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CLIMATE CHANGE AND SINGAPORE

Lee Kay Li

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING
COLLEGE OF ENGINEERING
NANYANG TECHNOLOGICAL UNIVERSITY

2011
CLIMATE CHANGE AND SINGAPORE

Submitted by
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SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING
COLLEGE OF ENGINEERING
NANYANG TECHNOLOGICAL UNIVERSITY

A Final Year Project presented to Nanyang Technological University
in partial fulfillment of the requirements for the
Degree of Bachelor of Science in Maritime Studies

2011
ABSTRACT

The Northern Sea Route (NSR), located in the Arctic, is a shipping route linking the Pacific and Atlantic Ocean. The heightened focus on the Arctic of late is primarily due to the impacts of climate change and the fact that these changes are occurring at an unprecedented rate in this region. Presently, ships can pass the NSR two to three months a year. With the thawing of the Arctic ice, not only will the NSR be passable for longer periods of time, Arctic offshore resources will be more accessible as well. The objectives of this research project aims to investigate the potential impacts on Singapore as a major Hub; and to identify business opportunities for Singapore and the local maritime industries.

This research report concentrated on two work packages: the Arctic region to find out the main driving force in the development of NSR, and an overview of Russia to find out the conduciveness of the business environment for foreign investments. A general research was performed to gain an overall understanding of the undertaking before raising research questions and propositions relevant to the issues of each work package for verification. Findings and results revealed that the NSR will not threaten Singapore’s position as a maritime hub. Firstly, the abundance of Arctic oil and gas reserves, not distance savings, is the main driver in the development of the NSR. Secondly, Russia is deemed unfavourable for investments today and in the next fifty years. However, the Arctic offers opportunities for Singapore. Six strategy propositions on how local maritime industries could enter the Arctic market and for Singapore to further establish her position as a maritime hub were discussed.
ACKNOWLEDGEMENTS

I would like to express my heartfelt gratitude to Dr Bengt Ramberg, my project supervisor, for his continuous guidance and unwavering support to my team throughout the entire duration of the project.

I would like to sincerely extend my appreciation to all interviewees who took precious time out of their busy schedule to participate in the interview sessions, and their meaningful contributions to the project.

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CHAPTER 1: INTRODUCTION

1.1 Background

The Arctic is a region located at the Northern Hemisphere with an area of 14 million square kilometres (CIA, 2010). This accounts for about 6% of the Earth’s surface area which is roughly the size of an African continent. Countries surrounding this region include United States, Russia, Canada, Greenland, Norway, Sweden, Finland and Iceland.

Climate models used by the Intergovernmental Panel on Climate Change (IPCC) have predicted a three to four degrees rise in global temperature in the next 50 years, resulting in a decreasing rate of three to five percent per decade of total ice extent (Ho, 2009). Figure 1 and 2 illustrate the area of ice extent in the Arctic Circle. Area of ice has decreased from 6.2 million square kilometres in September 1999 to 5.4 million square kilometres in September 2010. This is an alarming shrinking rate of 12.9% over a span of 11 years.

<table>
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<th>September/March</th>
<th>September Average Extent</th>
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<td>(minimum/maximum)</td>
<td>(millions of square kilometers)</td>
<td>(millions of square kilometers)</td>
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<tr>
<td>1979-2000 mean</td>
<td>7.0</td>
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Figure 1: Extent of Arctic Sea Ice

Source: **Earth Observatory - Arctic Sea Ice** (2010)
Conversely, Arctic scientists have predicted for an ice free Arctic as early as 2030 and no later than 2060 (Russel, 2008). Presently, many studies have shown that the Arctic has abundant oil and other natural resources and ships can pass the Northern Sea Route (NSR) two to three months a year. If these predictions were true, maritime activities relating to the transportation of goods, oil and gas, and research will surely increase as the marine access to the Arctic Ocean increases.

1.2 Objectives

The objectives of this research project aims to investigate:

1. the potential impacts on Singapore as a major Hub, and
2. how the maritime industries can develop proactive strategies and take advantage of the new business opportunities.
CHAPTER 2: PROJECT ORGANISATION

2.1 Work Breakdown Structure

Table 1: Work Breakdown Structure
2.2 Scope

The project seeks to evaluate two parts: the potential impacts on Singapore and opportunities for Singapore. Due to the overwhelming number of factors which could affect the developments of the NSR relative to the research period, the study will converge on six work packages as illustrated in Table 1 to increase the niche of our scope.

The 6 major Work Packages (WP) considered in this study are:
-WP1: Arctic Region Overview
-WP2: Russia Overview
-WP3: Shipping Carbon Emissions
-WP4: Green Arctic Technologies
-WP5: Impacts of Global Warming on the Arctic
-WP6: Looking ahead into 2050

The potential impacts and opportunities of each WP will be examined and evaluated. Each of the three members in the team will investigate two work packages:
-WP1 and WP2 by the author of this report
-WP3 and WP4 by teammate Lim Wei Ling
-WP5 and WP6 by teammate Gwendolyn Ng
CHAPTER 3: LITERATURE STUDY

This chapter gathers past research findings done by academics in the area of Arctic region and Russia. A wide range of studies in these two areas are being done across different periods, during which the environment had undergone immense changes due to a series of external factors. Hence to facilitate this research project, it is necessary to understand changes in the Arctic region and Russia from past to present, and identify the potential impacts and opportunities.

3.1 WP 1 on Arctic Region Overview

The first part of the literature review will cover geography of Arctic and NSR, history and current developments of NSR and Arctic resources to understand the driving forces of NSR shipping.

3.11 Arctic Ocean in Brief

The Arctic Ocean is the smallest and shallowest among the world’s five oceans (CIA, 2010). It has a total area and coastline of about 14 million square kilometers and 45,389 kilometers respectively; calculation includes Baffin Bay, Barents Sea, Beaufort Sea, Chukchi Sea, East Siberian Sea, Greenland Sea, Hudson Bay, Hudson Strait, Kara Sea, Laptev Sea, Northwest Passage and other tributary water bodies (CIA, 2010). The Arctic Ocean accounts for about 6% of the Earth’s surface area which is roughly the size of an African continent (Rekacewicz, 2000).

As illustrated in Figure 3, the ocean is located almost entirely within the Arctic Circle in the North Polar Region and virtually landlocked as it is surrounded by five Arctic coastal states – the United States, Canada, Russia, Norway and Denmark (of which Greenland is a territory.)
The Arctic Ocean is connected to the Pacific and Atlantic oceans at the Bering Straits and Greenland Sea respectively. A layer of sea ice covers a significant portion of the Arctic Ocean most of the year. These sea ice forms during the winter season and melts during the warmer summer periods. Due to global warming, there is a shrink in the amount of Arctic sea ice reported in recent years.

The Northwest Passage and Northern Sea Route are two important seasonal waterways. Climate models used by the Intergovernmental Panel on Climate Change (IPCC) have predicted a three to four degrees rise in global temperature in the next 50 years, resulting in a decreasing rate of three to five percent per decade of total ice extent (Ho, 2009). Therefore global warming may enable ship transportation along the NSR for at least several months every year.

3.12 The Northern Sea Route (NSR)

Distance and Route
The NSR, also known as the Northeast Passage, is a shipping route linking the Pacific and Atlantic Ocean, passing five Arctic seas: Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea and Chukchi Sea to Northern Russia as illustrated in Figure 4 (Liu & Kronbak, 2010).
This new route measuring between 2,100 and 2,900 nautical miles (NM), will substantially shorten the shipping route linking Northern Europe and Northeast Asia (Liu & Kronbak, 2010). The measured distance takes into account the NSR short of a clearly defined linear route due to variable and difficult ice conditions, and also considerations of all possible routes using the NSR (Liu & Kronbak, 2010).
A look at the globe in Figure 5 shows the NSR is shorter than the current shipping route via Suez Canal. This could mean in some instances a shortening of the shipping distance of up to 40% as compared to the traditional route via the Suez Canal (Liu & Kronbak, 2010). Hence, the NSR can offer great savings in distance, and thus potentially also in time and expenses, for transport between Northern Europe and East Asia.

**History and Developments of NSR**

The NSR was originally known as the Northeast Passage (NEP) until the 20th century. Arctic expeditions for an Arctic shortcut began as early as the 16th century and the driving force was the desire of European colonial powers to find an alternate shorter seaway to Asia via the NEP along the coast of Siberia as they expanded their empires and trading routes. Despite the great number of expeditions ventured over the centuries, a viable passage could not be discovered. Most vessels could only map out some of the western part of the NEP and were forced to return due to difficult ice conditions and ship damages (Foundation, 2001).

It was only about two centuries later in 1879 that the NSR was finally discovered and mapped out. Adolf Eric Nordenskiold, a Finish-Swedish explorer, onboard the Vega, successfully navigated through the NSR from Sweden to Japan, via the Bering Straits (Encyclopedias, 2010). Although Nordenskiold’s discovery of the NSR was a historic achievement, the sailing conditions along the eastern part of the route were considered too harsh for sailing and trade with Asia. Instead, the Kara Sea Route which links Europe with the Ob-Yenisey river basin spurred international trade (Foundation, 2001). Soon, many vessels used the Kara Sea Route for commercial activities while the relevance of the NSR further diminished. Later during the Russian revolution in 1917, non-Soviet vessels were restricted from gaining access to the Russian Arctic waters. Despite the tumultuous Russian Civil War, efforts to further develop the Kara Sea Route continued (Foundation, 2001).

In the 1930s, the Soviet Union shifted their priority to domestic trade and the entire NSR was developed as an internal waterway for economic self-sufficiency (Drent, 2000). Industries were established and port facilities were constructed to support industrial development of Arctic resources. A large bureaucracy, Glavsevmorput, was also established in 1932 to administer the NSR and all economic activities in NSR (Drent, 2000).
Later during the Second World War, the NSR played an important role in transporting and supplying food and ammunition to the Arctic regions (Foundation, 2001). The Soviets recognised the value of the NSR and committed considerable resources to NSR navigation after the war. In the 1970s, the Russians developed the northern oil and gas industry, and the NSR was used as an important supply line (Drent, 2000). The NSR was increasingly used and reached its peak in 1987 with cargo volume of 6.6 million tons, but the numbers fell when the Soviet system started to crumble (Drent, 2000).

In 1991, the NSR was declared open to non-Soviet vessels as part of a policy to open up Soviet Union (Drent, 2000). Although the official opening of the NSR brought about much anticipation to the international shipping community, Arctic commercial activities by non-Soviet vessels were almost zero (Drent, 2000). Most shipping companies considered the NSR unattractive because of stringent regulations, high costs and lack of information about the NSR (Drent, 2000). Hence, commercial shipping on the NSR was mainly coastal services in the 1990s.

**The NSR Today**

Due to historical reasons, the NSR stretching from the straits linking the Barents and Kara Seas in the west to the Bering Strait in the east has until now mostly been an internal Russian trade and shipping route. Despite its opening in 1991, there has not been one commercial transit by a non-Russian vessel. Non-Russian Transits were mainly research and military vessels.

