, which is heavily dependent upon the sea lane in terms of transportation of its exports and imports,⁴ is very much interested in the Arctic sea routes, particularly the NSR. Korea believes that the Arctic sea route could serve as a new useful sea lane, which will enable shorter times between Europe and East Asia, thus resulting in substantial cost saving for ship operators. In fact, in early September 2009, two German merchant

vessels (Beluga Fraternity and Beluga Foresight) made successful voyages through the NSR and the Northeast Passage, departing from Ulsan of Korea to Novy Port in Russia. They eventually sailed around the Yamal Peninsula, crossed the Barents Sea to Murmansk, and headed on to Onne, Nigeria, being escorted along sections of the NSR by Russian nuclear ice breakers. No doubt, these voyages highlight the possibility of clear passage through the Arctic sea routes.

Before the Arctic sea route can be reliably used as a transit passage between Europe and East Asia, however, several issues will need to be resolved. Dr. Sung-Woo Lee identified a number of obstacles and challenges in the chapter, and these risks have to be properly addressed. We believe that all the stakeholders in the Arctic shipping—Arctic and non-Arctic states and relevant international organizations—must be included in discussions of the improvement of a critical waterway used for international navigation.

In addition to shipping, Korea is interested in other Arctic-related maritime industries. Korea, as a leading shipbuilder in the global market, is interested in building icebreakers, drill ships and other vessels which can contribute to safe operation in Arctic resource development and exploration. For instance, in recent years, the STX, the Hyundai and Samsung Heavy Industry have won several deals with Russia to build a LNG carrier, oil tanker (Vasily Dinkov) and a drill ship with ice breaking capacity.⁵

Korea, as one of the stakeholders in Arctic shipping, will do its best to foster international cooperation. Korea's efforts to promote cooperation in the Arctic may be grouped into three levels: bilateral, regional (multilateral), and global. First, the bilateral efforts include the joint ventures and the business-to-business talks with the Arctic states including Russia. Secondly, the regional measures may include the strengthening discussion and cooperation with China and Japan on Arctic marine transport. Finally, in view of the comprehensive nature of the Arctic environment, international cooperation will be necessary at the global level to include all the stakeholders of the Arctic.

Notes

1. Lawson W. Brigham, "The Challenges and Security Issues of Arctic Marine Transport," in James Kraska, ed., *Arctic Security in an Age of Climate Change* (New York: Cambridge University Press, 2011), p. 20.
2. *The Economist*, June 16th 2012, Special Report, p. 15.
3. *Ibid.*
4. In Korea, in terms of volume, seaborne trade accounts for 99.6~99.7%

of the total foreign trade; airborne trade represents 0.3~0.4%. Almost no cargo movement over land is reported since Korea does not have much trade with the communist regime of Pyongyang.

5. The Economic Daily (Maeil Kyungje), July 19 and 20, 2012.