Summary

The sea-ice that has been covering the Arctic Ocean is melting. In the past 30 years the average extent of sea-ice cover on the North Pole has declined with approximately 15-20% and it is expected that this trend will not only continue but even accelerate when more sea-ice disappears. When there is less ice, it could become possible to ship goods between Europe to the Far East with container ships via the Northern Sea Route (NSR) along the north shore of Russia which is up to 40% shorter than the current route via the Suez Canal. However, there are many difficulties that have to be overcome.

The initiative for this research is at the Port of Rotterdam together with Delft University of Technology. Although the port is the initiator it has no direct commercial interest in the NSR. The shipping lines, the main stakeholder, do have an interest. Also governance organizations could have an interest in the results of this research for developing an Arctic policy. To satisfy both the port and the industry this research aims to act in a catalyzing way by gathering existing knowledge and information, adding knowledge and making it all accessible for a larger audience.

The main research question, which is being answered in this report, is:

Under what conditions can a future shipping service, using the Northern Sea Route as a link between North Europe and the Far East, become feasible before 2030 to 2040; and how can the path towards this future be characterized and realized?

A backcasting approach to answer the main question

The approach for answering the main question that was chosen for this research is a variant of ´backcasting´ that was introduced by Robinson (1990). In a forecasting scenario study, existing trends are projected into the future to learn about the way the future might look so that stakeholders can prepare for the possible scenarios. In backcasting, extra steps are taken in which, given certain organizational or societal goals, the most favourable future scenario is selected. Then, the possible paths towards this future are determined in the form of a set of events that lead to the selected end-state. Some of these events can be influenced and some events can not, some other can only be influenced by other stakeholders.

The methods used for answering the sub questions

Some of the methods that were used for finding information are:

- Literature research
- 12 interviews
- A survey among 18 experts

Part of the literature research is a (forecasting) scenario study by Global Business Network (GBN) organised and written for the Arctic Marine Shipping Assessment (AMSA) in particular (Smith et al., 2008). This report is used to indicate which scenarios of Arctic shipping are possible. Besides the many other reports that have been used, two

reports are reviewed in chapter 6 for the financial feasibility of the route. The survey that was sent out consists of 61 future events that might or might not be on the path towards the selected most favourable future concerning a shipping service on the NSR. The events were determined with knowledge gained from the interviews and the literature research. The product of the survey is a list of most critical and important events that are considered to be on the path to this most favourable end-state. The amount of surveys that were sent out is 35. This makes the response rate slightly higher than 50%. Still, results would be more reliable when a larger amount of surveys would have been available.

The results of the research

The NSR is currently used primarily for the export of natural resources and the import of food fuel and building materials with a total flow of approximately 1.5 to 2 million tons of cargo per year. The route as a whole is open for a couple of weeks per year, while eastern and western ends of the route are open for longer periods. It is not used for commercial transit traffic. Access to the route has to be granted by the Russian authorities and is allowed only with the proper ice classification.

Infrastructure on the route is minimal and obligatory icebreaker assistance and other services like ice forecast and pilot costs form a transit fee that could add up to an enormous amount of approximately $600 per TEU[1]. Besides this the operating environment is harsh, also in summer. Some of the straits on the route are rather shallow; the straits at the New Siberian Islands should be avoided by vessels with a draft of 12 meters or more.

So, in present day the feasibility for the NSR as a transit trade route is limited. To learn about the future possibilities four possible scenario end-states were derived from a report by the Global Business Network. The four main possible combinations of these factors are the possible end-states, shown in Figure 0.1.

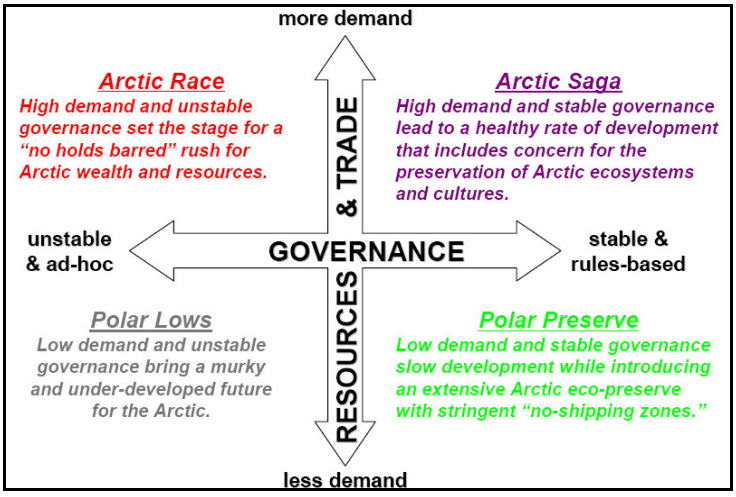

Figure 0.1 – Scenario matrix constructed for GBN/AMSA workshop in 2007 (Smith et al., 2008)

[1] TEU (Twenty-foot Equivalent Unit): A unit based on the volume of a standard 20 foot long shipping container mostly. For instance: one 40 foot container is 2 TEU.