The first commercial transit by non-Russian vessel was made in NSR history in September 2009. This breakthrough was made by Beluga Group. Two German ice-class heavy-lift vessels, MV Beluga Fraternity and MV Beluga Foresight, made the first-ever commercial voyage though the NSR (International, 2009). The east-west passage began from Ulsan, South Korea to Rotterdam via the NSR, stopping to discharge cargo at the Ob River port of Novy Port. They then continued west to Murmansk and to Rotterdam.

2010 was an achievement year for the NSR as a new sea highway between Europe and Asia. MV SCF Baltica, carrying gas condensate sailed from Murmansk to Ningbo, China via the NSR and Bering Strait in August (Nilsen, 2010b). She is the first Aframax tanker of more than 100,000 dwt navigating through the NSR. MV Nordic Barents, carrying 41,000 tons of iron ore sailed from Kirkenes in Northern Norway to China via the NSR in October. She is the first bulk carrier with
non-Russian flag to use the NSR for Europe-Asia trade (Nilsen, 2010b). Later in October, an ice-class diesel-electric vessel, MV Monchegorsk, became the first vessel to sail a round-trip to Asia via the NSR without icebreaker assistance (Nilsen, 2010a). The vessel carried metal from Murmansk via Dudinka Port to Shanghai via Yenisei River and carried Chinese consumer goods on her return to Norilsk (Nilsen, 2010a).

For voyages across the Arctic in 2011, state-owned icebreakers company, Rosatomflot, reported receiving ‘15 applications to accompany voyages across the Arctic against 4 trips in 2010’ (AK, 2011). It can be anticipated that there will be an increasing trend in the number of voyages in future.

### 3.13 Arctic Resources

Energy is a vital resource in all parts of our daily lives today. Although global warming results in tremendous changes in climate patterns, it offers the possibility of discovery and extraction of new energy resources in the Arctic region amidst dwindling energy resources throughout the world.

The Arctic region is rich in its natural resources reservation and holds huge potential as an oil and gas producing region. Other minerals and metals which are also abundant are coal, nickel, copper, tungsten, lead, zinc, gold, silver, diamonds, manganese, chromium and titanium (USGS, 2008). The Arctic is currently in focus like never before as the world is increasingly looking North for commercial opportunities.

Among the varieties of natural resources in Arctic regions that we can tap on, crude oil, natural gas and natural gas liquids (NGLs) have attracted the most attention and are one of the most assessed resources.

Today, a number of onshore areas in Alaska, Canada and Russia have been explored for petroleum and this resulted in the discovery of more than 400 oil and gas fields north of the Arctic Circle (USGS, 2008). These fields, accounting for about 240 billion barrels of oil and oil-equivalent (BBOE) natural gas, is approximately 10% of the world’s known conventional petroleum resources, which means cumulative and remaining proved reserves (USGS, 2008).
As onshore areas in the Arctic region are being explored, offshore resources are set to be the new target. According to a report by United States Geological Survey –USGS (2008), the mean estimate of undiscovered Arctic oil and gas is estimated to be worth 90 billion barrels of oil, 44 billion barrels of natural gas liquid and 1,670 trillion cubic feet of natural gas. It is also estimated that 84% of these resources are located in offshore areas.

More than 70% of the mean undiscovered oil is estimated to be located in five regions as shown in Figure 6: Arctic Alaska, Amerasia Basin, East Greenland Rift Basins, East Barents Basin and West-Greenland-East Canada (USGS, 2008).

![Probability Map of Undiscovered Arctic Oil](image)

*Figure 6: Probability Map of Undiscovered Arctic Oil*

*Source: Modified from USGS Circum-Arctic Resource Appraisal (2008)*

Whereas, more than 70% of the undiscovered natural gas is estimated to occur in three regions as shown in Figure 7: Arctic Alaska, East Barents Basins and West Siberian Basin (USGS, 2008).
Figure 7: Probability Map of Undiscovered Arctic Gas  
*Source: Modified from USGS Circum-Arctic Resource Appraisal (2008)*

Although vast amounts of Arctic oil and natural gas and their locations have been discovered, development in the Arctic’s productions has been slow. Today, only a few basins, such as the North Slope of Alaska, Timan-Pechora and the West Siberian Basin, have been confirmed to contain large volumes of hydrocarbons while most of the Arctic, especially offshore remains essentially unexplored.

Approximately sixty-one large oil and natural gas fields have been discovered and located within the Arctic Circle in Russia, Alaska, Canada’s Northwest Territories, and Norway (*EIA, 2009*). Among the discovered fields, fifteen of these large Arctic fields (eleven in Canada’s Northwest Territories, two in Russia and two in Arctic Alaska) have not yet gone into production.

There is a large proportion of oil fields discovered in Russia: forty-three of the sixty-one large arctic fields are located (*EIA, 2009*). These large Russian fields are located in the West Siberian Basin: thirty-three natural gas fields and two oil fields. As for the eight remaining large Russian fields, five are in the Timan-Pechora Basin, two are in the South Barents Basin and one is in the Ludlov Saddle.
Out of the sixty one large Arctic fields discovered, eighteen are outside Russia: six in Alaska, eleven in Canada’s Northwest Territories and one in Norway.

As for undiscovered resources, United States Geological Survey (USGS) conducted an assessment of undiscovered but technically recoverable Arctic conventional oil and natural gas resources. The assessment identified thirty-three sedimentary regions with depth exceeding three kilometres of which twenty-eight could be quantitatively assessed. A criterion of more than 10% probability of reserves in larger than 50 million barrels of oil equivalent (MMBOE) in each region is required for quantitative analysis (USGS, 2008).

![Figure 8: Probability Map of Undiscovered Arctic Oil and Gas](image)

*Source: Modified from USGS Circum-Arctic Resource Appraisal (2008)*

A breakdown of the estimated reserves in each province as illustrated in *Figure 8* is shown in *Table 2* below. (NGL, natural gas liquids; MMBO, million barrels of oil; BCFG, billion cubic feet of natural gas; MMBNGL, million barrels of natural gas liquids; BOE, total barrels of oil and oil-equivalent natural gas; NQA, not quantitatively assessed.)
As observed from Figure 8 and Table 2, much of the estimated undiscovered resources are found in the Russian areas and located offshore. In addition, there is higher certainty that a significant amount is recoverable.

While proven resources are fully identified and economically viable resources, these undiscovered reserves are estimated based on geological data and assumption that they are recoverable with existing technology given present permanent sea ice and oceanic water depth conditions (USGS, 2008). As Arctic infrastructure development is sufficiently expensive that many large Arctic fields remain undeveloped, economic considerations are excluded in this assessment (USGS, 2008).

Although vast quantity and locations of Arctic oil and natural gas have been discovered, development in the Arctic’s productions has been slow. Nonetheless, the extensive Arctic Circle represents geographically the largest unexplored prospective area for petroleum remaining on Earth.
3.2 WP 2 on Russia Overview

The second part of the literature review will investigate the politics and economic developments of Post-Soviet Russia, and Russia’s response to the NSR. This is to understand the business environment in Russia which in turn have an impact on the future of NSR.

3.21 Russia in Brief

To forecast the future of NSR, it is essential to look into Russia with depth since Russia is the sole nation who has the largest land area located in the Arctic Ocean as illustrates in Figure 9. Russia has bountiful natural resources off its Arctic coast to develop and export, and new sea lanes to bring these resources to market whether to emerging economies like China and India or mature industrial economies like Japan and Europe as discussed in Chapter 3.1. Already, Russia is pursuing offshore development opportunities such as at its massive Shtokman natural gas field, located 340 miles north of Russia’s Arctic coast.

Figure 9: Map of Arctic Region

In addition, Russia is currently a major exporter of oil and natural gas. The nation has the world’s largest natural gas reserves and is the second largest producer of natural gas (EIA, 2010). She is also the world’s second largest producer and exporter of oil after Saudi Arabia (Nichol, 2010).

Being a major ownership and producer of energy, and whose economic growth over the past decade has been driven by energy exports, Russia is anticipated to be a big player in Arctic developments. Hence, the world’s interest is now on Russia being a potentially important trading partner.

### 3.22 Post Soviet Russia and Political Development


The years of President Yeltsin’s rule brought about a breakdown of the central state authority. Since Vladimir Putin’s was made President on 31 December 1999, the political system he ran was a remarkable contrast to President Yeltsin’s administration. He set his priorities to strengthen the central government to restore Russia’s status as a great power (Nichol, 2010).

Putin transformed the State Duma, i.e. lower legislative chamber, who was once a strong opponent of market reforms to one that approves and accepts with minimal debate all of the President’s initiatives. In addition, he weakened the power of regional governors by reducing them to the status of Presidential appointees. Large enterprises viewed as ‘strategic assets’ were also taken over. These assets included ship, aircraft, auto manufacturing, as well as other raw material extraction sectors (Nichol, 2010). He also took government control over state-owned companies and reconstituted the management by appointing senior administration officials or close allies to their boards (MacFarquhar, 2007). To restrict foreign investment, the Kremlin also drafted legislation for certain strategic sectors of the economy and in large natural resource deposits (Nichol, 2010).

During Putin’s presidency, Putin ran a system to stabilize governance by consolidating power and reducing political freedom. He was successful in reversing the chaotic decentralisation and re-centralized power by eliminating independent deputies and small parties from the legislature. Under the 1993 Russian constitution, a President is not allowed to serve more than two consecutive terms in Office (MacFarquhar, 2007). Hence, as Putin’s second term came to an end, Dmitry Medvedev was Putin’s chosen successor to succeed him.
President Medvedev and Politics (2008 – Present)

Dmitry Medvedev was elected president in March 2008, while Putin was made prime minister. While Putin’s term was to stabilize governance, Medvedev’s goal is to modernise Russia (Abdullaev, 2010). By modernisation, he means enhancing freedom in Russia (Frolov, 2011).

Although Medvedev is viewed as more liberal than Putin, the political framework which Putin built largely remains. However, this system is not working as effectively since conditions are no longer the same and political stagnation ensued (Gorbachev, 2010). He has made few political reforms and such phenomenon has not been felt in Russia till today. An example of a continued political framework passed down from Putin’s governance is a law which forbids certain other structural reforms especially in the oil and gas sector. According to Nichol (2010), the Kremlin believes that state ownership brings about political stability and efficiency as re-nationalising efforts would prevent the sector falling into the hands of its political opponents.

Corporate governance is also not taken seriously (Frolov, 2010). A lack of a transparent government, law enforcement and contract protection have given rise to rampant corruption and nepotism of briberies and resource ownership (Aleksashenko, 2011). Even state enterprises, for instance the energy sector, are not being governed in a transparent manner (Frolov, 2010).

Medvedev’s first term in office is expiring in March 2012 and he has signalled through media about his intention to run for a second term. Recently, he expressed not sharing the same concept of ‘conservative modernization’ which Putin embraced. Changing the economy and political system is his political agenda in his second term and he has plans to implement liberal reforms for a fairer and improved political system.

Many sources have expressed that Russia is not ready for massive liberal reforms to achieve Medvedev’s goal of modernising Russia, and that the political system would remain repressed for some periods of time.
3.23 Post Soviet Russia and Economic Development

Post-Communist Collapse

The 1990s was a period of deep economic recession in Russia where the economy contracted as much as 35% during Yeltsin’s presidency (MacFarquhar, 2007).

