The Future of Arctic Shipping:

A New Silk Road for China?

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The Future of Arctic Shipping:
A New Silk Road for China?

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Executive Summary:

Every time Arctic sea ice extent reaches a new record low a host of new reports and studies predict a rapid increase in shipping activities in the Arctic. Expectations are high that Arctic shipping routes, particularly the Northern Sea Route, will rival traditional shipping routes and complement the Suez Canal route as a key waterway for trade to and from Asia by the middle of this century. One of the drivers of Arctic shipping, as the logic goes, is China's rapidly growing international trade. As China aims to diversify its trade routes and reduce its dependence on trade passing through the Strait of Malacca, the Arctic offers an alternative and shorter route to conduct part of its trade. How realistic are such scenarios?

Trans-Arctic shipping is most viable where it offers a significant shortcut in comparison to traditional trade routes. In the case of China, this applies only to its trade with Europe, especially Central and Northern Europe. Trade with all other regions, including Africa, the Americas, and the Middle East, will not be routed though the Arctic even if ice-free periods were to increase dramatically. China's existing trade patterns offer little opportunity to take advantage of Arctic distance savings. Its major trade routes are far removed from the Arctic as most of its imports arrive from its direct neighbors, such as Japan and South Korea, or from countries near to or south of the equator, such as Australia and Brazil. Trade with Northern Europe, the region most relevant to Arctic shipping, accounts for just 2.9 percent of China's international trade.

Over the next two decades Chinese trade within the Asia-Pacific region and with countries in the southern hemisphere will experience the sharpest growth. Africa and Latin America will be supplying a growing share of China's commodity needs. The importance of Europe as one of China's major trading partners, on the other hand, will decline over the coming decades. In fact, China has been investing heavily in port infrastructure throughout Asia, the Middle East, Africa and Europe and has built an extensive network of ports in which it holds a stake. None of these investments point to the Arctic being considered as a new transportation corridor. China's Ocean Shipping Company (COSCO) has shown little interest in Arctic shipping as it continues to invest heavily in ports along the Suez Canal route.

After more than a decade of delays, a new generation of Ultra Large Container Ships (ULCS), about twice the size of existing vessels, is about to enter into service. As container ships are becoming increasingly larger to take advantage of economies of scale, draft and beam restrictions will prevent a growing share of the global merchant fleet to transit the northernmost ocean along the NSR. Furthermore, the absence of major ports throughout the Arctic Ocean makes it impossible for operators to benefit from network economics. A similar trend can be observed in the bulk-shipping sector. As in the container shipping business, economies of scale allow for the transport of raw materials over vast distances at ever-decreasing rates. Specialized Arcticmax ships will be unable to compete with these new realities.

Future shipping in the Polar region will mostly consist of seasonal destinational transport, delivering supplies into the Arctic for its increasing economic activity and transporting the region's natural resources to markets in East Asia. Apart from these niche opportunities, Arctic shipping routes will be unable to compete with the world's existing major trade routes. Thus, while climate change will, over the coming decades, transform the frozen north into a seasonally navigable ocean, Arctic shipping routes will not become a new silk road for China.

Introduction

Every time Arctic sea ice extent reaches a new record low, as it last did in September 2012, a host of new reports and studies predict a rapid increase in shipping activities in the Arctic. Expectations are high that Arctic shipping routes, particularly the Northern Sea Route (NSR), will rival traditional shipping routes and complement the Suez Canal route as a key waterway for trade to and from Asia by the middle of this century.

One of the drivers of Arctic shipping, as the logic goes, is China's rapidly growing international trade. As China aims to diversify its trade routes and reduce its dependence on trade passing through the Strait of Malacca, the Arctic offers an alternative and shorter route to conduct part of its trade.

A recent study by the Polar Research Institute of China concludes that Arctic shipping will play a major role in the country's future trade networks and indicates that by the year 2020 between 5-15% of China's trade value, about 300-900 billion USD, could pass through the Arctic. (Doyle, 2013) Researchers at Dalian Maritime University suggest that Arctic shipping will alter the "market patterns of the global shipping industry." (Salvadove, 2013)

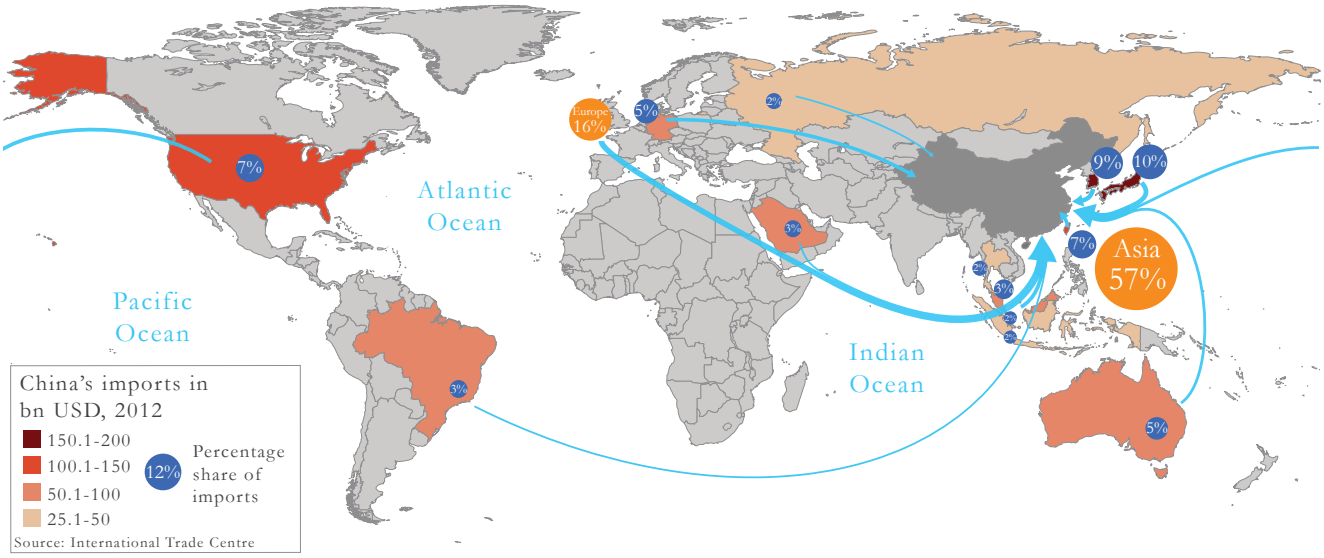
How realistic are such scenarios? The geographic distribution of China's main trade partners and its substantial investments in port infrastructure along the existing trade routes do not support the idea of large-scale trans-Arctic shipping. Furthermore, a new generation of ultra-large container ships and bulk carriers will offer vastly improved economies of scale and reduce costs to the point where Arctic shipping will not be economically viable even under ideal conditions.