The 'Arctic Saga' is the end-state that the shipping companies will aim for, when it proves to be financially feasible and is therefore selected as the most favourable future situation that should be achieved.

When the starting point and the desired end point are known, the path towards the future can be set. To obtain the events that are on the path towards this selected future a survey was sent out to experts and stakeholders from the market. The result is a list of events ranked on their importance for realizing the Arctic Saga (Can they be missed on the path?) and their probability of occurring before 2030 to 2040 (Are they likely to occur?) as can be seen in Table 0.1. The scores on importance and probability (on a scale of 1 to 5) are also combined in a factor that indicates how critical (scale between 0 and 2) the event is for realizing the shipping service in the 'Arctic Saga' end-state. Events with a criticality above 1.25 are marked red.

Table 0.1 - The most important and critical events according to 18 experts ordered by importance

#	Event description	Importance	Probability	Criticality
9	Reliable nautical charts available	4.89	4.06	1.21
16	Satellite navigation system available for Arctic region	4.81	3.94	1.22
40	IMO determines guidelines for arctic sailing.	4.67	4.33	1.08
57	Russia sets up emergency response system for NSR	4.61	3.72	1.22
13	Ice prediction service predicts ice situation 7 days in advance	4.50	3.82	1.17
50	First insurance company determines premiums for NSR transits	4.50	3.81	1.17
54	Requirements for ice navigator and Arctic crew determined	4.50	4.22	1.07
59	Environmental impact assessment of Arctic shipping completed	4.50	3.76	1.18
38	Russia promises unlimited access to NSR for commercial ships	4.47	2.65	1.46
23	Icebreaker service guarantees fixed navigation season	4.44	3.06	1.35
7	A liner shipping service on the NSR is started by a shipping line	4.18	3.17	1.25
36	Russia couples fee structure for the NSR directly to services provided	4.18	3.12	1.26
11	5000 TEU Arctic ice class vessel available for independent crossing of NSR	4.17	3.11	1.26
24	Dredgers deepen Russian straits to minimum of 15 meters	4.17	2.53	1.41
17	Improved ice class vessel lowers slot costs to almost regular values	4.11	3.00	1.28
37	Icebreaker support fees no longer mandatory	4.00	2.63	1.34

The most important events are not very critical which means that these are not likely to be a problem on the path to the feasible shipping service. For realising most events, the Russian government is the most important stakeholder. When Russia is not motivated and does not form a consolidated NSR strategy, the chances for container transit shipping are low. Unrestricted access to commercial vessels is considered the most critical event. Russia could put effort in creating guarantees for shipping lines if they want the NSR to become a success. Dredgers deepening the straits to 15 meters would be necessary when large ships want to use the straits. If they are strong enough and ice conditions permit, they can also take a route more to the north to avoid the shallows. This option is advised. The high icebreaker fees should be reduced and independently navigating vessels should not be charged for icebreaker services. Ship technology should provide new and larger arctic vessels so that larger ships with lower slot costs and ice classification can be built and navigate independently on the NSR.

Stakeholders and experts still see the implementation of a shipping service on the NSR within 20-30 years (Event 7) as a critical event. This means they believe its probability of occurring to be low. It scores an average of 3.17 on a scale of 1 to 5 to be precise. So it is between the scores (3) labelled as possible and (4) labelled as likely.

To assess the feasibility of an Arctic shipping service two different reports are analysed and some rough calculations were done. The conclusion is that in theory the NSR can be financially feasible and generate higher profits under specific circumstances. Important things that were mentioned in these reports and other literature are:

- The transit fees for the NSR should be lowered by at least 85% for the NSR to become an attractive shipping area for foreign companies.
- The fee structure should be modernized and fees should only be charged for actually provided services.
- Large ships (preferably operating independent of icebreakers) should be used to keep the slot costs low.
- The reliability of the transit times is very important for keeping to the schedules.
- The longer the navigation season, the larger the benefit compared to the Suez Canal route.
- Ships will probably be used on alternative routes when NSR is 'closed'.
- High bunker prices lead to advantage for NSR over the Suez Canal route when the navigation season is long enough. (Obviously, low bunker prices are always better for keeping transport costs low)
- There may be more emphasis on regional trade and export of oil and gas to Europe than on container transit shipping.