Hyperinflation began in the early 1990s and it was later brought down by the government through an exchange-rate based stabilisation (MacFarquhar, 2007). However, fixing the exchange rate resulted in the severe-valuation of the currency. This situation made worse the nation’s economy caught in a deep recession and low oil trading prices. Consequently, the Russian government was unable to collect taxes to cover its large expenditure commitments, resulting in privatisation of many state-owned assets.

The period between 1996 and 1998 was one of the worst times where the economy shrank 40% in real terms and industrial capacity utilisation was 50% lower than in 1990 (MacFarquhar, 2007). There was a severe financial crisis in August 1998 and there were rising inflation, fled of foreign investors and the ruble declined about 60% (Lashley, 2010). By year end, the situation was so bad that industrial companies and even government sectors owed employees more than ten months of wages and that more than half of industrial transactions were barter traded (MacFarquhar, 2007).

Economic Rebound after 1998 Crisis

Russia’s economy was revived when President Vladimir Putin took power on 31 December in 1999. By end of 2003, Russia’s international financial position and oil export earnings improved significantly, with foreign debts declining from 90% of GDP to around 28%, and foreign reserves increasing from only $12 billion to some $80 billion (Erochenko, 2011). By the end of 2003, Russia has achieved five straight years of growth, averaging 6.5% annually since the financial crisis of 1998 (Erochenko, 2011).

Russia also operated a tight fiscal policy to stabilize exchange rates and inflation to drive economic recovery which has allowed the nation to run a budget surplus since 2003 (Lashley, 2010). Furthermore, the government created a stabilization fund worth $127 billion in mid-2007 for use in an emergency and to shelter the nation from commodity price shocks (Lashley, 2010).
By mid 2007, Russia was the third-largest foreign exchange reserves in the world of about $420 billion. Together with a stronger Ruble and rising oil price, the increasing demand of oil production allowed the Russian government to restore their nation’s financial stability quickly after a decade of large budget deficits. Within a short period of time, the depreciated Ruble re-established the competitiveness of many Russia’s tradable sectors.

From 2000, investments and consumers demand since 2000 are important drivers of the economic recovery besides high oil prices and a relatively cheap Ruble (Erochenko, 2011). As a result, these achievements, together with government efforts raised business and investor confidence in Russia's economic prospects.

Overall, Russia has achieved a strong economic growth over the eight years under Putin’s presidency where Russia’s GDP grew an average of 6.8% per annum (MacFarquhar, 2007).

2008 Financial Crisis
Russia’s oil and gas exports led the recovery of Russia’s economy from the Soviet collapse in 1999 (MacFarquhar, 2007). However, the sharp decline in oil and gas prices and global economic downturn which started in mid year 2008 cooled and ceased the growth. As in many other countries, the economic repercussions in Russia was so severe that GDP growth swung from positive 8.1% at the end of 2007 to negative 7.9% in 2009 (WorldBank, 2009).

According to a report, Russia’s economic policy outlook 2011, the government planned and executed a short-term economic policy priority in an attempt to recover the nation’s economy from the global economic and financial crisis (EIU, 2010). Petroleum receipts were used to maintain an expansionary fiscal policy and support employment in public services sector (EIU, 2010).

Russia Today
Russia’s economy expanded 2.9% for the first time in the first quarter of 2009 since the 2008 financial crisis, with an oil-funded stimulus program and record low borrowing cost (Abelsky, 2010). The upturn was also led by the recovery of the global economy and commodity prices.

According to a 2001 report by The World Bank, Russia's economic recovery has been too narrowly reliant on windfall profits from high global oil prices (Weir, 2001). Russia being the world’s biggest
energy producer and a major exporter of oil and gas, accounts for about 25 percent of GDP (Abelsky, 2010). Since then, the Russian economy has been on track and has continued to recover rapidly. Most key indicators, including real income, investment, manufacturing, and consumer spending have an upward trend (Weir, 2001). The government has also continually attracted global investors to invest in Russia (Weir, 2001).

Despite economic expansion in Russia over the past decade, serious problems persisted. The country had a weak banking system, poor manufacturing base, an overall weak business environment to attract domestic and foreign investors, corruption and unfair laws (Erochenko, 2011). Hence, although Russia has been experiencing economic growth yearly, the nation is still plagued by some persisting problems.

In addition, there is still too little protection for property rights and Russia remains an economy dominated by a few large corporations. Corruption is still pervasive despite being compensated for by strong economic growth and rising incomes (Economist, 2010). Although potential investors may be heartened by the legal changes, the Berlin-based Transparency International still rates Russia one of the most corrupt places on earth. According to the latest rankings in 2010, Russia has a corruption perceptions index at 154 (Adminkan, 2010). This is well below any other G8 nations and even below Egypt and Libya with index 98 and 146 respectively. Excessive corruption has resulted in capital flight at catastrophic levels and investment remaining far below the amounts needed to sustain existing capacities (Weir, 2001).

Recently, President Medvedev pledged economic reforms, declaring it as a top priority (Frolov, 2010). Medvedev, a lawyer by training, is also pushing legal reform (Abdullaev, 2010). He wanted to improve the court system and an effective and trustable working justice system (Abdullaev, 2010).
3.24 Russia’s Response to NSR

Russia’s Claim in Arctic Circle
Since President Vladimir Putin’s term, Russia had been focusing on the Arctic as a major natural resource base and has been aggressive in her Arctic claims (Cohen, 2010). These plentiful resources in the Arctic that surround the territory of Russia are therefore viewed as a boost to economic development. Putin’s objective is to transform the Arctic into Russia’s strategic resource base and make Russia a leading Arctic power by 2020 (Cohen, 2010).

Russia is also aware of her influential status in the Arctic. This is because Russia has abundant Arctic resources located in her territory, an extensive history in the Arctic and has the most freshwater rivers emptying into the Arctic.

According to 1982 United Nations Convention on the Law of the Sea (UNCLOS), all coastal states have economic rights over resources up to 200 nautical miles from their coastline (Manusama, 2011). There are five countries bordering the Arctic Ocean: Russia, USA, Canada, Denmark and Norway. It is a requirement that each country defines the outer limit of its continental shelf (ECS) and submits data to prove any claimed areas are an extension of their territory (Manusama, 2011).

According to UNCLOS as shown in Figure 10, Territorial Sea refers to the waters up to 12 nautical miles from the Baseline; Exclusive Economic Zone (EEZ) refers to the Area adjacent and beyond the Territorial Sea and up to 200 nautical miles; and Continental Shelf refers to the sea up to the fall of the continental shelf into the deep sea or at least up to the end of the EEZ.

![Figure 10: Legal Boundary of Ocean](source: The Arctic Legal Consideration (2011))
Russia has submitted several formal claims supporting Russia’s expansion into the High North. Norway, adjacent to Russia, and the United States (U.S.), opposite Russia, are two nations which have overlapping maritime claims with Russia as shown in *Figure 11*. While some border disputes have been resolved, the others remain unresolved.

![Arctic Territorial Claims](image_url)

**Figure 11: Arctic Territorial Claims**

*Source: Encyclopedia Britannica Inc. (2010)*

The maritime boundary conflict between Russia and Norway was resolved recently. On September 15, 2010, both nations ended a forty year dispute over a 175,000 square kilometres area in the Barents Sea (*BBC, 2010a*). The two nations signed a maritime border agreement after an agreement on the equal division of the Arctic border as shown in *Figure 12*. In time, both nations will also have to work together to resolve future challenges and potential joint oil and gas exploration in the Arctic region where they share a border.
However, the maritime boundary conflict between Russia and U.S. over the Lomonosov Ridge remains unresolved. Russia claims that the Lomonosov Ridge passing through the North pole belongs to its continental shelves and alleged ownership of an area of 1.2 million square kilometers (460,000 square miles) that runs from the undersea Lomonosov Ridge and Mendeleev Ridge to the North Pole (Cohen, 2010). As observed from Figure 11, this is an approximate combined area of Germany, France, and Italy (Cohen, 2010). In August 2007, Russia planted the Russian flag on the sea-bed on the North Pole to claim its right and demonstrate their Arctic dominance to the world (Romans, 2010). Russia alleged that the undersea Arctic territories near the North Pole is a natural extension of her continental plate and wanted to claim ownership (Novosti, 2010). With a deadline till 2013 to establish evidence, Russia has been actively collecting bathymetric and seismic data to submit their evidence to support their claim to the Arctic undersea territories which would cost Ruble 2 billion, equivalent to US$64.53 million (Novosti, 2010).

**Russia and Shipping**

The shipping industry, specifically shipbuilding in Russia, is gaining prominence today. It has been classified by the government as being responsible for developing future Russian marine and river technology, and technological modernisation. (BBC, 2010b).

In addition, statistics have shown that the estimated overall demand for shipbuilding through 2020 is approximately Ruble $3.2 trillion (BBC, 2010b). However, the annual volume of civilian output
from the shipbuilding sector is only Ruble $44 billion in 2009. Although these figures reflect the demand of shipbuilding orders, the current output volumes is insufficient to support future output. To capture the strategic interests of Russia and a sizable segment of the shipbuilding market, President Dmitriy Medvedev has tasked the government to formulate a long-term comprehensive shipbuilding development plan to create cutting-edge, competitive and high-performance seagoing vessels (BBC, 2010b).

Today, the Russian government is supporting many shipbuilding and innovative projects. For instance, the Russian Ministry of Industry and Trade is focusing on the issues of shipbuilding development and the modernisation of Russian ports (RusNavy, 2010). They are also looking into the application of new technologies in maritime engineering such as oil and gas production equipment, ocean mineral resources and continental shelf exploration facilities.

The Russian government has various projects as well to develop Arctic shipping. Three new port projects are set to be constructed: one port will be constructed on the coast of the Murmansk Bay to be an Arctic transport hub (Arctic, 2010), Petropavlovsk Port at Kamchatka to be developed as an eastern hub for the Northern Sea Route (Arctic, 2010-b) and a new port near Belomorsk by the White Sea to boost Arctic shipping capacity (Arctic, 2010-a).

Russia is also collaborating with Norway to improve logistics and transport in the Arctic areas. Four transport hubs in the area where the Northern Maritime Corridor meets the Northern Sea Route will be built (Pettersen, 2010). They are Kirkenes in Norway, Murmansk, Arkhangelsk and Naryan-Mar in Russia.
CHAPTER 4: METHODOLOGY

In this section, a method for testing a set of propositions based on earlier literature reviews in Chapter 3 will be described. This chapter starts out with a discussion of the main methodological approach of this study, followed by an elaboration on research design, a section on objectives and research questions relevant to the work packages in this report.

4.1 Research Approach

This section aims to cover and inform readers an overview of the major techniques that are used in this report.

4.11 Major Techniques in a Research Project

Methodology involves preparation of strategies of how one would concretely implement research (Babbie, 1989). The strategies include precise specifications of what one wants to find out and establishment of the most effective procedure to reach the aim of this research.

The choice of methodology must be adapted to specific research situations related to past knowledge in the area, the choice of the problem, access to the research’s objects and available resources. Choice of methodology must at all times be related to the aim of the research.