Hence, Arctic shipping will remain of limited importance to China, as it will for the rest of the world. Future shipping in the Polar region will mostly consist of seasonal destinational transport, delivering supplies into the Arctic for its increasing economic activity and transporting the region's natural resources to markets in East Asia. (Arctic Council, 2009).

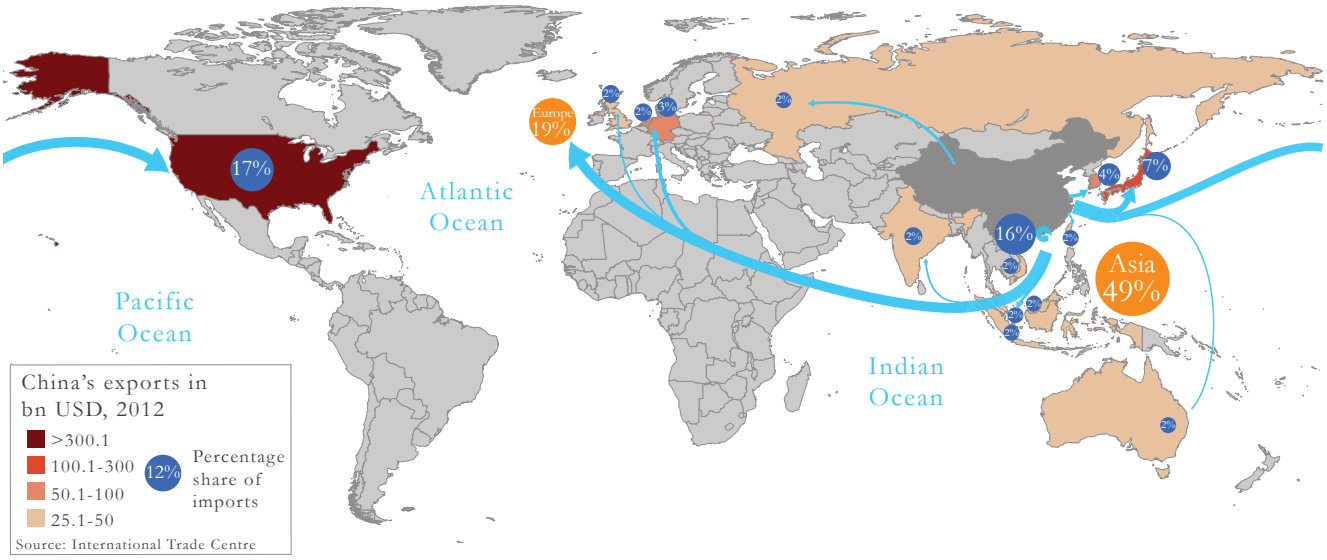
China's International Trade

Trans-Arctic shipping is most viable where it offers a significant shortcut in comparison to traditional trade routes. In the case of China, this applies only to its trade with Europe, especially Central and Northern Europe. Trade with all other regions, including Africa, the Americas, and the Middle

Map 1: China's Major Import Partners, 2012



Map 2: China's Major Export Partners, 2012



East, will not be routed though the Arctic even if ice-free periods were to increase dramatically.

In fact, China's existing trade patterns offer little opportunity to take advantage of Arctic distance savings. Its major trade routes are far removed from the Arctic as most of its imports arrive from its direct neighbors, such as Japan and South Korea, or from countries near to or south of the equator, such as Australia and Brazil. Similarly, the bulk of China's exports is shipped within Asia or is destined for North America.

A closer look at the geographic distribution of China's exports and imports reveals the impossibility of large-scale trans-Arctic shipping. China conducts the majority of its trade, about 51 percent, with its neighbors in the Pacific region. Europe's share on the other hand is substantially smaller, accounting for 17.6 percent (about USD 681bn) in 2012. Trade with Northern Europe, the region most relevant to Arctic shipping, accounts for just 2.9 percent (about USD 113bn) of China's overall trade. (International Trade Centre, 2013) As most of this trade is of a containerized nature, only a very small fraction of it could, in theory, be rerouted via the Arctic.

Chart 1: China's Imports, 2012

Trade Partner	Trade Value, USD, bn
Japan	177.8
South Korea	168.5
United States	133.7
Taiwan	132.2
Germany	92.0
Australia	84.6
Malaysia	58.2
Saudi Arabia	54.9
Brazil	52.0
Russia	44.0

