

**Polar Seaways?  
Maritime Transport in the Arctic: An Analysis of Shipowners' Intentions II.**

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Abstract

Climate change in the Arctic is leading to the fast recession of the sea ice extent in the summer. This evolution leads several observers, scientists, media and government officials, to consider the possibility of developing new shipping routes along Arctic routes, as these routes are much shorter between Europe and Asia. The literature displays a strong interest for these potential shipping routes while the media often assume shipping companies nurture a sustained attraction for Arctic routes. This paper tackles with this idea and examines to what extent shipping companies, the ultimate economic agents, are really interested in Arctic shipping routes. The image the research portrayed is that only a minority of shipping companies are indeed interested, and those that are interested stress the destination dimension of Arctic shipping, not transit shipping.

Keywords: Arctic shipping; NSR; NWP; transit; destination traffic; business strategy.

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The impact of climate change on the melting Arctic sea ice has been widely discussed in the scientific literature, as well as in the media. It has triggered debates among scholars, government officials, and journalists, about the potential development of commercial shipping in the Arctic, in particular along the fabled Northwest and Northeast Passages, which offer much shorter distances between Europe and Asia than the classic itineraries through Panama, or through the Suez and the Malacca. Thanks to climate change sea ice conditions are changing, and the length of the navigable season is expected to increase, although this also depends on the vessel's ice class (Stephenson et al, 2014).

Several dozen papers have been published on the future of Arctic shipping since the turn of the century, mostly focusing on the idea of climate change and shorter distances as the driver for the expansion of shipping: as sea ice retreated and shorter maritime routes became available, Arctic shipping was described as being bound to expand quickly (Borgerson 2008; Howard 2009; Lasserre 2010a; Maurette 2010; Emerson 2011; Young 2011; Rahman et al 2014). Sixteen years later, climate change is causing the ice to melt at an unabated rate, and commercial shipping and vessel traffic in the Arctic has observably increased. For instance, the number of ship voyages to the Canadian Arctic went from 121 in 2005 to 317 in 2015 (NORDREG 2016). However, transit shipping traffic, (trans-Arctic voyages as opposed to destination shipping), remains very limited.

The idea of a developing market for Arctic shipping still attracts sustained attention from the scientific community. A few have looked at destination shipping (Thorez 2008; Brigham, 2010; Pelletier and Guy, 2012, 2015), but the majority focuses on transit shipping, probably reflecting the ongoing interest of the media, governments, and academia in the opening of these potential Arctic routes.

However, although the idea is widely recurrent in the literature, it is questionable whether climate change is indeed the key driver for the developing market in Arctic shipping, especially with respect to transit shipping. If the correlation was mechanical, transit traffic would have reached much higher levels than those presently observed. The AMSA report (2009), and Lasserre (2009), already hinted that shipping economics and the expanded exploitation of natural resources were the real drivers for shipping companies' increased presence in the Arctic, not the melting sea ice per se. In 2011, Lasserre and Pelletier published a survey conducted with shipping firms in Asia, North America, and Europe, about their vision of Arctic shipping: the research underlined that, contrary to the widely accepted view, shipping companies were very prudent with respect to the prospect of Arctic shipping.

Since 2011, several papers have suggested that the shrinking of the sea ice, given favorable operational conditions and cost effectiveness, would make Arctic shipping highly attractive. Given the continued melting of the sea ice, the authors wanted to assess to what extent this change in operational conditions could have altered shipping companies' perceptions. What are the present perceptions of the attractiveness of Arctic shipping by shipping companies? Departing from analyses which stress sea-ice melt or cost-computing independent of business strategy analysis, this study intends to reflect the points of view of the operators embedded in the companies' management. It is based upon the evolution of commercial activities in the Arctic in the five years following the survey conducted by Lasserre and Pelletier (2011). It confirms the complexity of operating in these waters and the relative lack of interest for transit shipping. The main driver for shipping companies is not merely the shrinking ice or the theoretically shorter distances, but the perception of market opportunity in the Arctic and the relevance of this to shipping companies' business strategies.

## 1. A literature focusing on technical feasibility and cost analyses

Among this literature on Arctic transit shipping, a first group of papers tackles policy-related issues, trying to portray the expansion of Arctic shipping, (accepted as a qualified given), in the political frame of a changing Arctic (Huebert 2001, 2002; Griffiths, 2003; Macneil 2007; Borgerson, 2008; Brigham 2008; Arctic Council 2009; Chircop, 2007, 2009; Jakobson 2010; Ho 2010; Lasserre 2010b; Valsson & Ulfarsson 2011; Blunden 2012; Dalaklis and Baxevani 2016).

A second category of articles have focused on sea-ice models and their evolution in forecasting the feasibility of Arctic voyages (Howell et al 2004; Khon et al 2010; Smith and Stephenson 2013; Etienne et al 2013; Stephenson et al 2013, 2014; Pizzolato et al 2014; Bourbonnais and Lasserre 2015). These are not econometric in nature, but rather try to assess the physical feasibility of shipping given ice conditions and water depth (depending on the vessel type) in a probabilistic manner. They conclude that shipping *conditions* should keep improving over the 21<sup>st</sup> century with the ongoing sea-ice melt, despite remaining difficult and varying from year to year, but fail to mention that open ice-free waters also implies risky shipping conditions, such as increased icing, drifting growlers, and higher waves. However, these articles do not assess the profitability issue.