There are three major techniques in research methodology: experimental research, survey research, and case research.

Experimental Research

Experimental Research is a method which allows researchers to establish, with some certainty, correlations between variables (Maanen, 1983). This method is popular in studies of social and human life.
Survey Research
Survey Research is a method that is used to obtain data directly from a defined set of population representative samples of respondents in a structured manner (Maanen, 1983). The data collection is usually conducted by means of mail, telephone or personal interviews.

Case Research
Case Research is another method to obtain information from one or a few situations that are similar to the researcher’s problem situation. Conducting a case study often requires the cooperation of the party whose history is being studied. Usually, intensive interviews or discussions have been carried out (Yin, 1989). Case research is often referred to as exploratory research.

4.12 Data Collection and Analysis

Before choosing a method to collect data, it is necessary to clarify the data needed for this research. Data analysis consists of examining, categorizing, tabulating and otherwise recombining evidence to address initial propositions of a study (Yin, 1989).

The methodology used must all the time be adapted to the need of data. It is therefore of great importance to justify the choice of methodology. Many factors are taken into consideration when choosing the methods to collect data. It is important to evaluate which method will give the best data in accordance with the problem. Furthermore, it is important to weigh the resources which are available.

Research data can be broadly classified as primary and secondary:

Primary Data
Primary research is data collected by a researcher for the particular research project currently being undertaken. It involves communication between a researcher and study participants doing data collection. Primary research data exists in two general forms: overt and non-overt.

Overt primary data are data which result from asking questions to the study participants and obtaining their answers. Thus, it requires the explicit consent and co-operation of the individual
being studied. There are three overt primary data collection modes: personal interview, telephone interview and mail interview.

In personal interviews, data are collected by means of face-to-face communication between an interviewer and study participants. Personal interviews have the potential of yielding both the largest quantity and highest quality of research data of the three data collection modes. In personal interviews and telephone interviews, the interviewer has the ability to notice and correct the respondent’s misunderstandings, to probe inadequate or vague responses or to answer questions and allay concerns which are important in obtaining complete and meaningful data (Peterson, 1993). In a mail interview, data are collected by means of mail communication between a researcher and study participants. Under such conditions there is no oral interaction between the researcher and study participants.

Non-overt primary data are all primary data other than those derived from the oral or written responses given by individuals being studied. Thus, they are generally collected by means other than questioning study participants.

**Secondary Data**
Secondary data is collected by someone other than the researcher, but for the particular research purpose at hand.

There are numerous ways in which secondary data can be useful when conducting a research project. The review of secondary data uncovers information that the author explored when carrying out the primary data-based study. Furthermore, they are useful as a reference base against which to compare primary data collected at a later stage in the research process. Additionally, secondary data are used in determining who or what to sample when collecting primary data. Furthermore, what makes secondary data so valuable is their relatively low costs and in many instances they are the only data available (Peterson, 1993).

On the other hand, there are certain potential limitations and disadvantages associated with secondary data. Many of these limitations are due to, and arise from the fact that secondary data by definition, are collected for a purpose other than the one with which a researcher is currently
concerned (Churchill, 1991). Thus, we frequently have no control over the procedures associated with collecting, analyzing, interpreting, or reporting secondary data.

4.2 Research Design

4.2.1 Research Approach

According to the research question, ice in the Arctic is reducing and ships are already passing the NSR 2-3 months a year. The research question paints a scenario of the NSR being a new passage along the Siberian coast as a reality 50 years from today. Hence, this research paper requires the author to examine how the above scenario will affect Singapore as a major Hub and how the maritime industries can develop proactive strategies and take advantage of the new business opportunities.

To examine the impacts and opportunities, a general research on the Arctic and Russian region background will be performed to gain an overall understanding of the undertaking. Next, research questions and propositions relevant to the issues of each work package are raised. Finally, the validity of the propositions is discussed. The verification of the propositions should foster a better understanding of the impacts on Singapore, and hence place the author in a better position to make an informed decision on her choice of strategy propositions.

Assessment of the impacts that the NSR have on Singapore and the strategies that Singapore maritime industry can develop will be carried out. This assessment will be based on:

1. Case study approach: Interviews of professionals in the shipping industry
2. Secondary data: Review of professional literature and estimates by experts
4.22 Cases in the Empirical Research

4.221 Case study approach

The case study allows in-depth search for information where respondents can freely express their views and opinions during the interview and discussion processes, providing information necessary for the study. No other research method allows respondents to express their views and opinions as freely as the case study approach.

Interview Questions

The interview questions were drafted separately for each interviewee, but were phrased to seek their opinions on three core issues: namely their opinions on the NSR, potential impacts on Singapore and opportunities for the Singapore maritime industries. Interview requests were sent out via electronic mail to the targeted interviewees. Copies of interview questions can be found in Appendix A.

Selection of Target Interviewees

As this is a specialized topic and not many are aware and have in-depth knowledge of Arctic and Russia, interviewees are therefore selected carefully to conduct interviews. Interview requests are sent to contacts who hit two minimum criteria.

The selection criteria for the interviewees are as follows:

1. Office based in Singapore, so as to better facilitate interview arrangement at the convenience of their office
2. Companies which have large scale operations in Singapore
3. Companies/Organizations based in Singapore with links to Russia
4. Companies/Academic Researchers who have expressed interest in Arctic

Successful Interviews

The profiles of the interviewees who agreed to the interview as shown below in Table 3:
As observed from Table 3, the interviewees are well represented from diverse business and academic background. This ensures that the views of various interviewees from different backgrounds are considered, contributing to a well-rounded analysis of the research findings.

In particular, three of our interviewees: Jan Erik Schulte, Geir Fuglerud and Liu Miao Jia have in-depth knowledge of the NSR. Jan Erik Schulte has experience in navigation through the NSR. Beluga is the first foreign merchant vessel to sail the NSR and Jan was the operations manager in charge of the operations of MV Beluga Fraternity and MV Beluga in 2009. Geir Fuglerud has done a research with his team in DNV Norway on the challenges of Arctic shipping in 2009. Liu Miao
Jia is the co-author of ‘The economic potential of using Northern Sea Route (NSR) as an alternative route between Asia and Europe’ research project with Jacob Kronbak. Hence, their interviews were especially valuable in the author’s research as they shared their knowledge and experience of the NSR with the team.

In addition, interviewees representing companies all held managerial positions and should hold considerable credibility. Finally, as an agreement with the companies prior to the interviews, certain sensitive opinions provided will not be identified with the company or the person unless approved.

**Unsuccessful Interviewees**

Unfortunately, the team was unable to interview the following to seek their valuable opinions:

1. **Koh Tien Yong, Earth Observatory of Singapore**
   The objective of the interview was to gain a deeper understanding on global warming and its impacts on Singapore.

2. **International Enterprise (IE) Singapore**
   The objective of the interview was to find out how IE Singapore has helped local companies venture into the Russian market.

3. **Lukoil Asia Pacific**
   Lukoil is Russia’s second largest oil company and its second largest producer of oil, and has operations in Singapore. The objective of the interview was to gain a deeper understanding on Lukoil’s operations in Arctic and Russia.

4. **Keppel Offshore and Marine (O&M)**
   The objective of the interview was to gain a deeper understanding about Keppel’s Arctic shipbuilding technology and its involvement in the Arctic region.

5. **Portek International Limited**
   Portek’s subsidiary-Europort International Pte Ltd collaborated with Russian Armley Investments Limited to develop and operate container and multi-purpose terminals in Russia in 2010. The
objective of this interview was to gain a deeper understanding about partnerships with Russian companies and the business environment in Russia. the Attached is the Authorization Letter and a background of my project.

6. International Maritime Cluster (IMC) Department, Maritime Port Authority of Singapore
The IMC department promotes Singapore as a Maritime Hub. The objective of the interview was to seek their opinions on the future outlook of Singapore as an International Maritime Hub.

7. APL
APL is a wholly owned subsidiary of Singapore-based Neptune Orient Lines (NOL). The objective of the interview was to seek their opinions on the future outlook of Singapore as an International Maritime Hub.

4.222 Secondary Data Collection
The secondary data collection was carried out as well. They are collected and analyzed for its implications on impacts and opportunities by cross referencing with data collected from interviews.

4.23 Objectives

Objective of overall research project:
To investigate the potential impacts of WP1 and WP2 on Singapore as a major Hub, and how the maritime industries can develop proactive strategies and take advantage of the new business opportunities

Objective of conducting interviews:
To gain opinions from professionals in the maritime industry. The author wanted to seek interviewees’ opinions and have a in-depth discussion on the topic to gain better insights into the project.

Objective of secondary data:
To reach out to a bigger pool of professionals to substantiate research findings. The author wanted to ensure a well-rounded analysis of the current situation of the research topic.

4.24 Research Questions

4.241 WP1 on Arctic Region Overview

1. Based on academic research, global warming, distance savings between Euro-Asia trade and abundant Arctic resources are expected to drive the developments in NSR. Which factor is the prime driving force?

4.242 WP2 on Russia Overview

1. Does the Russian government play a significant role in Arctic shipping and its developments?

2. Is Russia’s business environment favourable for foreign investments by local companies in the maritime sector today?

3. Will Russia’s business environment be favourable for foreign investments by local companies in the maritime sector fifty years later?
CHAPTER 5: EMPIRICAL STUDY

In this chapter, propositions stemming from research questions in WP1 and WP2 are raised. The validity of the propositions is examined based on the research design described in Chapter 4. The validity of the propositions is based on interviews of professionals in the maritime industry and secondary data. Finally, the propositions are verified.

5.1 WP 1 on Arctic Region Overview

5.11 Proposition

An abundant resource in Arctic is the prime driving force in the development of the NSR.

5.12 Arctic Resources

In a journal paper, Russia’s Failure in Asia, Stephen Blank commented that ‘energy has long been Russia’s calling card and they key to the large-scale task of rebuilding Siberia and ensuring Russia’s recognition as a great Asian power’ (Blank, 2010).

On asking what is one main factor the interviewees consider as the driver in the development of NSR, all interviewees but two generally agreed and pointed to oil and gas reserves in Arctic as the main driver.

Jan Erik Schulte believes that the distance savings is the main driver in the development of the NSR. Jan explained that ‘MV Beluga Fraternity and MV Beluga Foresight saved 3000 nautical miles from the 11,000 miles long traditional journey through the Suez Canal, taking 21 days instead of 51 days from loading various heavy lift modules from Ulsan, South Korea to discharging at Novyy Port/Yamburg at the River Ob in Siberia’. He added that ‘by using the NSR, we reduced bunker consumption of the used low sulphur Intermediate Fuel Oil 380 by roughly 200 tons in total per vessel. This resulted in financial savings of about US$100,000 of bunker costs and US$20,000 for each day travelling the NSR although MV Beluga Fraternity and MV Beluga Foresight are ice-
class 1a ship and more expensive’. Besides both vessels transited the NSR during the summer periods in July where Ian remarked ‘it was a straightforward operation and we did not use the Russian ice breaker as the NSR was ice-free that time’. Hence, for Beluga’s case, significant time and distance was saved overall.