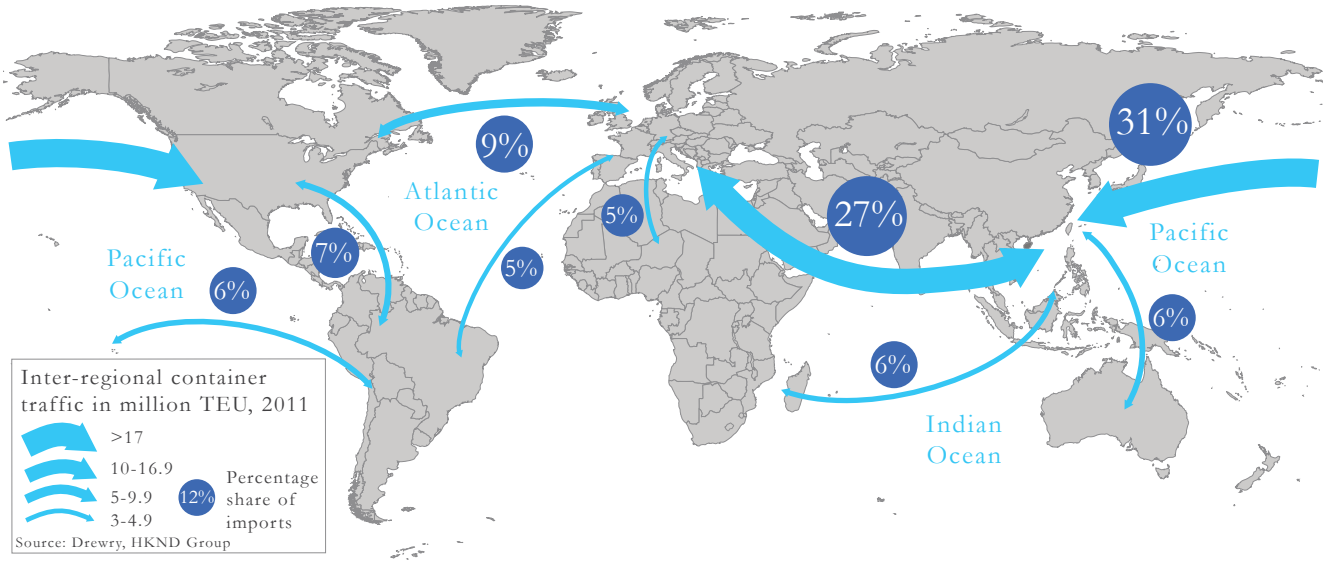
Source: International Trade Centre

Chart 2: China's Exports, 2012

Trade Partner	Trade value, USD, bn
United States	352.6
Hong Kong	323.6
Japan	151.7
South Korea	87.7
Germany	69.1
Netherlands	58.9
India	47.7
United Kingdom	46.3
Russia	44.0
Singapore	40.8

Source: International Trade Centre

Map 3: Inter-Regional Container Traffic, 2011



Global Container Trade

The vast majority of trade between China and Europe is conducted by a fleet of container ships transporting up to 18,400 twenty-foot equivalent units (TEU). Around the globe, 490 container ship liner services follow regular and precisely timed schedules and create a network of ports along the main shipping corridors. (World Shipping Council, 2013) The Asia-Europe route is the most important of these shipping highways. (Wright, 2011)

Serving a large number of ports of call allows for the use of high-capacity vessels and improved economies of scale in times of declining container freight rates. These network economics are especially important along the world's busiest shipping highway for containerized goods, the Suez Canal route connecting Asia and Europe.

In contrast, Arctic shipping does not offer the benefits of network economics as it lacks major ports and transportation infrastructure. Most experts agree that containerized traffic will not be routed through the Arctic Ocean, due to the brevity of the Arctic shipping season, limited reliability and predictability, and the lack of infrastructure. (Arctic Council, 2009)

The global flow of container traffic, especially between Asia and Europe, is thus highly concentrated. Nearly half of the world's container throughput is handled by the Top 20 ports, most of which are located in lower latitudes far from the Arctic. Container traffic between Asia and Europe accounted for just 27 percent of total inter-regional container trade and only a negligible fraction could, in theory, profitably be rerouted via the Arctic.

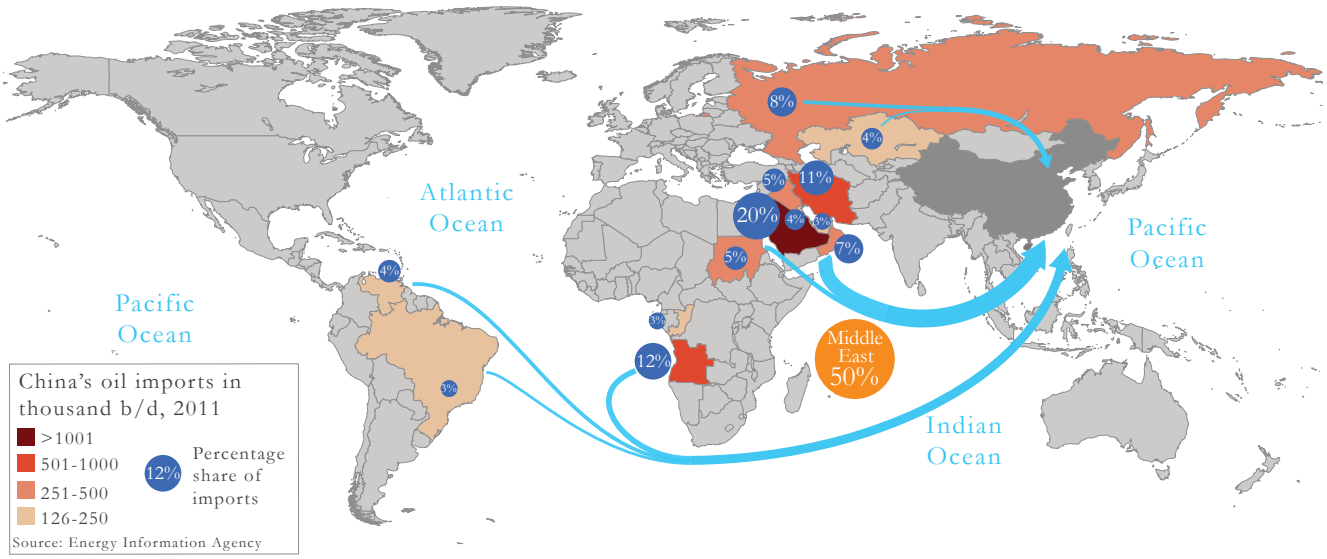
Containerized shipping through the Arctic will always remain a niche market, but it will be especially infeasible for shipping between China and Europe. (UNCTAD, 2012)

Chart 3: Global Container Traffic, 2011

Regions	TEU, thousand
Trans Pacific - North	21,425
Europe - Far East	18,973
Trans Atlantic	6,235
North America - Latin America	4,525
Far East - Australasia	4,225
Trans pacific - South	4,150
Africa - Far East	3,950
Europe - Africa	3,350
Europe - Latin America	3,275

Source: Drewry, HKND Group

Map 4: China's Crude Oil Imports, 2011



China's Raw Material Imports

China is the world's dominant consumer of raw materials and hydrocarbon resources. In 2013 it became the largest importer of crude oil ahead of the United States and has been the largest importer of iron ore since 2003 when it surpassed Japan. (Wong & Yam, 2013; OECD, 2011) China's growing demand for these resources has had a significant impact on the global flow of bulk goods and liquids.