A third category of papers groups those studies that analyze Arctic shipping in terms of cost structure and analysis, with a view to assessing the logistical operational profit margin and thus the likely future of the different routes. Based on a variety of assumptions, as they all rely on models of potential Arctic shipping, 16 papers out of the 36 we identified in this category hint at the potential profitability of Arctic routes while underlining the inherent difficulties of Arctic shipping (Arpiainen and Kiili 2006; Borgerson 2008, 2013; Liu and Kronbak 2010; Schøyen and Bråthen 2011; Hong 2012; Cho 2012; Falck 2012; Furuichi and Otsuka 2013; Wergeland 1991, 2013; Lasserre 2014; Raza and Schøyen 2014; Chang *et al* 2015; Furuichi and Otsuka 2015; Zhao et al 2016). Twenty also come to a more nuanced conclusion and point to poor profitability levels, if not to deficits, and to at least

difficult operational conditions (Guy 2006; Somanathan et al 2007, 2009; Pharand 2007; Kitagawa 2008; Laulajainen 2008; Verny and Grigentin 2009; Arctic Council 2009; Liu and Kronbak 2010; DNV 2010; Hua et al 2011; Carmel 2012; Erikstad & Ehlers 2012; Østreng et al 2013; Buixadé Farré *et al* 2014; Lasserre 2014; Lee and Song 2014; Cariou and Faury 2015; Zhang and Meng 2015; Keupp and Schöb 2015; Mietzner 2015).

We chose a theoretical framework focusing on corporate strategy: what are the processes that drive a company to opt for a specific business strategy? We drew from conceptual tools like Porter's matrix that theorizes the process of strategy design (Porter 1980; Gamble et al 2010) and, applied to the shipping industry, theories of business strategy and risk management in shipping from Stopford (1997), Lorange (2009) and Lun et al (2010). These theories model the design of strategies, and emphasize the multi-dimensional nature of strategy design processes; firms integrate several variables, both external and internal, into their strategic thinking. This theoretical framework underpins the interest of exploring cost issues, but also operational, marketing, and economic issues, in shipping strategy design.

Papers have described the theoretical interest of Arctic shipping for States and shipping companies for several years now, underlining shorter routes and depending on the model, the possible profitability of Arctic routes. However, transit traffic remains low (Table 1).

Table 1. Commercial transit shipping across the Northwest Passage and the Northern Sea Route.

	2010	2011	2012	2013	2014	2015
Northwest Passage	0	1	1	1	1	0
Northern Sea Route, aggregated figure	4	41	46	71	31	18
Of which, Northern Sea Route, trans-Arctic transits	0	16	27	28	n/a	9
NSR, official transit tonnage, metric tons	111 000	820 789	1 261 545	1 176 454	274 103	39 586
NSR, total tonnage, metric tons	2 085 000	3 225 000	3 750 000	3 914 000	3 982 000	5 432 000

Source: Arctic Traffic, NORDREG, Canadian Coast Guard, Iqaluit; Northern Sea Route Information Office.

Note: Transit must be understood here as trans-Arctic shipping, as used in the AMSA report (Arctic Council, 2009), as opposed to destinational – ships calling at an Arctic port or stopping in the Arctic to perform economic activities, like fishing or cruise shipping. This specification is all the more necessary as the NSR Information Office, for instance, calls “transit” ship movements between the Kara Gate and the Bering Strait, thus voyaging along the extent of the legal definition of the Northern Sea Route, even for ships to or from

Murmansk for instance, whereas these are by definition destinational movements as the ships stopped in an Arctic port. Statistics also show that a few ship movements to and from Dudinka or Pevek were counted as transits in 2011 and 2012 (Lasserre and Alexeeva 2015). Therefore, traffic figures here give first the aggregated value for the Northern Sea Route, and then the trans-Arctic transit figure that can be deduced from the Northern Sea Route Information Office statistics.

In this context, one may wonder why there is such a discrepancy between models that point towards a possible profitability of Arctic transit routes, and the low figures of actual traffic. Part of the answer may lie in market and corporate policy issues, elements few articles investigate (Lasserre 2010; Lasserre and Pelletier 2011; Bourbonnais and Lasserre 2015; Lee and Kim 2015).

## 2. Shipping companies survey – Methodology

### 2.1. An empirical and comparative survey in four steps

Our approach is a qualitative analysis based on the triangulation described by Webb et al. (Webb et al. 1966) and completed by authors such as Arksey and Knight (1999), Creswell (2007) and Lejeune (2014). We designed our survey (see Appendix 1) in a way that allowed us to combine the questionnaire method sent by email, and the phone interview method in order to gather more information, more descriptions about the positioning of the shipping companies on the Arctic market, and in order to limit the drawing of wrong or biased conclusions. We directed the questionnaire towards operational executives, preferably market executives, in shipping companies, and corporations that operate cargo ships (containers, Ro-Ro, reefers, tankers, bulkers, general cargo, heavy lift...) that are either owned or chartered, and for which they have a control over the routes the ships ply. We therefore did not include companies that merely own ships and charter them to shipping companies.

We first designed a short questionnaire (9 questions) using similar topics to the first survey published in 2011 (Lasserre and Pelletier 2011) for the sake of comparison. We added new topics about risks and monitoring systems (Beveridge et al. 2016). The objective was to have the companies detail their views on the business challenges and opportunities presented by Arctic routes and how they position themselves regarding this market. The questionnaires were thus sent or administered with management personnel as the objective was to assess how the shipping companies view the Arctic market from a profitability and strategic perspective. The last phase was dedicated to analyzing the replies based on a coding set of keywords (Creswell 2007; Lejeune 2014) and the occurrence of those keywords in the responses of each company in question.

A few concepts appear in the questionnaire which are meant to clarify the goals of our questions. These concepts are widely used in the shipping industry and in no interview did they elicit questions as to what we meant; they are all present in Lasserre and Pelletier (2011). These categories are:

Seasonal route change: the obligation for a shipping company to alter a route depending on the season (winter/summer), in this case to avoid ice in the winter.

Delays, as opposed to the respect of just-in-time, which is the basis of commercial operations for reefers, containerships and Ro-Ro ships.

Destinational traffic is traffic that originates from or goes to a specific destination. In this case, Arctic destinal traffic consists of ships calling at an Arctic port, or stopping in the Arctic to perform economic activities (Beveridge et al 2016). It is opposed to transit traffic, where the ships merely sail through without stopping over.

Drifting ice: mobile sea-ice, pushed by winds and currents.

Multi-year ice is sea ice that did not melt during a summer and that is thus at least one-year-old. Ice may likewise survive several summers, getting harder over time.

Icing from sea spray is the accumulation of ice on the superstructure of a ship when sea spray from crashing waves immediately freezes upon contact with the ship.