Joshua Ho believes that global warming is the main driver in the development of NSR. He commented that ‘climate models used by the Intergovernmental Panel on Climate Change (IPCC) have predicted a three to four degrees rise in global temperature in the next 50 years, resulting in a decreasing rate of three to five percent per decade of total ice extent. Hence, it is evident that global warming will have a strong impact on oil and gas exploration, and ship transportation along the NSR’.

As for the remaining interviewees, they believe that the abundant oil and gas reserves in Arctic are the main driver.

Firstly Soh Wei Liang and Teh Kong Leong highlighted that ‘the place of consumption and production is very important for the commercial viability of NSR’. As discussed in Chapter 3.13 on Arctic resources, it is estimated that the amount of undiscovered Arctic oil and gas is estimated to be worth 90 billion barrels of oil, 4.4 billion barrels of natural gas liquids and 1,670 trillion cubic feet of natural gas. Besides that, rapid expansions of newly industrialized countries have caused uproar in oil demand. According to EIA (1009b), although world’s petroleum consumption increases 27%, emerging countries such as China has shown an appalling 215% increase of oil consumption over the past sixteen years. The author feels that with other rising nations following closely behind, the demand for energy will see a continuous upwards trend. Coupled with the depleting oil fields production in the world today, the world’s attention is now turned to the undiscovered oil resources in the Arctic. In this case, the NSR can no doubt assist Russia in energy sales to big consumers in Asia such as China, Japan and South Korea.

Secondly, the time and distance saved may not be very significant. Lie Sek Guan remarked that ‘distance saved depends on the location and the NSR benefits the northern regions such as Japan. For instance, there is insignificant distance difference of a vessel sailing from Singapore to Rotterdam via Suez Canal and the NSR’.
Thirdly, there is much uncertainty transiting a vessel along the NSR in ice conditions although it has a shorter distance. Geir Fuglerud commented that it is a challenge for shipowners to plan vessel operations from a logistical perspective. He listed many risks which include collision with glacier ice or ridges, vessel stuck in ice and loses propulsion power which will affect delivery time especially food transport, freezing of navigation equipment (GPS) which might not work, navigation in the dark and foggy periods, instability of ships due to ice, encountering Arctic storms lasting twenty minutes with 25 metres waves, collision or grounding which result in oil spillage and affecting ecosystems, lack of trained crew, system shut-down due to extreme temperatures and causing blackout situations, lifeboats which are useless in ice conditions and, remoteness resulting in difficulties for search and rescue. Unlike a usual sailing, sailing in ice conditions cannot be planned ahead as ice conditions are uncertain and always changing. This is supported by Jan Erik Schulte who commented that ‘during the operations of MV Beluga Fraternity and MV Beluga Foresight along the NSR, the Beluga meteorologists had to use up-to-date satellite pictures to analyze ice situations very professionally on a daily basis, and provide captains with daily routing suggestions avoiding ice contact as best as possible to minimize risk’. Hence, shipowners might not want to change their traditional route via the Suez Canal to a new route of a shorter distance which might bring new uncertainties.

Next, cost savings may not be significant. Although there may be savings in fuel costs and charter hire provided time is actually saved, charges and other costs could offset any savings. Soh Wei Liang commented that ‘a shorter distance is not feasible if shipowners could only benefit from cost savings during the summer periods’. According to Liu Miao Jia, ‘a 40% reduction in distance does not mean a corresponding 40% in cost savings due to many factors such as higher building costs for ice-classed ships, Russian NSR fees, non-regularity, slower speeds, navigation difficulties and greater risks, as well as the need for extra ice breaker service’.

Lastly, infrastructures are lacking along the NSR. There are insufficient ports and supporting services such as bunkering, repairs, supplies and surveys. According to Liu Miao Jia, she commented that ‘there are very limited infrastructure and port facilities along the Siberian coast, hardly anything from western Siberia to Russia’s Pacific coast. Industrial development in this region is also too insignificant to be noticed’. This is also supported by Jan Erik Schulte who commented that ‘Novyy Port is not a port. Currently, there is no land-based infrastructure at all to deliver goods. Cargoes are taken off by ships and delivered to land by barges’. 
5.13 Verification of Proposition

The proposition is validated.

In the interviews, all interviewees but two replied that oil and gas reserves in Arctic are the main driver. Hence, the abundance of Arctic oil and gas reserves is the main driver in the development of the NSR as an important trade route by 2050.

5.2 WP 2 on Russia Overview

5.21 Proposition

The Russian government plays an important role in Arctic shipping and its developments.

5.22 Russia and Arctic Shipping

All interviewees agreed that the Russian government plays an important role in Arctic shipping and developments.

With regards to Arctic shipping, Liu Miao Jia commented that ‘actual operations along the NSR, including scheduling, route assignment, navigational support, and pilotage and so on are controlled by two Marine Operations Headquarters (MOHQs). The first step toward arranging passage through the NSR is to obtain official permission. Shipowners should submit their request at least four months in advance to the administration of NSR’. This is supported by Jan Erik Schulte. He said that ‘Beluga experts travelled to Moscow in March 2009 in order to enter personal talks with Russian administration policies and learn more about the requirements for an efficiently target-aimed process of approval. The written form of application for the official permit to transit the NSR is handed in April 2009. All documents are signed and stamped and Beluga vessels are granted official permission to use the NSR the day the vessels depart from Vladivostok in August 2009 for Novyy port’.
With regards to Arctic developments, all interviewees pointed out that Russia’s policies will determine the future of Arctic developments. It is commonly understood by all interviewees that there is a lack of business freedom in Russia as almost all businesses are controlled by bureaucracy. As supported by the literature study in Chapter 3.2, the post-Soviet Russia has an authoritarian political system. For instance, the oil and gas enterprises such as Gazprom and Lukoil are state-owned and controlled by the government. The country is dependent on oil and gas exports, which accounts for nearly two-thirds of Russia’s exports. Lie Sek Guan commented that ‘Russia is not exactly politically open even till today’. Soh Wei Liang thinks that the government’s policy is important for investors to decide if partnerships with Russian companies are possible. Liu Miao Jia did not think Russia will wipe the ice breaking fees entirely to attract vessels to use the NSR as ‘Russia’s interest in NSR might not lie in the commercial profitability of the route’.

5.23 Verification of Proposition

The proposition is validated.

All interviewees expressed that the Russian government plays and will serve an important role in Arctic shipping and developments. In addition, secondary data supports the proposition. Hence, the Russian government plays an important role in Arctic shipping and its developments.

5.3 WP 2 on Russia Overview

5.31 Proposition

Russia’s business environment is unfavourable for foreign investments by local companies in the maritime sector today.

5.32 Russia and Business Environment Today

The author is unable to interview International Enterprise (IE) Singapore, Lukoil Asia Pacific and Portek International’s Manager to obtain their valuable opinions. However, the remaining interviewees gave important insights as well. All interviewees expressed that business environment
in Russia is still unfavourable today despite being one of the fastest growing emerging markets today. When asked for a reason, all interviewees pointed that the political instability in Russia today is making businesses too high-risk and hence is the main factor accounting for an unfavourable business environment for foreign investors.

Lie Sek Guan remarked that although ‘Russia is part of the BRIC (Brazil-Russia- India-China) nations; Russia is still not attractive enough to lure foreign investments. Even India’s economic growth is greater than Russia’. He added that businesses need to have a certain level of stability in an environment in the long run, in order for a foreign investor to be willing to invest and secure long term growth.

In a journal paper, Russia’s Failure in Asia, Russia has failed to make the nation an attractive investment place and failed to respond their critical political interests in making Russia a safe haven for foreign investment (Blank, 2010). For example, Russia forced Shell to sell Sakhalin-2 LNG field’s shares and welcomed Shell back two and a half years later. In addition, among the growth of BRIC nations, China has experienced the strongest growth in scientific research over the past three decades of any country instead. Moreover, India’s economy is now one and a half times greater than Russia and the gap continues.

The reason for the instability and uncertainty in Russia’s business environment is closely related to the rampant corruption. Interestingly, although all interviewees expressed that corruption is another important factor, three interviewees commented that corruption may not be a prime barrier to investments in Russia. Their names shall not be disclosed due to confidentiality reasons.

The Corruption Perception Index (CPI) 2010 lists Russia as the most corrupt nation, ranking position 154 out of 178 countries. Corruption is defined as ‘the sale of government property for personal gain’ (Shleifer & Vishny, 1993). In a journal, Contemporary challenges within the Russian business environment, three dimensions of a national culture reason why corruption is more common in Russia. They are: individualism vs. collectivism (IDV), power distance (PDI) and uncertainty unavoidance (UAI). Russia has low individualism index score, a high power distance index and high uncertainty avoidance index (Gassner, 2007).
Some other potential obstacles Singapore companies may face are language barrier and difficulty in market navigation. According to an interview with Miss Jaisey Yip, IE Singapore’s Centre Director in Moscow by iNews, ‘most local service personnel neither speak nor understand English, and business correspondences and legal documents are usually worded in Russian. Basic business information about regulations, company ownership and credit worthiness are sometimes hard to find. Further obstacles that Singapore businesses may find difficult to cope with will be the lack of operational know-how, complex Russian bureaucratic procedures and the uncertain regulatory framework’ (iNews, 2009).

Teh Kong Leong remarked that ‘although foreign investments in Russia are unfavourable today, Singapore can still expand into Russia by exports. Keppel’s building of offshore structures for Russia is one good example’.

Russia and Singapore have a close bilateral relationship since 1968 and the beginning of President Putin’s era have allowed for further development of relations (Hong, 2003). Indeed, bilateral trade has increased in parallel with the popularity of RSBF. Singapore's bilateral trade with Russia in 2005 was S$1.32 billion and reached S$3.9 billion in 2009 (Bonar, 2010). At the fifth annual Russia-Singapore Business Forum (RSBF), the Russia-Singapore Inter-Governmental Commission (IGC) aims to facilitate trade and investment by exploring opportunities and identifying projects for collaboration in areas such as economics, trade and investment, science and technology, and education (Bonar, 2010).

5.3.3 Verification of Proposition

The proposition is validated.

According to interviewees, instability has the biggest impact on a business and is the most important deterrent when it comes to investment making decisions. Therefore, given the situation in Russia today, Russia’s business environment is unfavourable for foreign investments by local companies in the maritime sector.
5.4 WP 2 on Russia Overview

5.41 Proposition

Russia’s business environment will be favourable for foreign investments by local companies in the maritime sector fifty years later.

5.42 Russia and Future Business Environment

When this question was posed to interviewees, most declined comments as fifty years is considered too long a period of time to forecast the future amidst a constant changing environment. Only four interviewees offered comments.

Lie Sek Guan, Soh Wei Liang and Teh Kong Leong are conservative about the outlook of the business environment and investment fifty years later. They cited political history and culture of the society as their reason. The modern Russia has an authoritarian political system which runs most large enterprises till today. In addition, Lie and Soh believe that the political system and national culture in Russia are hard to change, and fifty years is too short for significant changes.