China imports the vast majority of its resources from countries located near or south of the Equator. More than 90 percent of iron ore imports come to China from countries in the southern hemisphere. Its oil imports also originate primarily from countries far removed from the Arctic. In 2012, the Middle East supplied 50 percent of China's oil imports followed by West Africa and Latin America with 15 and 7 percent respectively.

Arctic bulk and liquids shipping will remain of very limited importance in China's efforts to secure its resource base in the 21st century. Instead, three supply and demand networks, Asia-Middle East, Asia-Latin America, and Asia-Oceania, will dominate the global bulk and liquid shipping sector. (Fang, Cheng, Atilla, & Carnie, 2013)

Chart 4: China's Oil Imports, 2012

Country	Barrels/Day, thousand
Saudi Arabia	1,005
Angola	623
Iran	555
Russia	395
Oman	363
Iraq	276
Sudan	260
Venezuela	230
Kazakhstan	224
Kuwait	191

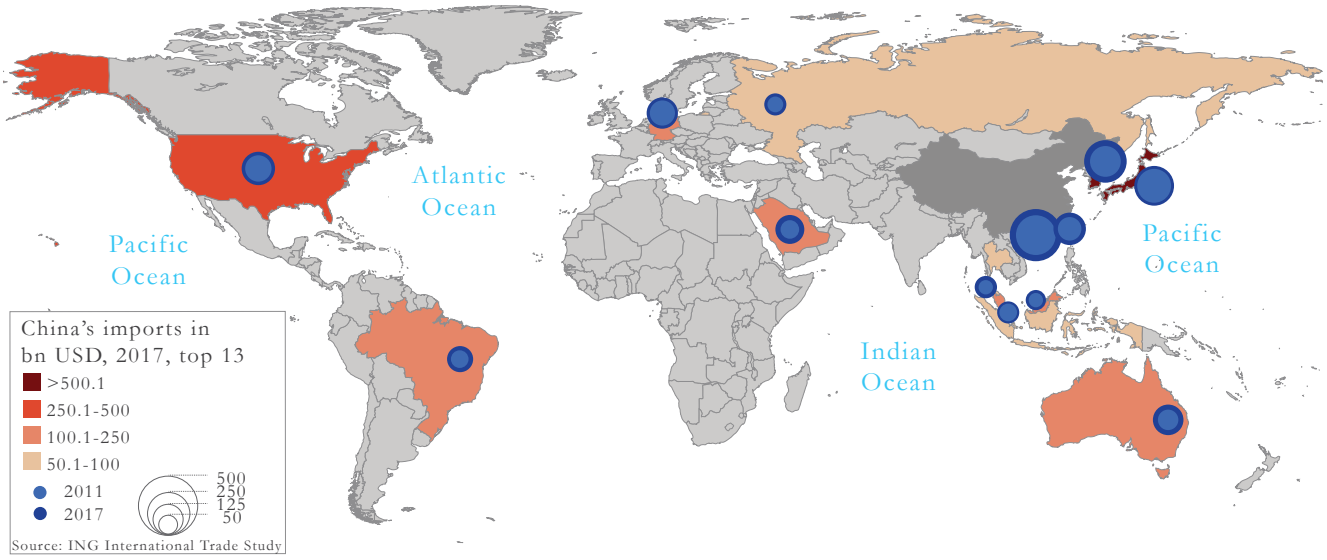
Source: EIA

Chart 5: China's Iron Ore Imports, 2012

Country	Tons, thousand
Australia	351,656
Brazil	164,555
South Africa	40,677
India	33,386
Iran	17,396
Ukraine	16,254
Canada	16,096
Russia	13,255
Indonesia	10,365
Peru	9,205

Source: International Trade Centre

Map 5: China's Major Import Partners, 2017



China's Future Trade

In 2012 China surpassed the United States as the largest trading nation in the world and the country is on track to double its trade volume, from 3.8 billion USD in 2012 to almost 8 billion USD by 2017. By the year 2030 China will, by some estimates, control seventeen of the top twenty-five bilateral trade routes. (Selfin & Hope, 2011)

Chinese trade within the Asia-Pacific region and with countries in the southern hemisphere will experience the sharpest growth. Africa and Latin America are supplying a growing share of China's commodity needs. The importance of Europe as one of China's major trading partners, on the other hand, will decline over the coming decades, reducing the likelihood of significant levels of trade between the two regions conducted via the Arctic. (ING Financial Services, 2012)

From a global perspective, international trade will experience a gradual southward shift as emerging economies increase their shares of overall trade. A study by PricewaterhouseCoopers suggests that new "transport corridors" will emerge between Asia and Africa, Asia and South America and within Asia. (PWC, 2010) These new patterns of maritime transportation go counter to the development of the Arctic as a major shipping corridor, not only for China but also for the rest of the world.

Chart 6: China's Imports, 2017

Trade Partner	Trade value, USD, bn
South Korea	260
Japan	225
United States	160
Taiwan	150
Germany	140
Australia	130
Saudi Arabia	120
Brazil	95
Singapore	70
Russia	70