Growlers are pieces of ice, usually the result of the breaking apart of icebergs, rising to below 50 cm above the sea surface. They thus represent a major navigation hazard as it is made of very hard ice. The product of icebergs melting and breaking apart, their number is rapidly increasing in Arctic waters, especially near iceberg-producing waters, along Greenland's coasts, in the Canadian archipelago and in the Barents and Kara Seas south of Novaya Zemlya and Franz-Joseph Islands.

Ice ridges or pressure ridges are accumulation of ice forced up by pressure of moving sea ice, often up to 10 to 12 meters thick, on average between 5 and 30 m (Bourbonnais and Lasserre 2015). They represent major obstacles to navigation, even for icebreakers.

All the other concepts and categories were introduced by the respondents in shipping companies.

## **2.2. Text analysis: categorizing, coding and filtering**

We opted for a qualitative analysis process focusing on thematic content analysis (Krippendorff 2013; Miles and Huberman 2013; Paillé and Mucchielli 2013). Our first step was to create a database related to the shipping company (name, country, and major type of traffic), and including the data extracted from the answers we received (coding process). The second stage of the data processing was to extract the indicators that would allow us to compare shipping companies, and to determine trends and analyze the level of knowledge and interest the shipping companies have with respect to the Arctic shipping market; here, we use the terms indicators and keywords interchangeably. For each answer given we extracted keywords and coded them with a simple coefficient: 0 for no answer and 1 when the keywords were present in the survey response (Auerbach and Silverstein 2003; Saldaña 2012). We defined the main analytical classes based on the thematic

questions. These classes were drawn from the subject of each question. When an answer displays elements that belong to another class, we moved it into the relevant class. Classes included some main categories such as ice or weather, for which we detailed the indicators when possible. For example, question 4 of our survey was dedicated to risks and one of the main categories was “ice”. We detailed the topic with sub-categories, such as drifting ice, multi-year ice, ice ridges, growlers, etc., whenever these concepts were mentioned. Once we had finished categorizing and coding the responses, we applied filters to cross-reference the information we extracted from each answer, and counted how many shipping firms mentioned every keyword or coded phrase. Coded items usually appear with the question where they were mentioned – general market evolution; costs; operational challenges; operational risks; business opportunities and specific corporate reasoning regarding Arctic shipping. When items appeared in another question, we replaced this specific item in the relevant category.

### 2.3. The collected sample

In 2011, Lasserre and Pelletier published a first analysis of the shipping industry’s views on Arctic shipping after conducting a survey with 142 shipping companies from the Northern hemisphere; 98 answers were compiled. We used the 2011 database as it enables this survey to offer a follow-up on the possible changes of strategies by shipping companies; we extended the database through professional lists of shipping companies (Lloyds, Drewry, Maritime Professional, Clarkson, chambers of commerce).

For this survey, we contacted 245 companies in North America, Europe, and Asia. These were all companies in the northern hemisphere, as Arctic routes present little interest for companies from the southern hemisphere, except maybe for bulk destination shipping.

A total of 189 companies answered with exploitable answers, distributed as such by region and by market segment (see Appendix 2 for the list of answering companies). For each subsequent table displaying the survey results, each figure shows the number of shipping companies for each category.

Table 2. Number of answering shipping companies by region and by market segment.

	Containers & RoRo	Dry Bulk	Tanker	Mixed	Multipurpose	Total
Asia	16 (8,7%)	18 (9,5%)	10 (5,3%)	28 (14,8%)	5 (2,6%)	77 (40,7%)
North America	12 (6,3%)	5 (2,6%)	2 (1,1%)	7 (3,7%)	4 (2,1%)	30 (15,9%)
Europe	25 (13,2%)	20 (10,6%)	21 (11,1%)	4 (2,1%)	12 (6,3%)	82 (43,4%)
Total	53 (28%)	43 (22,8%)	33 (17,5%)	39 (20,6%)	21 (11,1%)	189

Absolute numbers and (percentages of total). Percentages may not add up due to roundup. Percentages are given if the figure is significative.

### 3. Results of the survey

#### 3.1. Commercial future for Arctic shipping (Q1)

The shipping companies were asked what they thought about the commercial future of Arctic shipping.

Table 3. What is the future of Arctic shipping? What reasons? Number of answers by region.

Keyword	Asian c'ies	North American c'ies	European c'ies	Total
Good prospects	28	8	10	46
Natural resources, bulk and destinational	15	16	11	42
But not for our company	19	5	8	32
Transit shipping and shorter distances	16	6	8	30
Not yet, too early for the industry	14	1	0	15

Several companies think there is potential for Arctic shipping in general; more think it will benefit destinational shipping and natural resources exploitation (42) as opposed to transit (30). 32, however, think that despite these positive trends, an Arctic route is still not relevant for their own company.

Interestingly, 14 Asian shipping companies were hesitant and mentioned that there may not be potential now, but that there may be later. This hesitation is not shared by North American and European companies.

#### 3.2. What are the costs associated with Arctic shipping? (Q2)

Table 4. What are the costs associated with Arctic shipping? Number of shipping firms mentioning each category.



Keyword	Asian c'ies	North American c'ies	European c'ies	Total	Total, %
Ice-class ship construction (capital cost)	49	16	59	124	65,6
Equipment	7	2	20	29	15,3
Insurance	29	10	39	78	41,3
Crew training	26	9	42	77	40,7
Maintenance	12	7	13	32	16,9
Russian administration fees (NSR)	13	0	19	32	16,9
Russian icebreaker fees (NSR)	9	0	3	12	6,3
Cost-benefit too low as not enough business	15	3	7	25	13,2
Fuel (special type required in cold conditions; higher consumption in ice)	7	3	13	23	12,2
General costs	0	11	0	11	5,8
Penalties for delays	4	1	5	10	5,3

Unsurprisingly, Asian, North American and European companies list ice-class ship and equipment high in the costs. They also all consider insurance costs and crew training.

Several (25) also underline the high cost-benefit ratio due to a small market, and 10 underline penalties for delays, an aspect of liner shipping.