To elaborate the interviewees’ point on political history, a journal, Why is Russia Still an Authoritarian State, Tocequeville’s approach is used to explain the absence and prospects of democracy in Russia since 1991. Russia lacks a very important criterion for successful transition to democracy: experience of democracy (Bonar, 2010). Even till post-Soviet Russia under Putin, Moscow resisted international pressures to embrace democratization which was seen as weakening the Russian state. Although the Russian economy is more internationally integrated today, this is driven by the export of oil, gas and metals, leaving Russia to be resource dependent for economic development. However, this makes Russia more prone to authoritarian politics as it is easier for the government to capture the revenue flow from resource exports (Bonar, 2010).

To elaborate the interviewees’ point on nationality culture, culture is defined as the predominating attitudes and behaviour that characterize the functioning of a group or organization. According to Gassner (2007), Russia has low individualism index score, a high power distance index and high
uncertainty avoidance index. A low individualism index shows business people are expected to be loyal to the existing system by paying bribes and receive security to conduct business uninterrupted in return. A high power distance index shows that inequality is rather accepted among the Russian people. Hence, officials abuse their power since power is distributed unevenly. A high uncertainty avoidance index shows that people tend to have more formal rules and less tolerance for unusual ideas, thus leading to a bureaucratic system of government administration.

However, both three interviewees expressed that the business environment would definitely be better than today although corruption problem might not be totally eliminated. Soh and Teh commented that investors should invest in Russia as long as there is a market for development and investments are worthwhile; and another important factor listed by Lie, ‘the Russian welcomes Singapore’.

On the other hand, Jan Erik Schulte believes that the business environment will be attractive fifty years later. He commented that’ the Russian government is different today as foreign vessels are allowed to discharge cargoes in Russian waters as long they have cargoes for Russia’. Moreover, ‘the world is exerting pressure on Russia and this will drive Russia’s economy’. Based on literature study, President Medvedev has a modernization agenda which emphasises on strategic industries and infrastructure development. The author believes that with time, there will be a positive trend in foreign investments inflow and measures taken to improve business environment such as reducing taxes.

5.43 Verification of Proposition

The proposition is invalidated.

An investment is only made when businesses have a certain level of stability in their environment in the long run, in order to be willing to invest and secure long term growth. Hence based on majority of interviewees’ responses, Russia’s business environment will remain unfavourable for foreign investments by local companies in the maritime sector fifty years later.
CHAPTER 6: ANALYSIS OF IMPACTS ON SINGAPORE AS A MARITIME HUB

This section will evaluate the impacts of WP1 and WP2 on Singapore as a maritime Hub based on literature study in Chapter 3 and empirical study in Chapter 5.

6.1 Impacts of WP1 on Singapore as a Maritime Hub

After much investigation, it is concluded that the NSR will not threaten Singapore’s position as a major container transhipment and bunkering hub in the region.

Firstly, the proposition has been validated that Arctic oil and gas will drive the developments in NSR. Soh Wei Liang and Teh Kong Leong had explained in Chapter 5.12 that the place of consumption and production being a very important factor for the commercial viability of NSR. Hence, the exploration and transportation of the resources are unlikely to threaten Singapore’s position as a leading port. Instead, oil and gas developments in Arctic are an opportunity to Singapore.

Secondly, distance savings as much as 40% using the NSR is not considered as a main driver to Arctic developments. The reasons provided by interviewees on the shorter distance of NSR are carefully reviewed by the author in Chapter 5.12 and finally deduced that it unlikely to threaten Singapore as a maritime hub. The 4 factors are: no significant time and distance savings supported by Lie Sek Guan, too much uncertainty by Geir Fuglerud and Jan Erik Schulte, no significant cost savings by Liu Miao Jia, and lacking infrastructures by Liu Miao Jia and Jan Erik Schulte.

Thirdly, according to Lie Sek Guan, a hub is regional based and South East Asia is Singapore’s hinterland. Therefore Singapore is a transhipment hub for South East Asia market and would not be affected by any developments in the NSR. Joshua Ho also believes that total container throughput and vessels calling at Singapore for refuel in Singapore would not decrease significantly. Geir Fuglerud did not think that Singapore would be affected as well. He commented that major types of
cargoes that would take the Arctic route will be mainly bulk and break-bulk cargoes, and not container cargoes.

Next, the trades are different and there is no overlapping of trade. Singapore is a major maritime hub providing maritime services and specializes in container and transhipment trade. On the other hand, due to the nature of NSR, it is unsuitable for container and transhipment trade. It is unlikely to be Russia’s maritime plans for NSR to be a transhipment hub as well as there are lacking network points. Instead, cargo trades for vessels transiting the NSR would most likely be tramp shipping. Hence, dry bulk, project cargoes and tankers vessels would thrive with the developments of NSR.

Lastly, according to Soh Wei Liang, for Singapore’s position to be overtaken and replaced by nations who would benefit from shipping via the NSR, the ports along the NSR will require infrastructures similar to Singapore ports. This is vital for an efficient port however, this important factor is apparently lacking in Russia. There are no readily available bunkers, cheap supply parts and sustainable container cargo base. Both Liu Miao Jia and Jan Erik Schulte have also expressed similar stands and elaborated in Chapter 5 on the limited port infrastructures and facilities along ports in NSR.

6.2 Impacts of WP2 on Singapore as a Maritime Hub

After much evaluation, the environmental factors in Russia are evaluated as unfavourable for investors to invest in Russia today and in the next fifty years. Hence, any developments of the NSR is unlikely threaten Singapore’s position as a major container transhipment and bunkering hub in the region.

Firstly, the proposition has been validated that the Russian government plays an important role in Arctic shipping and its developments. Russia has an authoritarian political system and almost all businesses are controlled by bureaucracy. Actual operations through the NSR are controlled by the Russian marine officials and it is certain any plans to develop the NSR are determined by the government. In addition, Liu Miao Jia has commented in Chapter 5.22 that the Russian government is not concerned about the commercial profitability of the NSR today. The author understands that much effort, time and money are expensed for foreign vessels to transit the NSR today. There were
only five transits in 2010 and an expected eleven transits this year. Hence, the NSR is still considered unattractive by many shipowners.

Secondly, it has been validated that the business environment in Russia is unfavourable for foreign investments by local companies in the maritime sector today. The main reason is that Russia is not pro-business environment friendly to attract foreign investments. Political instability and corruption are the top two factors listed by interviewees. Although the opportunities stemming from the NSR is attractive, effective protection of economic interests and legislation rights are lacking. There are many bad examples reflecting such situations that businesses are not treated in accordance to Russian law. Hard assets are direct investments in a country and they cannot be sold quickly. Hence, direct investors who own these foreign businesses will incur hefty losses should there be any inadequate protection and unfair treatment. Hence, it is highly probable that investors are not willing to invest in marine transportation and services in the NSR.

Lastly, it has been validated that the business environment in Russia will remain unfavourable for foreign investments by local companies in the maritime sector fifty years from today. It is explained in Chapter 5.42 that political history and culture is hard to eliminate in fifty years. However, environments are anticipated to improve in areas such as business freedom and infrastructures. As a result, there will be a positive trend in foreign business inflows.

The author feels that Singapore would be a more competitive and established maritime hub fifty years later, specializing in container transhipment and maritime services in finance, insurance and law. The Russian-Singapore Business Forum (RSBF) would be more established as well, attracting more Russian shipping companies and investors to expand their businesses into Singapore. As mentioned by various interviewees, there are opportunities for development in equipment exports, education, oil and gas sectors and other maritime services.
CHAPTER 7: OPPORTUNITIES AND STRATEGIES FOR SINGAPORE MARITIME INDUSTRIES

7.1 Strategy Proposition 1

Local companies in the maritime industry should expand their business and invest in Russia.

7.11 Local Shipbuilders Expand Business Portfolio into Russia

Joshua Ho, Soh Wei Liang and Teh Kong Leong suggest local shipbuilders to continue and focus on rigs and ship building. Teh added that ‘local companies should plan for the future where the opportunities lie’.

7.111 Specialize in building ice-breakers as one of its core business

Icebreakers are essential for Russia as they lay the way for vessels in ocean waters and provide all-year-round navigation even in the summer months. Majority of Russia’s minerals are located offshore deep under sea from where they have be extracted and transported by sea. International shipment volumes along the Northern Sea Route are poised to increase significantly in future and demand for icebreakers will increase. Therefore, Keppel O&M should continue building and to expand the icebreaker business while SembCorp Marine can plan to go into ice-breaker business.

7.112 Specialize in building offshore structures as one of its core business

The local shipbuilders are global leaders in the construction of special floating structures such as FPSOs and FSOs. These floating structures are considered cost-effective alternatives to laying undersea pipelines to transport hydrocarbon resources to shore (Geok & Buche, 2007). Hence in the current offshore oil boom, the floating structures will emerge the main method of production, storage and offloading oil to shuttle tankers from deep ocean sites.

Keppel has been working closely with Lukoil in the building of offshore rigs, special purpose offshore facilities and vessels to service LUKOIL’s offshore oil terminal (Yard-News, 2006). Keppel should continue to work with Lukoil and strengthen ties with other Russian owners. SembCorp Marine should also build ties with Russian owners to offer them a comprehensive range of ice-class structures to meet their needs.
7.113 Set up shipyards in Russia

Russia has abundant offshore oil resources which require transportation. Keppel Corp and SembCorp Marine could eye opportunities in Russia to grow their global network of shipyards for their next stage of expansion. The repair yards can be utilized to build newbuildings and for repair and maintenance purposes. Establishing a shipyard in Russia also allows the local builders to leverage on the abundance of experienced workforce, offshore related materials and equipment suppliers to meet the needs of the booming offshore market in Russia.

If full ownership of shipyards in Russia is not possible, strategic partnerships in the form of Strategic Alliance Agreement and joint venture with Russian-based shipyard owners to enable local builders to be a key player in Russia’s oil and gas construction industry. The local builders could collaborate with Russian shipyard owners for all future offshore oil and gas related projects to be undertaken in Russia and have management lead for the projects. In return, the Russian shipyard owners would provide Keppel and SembCorp Marine the exclusive use of its existing facilities located in Russia.

7.12 Local Port Operators Invest in Port Projects

Joshua Ho, Teh Kong Leong and Lie Sek Guan suggested PSA International to invest in and operate a port in Russia to serve that region. Lie Sek Guan added that ‘PSA International is generally interested in Russia as it is a country with high growth potential. The strategy is to go where the high volume cargo is, how to charge a good rate and to look out for competitors’. Lie also listed the top three factors which affect the competitiveness of a port: Politics, economics and Union. However, Lie noted that port investment is tricky as PSA may be interested but the country may not welcome them.

Presently, none of the local port operators have any port project in the Arctic region. The Russian state had expressed their interest to revive the Arctic transportation system as the whole infrastructure of the Northern Sea Route is lacking and needing development (Rianovostii, 2007). In addition, there is a possibility that the NSR could become a major Eurasian transhipment route due to the shorter distance between Russia and Japan (Zaitsev, 2007).
In view of various predictions of an ice-free Arctic as early as 2030, the NSR could become the next commercial shipping route for Europe-Far East trade. PSA International could look into a partnership with Russia as a private investor to develop the ports there. A Northern Pacific Terminal could be built near Bering Straits to collect cargo on the Great Circle route in the Pacific for transfer on to ice-class ships on the Northern sea voyage.

7.13 Verification of Proposition 1

The proposition is validated.