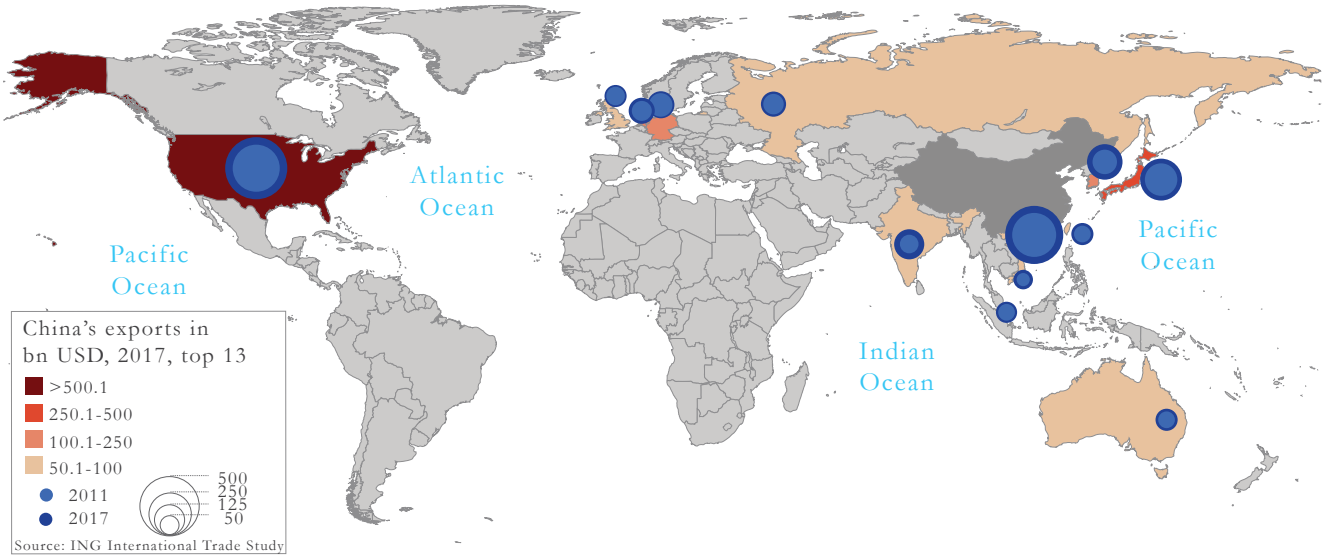
Source: ING

Chart 7: China's Exports, 2017

Trade Partner	Trade value, USD, bn
United States	550
Hong Kong	480
Japan	250
South Korea	180
India	130
Germany	105
Netherlands	95
Russia	90
Taiwan	70
United Kingdom	70

Source: ING

Map 6 : China's Major Export Partners, 2017



By 2030 only four of China's Top 20 trade partners will be European countries (Germany, United Kingdom, France, and the Netherlands). Out of its Top 10 trade partners, only trade with Germany could potentially benefit from shorter and more efficient shipping routes through the Arctic. As the role of Europe declines, countries such as India, Indonesia, Malaysia, Nigeria, and Thailand will emerge as major trade partners. All of them are located along existing trade routes far from the Arctic Ocean.

Chart 8: China's Top Trade Partners, 2030

Trade Partner	Trade value, USD*, bn
United States	594
Japan	336
South Korea	281
India	263
Germany	201
Singapore	178
Indonesia	169
Malaysia	162
Nigeria	151
Thailand	141

Source: PricewaterhouseCoopers
*in 2009 USD

All Arctic Shipping isn't Created Equal

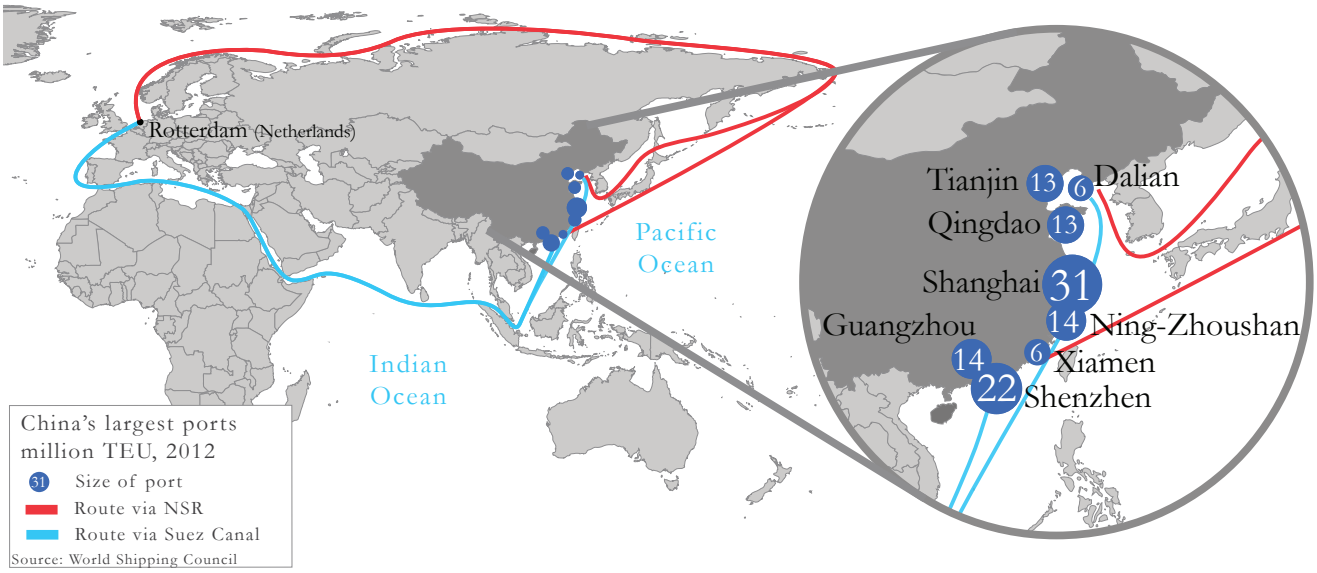
Proponents of a golden age of Arctic shipping frequently cite a 40 percent reduction in sailing distance. (Eide, Eide, & Endresen, 2010) Distance savings, however, vary substantially depending on where in East Asia trade originates.

For ships departing from ports in Northern China, distance savings can be as large as 28 percent. A trip from the port of Shanghai, China's largest, to the port of Rotterdam, Europe's largest, is about 7,600 nautical miles (nm) long in comparison to 10,800 nm along the traditional route through the Strait of Malacca and the Suez Canal.

Distance savings decrease significantly the further south Chinese ports are located. A voyage from the port of Shenzhen, the country's second largest and fastest growing port, to Rotterdam through the Arctic would reduce the distance by only 15 percent, from 10,100 nm to 8,500 nm.

The majority of China's fastest growing ports are located in its southern provinces, which reduces the potential distance savings to a less significant 10-15 percent. Hence, only trade originating from or destined for Northern China could benefit from the substantial distance savings of Arctic shipping routes.

Map 7: China's Largest Ports, 2012



Reduced sailing distances allow for, at least in theory, faster trips between ports in Europe and Asia. An analysis of 2012 and 2013 transit data of the NSR for vessels larger than 50,000 dwt, however, shows that average speeds in the Arctic are significantly lower than speeds on the Suez Canal route. Maersk's new EEE class will steam at 16 knots compared to just 11 knots for ships along the NSR. In practice this reduces the time savings to just 6.5 days between Tianjin and Rotterdam and to a negligible 1.1 days between Shenzhen and Rotterdam.

