NTNU – Trondheim
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Science and Technology

How the Norwegian Maritime Sector can succeed in internationalizing LNG-technology to Southeast Asia

A Case Study of Rolls-Royce Marine

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Problem description

The problem description was defined in collaboration with our supervisor at the start of the semester. It has been the starting point of our work and a basis for defining the research question. The initial problem description:

> *"The Ministry of Industry and Trade has established a strategic council for the Norwegian maritime sector, which is called Maritime21. One of the ambitions of Maritime21 is to export technology for using LNG as a marine bunker fuel to Southeast Asia. Based on our work in the project thesis on the future potential of LNG as a bunker fuel, we will assess this challenge. We will investigate the opportunities and challenges.*
>
> *The thesis will be structured with an introduction, a literature review, methodology, empirical data, discussion and implications for managers, researchers and policy makers. We will try to gather an extensive data collection to offer a thorough research design and valid proposals."*

In the following pages we will present a preface, an executive summary and list of contents, figures and tables. The introduction given in Chapter 1 defines the start of the master's thesis.

Assignment given: 16th of January 2012
Supervisor: Professor Øystein Moen

“If you are going to succeed in Southeast Asia, you must succeed in Singapore”

– Petter Stensaker, General Manager, System Sales & Marketing Campaigns, Rolls-Royce Marine

Preface

This master thesis is a 30 credit points assignment and the final work to acquire a *Master of Science* degree at the department of Industrial Economics and Technology Management (IØT) at the Norwegian University of Science and Technology (NTNU). The thesis has been written during the spring 2012 with a specialization within International Business Development. The topic of the thesis has been "*How the Norwegian maritime sector can succeed in internationalizing LNG-technology to Southeast Asia?"* By carrying out a case study of Rolls-Royce Marine we have gained valuable insight from internationalization literature, research methods and data collection. The study has been interesting, rewarding and useful.

We would like to thank our supervisor, Professor Øystein Moen. He has contributed with written and oral feedback from the planning phase to the completion of the thesis. His insight to strategic management literature, data collection, interviewing and academic writing has been crucial, and a vital part to enhance our abilities as researchers.

We will also like to express our deepest gratefulness to Rolls-Royce Marine. Rolls-Royce Marine has been our single case company, primarily chosen due to their great interest into our research topic. They have supported us with expertise, and also financially supported an excursion we had to Singapore. Without the help from Rolls-Royce Marine, this thesis would never hold its quality and content.

Moreover, we would thank all our interviewees in Singapore. Each one of them contributed with useful input and enhanced the thesis and made it better. It is highly appreciated that executives in large firms set aside time to assist students in their thesis work.

Trondheim, 22th of May, 2012

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Gaute Dag Løset Rolf Erik Tveten

Executive summary

The future potential of LNG as a bunker fuel in the Southeast Asian market is huge, although it is still an immature technology. An emerging market for propulsion based on Liquefied Natural Gas (LNG) in the region creates a business opportunity for Norwegian companies delivering relevant products and services. This is a summary of the strategy that will yield the highest return on a foreign market entry with focus on export of LNG-technology in the Southeast Asian region.

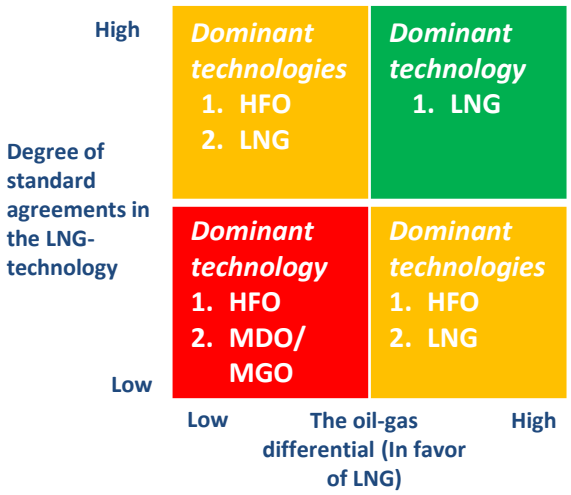
This thesis has assessed the gas producing and consuming countries, Brunei, Indonesia, Malaysia, The Philippines, Thailand, Singapore and Vietnam, hereby referred to as the ASEAN-countries. Successful internationalization demands resource commitment and good timing, and therefore we recommend entering two countries with the purpose of exporting LNG-propulsion technology: Singapore and Indonesia. All countries can potentially adapt technology for using LNG as a marine fuel, but Singapore and Indonesia are most likely to develop small-scale LNG first.

Singapore has one of the busiest ports in the world with a 20 % global market share for bunkering. It is a technological frontrunner in the region, and the government has taken initiatives towards establishing standards for bunkering and operations with LNG as a bunker fuel. Companies are invited to attend *Joint Industry Projects* on technical and commercial aspects concerning LNG-propulsion, and this is an opportunity to *change the context* and affect how the market will evolve. Moreover, Singapore has one of the best business environments in the world and it is easy, but expensive to establish with an entity in the country. In total, Singapore is most likely to adapt LNG as a bunker fuel and consequently LNG-sponsors should be present in the country.