As for fuel, whereas the media and the literature often underline the advantages of shorter routes in terms of fuel consumption reduction, 23 companies mention a significant cost component because special fuels are required in the Arctic (fuel that resists very low temperatures and that meets pollution emission norms in MARPOL (North Sea, Baltic Sea, waters often plied by Arctic transiting ships)<sup>1</sup> and the increased consumption when plowing ice packs.

North American shipping companies (11 quotes) invoke “general costs”, referring to both exploitation costs and capital costs, a keyword not mentioned by European nor Asian companies.

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<sup>1</sup> However, the Polar Code, to be enforced in January 2017, despite some debate, does not ban high-sulphur bunker fuels in the Arctic, contrary to the prevailing situation in the Antarctic.

A significant difference is to be noted regarding the Northern Sea Route, the costs of which are deemed important for several Asian and European companies (22 mentions each). No North American shipping company mentions this, either because they considered these costs as negligible, or more likely because they are not considering shipping along the NSR.

### 3.3. What are the operational challenges associated with Arctic shipping? (Q3)

Table 5. What are the operational challenges associated with Arctic shipping? Number of shipping firms mentioning each category.

Keyword	Asian c'ies	North American c'ies	European c'ies	Total
Environment (ice, weather, remoteness...)	36	10	37	83
Seasonality, unpredictability of transit times, delays	26	20	19	65
Secure long-term contracts	15	12	5	32
Ship size limitation	8	7	3	18
NSR administration	5	4	3	12
Lack of experience	3	3	5	11
Cost of operating an ice-class vessel in non-arctic waters	3	3	4	10

For 83 companies, environmental factors (ice, weather, remoteness, etc.) are important operational constraints. The seasonality and unpredictability of Arctic sea routes (no precise opening and closing date; drifting ice; unpredictable spatial ice distribution from year to year, fast changing weather) is deemed important by 65 companies, among which 52 are container or mixed shipping companies involved in liner shipping. The need to secure long-term contracts in the Arctic so as to make up for the higher capital cost of ice-class ships is mentioned 32 times, mostly by bulk, tanker and mixed companies (27 mentions). Fednav's senior executive vice-president Tom Paterson underlines that even in the best of circumstances there will still be ice clogging up the [Northwest] passage (CCTV 2015).

Other mentions relate to the constraints to ship size that erode economies of scale (18 mentions); the burden of the NSR bureaucracy (12 mentions); the lack of experience (11 mentions) and the cost of operating an ice-class vessel in non-Arctic waters (10 mentions).

### 3.4. What are the risks associated with Arctic shipping? (Q4)

Table 6. What are the risks associated with Arctic shipping? Number of shipping firms mentioning each category.

Keyword	Asian c'ies	North American c'ies	European c'ies	Total
Ice	40	37	12	89
Drifting ice	13	10	31	54
Growlers and icebergs	6	6	13	25
Multiyear ice	1	1	5	7
Ice ridges	2	2	11	15
Remoteness	17	17	22	56
Weather	19	18	15	52
Cold	12	12	10	34
Fog	3	3	4	10
Icing	4	4	18	26
Uncertainty	12	10	1	23
Accidents	9	8	8	25
Search & rescue	5	6	6	17

Remoteness is seen as a major risk: it is mentioned 56 times and the uncertainty of SAR (search and rescue) in remote areas, 17 times.

Ice is definitely the major risk: it is mentioned 89 times. It is also specified in various forms, including drifting ice (54 mentions), growlers and icebergs (25 mentions), ice ridges (15 mentions) and multiyear ice (7 mentions). It is interesting to underline here that European companies are much more specific in their description of the components of the ice risk; the specific keywords are mentioned 22 times by Asian shipping firms; 19 times by North American shipping firms, but 97 times by European companies.

The Arctic weather is mentioned 52 times, as well as specific keywords like coldness (34 mentions), icing<sup>2</sup> (26 times), and fog (10 times). Here again, icing seems much more a concern for European companies (18 mentions) than for Asian or North American companies (4 mentions each).

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<sup>2</sup> Icing on ships is a serious hazard where cold temperatures combined with high wind speed result in spray blown off the sea freezing immediately on contact with the ship. The ice can quickly build up on the ship's superstructure, which at a certain weight can cause the ship to capsize.

3.5. Does your company offer services (regular or occasional) in the Arctic? For what kind of service? If yes, do you intend to expand your activities? If not, do you intend to enter the Arctic shipping market? (Q5-Q6-Q7)

Companies were asked whether they were already present in the Arctic or if they intended to enter this market. When indicating they were “interested in” the Arctic market, they mean that their management has undertaken actions (active market study; operational action; ship order...), differing from company to company, with a view to actively assess the opportunity of entering the Arctic market, or of taking steps to enter it. When indicating “Maybe”, they mean that the possibility of entering the Arctic market has been considered without specific action being taken.

Table 7. Distribution of shipping companies according to their positioning regarding Arctic shipping, by region and market segment (percentages: by region)

	Already in the Arctic	Interested in	Maybe	Not interested	No longer interested
Asia	1 (1,4%)	5 (6,9%)	8 (11,1%)	57 (79,2%)	1 (1,4%)
Containers & RoRo		0	0	15	
Dry Bulk		1	1	16	
Tanker		2	2	5	1
Mixed	1	2	4	18	
Multipurpose		0	1	3	
For destinational		5	5		
For transit			3		
For both	1				
North America	7 (24%)	0	0	22 (75,9%)	0
Containers&RoRo	0	0	0	10	
Dry Bulk	1	0	0	5	
Tanker	1	0	0	2	
Mixed	2	0	0	4	
Multipurpose	3	0	0	1	
For destinational	7	-	-		
For transit	-	-	-		
Europe	22 (27,5%)	1 (1,25%)	4 (5%)	50 (62,5%)	3 (3,75%)
Containers&RoRo	4	0	0	14	
Dry Bulk	6	0	1	11	1

Tanker	7	0	2	12	1
Mixed	0	0	1	9	1
Multipurpose	5	1	0	4	
For destinational	17	1	4		
For transit	5	-	-		

Table 8. Summary of positions, by region and market segment. Number of shipping firms mentioning each category.