Chart 9: Comparison Suez Canal vs. NSR

Trade Route	Suez Canal, nm	NSR, nm
Tianjin - Rotterdam	11,500	7,800
Shanghai - Rotterdam	10,800	7,600
Shenzhen - Rotterdam	10,100	8,500
	Suez Canal, Days	NSR, Days
Tianjin - Rotterdam	29.9	23.4
Shanghai - Rotterdam	28.1	22.9
Shenzhen - Rotterdam	26.3	25.2

Source: Hofstra, Maersk, NSR Administration

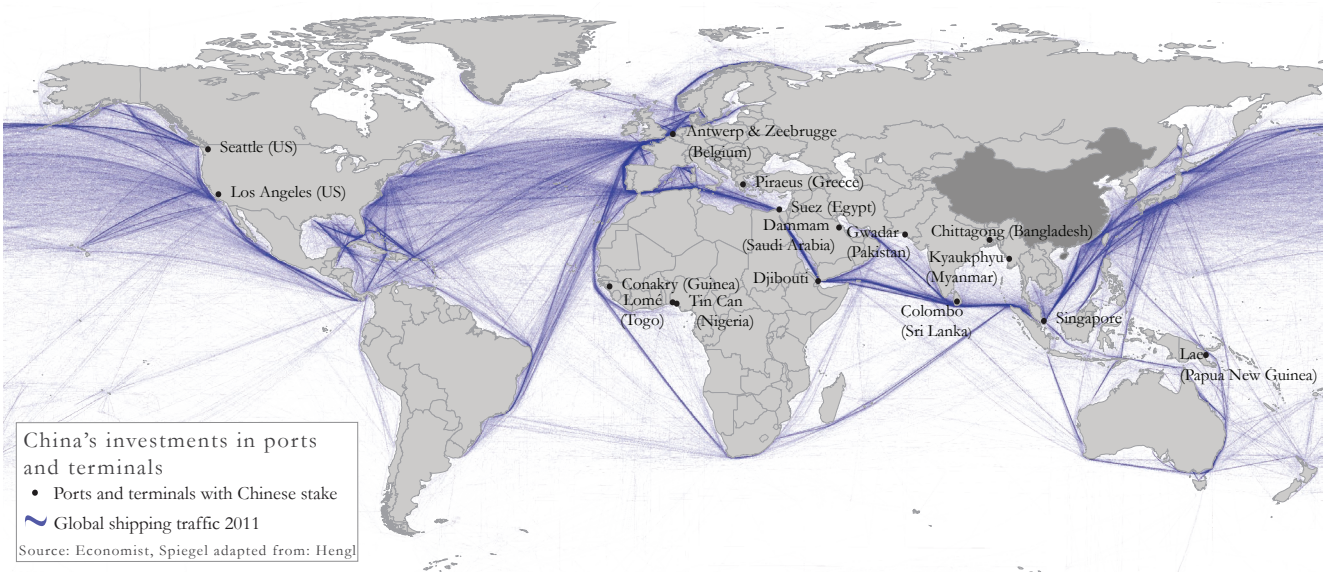
China's Investments in the Shipping Sector

Over the past decade, China has been investing heavily in port infrastructure throughout Asia, the Middle East, Africa and Europe and has built an extensive network of ports in which it holds a stake. None of these investments point to the Arctic being considered as a new transportation corridor. China's Ocean Shipping Company (COSCO) has shown little interest in Arctic shipping as it continues to invest heavily in ports along the Suez Canal route.

Cosco Pacific, a subsidiary of COSCO, holds minority stakes in terminals in Antwerp, Belgium, Suez, Egypt, and Singapore and recently secured a majority stake in the Port of Piraeus, Greece. (Economist, 2013) China Merchants Holdings owns stakes in Togo and Djibouti and agreed to construct a billion-dollar port in Tanzania. The newly upgraded port of Colombo, Sri Lanka, again with the help of massive Chinese investments, will rank among the Top 20 largest container ports once it operates at full capacity after completion in 2014. (Ondaatje, 2013)

In total, Chinese companies own stakes in more than 20 major ports around the world, none of them in proximity to Arctic shipping routes.

Map 8: China's Investments in Port and Port Infrastructure



China's foray into Arctic shipping remains limited to a host of cooperative agreements with Iceland, with whom it signed a Free Trade Agreement in April 2013. Chinese and Icelandic officials have discussed the potential of establishing the island nation as a trans-Arctic shipping hub. (Ma, 2013) This would allow China to gain a strategic foothold in the region and allow Iceland to potentially benefit from its strategic location at the entrance of the Arctic Ocean.[1]

It remains doubtful, however, that it can transform itself into anything more than a regional shipping hub. The island state recently announced a partnership with Bremenports to develop a deepwater port in Finna Fjord in the northeast of the country. (Bremenports, 2013) Furthermore, Eimskip, Iceland's largest shipping company, established a bi-weekly trans-Atlantic shuttle service between Portland, ME and its hub in Reykjavik using two 700 TEU vessels. (Eimskip, 2013; Richardson, 2013)

These investments and this cooperation may succeed at developing Iceland into a secondary hub for small-scale container traffic and destinational shipping, e.g. for raw materials from Greenland, but Iceland will always remain far off the global shipping highways.

A New Dimension in Container Shipping

The economic development of the Arctic does not occur in isolation from the global economic system. Technological advances in other regions of the world have a substantial and lasting impact on the realization of the Arctic's economic prospects. The shale gas revolution in North America delayed Norwegian and Russian plans for the development and production of Arctic natural gas. (Carmel, 2013) Likewise, the emergence of ever-larger and more cost effective vessels will undercut the economic potential of Arctic shipping and end its future before it truly ever began.

After more than a decade of delays, a new generation of Ultra Large Container Ships (ULCS), about twice the size of existing vessels, is about to enter into service. These behemoths, such as Maersk Line's Triple E-class, offer vastly improved economies of scale and significantly lower per-container costs to the point where Arctic shipping will no longer be economically viable, even under ideal conditions. Ships capable of traversing the Arctic Ocean, referred to as Arcticmax, are only a fraction of the size of these new megaliners and will not be able to compete with the new economics of global shipping.