Four interviewees think that investing in Russia is an opportunity for Singapore. Teh Kong Leong commented that ‘local companies must venture out of Singapore to expand the company and economy, and that they should shift their operations up North where the business is. We have to try then we know it works’. He added that ‘we must go overseas, accept the risks, be a risk-taker and of course minimize risks’. Soh Wei Liang suggested that Government-Linked Companies (GLC) can invest in Singapore. Joshua Ho recommended local companies to form partnerships with Russian companies.

From the literature study, there is a market for newbuilding of icebreakers, offshore structures for storage and transportation of hydrocarbons. Hence, local companies in the maritime industry should expand their business and invest in Russia.

7.2 Strategy Proposition 2

Local port operators can offer consultancy service to Russian port operators.

7.21 Consultancy Services

Russia is inefficient and technologically lagging in terminal operations. On the other hand, both PSA Singapore and Jurong Port are at the forefront of e-business operations in the shipping industry.
They have the technical knowledge and expertise for the operation of a successful, efficient and reputable port.

Firstly, local port operators offer a suite of advanced IT solutions for Russian port terminals. For instance, PSA has a renowned PORTNET service which is a real-time container tracking and documentation system.

Secondly, local port operators can provide consultancy for Russian terminals operation and management. PSA International can provide consultancy for Russian container terminals while Jurong Port can offer consultancy for the management of Russian multi-purpose terminals to handle bulk, break-bulk, palletized and project cargo. For instance, Jurong Port has a GBMS advanced solutions system such as berth planning, cargo space planning, cargo entry and exit applications (Jurong-Port, 2011b). In addition, PSA International has experience operating ports in Europe since it has operations in Belgium, Italy, Portugal, United Kingdom and Netherlands (PSA-Singapore, 2010).

Hence, offer consultancy services to Russian arctic port operators enable them to be more efficient and productive.

7.22 Verification of Proposition 2

The proposition is validated.

Lie Sek Guan commented that ‘PSA International has provided Tianjin Port consultancy service. It is possible to provide Russia consultancy service, which is purely commercial, on port building and port management’. Hence, local port operators can offer consultancy service to Russian port operators.
7.3 Strategy Proposition 3

Sectors in the maritime industry should continue to invest and focus on Research and Development (R&D).

7.31 Research and Development (R&D)

It is vital for Singapore to be innovative to thrive in the opportunities that stem from developments in the Arctic. There have been significant investments in R&D in the maritime industry since 2003. Tay Lim Heng, Deputy CEO of Keppel, had mentioned recently that ‘staying at the forefront of technology is an integral part of Singapore’s growth as an international maritime centre’ (MPA, 2009b).

In 2003, MPA set up a S$100 million Maritime Innovation and Technology (MINT) Fund (MPA, 2009b). In 2009, S$25 million from MINT Fund was set aside to support the development of new strategic R&D areas in maritime telecommunications, port operations, clean energy and maritime environment (MPA, 2009a).

In 2010, the Singapore Maritime Institute (MI) was set up to enhance Singapore’s research capabilities, manpower and overall competitiveness to be an International Maritime Centre (MPA, 2010). MPA is collaborating with the Agency for Science, Technology and Research (A*STAR) and the Economic Development Board (EDB) and the three parties will work with key institutes, government agencies and the industry and also co-fund R&D initiatives, with MPA funding as much as S$200 million (MPA, 2010). To stay ahead at the forefront of technology, the MI will encourage more industry R&D projects to be undertaken in Singapore and focus on research areas in shipping, port and maritime service, and offshore and marine engineering (MPA, 2010).

The local port operators use R&D extensively to develop and continuously improve their e-business operations. PSA Singapore has two award-winning systems: CITOS and PORTNET (PSA, 2007). PORTNET is the world’s first B2B shipping e-community that has the participation of the entire shipping and port community (PSA, 2007). Similarly, Jurong Port has a sophisticated front-end portal system, JP-Online, which functions like PORTNET (Jurong-Port, 2011c). Jurong Port also launched a new integrated operation management system last year for its general and bulk cargo
(GBC) operations. This system which makes use of state-of-the-art infocomm and mobile technologies, is called the General and Bulk Cargo Management System (GBMS) (Jurong-Port, 2011a).

Similarly, the local shipbuilders have strong R&D teams to develop in-house technology, design and engineering expertise. For instance, the Marine Technology Development (MTD), a technology arm of Keppel Singmarine, designed the first ice-class FSO which can withstand ice conditions minus 20 degrees Celsius and ice thickness of 0.6 meters for deployment in the Caspian region and the world’s first Ice-class Floating Storage and Offloading (FSO) facility for LUKOIL. Today, Keppel Singmarine’s R&D areas have expanded to experimentation of new materials and equipment, prototype design of mobile ice-resistant offshore drilling units, ice-capable jack-ups and various specialized vessels.

7.32 Verification of Proposition 3

The proposition is validated.

Both Soh Wei Liang and Teh Kong Leong believe that Singapore should continue to invest in R&D. Soh elaborated that ‘then we can exploit our resources, export our services and expand our economy’. Teh gave an example of Keppel that ‘their challenges are new designs which can go deeper seas, deeper grounds, harsh cold temperatures and thick ice cover. Hence, R&D is especially important to enter the Arctic market’. PSA and Keppel’s examples have proved that with R&D, key business processes can be made more efficient, providing good customer service experience to clients, thereby staying ahead of competitors. Hence, sectors in the maritime industry should continue to invest and focus on Research and Development (R&D).
7.4 Strategy Proposition 4

Singapore shipping lines can open a regular liner shipping route which passes the NSR.

7.41 New Liner Shipping Route along NSR

Presently, the NSR serves mainly as a coastal service and there is no regular liner shipping. It would be a first-mover advantage if local shipping lines sets up the first liner route.

The local container shipping lines, APL-a wholly owned subsidiary of Singapore-based Neptune Orient Lines (NOL) and Pacific International Lines (PIL) could open a new route which passes along the NSR if there is sufficient container cargo demand. Demand refers to sufficient container cargoes to fill up a container vessel in the liner business where there are frequent trips along this route.

The container carriers would be intended to operate along the NSR route, taking advantage of the shorter distance between Europe and China. Since China exports substantial cargoes to Europe, unitized cargo can be loaded at several ports of loading, passed the NSR and unloaded at a few ports of discharge in Europe.

7.42 Verification of Proposition 4

The proposition is validated.

Lie Sek Guan and Teh Kong Leong proposed shipping lines to open a new route in NSR. Teh mentioned that ‘APL and NOL must shift their operations up North where the business is. We have to try then we know if it works’. Hence, Singapore shipping lines can open a regular liner shipping route which passes the NSR.
7.5 Strategy Proposition 5

Singapore can develop expertise and experience in oil exploration.

7.51 Develop expertise and experience

The literature study on arctic resources has suggested an abundant supply. Local marine companies could start-up Oil and Gas Exploration Company that operates like Shell in the Northern region should Russia one day welcomes foreign entry into the oil and gas sector.

One way to get involved in this business could be a joint venture with exploration companies such as Shell or BP Energy, or Russian offshore companies such as Gazprom. The joint company will own offshore vessels and operate them in the Arctic waters. Singapore will learn and gain experience in this field from here. Another way suggested by Teh Kong Leong would be to build offshore structures and charter them out to exploration companies. Singapore will learn the operations of offshore exploration activities from there.

Should Singapore be successful in her involvements in offshore resource extractions, Singapore will definitely be positioned as an important market in Arctic’s developments.

7.52 Verification of Proposition 5

The proposition is validated.

Teh Kong Leong and Joshua Ho suggested that Singapore can develop expertise in oil explorations activities. Hence, Singapore can develop expertise and experience in oil exploration.
7.6 Strategy Proposition 6

Singapore must continue to focus on education to be an International Maritime Centre.

7.61 Singapore as a Maritime Education Hub

Singapore has emerged to be one of the world’s busiest transhipment hubs and is the base for major shipping companies, container carriers, international banks and insurance companies. As a result, this has led to a status as an international maritime centre.

Tay Lim Heng, Deputy CEO of Keppel, had mentioned that ‘it is important to develop Singapore as a global maritime knowledge hub if we want our maritime cluster to move to the next level of competition’ (MPA, 2009b).

In the area of education, Singapore aims to be a maritime education hub by 2025 and is active in training students and career professionals. There is a wide range of maritime programmes offered by the three local universities and other institutions such as BI Norwegian School of Management, Singapore Maritime Academy, Institute of Chartered Shipbrokers, Singapore Shipping Association, Institute of Ship Management and the Singapore College of Insurance. For instance Nanyang Technological University's Bachelor of Science in Maritime Studies and the two-year Bachelor of Engineering in Naval Architecture with Honours, run by Ngee Ann Polytechnic and Singapore Polytechnic, in collaboration with Newcastle University.

To promote and develop maritime manpower capabilities, MPA launched a MaritimeONE initiative in 2007 (MPA, 2009a). The initiatives include scholarships and networking events and internship opportunities for students. MPA also sets up the Maritime Cluster Fund (MCF) to support the growth of Singapore’s maritime cluster by supporting the industry’s manpower and business development efforts (MPA, 2009a). The objective of MCF is to attract quality manpower into the industry and encourage knowledge-based learning. Recently, MPA introduced three new schemes to further encourage maritime individuals and organisations. They are Training@Maritime Singapore, Talent@Maritime Singapore and InvestManpower@Maritime Singapore (MPA, 2011). These new schemes co-fund maritime individuals and organisations to upgrade knowledge and
expertise through attending approved training and development programmes, groom local talent for management and leadership positions, and students to develop expertise through industrial attachments and overseas attachment programmes.

The Singapore Maritime Institute (MI) was set up in 2010 to promote maritime education where various maritime institutes will collaborate to build local maritime talent. Besides that, Singapore MI is aiming to attract renowned academics and researchers from all over the world to Singapore (MPA, 2010).

For Singapore to further establish herself as a global maritime hub, it is important for Singapore to continue her efforts in building a pool of skilled manpower in Singapore and train them through education. Through maritime education and learning, local manpower will be equipped with practical experiences, knowledge skills and technical know-how of the trade. In turn, new businesses will be attracted and existing ones will expand.

**7.62 Verification of Proposition 6**

The proposition is validated.

Soh Wei Liang highlighted in the interview that education is one opportunity for the industry. He commented that ‘for Singapore to be a maritime hub, we need to encourage and attract young people to join the shipping industry’. Hence, Singapore must focus on education to be a maritime hub.
Chapter 8: Limitations and Recommendations

The discussion above has focused on investigating the impacts of NSR and identifying business opportunities for Singapore. However, there are several areas the author feels could be better well represented. Hence, this section will seek to address the limitations and directions for future researches.

Firstly, the team concedes that a key limitation of this project is the small number of interviewees. Due to limited network and points of contact, the team was only able to achieve the mentioned sample size and a small sample size may not reflect the true sentiments of the shipping community. Nonetheless, all the interviewees have very good knowledge and wide experience, and gave the team valuable opinions and insights for the success of this research paper. For future studies, the sample size could be bigger. Researchers should interview more companies and academic researchers.