Indonesia is the Southeast Asian region's largest country in terms of population, area and economy. Combined with an ideal topography for small-scale LNG, Indonesia is the potentially largest market for LNG-technology in the region. LNG as marine fuel can become a reality, especially in Eastern parts of Indonesia, quite fast. The challenge in Indonesia is a complicated business environment with poor property rights as foreigners cannot have a majority share post in a local company, the red tape is extensive and corruption is a problem. However, it is possible to do ethical business in the country and at the same time succeed, but it takes *adaption of strategy*. Traditional Western-style strategy will not work. Long-term relations, trust and efficient alliances with local companies are required to capitalize from the Indonesian market for LNG-technology and other products and services.

The figure at the right demonstrates the two most decisive variables that will determine the evolvement of the LNG bunker fuel market in Southeast Asia:

- **The oil-gas differential:** If the price difference increase in favor of LNG, it is very stimulating
- **Degree of standard agreements in the LNG-technology**: Ship owners rely on standards for bunkering and operations for LNG



The internationalization strategy

Singapore:  **Population:** 4.7 millions **GDP:** $315 billion (PPP) **Economic growth:** 5.30 %	**Indonesia:**  **Population:** 247 millions **GDP:** $1121 billion (PPP) **Economic growth:** 6.40 %
Singapore is opening a LNG receiving terminal on Jurong Island during 2013. The purpose is to increase energy security and introduce LNG to the energy mix. To exploit the terminal in the best manner the government has started to look into export opportunities and distribution of small-scale LNG. Accordingly, it is realistic to see retail availability of LNG as a marine fuel during 2014. **Entry mode:** Singapore has an open business environment and a strong protection of property rights which allow foreign market firms to adapt all types of entry modes. If the entering firm requires a strong institutional framework which Singapore possess and at the same time demands high level of local resources, acquisition is recommended to access the market fast. **Alliances:** Alliances are an effective tool to share risk and gain complementary capabilities. No particular alliance agreement is recommended for Singapore, however long-term relations and trust is key success factors with both partners and customers. **Partner selection:** Potential partners may have conflicting interests, which can be more costly than the benefits associated. Innovation Norway can assist in selecting partners, which we recommend to employ. **Timing:** Timing is an important variable in determining market success and profitability. Early entry is required to establish the necessary relations needed to get customers.	Indonesia has an extensive production and consumption of natural gas. Especially the Eastern parts of the country have an ideal topography with many islands, which makes LNG the most realistic alternative. Höegh LNG is a Norwegian company who has signed a deal to deliver a FSRU to Indonesia, implying a growing interest for LNG. Small-scale distribution is likely to arise during 2014. **Entry mode:** As Indonesia does not allow foreign companies to hold the majority share post; Joint Ventures are required as an entry mode. Joint Ventures are a demanding entry mode, but silent partners may allow you to control the firm. **Alliances:** Alliances are not a question of choice, but a necessity in Indonesia. The country has extensive red tape and a local partner can offer local market knowledge and market access that can be very beneficial to have. Long-term relations and trust is key ingredients in successful alliances. **Partner selection:** As the partner has extremely high importance, partner selection is a key strategic process in Indonesia. It is important to avoid corruption, and to ensure that the partner is serious. Innovation Norway has recently opened an office in Jakarta and can assist Norwegian firms in selecting partners. **Timing:** As in Singapore, timing is a crucial strategic decision. Long-term relations and trust takes time to establish, and consequently an early entry is recommended.
Government trade initiatives: In countries where politics and business are more intertwined than in Western countries, government agencies such as Innovation Norway has a more important function as they can function as door openers and relational builders. We recommend Innovation Norway to organize delegations travelling to Norway to experience LNG-propulsion to share knowledge and to help Norwegian companies building long-term relations with government officials and local firms.	

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List of abbreviations

ASEAN	Association of Southeast Asian Nations
API	Alliance Portfolio Internationalization
CAPEX	Capital Expenditure
CO_2	Carbon Dioxide
CNG	Compressed Natural Gas
CSR	Corporate Social Responsibility
DNV	Det Norske Veritas
DOI	Degree of Internationalization
ECA	Environmental Control Areas
EU	European Union
FDI	Foreign Direct Investment
FSRU	Floating Storage and Re-gasification Unit
FWE	Fuel-Water Emulsion
GHG	Greenhouse Gases
HFO	Heavy Fuel Oil
IEA	International Energy Agency
IGF	International Code on Safety for Natural Gas Fueled Ships
IJV	International Joint Ventures
IMO	International Maritime Organization
ISO	International Organization for Standardization
JIP	Joint Industry Projects
LNG	Liquefied Natural Gas
LCA	Life Cycle Analysis
MARPOL	The International Convention for the Prevention of Pollution from ships
MARINTEK	The Norwegian Marine Technology Research Institute
MDO/MGO	Marine Diesel Oil/ Marine Gas Oil (Similar oil product from distillates)
MNC	Multinational Company
MPA	Maritime Port Authority
NO_X	Nitrogen Oxides
OECD	Organization for Economic Co-operation and Development
OPEX	Operational Expenditure
OSV	Offshore Support Vessels
PSV	Platform Supply Vessels
R&D	Research and Development
ROA	Return on Assets (Net income / total assets)
SCR	Selective Catalytic Reduction
SECA	Sulphur Emission Control Area
SO_X	Sulphur Oxides
UN	United Nations
VOC	Volatile Organic Compounds