	Already in the Arctic	Interested in	Maybe	Not interested	No longer interested	Total
Asia	1	5	8	57	1	72
North America	7	0	0	22	0	29
Europe	22	1	4	50	3	80
<b>Total</b>	<b>30 (16,6%)</b>	<b>6 (3,3%)</b>	<b>12 (6,6%)</b>	<b>129 (71,3%)</b>	<b>4 (2,2%)</b>	<b>181</b>
Containers&RoRo	4	0	0	39	0	43
Dry Bulk	7	1	2	32	1	43
Tanker	8	2	4	19	2	35
Mixed	3	2	5	31	1	42
Multipurpose	8	1	1	8	0	18
For destinational	24	6	9			39
For transit	5	-	3			8
For both	1	-	-			1

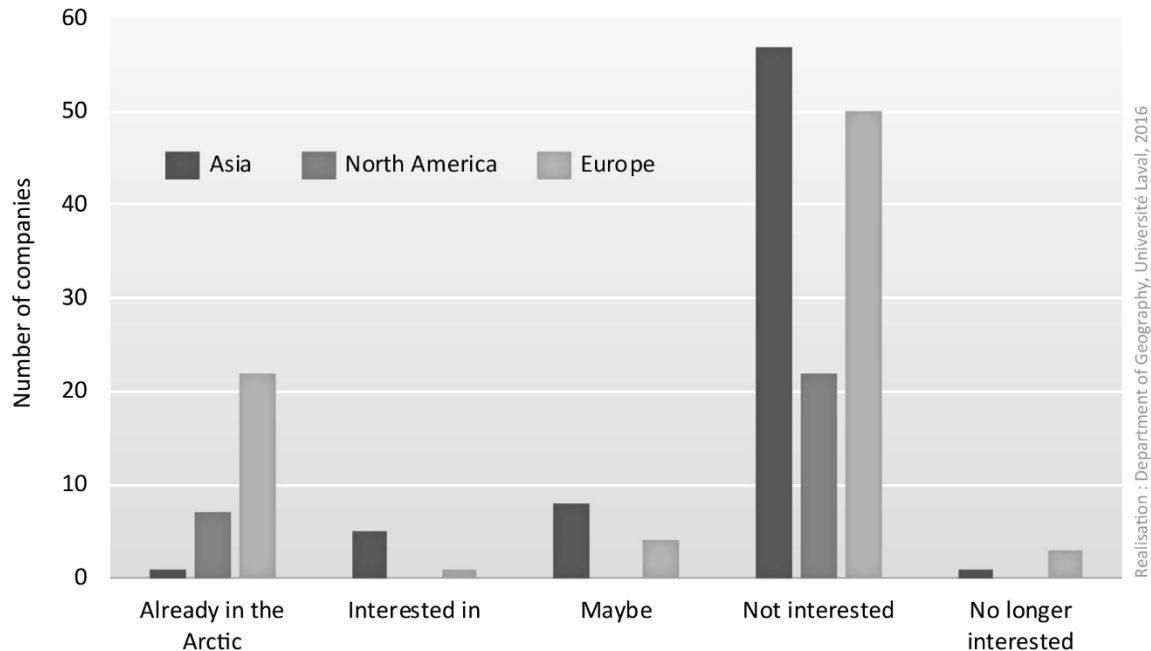


Fig. 1. Interest of surveyed shipping companies.

Among the 30 companies that already operate in the Arctic, nine answered the question as to whether they will expand their activities. One said maybe, one said no without a specific project so as to recoup high capital costs, and seven said that they are considering expanding their activities. All of these nine firms are considering destination shipping.

Geographically, 11 mentioned activities in the NSR; 8 in the Barents Sea or in the North Atlantic; and 2 in Hudson Bay or the NWP.

The data shows several key features of shipping companies' strategies towards the Arctic. Most of the surveyed companies are not interested in Arctic shipping, which is consistent with the 2011 survey.

A significant number of companies are already present in the market, whether for regular or recurrent service, or for occasional contracts. This group is comprised mostly of European (22) and North American (7) companies, as only one Asian company has so far developed occasional Arctic shipping.

Destination traffic is preferred among companies that already are in the Arctic or that consider this submarket (39), as opposed to transit (8).

The attitudes of shipping companies seem polarized between companies that already have developed business opportunities in the Arctic, and those that are not interested, as those displaying interest (6), or asserting that they may be interested (12), are not numerous and mostly Asian; few European or North American companies have not

made a choice as of now. Among those interested, 6 expressed a definite interest for the NSR, none for the NWP.

As in 2011, there are also major differences between segments.

Container shipping is not interested: 39 companies are not interested and 4 already present; for mixed companies, 32 are not or no longer interested, 3 in the market, 7 interested or potentially interested. In 2011, no container company displayed a real interest out of 38, and only 2 mixed container and bulk companies declared they were interested out of 8 (Lasserre and Pelletier 2011).

The dry bulk (33) and tanker (21) segments are mostly not interested, though some players are already involved (15) and 9 display an interest or a potential interest, mostly for destination shipping. In 2011, 9 bulk companies out of 40 declared an interest.

Although the sample is smaller, the multipurpose segment appears to be more interested, with 8 players already in the market, 2 interested or potentially interested and 8 not interested. In 2011, 6 companies from the general cargo and special projects segments declared they were interested.

Table 9. Reasons invoked by shipping companies for not being interested in Arctic shipping. Number of shipping firms mentioning each category.

Keyword	Asian c'ies	North American c'ies	European c'ies	Total
Not our core business	32	17	52	101
Too risky	25	2	10	37
Too costly	11	4	15	30
Too big an investment, little incentive	24	0	0	24
Just not interested	21	1	0	22
Schedules/just in time	7	0	9	16
Too difficult to enter such a small market/niche market	9	2	4	15
Too much uncertainty	7	2	1	10
No intermediate market	6	1	1	8

The main reason that shipping companies invoke for turning away from the Arctic market is that it is not their core business (101 mentions), meaning they do not consider the Arctic market worth a diversification; despite the media hype, they do not seem to see

a place for themselves in this market. A similar reason, “just not interested”, is mentioned 21 times, mainly by Asian companies. These answers are very straightforward inasmuch as they clearly illustrate the lack of interest of these companies for the Arctic market. However they remain somewhat unspecific as to precisely what deters these shipping companies from considering an expansion.