[1] See also Malte Humpert and Andreas Raspotnik, "From 'Great Wall' to 'Great White North': Explaining China's politics in the Arctic."

These new giants of the sea will be able to carry 18,000+ twenty-foot equivalent units (TEU) on the Asia to Europe route, far exceeding today's common standard of 6,000-8,000 TEU. More than 100 of these Ultra Large Container Ships (ULCS) with a length of more than 366m, a beam of more than 49m and a draft exceeding 15.2m, will hit the water by 2016. (ILS, 2012) And the next generation of ships able to carry 25,000+ TEU is less than a decade away. In this context, the Suez Canal Authority is busy deepening the Canal to accommodate these new container ship giants.

As in other sectors, China is setting the pace in the field of these new mega vessels. China Shipping Container Lines recently placed an order for five 18,400 TEU vessels with South-Korean shipbuilder Hyundai. Today, there are 51 ports, many of which have seen significant Chinese investments, equipped to handle ships larger than 10,000 TEU. (Shaving, 2013)

The median vessel size of the global container ship fleet has doubled since 2001 and on the Asia-Europe route, the average vessel size has increased from 6,390 TEU to 9,350 TEU between 2008 and 2012. (Beard, 2012)

This growth is set to continue as the total tonnage of vessels larger than 7,600 TEU is expected to grow three times faster than the tonnage of smaller vessels over the next two decades. (Fang, 2013)

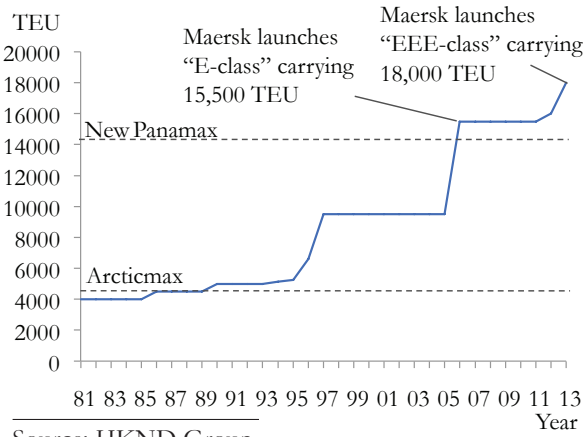
None of these new megaliners will be able to venture into the Arctic. Arcticmax ships, vessels capable of transiting the Arctic Ocean between Asia and Europe, can only carry a modest 2,500-4,500 TEU due to beam and draft restrictions. Mandatory icebreaker escorts for non-ice class vessels limit the ship's beam to 30 meters, the width of the icebreaker. (Ragner, 2008) A number of chokepoints, such as the Laptev Strait, limit the draft to 10-12 meters. (Carmel, 2013)

In comparison, the expanded Panama Canal will be able to accommodate vessels as large as 13,000 TEU and the upper limit for Suez Canal lies beyond 25,000 TEU.

The efficiency gains of using higher-capacity vessels is so significant that earlier this year Maersk Line decided to bypass the Panama Canal altogether and ship goods from the Eastern U.S. to Asia via the Suez Canal. Instead of using two 4,500 TEU vessels, they are employing one 9,000 TEU vessel; the efficiency gains easily make up for the five percent increase in distance. (Kyunghee, 2013)

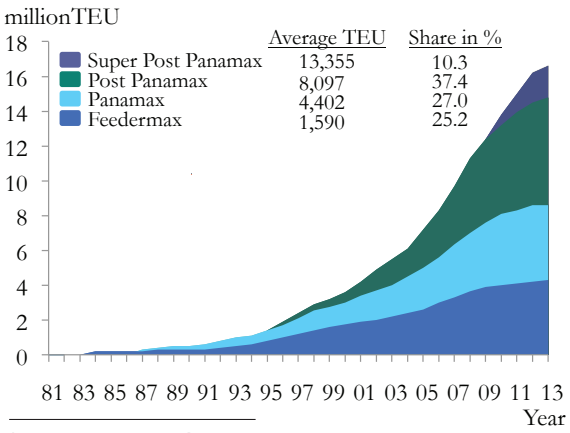
In the shipping industry size matters. Arcticmax vessels will not offer sufficient economies of scale to compete with the new realities of ever-larger container ships along the world's shipping corridors.

Chart 1: Maximum Ship Size 1981-2013



Source: HKND Group

Chart 2: Global Container Fleet Capacity



Source: HKND Group

A New Dimension in Bulk Shipping

The trend of increasingly large vessels can also be observed in the bulk-shipping sector. A new generation of extra-large ore carriers custom built for Vale, the Brazilian mining giant, about twice the size of existing ships entered service in 2011. These vessels, referred to as Chinamax or Valemax weigh in at 400,000 dwt. Vale hopes that improved economies of scale will allow it to better compete with its competitors Rio Tinto and BHP Billiton. Vale has more than 80 ore carriers, including 36 of the extra-large variety on order.

All of these vessels are Capesize ships, meaning they are too large to pass through the Suez Canal – let alone the Arctic – and have to round the Cape of Good Hope at the southern tip of Africa. Due to the ships' large size they can only serve very few ports in Brazil, China, Europe, India and the Middle East.

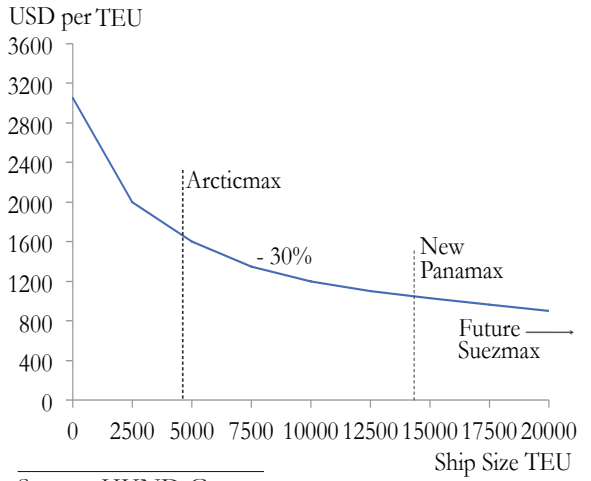
China's investments in port infrastructure are targeted at terminals equipped to handle these new vessels. It has also readied a number of its own ports, such as Dalian, Dongjiakou and Ningbo-Zoushan, to accommodate this new class of ships. (Business Times, 2012; Siyu, 2013)

The global tanker fleet is also increasingly dominated by vessels beyond 200,000 dwt. Of the 4,024 oil tankers above 10,000 dwt in service in 2010, 396 were larger than 320,000 dwt with the most popular size found between 220,000 and 279,000 dwt. (Auke Visser, 2010) Ships between 160,00 and 320,000 dwt are called Very Large Crude Carriers (VLCC) with larger vessels referred to as Ultra Large Crude Carriers (ULCC). Apart from the lack of ice-strengthened hulls none of these vessels will be able to venture into the Arctic due to their immense size and draft; up to 20m for VLCC and 35m for ULCC.