Secondly, the team has decided to investigate Russia as one of the research areas. While the author in this report has read up extensively on Russia by previous literatures, the author has difficulty attaining opinions on Russia’s business environment to obtain more conclusive evidence. Hence, for future research, researchers should focus on getting inputs that will help to elaborate further on Russia.

Lastly, due to time constraints, the team could only investigate six research areas. For future studies, researchers could work on other research areas such as maritime security, international law and insurances and logistic issues in NSR and Arctic.
Chapter 9 Conclusion

This paper aims to investigate the impacts of NSR and to identify business opportunities for Singapore.

Through literature study and empirical study, the author takes the stand that the NSR will not threaten Singapore’s position as a maritime hub. Firstly, interviewees have supported that Arctic reserves, and not a shorter distance between the Euro-Asia trade route, is the main driver in the development of NSR. Secondly, the Russian government plays an important role in Arctic shipping and its developments and Russia is deemed not favourable for investments today and in the next fifty years.

The Arctic offers opportunities for Singapore as the Arctic opens up, first to exploration and later to development. It will nonetheless undergo a transformation, from once an impenetrable barrier to an open and navigable NSR. Therefore, six strategy propositions on how local maritime industries could enter the Arctic market and for Singapore to further establish her position as a maritime hub are discussed in this research paper.
CHAPTER 10: REFERENCES


russia.com/en/international-relations/item/890-singapore-increases-role-as-asian-hub-for-russian-business.html


http://www.economist.com/research/articlesBySubject/displaystory.cfm?subjectid=349002&story_id=17674075


EIA. (2010). Russia Energy Data, Statistics and Analysis - Oil, Gas, Electricity, Coal *Energy Information Administration* (November 2010 ed.).


APPENDIX A: Interview Questions

Appendix A1: Jan Erik Schulte, Beluga Shipping

1. In 2009, two German heavy-lift vessels, M/V Beluga Fraternity and M/V Beluga Foresight, made the first-ever commercial voyage though the NSR. Why was there a special interest in the NSR?
2. Can you share with us M/V Beluga Fraternity’s and M/V Beluga Foresight’s experience in transiting through the NSR?
3. What were some of the obstacles Beluga faced during the voyage through the NSR?
4. From your understanding, can you share with us the port conditions and infrastructure along the Siberian coast in Russia?
5. In your opinion, what is the driving force of the NSR?
6. What is the business environment in Russia?
7. In your opinion, do you perceive the NSR as a popular international shipping route by 2050?

Appendix A2: Lie Sek Guan, PSA Corporation Limited

1. How does PSA position itself to compete in the global market today?
2. If PSA were given an opportunity to expand into Northern Europe, where would you strategically locate your port?
3. In your opinion, what factors would attract a global port operator to expand its port operations into Russia?
4. Has PSA thought of venturing into the Arctic region in the near future?
5. In your opinion, what is the driving force of the NSR?
6. What is the business environment in Russia?
7. In your opinion, do you perceive the NSR as a popular international shipping route in 2050?
8. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that PSA might face?

Appendix A3: Geir Fuglerud, DNV

1. Do you see a day when it is mandatory for all commercial vessels to run on renewable energy?
2. From your website, we understand that DNV has developed Triality concept VLCC. In your opinion, how is this concept extended to an Arctic going vessel?
3. What are some of the new technology solutions and ship designs developed for the Arctic?
4. What are the risks involved in ships operating in the Arctic region?
5. From your website, it mentions the carbon capture and storage (CCS) approach to reduce carbon dioxide and a de-carbonised energy future. Can you tell us more about it?
6. Can you share with us some of the green technologies which can minimize the impacts of ballast water and gaseous emissions?
7. In your opinion, what is the driving force of the NSR?
8. What is the business environment in Russia?
9. Predictions report an ice-free arctic by 2050. What are the opportunities and threats that Singapore might face?

Appendix A4: Soh Woei Liang, Glory Ship Management Pte Ltd
1. In your opinion, what is the driving force of the NSR?
2. What is the business environment in Russia?
3. In your opinion, do you perceive the NSR as a popular international shipping route in 2050?
4. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that Singapore might face?

Appendix A5: Teh Kong Leong, NTU Maritime Studies Guest Lecturer
1. In your opinion, what is the driving force of the NSR?
2. What is the business environment in Russia?
3. In your opinion, do you perceive the NSR as a popular international shipping route in 2050?
4. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that Singapore might face?

Appendix A6: Joshua Ho, Teaching and Research Fellow in NTU Maritime Security
1. In your opinion, what is the driving force of the NSR?
2. What is the business environment in Russia?
3. In your opinion, do you perceive the NSR as a popular international shipping route in 2050?
4. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that Singapore might face?
Appendix A7: Liu Miao Jia, co-author of ‘The economic potential of using Northern Sea Route (NSR) as an alternative route between Asia and Europe’ research project

1. Can you tell us more about the transport and infrastructure conditions along the Siberian coast?
2. Can you share with us some of the challenges you faced while gathering data about Russia?
3. Will the development of pipelines in Russia have an impact on tankers plying the NSR?
4. What growth potential do you see in Russia’s shipping market?
5. In your opinion, how will the world’s trade pattern change with the opening of the NSR?
6. In your opinion, what is the driving force of the NSR?
7. What is the business environment in Russia?

The following questions are made with reference to your research paper on “The economic potential of using Northern Sea Route (NSR) as an alternative route between Asia and Europe” in 2007.

1. You chose the ports of Rotterdam and Yokohama for your research paper. What was the reason behind this selection? Have you considered other Asian ports?
2. With the current developments in Russia, do you see a day that the ice breaking fees will be reduced by 100%? What developments/improvements do you think need to be in place for the NSR to gain popularity as an international route? Do you perceive the NSR to be a popular shipping route by 2050?

Appendix A8: Anthony Chin

1. Can you share with us the transport and infrastructure conditions along the Siberian coast?
2. In your opinion, what is the driving force of the NSR?
3. What is the business environment in Russia?
4. What growth potential do you see in Russia’s shipping market?
5. Will the development of pipelines in Russia have an impact on tankers plying the NSR?
6. In 40 years to come, do you see vessels running on LNG?
7. In your opinion, do you perceive the NSR as a popular shipping route in 2050?
8. In your opinion, do you think the opening of the NSR will have an impact on the number of vessels calling at Singapore for the Europe-Far East trade route?
Appendix A9: Koh Tien Yong, Earth Observatory of Singapore

1. With the current rate of Arctic ice melt, when do you expect to see an ice-free Arctic?
2. What are the impacts of Global Warming on the Arctic region?
3. What are the impacts of Global Warming on Singapore in terms of rainfall, temperature and etc?
4. Can you share with us some statistics on the amount of ice melt in the Arctic region presently and in 2050?
5. Predictions report an ice-free arctic by 2050. What are the opportunities and threats that Singapore might face?

Appendix A10: International Enterprise (IE) Singapore

1. What are the conditions required for a local company to invest in Russia?
2. What challenges might local companies face if they were to venture into the Russian market?
3. How does IE help local companies venture into the Russian markets?
4. How well was the response from local investors towards the Russia-Singapore Business Forum?
5. How many maritime companies have expressed interest and/or approached IE for assistance to invest in Russia?
6. In your opinion, do you think Singapore will sign a FTA with Russia within the next 5 years?
7. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that Singapore might face?

Appendix A11: Lukoil Asia Pacific Pte Ltd

1. What were the key reasons behind the collaboration with Keppel?
2. What growth potential do you see in Russia’s shipping market?
3. In your opinion, what is the driving force of the NSR?
4. What is the business environment in Russia?
5. In your opinion, do you perceive the NSR as a popular international shipping route in 2050?
6. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that Singapore might face?
7. Does Lukoil have any key projects in the Arctic region?
8. Statistics have shown that the demand for natural gas is on the rise. Do you see a day when the demand for natural gas will surpass the demand for oil?
9. Looking into the future, how do you see Lukoil’s business developing in the Arctic region?
10. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that Lukoil might face?

Appendix A12: Keppel Offshore and Marine (O&M)
1. What are some of the latest technologies and innovative practices developed by Marine Technology Development (MTD) needed for ice-classed vessels and Floating Storage and Offloading (FSO) vessels?
2. How does Keppel achieve the “Zero Discharge” and “Clean Design” for its ice breaking operations in the Arctic?
3. What percentage of Keppel’s R&D funds is allocated to Arctic technology?
4. How well is Keppel geared towards Arctic technology development? Can we say that Keppel is well prepared in moving towards more involvement in the Arctic region?
5. What were the key reasons behind the collaboration with Lukoil? Does Keppel see Russia as an up and coming market player in the oil and gas sector?
6. How do you see Keppel being more involved in the Arctic in the near future?
7. In your opinion, what is the driving force of the NSR?
8. What is the business environment in Russia?
9. In your opinion, do you perceive the NSR as a popular international shipping route in 2050?
10. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that Singapore might face?

Appendix A13: Portek International Limited
1. Can you share with us more about the operations of your subsidiary, Europort?
2. What were the reasons for Europort’s collaboration with Russian Armley Investments Limited?
3. Why did Portek choose to develop and operate a container and multi-purpose terminal in Kaliningrad, Russia?
4. In your opinion, what is the driving force of the NSR?
5. What is the business environment in Russia?
6. In your opinion, do you perceive the NSR as a popular international shipping route in 2050?
7. From your experience, what was the greatest difficulty faced when breaking into Russia’s maritime market?
8. Did the Russian-Singapore Business Forum (RSBF) serve as a helpful platform for your company in the collaboration with Russian Armley Investments Limited?
9. Does Portek see Russia as the next up and coming Maritime Hub?
10. Does Portek plan to have further investments in Russia?
11. Predictions report an ice-free arctic by 2050. What are the opportunities and threats that Portek might face?

Appendix A14: International Maritime Cluster (IMC) Department, Maritime Port Authority of Singapore

1. How does MPA enhance local maritime companies’ competitiveness on an international scale?
2. In your opinion, how will the rising concerns over Climate Change and Global Warming affect Singapore as a Maritime Hub?
3. How do you picture Singapore’s Maritime Industry to be like in 2050?
4. We understand that MPA has expressed interest in a project between NTU and Norway (BI Norwegian School of Management) – Climate Change and Singapore. What are the reasons that sparked the interest in this project?
5. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that Singapore might face?

Appendix A15: Kenneth Tan, APL

1. What are the reasons behind APL’s decision to expand into the Russian market?
2. From your experience, what are the challenges faced when breaking into Russia’s maritime market?
3. According to Transparency International, Russia is one of the most corrupted nations. To what extent has corruption impeded NOL Group’s advancement into Russia?
4. Beluga Shipping has successfully transited the NSR in 2009. In your opinion, do you perceive the NSR as a popular international shipping route in the container industry by 2050?
5. What is your view on APL using the NSR to transit from Far East to Europe the day when the Arctic is ice-free?
6. How do you see APL being more involved in the Arctic in the near future?
7. From a liner’s perspective, do you see liner shipping increasing its presence in the Arctic region?
8. What are the factors which drive liner companies to expand into the Northern trade?
9. Predictions report an ice-free Arctic by 2050. What are the opportunities and threats that APL might face?