The high costs involved in the venture is set forth 30 times; followed by the very high level of investment for little commercial incentive (24 mentions, mostly Asian shipping companies) or profit perspectives (low charter rates, 6 mentions), with 15 companies mentioning the difficulty of entering the small Arctic market. Confirming the survey, ESL Shipping’s managing director Mikki Koskinen said that the “Northern Sea Route contains big future potential, but in terms of profitable business it so far has marginal significance.” (Koskinen 2013).

The high risks are mentioned by 37 companies; 10 also quote the uncertainty.

Logistical reasons, such as the lack of an intermediate market (8 mentions) and the difficulty of respecting schedules for a liner service (mentioned 16 times) are reasons invoked mostly by liner companies (resp. 6 and 13 companies). Maersk’s senior vice-president Stephen Carmel underlined that because container shipping relies heavily on on-time delivery, it is unlikely the NSR will ever become a major pathway for this kind of global commerce (Lavelle 2013). He added that “maritime pundits believe a shrinking ice cap translates to a frenzy of traffic as shippers rush to exploit shorter sea routes. They’re wrong” (Carmel 2013:38). NEAS’s president and CEO Suzanne Paquin underlined the high amount of penalties for delays, over a quarter of a million dollars’ additional cost from a 6-day delay from being stuck in the ice in Kitikmeot in 2015 (Paquin 2015).

### 3.6. How do you think monitoring services could be improved in the Arctic? (Q8)

Table 10. How do you think monitoring services could be improved in the Arctic? Number of shipping firms mentioning each category.

Keyword	Asian c’ies	North American c’ies	European c’ies	Total
Better communication, information sharing	3	3	3	9
Less bureaucracy	3	1	4	8
Better reaction time	1	0	4	5
Better icebreaker availability	1	0	2	3
More SAR infrastructure	1	3	2	6
Better ice charts	1	0	3	4

SAR: search and rescue.

Few companies answered this question.



### 3.7. What are the navigation services you think are essential in the Arctic? (Q9)

Table 11. What are the navigation services you think are essential in the Arctic? Number of shipping firms mentioning each category.

Keyword	Asian c'ies	North American c'ies	European c'ies	Total
No idea	8	2	0	10
Mapping accuracy	2	2	8	12
Icebreaker escort	10	8	23	41
S&R	17	9	20	46
Monitoring	5	5	9	19
Provide information	2	3	15	20
Ports and mooring facilities	7	3	5	15
Ice charts	1	1	10	12
Weather information	4	1	4	9

Unsurprisingly, services that are deemed essential are icebreaker escort (41) and SAR (46). Monitoring (19) and its variant “information provided” (20) also rank high. Then come mooring facilities (15), ice charts (12) and nautical maps accuracy (12).

There are strong regional differences in the answers. Firstly, in what may boil down to a question of language, European companies prefer to talk about providing information (15). What is more interesting is that they do also stress the need for icebreaker escort (23 out of 41), accurate ice charts (10 out of 12), and accurate nautical charts (8 out of 12).

## 4. Discussion. Perceptions and strategies.

### 4.1. The Arctic is for destinational traffic and mostly along the NSR

Arctic shipping, long depicted in the media as a future polar maritime highway, may witness slowly growing destinational traffic (Lasserre 2014), but figures for transit remain low. Most shipping firms envision shipping traffic centered on destinational traffic (39 firms in this segment or interested in) rather than for transit (8 options). Fednav’s vice-president Tom Paterson had already underlined the fact that for the NWP: “The Northwest Passage is a destination, not a transit route.” (Quoted in Moore 2014:9).

From this perspective, the literature is in line with these analyses, as most authors envision an Arctic shipping market dominated by destinational traffic (Pelletier and Guy 2012, 2015; Lasserre and Alexeeva 2015; Humpert 2013, 2014; CPCS 2014; Têtu et al 2015; Huang et al 2015; Lasserre et al 2015; Abou-Abssi et al 2016), a fact that Russian

authorities recognize too, acknowledging that the NSR is “no alternative to Suez” (Pettersen 2013). This is confirmed by traffic figures from Canada and Russia. Along the NSR, destination cargo turnover in the area jumped 37% in one year to 5.3 million tons in 2015 (Pettersen 2016). In northern Canada, ship movements in the Arctic zone went from 121 voyages in 2005 to 317 in 2015 (NORDREG 2016).

Similarly, Smith and Stephenson (2013) did not expect the Arctic to ever replace the Suez and Panama canals, which are the main arteries for global marine transport today. However, a seasonally ice-free Arctic could boost the ability of companies to transport natural resources and goods from northern Europe and Russia to China.

Authors are also in line with shipping firms as many more articles consider development along the NSR (Kitagawa 2008; Verny and Grigentin 2009; Hua et al 2011; Schøyen and Bråthen 2011; Blunden 2012; Furuichi & Otsuka 2013; Moe 2014; Buixadé Farré et al 2014; Kiiski 2014; Chang et al 2015; Lee and Kim 2015; Lasserre & Alexeeva 2015; Gritsenko and Kiiski 2016; Zhao et al 2016), rather than along the NWP (Somanathan 2007, 2009; Headland 2010).