In comparison, the largest tanker along the NSR during the 2013 shipping season was the 85,000 dwt 1A ice-class Arctic Aurora. (NSR Information Office, 2013) Arcticmax vessels requiring icebreaker escorts and passing through the Laptev Strait are limited to about 50,000 dwt. (Moe & Jensen, 2010; Ragner, 2008) Even without icebreaker escorts, ship size is limited to about 100,000 dwt due to the aforementioned draft restrictions.

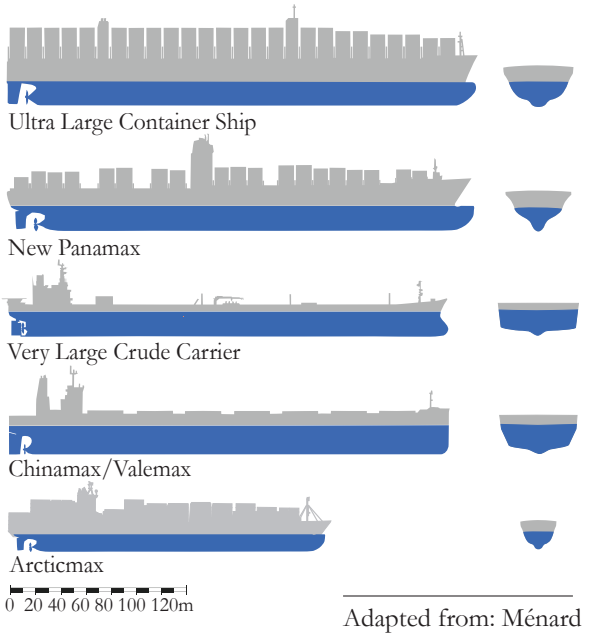
As in the container shipping business, economies of scale allow for the transport of raw materials over vast distances at ever-decreasing rates. Specialized Arcticmax ships will be unable to compete with these new realities.

Chart 3: Average Costs Per TEU



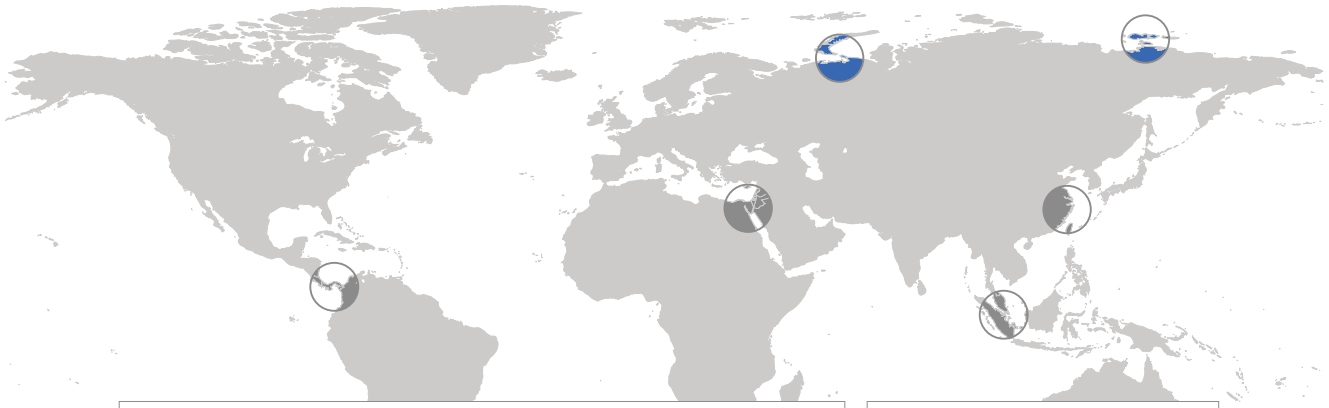
Source: HKND Group

Graphic 1: Ship Size Comparison



Adapted from: Ménard

Map 9: Global Shipping Choke Points and Maximum Ship Size



Sources: Carnel, Lloyd's Register, Maritime Connector, Ranger

* also referred to as Valemax

†maximum when ice-breaker escort required

Conclusion

China's influence on the global shipping market is substantial. It controls 20 percent of the world's container fleet and constructed more than 41 percent of newly built ships last year. (Economist, 2013) By 2030 Chinese companies will own more than a quarter of the global merchant fleet, ensuring a continuous supply of raw materials and delivery of its manufactured goods throughout the world.

Recent investments in port infrastructure along the Suez Canal route indicate that China expects the continued dominance of this major shipping corridor to deliver its manufactured goods to Europe. Future supplies of raw materials will originate in countries near the equator or farther south; and China has readied its own ports to handle a new generation of ultra-large ore carriers and tankers.

As ships are becoming increasingly larger to take advantage of economies of scale, draft and beam restrictions will prevent a growing share of the global merchant fleet to transit the northernmost ocean along the NSR. Furthermore, the absence of major ports throughout the Arctic Ocean makes it impossible for operators to benefit from network economics.

Future shipping in the Polar region will mostly consist of seasonal destinational transport, delivering supplies into the Arctic for its increasing economic activity and transporting the region's natural resources to markets in East Asia. Apart from these niche opportunities, Arctic shipping routes will be unable to compete with the world's existing major trade routes. Thus, while climate change will, over the coming decades, transform the frozen north into a seasonally navigable ocean, Arctic shipping routes will not become a new silk road for China.

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