In the impact analysis the impact of the NSR is divided in an economic impact and the strategic impact for both the port of Rotterdam and the shipping lines.

Economic impact

Volumes in the beginning will be low. A single small shipping service of 6 or 7 vessels on a weekly schedule for 3 or 6 months per year would result in a flow between 130.000 TEU and 260.000 TEU (both ways). This is roughly 0.6% to 1.2% of Suez Canal volumes in 2005. The single service can generate a yearly income for the Russian government of between $11 and $22 million when the fees are dropped to $85 per TEU (Suez Canal costs are between $50 and $80 per TEU).

The presence of natural resources can be a boost for the local economy and be beneficial for the development of infrastructure that also the containerships can use. It should be monitored however, that for instance the growing demand for icebreakers by commercial companies does not interfere with the supply flow of goods to the Russian north, if icebreaker capacity becomes scarce. Russia is very interested in extracting the natural resources in the Arctic which could lead to an emphasis on this at the cost of the transit shipping policy. However, the investments in infrastructure could also be beneficial to the development of the route.

Strategic impact

The impact on the port of Rotterdam can be divided in European scale competition and competition between the North West European ports in the Hamburg – Le Havre range. On both levels of competition the impact is very limited because volumes are low.

The volume of the NSR that could be reached in the coming 20 to 30 years is probably so low that this will have no significant effect on the distribution of flow over European ports. So there is no real advantage in this for the northern situated ports of Europe. There is a location advantage for northern ports over the southern ports in Europe when more ships will use the NSR. This effect is however very small. Besides, the share of sea transport costs on the total supply chain costs is also very small. Other factors than the distance at sea are more important for selecting a port. When volumes become larger in the future there could be more significant benefits.

More promising possibilities for the port of Rotterdam in the Arctic could be in the export of oil and gas from the Arctic. This market could grow much faster and sooner since it is an important goal of the Russian government. Rotterdam could become an important player in this. This is however not thoroughly investigated in this report and is a recommended topic for further research.

For shipping companies the impact is rather low in the beginning as well. Using the Northern Sea Route is only an option for the larger shipping companies. When a company has proven the NSR to be a feasible and economically attractive route others might follow. Volumes will remain limited until multiple shipping companies have invested in an Arctic fleet. When volumes do grow the Suez and Panama Canal will probably lower their prices and even more consolidation in container shipping will occur because the large shipping companies have the benefit of an NSR service. Besides this, global maritime transport costs could go down as a result of the extra (cheaper) service on the NSR and the lower prices on the existing route.

Finally, the findings of the research are translated into possible actions for involved stakeholders. The following items are considered for the port of Rotterdam:

- In present conditions there is no direct need for operational action by the port of Rotterdam concerning Arctic container shipping.
- It is suggested to monitor the developments in the ice extent and ice conditions in the Arctic and the activities of shipping lines on the area of Arctic navigation.
- When first liner service is started a research can be started to determine the possible role of the PoR and reassess the possibilities.
- Monitor developments in oil and gas extraction and transport from the Russian Arctic, and become involved.
- Joining the consortium for Dutch companies in the arctic and maintaining relations with important stakeholders like the Russian Government and shipping lines could be a good strategy.

Possible actions for shipping lines:

- Anticipate on possible developments in Arctic shipping, monitor the ice conditions in the Arctic and the safety and security facilities on the NSR.
- When the most important events are reality and the shipping lines consider the time is right for a NSR shipping service they can operate by ordering ships with sufficient ice classification for full time operation in the available season and set up small service of approximately 6 vessels.
- In order to be prepared for this, it is wise to maintain good relations with Russia for future cooperation and possibly investigate the alliances for arctic transport.

Because a large part of the events/actions can only be realised by the Russian government this is the most important stakeholder. Anticipating on the possible future developments the Russian government could:

- Set up a consolidated plan for development of the North and the NSR in Russia including NSR transits.
- Operational actions that can be done as of now are lowering the fees and guarantee access to the route for commercial foreign vessels (when conditions allow).
- To attract traffic there should also be a functional safety and rescue service and the information that is needed for shipping companies trying to access the route should be made easily accessible.
- On the path towards a profitable NSR it remains important for Russia to stay committed to the discussions with other arctic states about shared territorial claims of the continental shelf

Finally the role for the IMO is significant as they are responsible for the development of safety, security and environmental regulations for the Arctic area. If the IMO is determined to create a stable and rules based environment in the Arctic this would be good step in the right direction for a sustainable usage of the NSR for transit shipping. They will have to work together with other organizations in this like governments of Arctic states and economic partners and environmental interest groups.