#### 4.2. Arctic routes still do not attract many shipping companies

Shipping companies consider that there may be a commercial future for shipping in the Arctic, however few consider going into this market which they describe as small, or even niche. Out of the 189 companies that answered the survey, 30 are already in the Arctic market, 6 are interested and 12 may be interested in the future. Four are no longer interested and 129 are not interested at all. These results are in line with the 2011 survey and show the same lack of motivation and preference for destination shipping. Despite the often-described melting of sea ice, there is no rush towards the gradually-opening Arctic routes. Shipping companies as well as authors point to the persistence of several major obstacles to the development of Arctic shipping and its economic viability (Humpert and Raspotnik 2012a and 2012b; Hansen *et al* 2016), such as drifting ice and growlers. Between 2000 and 2010, 9 ships collided with icebergs or growlers, and one sank in Canadian Arctic waters (Hill 2006, 2016). The present economic downturn does not help, since many shipping firms are struggling with decreasing demand, depressed charter rates, and financial difficulties resulting from the conjunction of investment in large ships arriving in a depressed market, leading to overcapacity and decreasing turnover (Barnard 2016).

#### 4.3. Shipping companies do not integrate the Arctic in their business strategies

Traffic figures show a decline in interest for transit along the NSR, the route most shipping companies would think of. Part of the reasons may lie in the fact that “shipping rates are low, the bunker fuel is cheap and there is a general decline in world economy and a shrinking demand in China” (Balmasov, in Staalesen 2016). Norway’s Statoil, for example, seems to have lost interest in the route, after sending several tankers, including cargoes of naphtha and LNG, to Japan in previous years. “Statoil has not used the Northern route since 2013 and we currently have no plans to use it,” said a company spokeswoman (quoted in Pettersen 2016). “The attractiveness of a route depends on direct costs, and sailing time as well as the market characteristics of the respective commodities at the time

of sailing,” she added. Thus, costs and the technical feasibility, increasing as the sea ice melts away in summer, are not sufficient. Indeed, 24 companies mention the financial risk and 30 the high cost to explain their lack of interest; 16 mention schedules and just-in-time constraints. But most companies quote reasons that pertain to business strategy rather than cost issues: the market is too small (15); the company is just not interested (22); Arctic shipping does not fit in the core business of the company (101).

From that point of view, climate change and the onset of sea ice melt are not shipping drivers, but enablers of potentially increased shipping: sea ice conditions alone do not account for shipping activity (Lasserre 2008; Järvenpää and Ries 2011; Baker 2013; Lasserre 2013; Lasserre 2014; Pizzolato et al 2014; Bourbonnais and Lasserre 2015; Dawson 2015). For shipping companies it is not sufficient to simply see the ice melt, thus liberating shorter itineraries between Europe and Asia. Instead these companies must be convinced that these theoretically shorter routes (for it is average speed and not distance that determines whether a route is really shorter) fit into their business plans, and enable sustainably profitable activities within their global strategy. Their analysis fits with the business models developed by Prahalad and Hamel (1990) on core business and competence, and by Michael Porter on business strategy, which emphasizes that cost is only one element among several other dimensions in a company’s positioning in the market (Porter 1980, 2008).

#### 4.4. Significant regional differences appear

The survey also underlined regional differences among shipping companies regarding their vision of Arctic shipping. First, general costs are mentioned by North American companies only, whereas they never quote NSR fees and costs, as if they did not consider using the NSR. Second, it appears that a few Asian shipping companies are more hesitant in their assessment of the business potential of Arctic shipping (14 mentioning “not yet”). Companies that are already present in the Arctic are European and North American, whereas the majority of those declaring an interest are Asian. It is as if the business choices had already been made among European and North American players, whereas Asian companies were still considering their options. Another element that concurs with this hypothesis rests in the elements that are essential for safety. European companies are more specific and stress the need for icebreaker escort (23 out of 41), accurate ice charts (10 out of 12), and nautical charts (8 out of 12), whereas shipping companies that had “no idea” were predominantly from Asia.

## Conclusion

Climate change is indeed causing sea ice to melt and thus enables shipping companies to develop increased traffic across Arctic waters. The media, and several authors in the literature, often describe the phenomenon as a key driver in the onset of sustained Arctic shipping. This viewpoint is supported by several cost-analysis studies that

model navigation costs from a strict operational level, which indicate that Arctic shipping can be profitable under specific conditions. However, commercial traffic, especially transit traffic, remains limited, despite these observations about sea-ice reduction and cost efficiency. Other parameters must therefore be considered to account for this limited expansion of Arctic shipping.

The survey, confirming limited actual market figures, underlines that the melting of sea ice is not in of itself sufficient to trigger the development of massive traffic along Arctic seaways, nor of single-voyage cost-effectiveness. Shipping companies stress that entering the Arctic market is a strategic diversification move that implies much broader considerations. It continues to be seen as a risky choice, both operationally and commercially, and implies business strategy choices which involve the global picture of the positioning of the company in its regional or global market.

There is an Arctic shipping market, albeit small, and several shipping companies have seen opportunities to develop there, largely in destination traffic. However, most shipping firms are not interested in Arctic shipping, not merely because costs are high, but because Arctic shipping constraints and its' markets do not fit into the business strategies developed by companies. Despite the opening of the region, the decrease in NSR tariffs, and the shorter routes, most companies do not yet integrate Arctic shipping into their development perspectives. Arctic shipping is likely to keep growing, just as it has in the past ten years. But it will be mostly driven by local traffic linked to the servicing of communities, and by the exploitation of natural resources.

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## Appendix 1

Questionnaire used for the survey

- Q1. What do you think is the commercial potential of Arctic shipping?
- Q2. What are the costs associated with Arctic shipping? (e.g. ice-class ship; equipment; training; specific maintenance; possible penalties for delays...).
- Q3. What are the operational challenges associated with Arctic shipping? (e.g. seasonal route change; operation of a ship in ice; delays; respect of just-in-time; drifting and unpredictable ice patterns).
- Q4. What are the risks associated with Arctic shipping? (e.g. icing (from sea spray); extreme cold; blizzards; growlers; ice ridges; multi-year ice; accidents and spills; damage to cargo (intense cold...).
- Q5. Does your company offer services (regular or occasional) in the Arctic?
- Q6. If yes, do you intend to increase the level of your activity? Why? For what kind of service (transit, destination...).
- Q7. If not, do you intend to enter the Arctic shipping market and develop activities in the area? Why? For what kind of service (destination, transit...)?
- Q8. Do you know about current and planned monitoring systems in the North? How do you think monitoring services could be improved in the Arctic?
- Q9. What are the navigation services you think are essential in the Arctic?

## Appendix 2

List of shipping companies that answered the questionnaire.

Asia-Middle East		Europe		North America	
APL	Ningbo Jun Hao Ocean Shipping	Anangel	Maersk	Admiral Marine	International
Asahi Shipping Co.	Shipping	Arkas Line	Mann Lines	Antillean Marine	Shipholding
Asahi Tankers Co.	Ningbo Silver Star	BBC Chartering	Maran Tankers	Shipping Corp.	King Ocean
Azuma Shipping Co.	Maritime Shipping Co.	Big Roll Shipping	Marfret	Atlantic	Services
China LNG CLSICO	Nippon Yusen Kaisha,	BigLift Shipping	Marinvest Shipping	Container Line	Matson
China Merchants	NYK	Bocimar Internal	AB	Atlantic Ro-Ro	Northern
Energy Shipping Co.	Nissan Motor Car Carriers	Borchard Lines	Marmaras	Carriers	Transportation
China Shipping Bulk	NS United Kaiun Kaisha	Brostrom Tankers	Mineralien	Bermuda	Company
China Shipping	Ocean Bulk Shipping	BW Maritime	Schiffahrt Spedition	Container	(NTCL)
Container Line (CSCL)	OOCL/OOIL	Clipper Group	MST	Line/Somers Isles	Norvic Shipping
China Shipping	Pacific Glory Shipping	CMA-CGM	MSC	Shipping	North America
Development (CSDEV)	PIL Pacific Intl Line	CMB	Navigazione	Canada	Nunavut Eastern
China Shipping Tanker	Polaris Shipping Co.	Cobelfret	Montanari	Steamship Lines	Arctic Shipping
Chipolbrok	Sanko Line	Coeclerici	Nednor	International Inc.	NEAS
Conti-GMT Shipping	Shandong Ocean Shipping	Concordia Maritime AB	Nile Dutch	Caribbean Feeder	Oceanex
COSCO	Shanghai Fujian Guohang	D'Amico	Nordana	Services	OSG Overseas
Daiichi Chuo Kisen	Ocean Shipping Co.	Delmas	NORDEN	Crowley	Shipholding
Kiasha DCKK	Simatech	Double Hull Tankers	Nordic Bulk Carriers	Desgagnés Group	Group
Dandong Shipping	Sinokor	DHT	Nordic Tankers	Dole Ocean	Seaboard Marine
Group	Sinotrans – China	Dynagas	Normed	Cargo Express	Teekay Shipping
Eukor Car Carriers	Changjiang National	Eimskip	Northern Shipping	Eagle Bulk	TOTE Maritime
Evergreen Marine	Shipping (CSC)	Eitzen	Company NSC	Shipping	Tropical
Corporation	Sinotrans Container	Chemical	NSB Niederelbe	FEDNAV	Shipping
GMT Shipping	Sinotrans Shipping	Eletson	OP Svensson	FOSS Maritime	U.S. Shipping
Hachiuma Steamship	SITC Shipping	ESL Shipping	Portline	Frontline	Partners L.P.
Hanjin Shipping Co.	SK Shipping	Eureka Shipping	Rickmers Linie	Gearbulk	Woodward
Hong Union Shipping	STX Pan Ocean	Euronav	Royal Arctic Lines	Great White Fleet	Coastal Shipping
Hyundai Glovis	Suns International Shipping	F. Laeisz	Samskip		
Hyundai Merchant	Co.	Far Eastern Shipping Co.	Scorpio		
Marine	Swire Shipping	(FESCO)	Setaf Saget		
Iino Kaiun Kaisha	Tanker Pacific	Flinter	SMT Shipping		
Inui Steamship	Temas Line	Giuseppe Bottiglieri	Socatra		
JX Ocean	Toko Line	Grimaldi Group	South End Tanker		
Kawasaki Kisen K Line	Tokyo Marine Asia Group	Hacklin	Management		

KMTC Shipping Kokuka Sangyo Co. Korea Line Corporation (KLC) Kuang Ming Kyoei Tanker Co. Kyowa Shipping Lufeng Shipping Mitsubishi Ore Transport Mitsui OSK Lines (MOL) MT Maritime Namsung Shipping Nanjing Tanker	Tong Li Shipping Tsurumaru Shipping United Arab Shipping (UASC) Vinalines Wan Hai West Line Shipping Westline Shipping Co. Dry Bulk Winland Shipping Yang Ming Zhongchang Marine Shipping Co. ZIM	Hamburg Süd Hapag Lloyd Hoëgh Autoliner Hoëgh LNG Lauritzen Leonhardt & Blumberg Linea Messina Lundqvist Rederierna Italia Marittima SpA Jumbo Shipping Knutsen OAS Shipping	Sovcomflot SCF Stena Bulk AB Swedish Orient Line SOL Torm Tsakos Columbia Management Tschudi Shipping Turkon Line Wagenborg Shipping Wallenius Western Bulk Wijnne Barends Wilh. Wilhemsen Holding ASA		
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The answering companies managed over 15 600 ships.

Of the 53 container and Ro-Ro companies that answered, 49 are listed in the 100 top rank companies. The container and mixed shipping firms that answered represented 87% of the world container market capacity as of January 1<sup>st</sup>, 2016 (Alphaliner), which hints at an excellent representativeness in this segment in North America, Europe and Asia.

Of the 44 tanker companies that answered the survey, 17 have been listed in March 2014 in the 30 top rank companies (Tanker Operators). These tanker companies managed a capacity of 205,976,882 dwt; world oil and product tanker companies had a capacity of 491 million dwt in 2013, which hints at a very good representativeness in this segment in North America, Europe and Asia.

Dry bulk companies managed a capacity of 71,249,184 dwt; the total world bulk fleet had a capacity of 685 million dwt in 2013 (UNCTAD), which hints at a good representativeness in this segment in North America, Europe and Asia.

Answering mixed companies (bulk and tanker; bulk and container; tanker and container) managed a capacity of 52,487,479 dwt.