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1 Introduction

Chapter 1 presents the problem statement, the goals and the structure of the paper and the solution of the research question. Innovation Norway and Maritim21 have outlined Southeast Asia to be an attractive future market for technology ensuring distribution and application of LNG as an energy source. High economic growth and scarcity of energy in combination with extensive discoveries of stranded gas make LNG very suitable for the region (DNV Clean Technology Centre, 2010)**.** The topography makes pipeline infrastructure challenging, and several minor fields can only be economic viable with LNG-transportation. In total, Southeast Asia appears to be an important market for producers of LNG-technology.

Singapore will complete the region's first receiving terminal for LNG in 2013, and this is expected to boost the market opportunities (DNV Clean Technology Centre, 2011). Stranded gas fields become economic profitable with production based on FSRU-units. Infrastructure for bunkering of LNG as marine bunker fuel can be realized. But the primary use of LNG will be as energy source in land based power plants. Consequently, Southeast Asia will be a target market for refiners, distributors, engine manufacturers and sub suppliers. As Norway have production and large and small-scale distribution and application of LNG, Norwegian manufacturers of LNG-technology can benefit from exporting technology to the Southeast Asian market.

During the fall 2011 we completed our project thesis that assessed the future potential of LNG as a bunker fuel (Løset & Tveten, 2011). The conclusion stated that LNG is the most likely future bunker fuel, given the scenario that the IMO-regulations regarding maximum sulphur emissions are put into force. Norway contains a leading position on use of small-scale LNG, with extensive distributor experience through GASNOR, and with leading LNG-engine manufacturers such as Rolls-Royce. If the South-East Asian region starts to apply LNG as a marine bunker fuel, this represents a great market opportunity for Norwegian companies.

1.1 Problem definition

Maritim21 has established a goal to create bigger LNG-markets, and one of the measures will be to stimulate international markets to adopt LNG as a marine bunker fuel (Maritim21, 2011). This strategy was followed by a workshop held by Innovation Norway 18th January 2012 where several Norwegian enterprises with business in LNG-markets participated. The focus of the workshop was to identify which of the Southeast Asian markets that where most attractive, and how they could be targeted. Significant interest for export of LNG-solutions to this region is a strong motivation for writing a thesis on this subject. We have formulated the following research question:

- How can the Norwegian maritime sector succeed in internationalizing LNG-technology in South-East Asia?

There are two assumptions that are fundamental to our research question. Firstly the Southeast Asian market is chosen with reference to its focus from Innovation Norway and Maritim21. We assume it will be most fruitful to explore internationalization to these markets since the maritime sector already has directed efforts to this region. Secondly we assume that the Southeast Asian market will demand LNG-technology. Given that the Norwegian maritime cluster has chosen the emerging economies in Asia Pacific we expect these markets to be attractive. We will of course

explore the latter more closely in our thesis, but we rely on the analysis carried out by DNV and Innovation Norway when we define these markets as a great market opportunity.

To answer the research question, Rolls-Royce Marine is chosen as a single case study company. Norway is producing technology along the entire LNG value chain, while we have chosen to focus on engine manufacturing and ship design. This is because of the resources Rolls-Royce Marine has proposed to assist us with in our research. During the discussion of theoretical propositions, the degree of the focus on Rolls-Royce will vary. In general, the analysis starts at an industry level before we pay closer attention to Rolls-Royce where it is relevant.

1.2 Goals

To solve the research question properly, we have a series of goals that we seek to achieve:

- Present an comprehensive analysis of the Southeast Asian countries and the market opportunities in the chosen region, and an updated analysis of the LNG-market based on our project thesis (Løset & Tveten, 2011)
- Suggest theoretical propositions based on a thorough literature review of relevant strategic theory within entry strategies, barriers to internationalization, performance and alliances
- Gather data through expert interviews to identify export strategies that suits the capabilities of Norwegian enterprises, demands from the Asian buyers and the theoretical propositions
- Offer implications for managers, policy makers and researchers with specific actions that will increase the possibility of establishing successful trade of LNG-technology with the Southeast Asian region

By working through our objectives in their given order we have the ambition of answering the research question based on a case study methodology, with a high degree of validity and reliability (Yin, 2009). The first goal motivates the authors to offer an updated analysis of Southeast Asia regarding economic development, geography and their energy demand. Moreover, we present the latest analysis of the LNG-market. Secondly we review relevant strategic management literature. An extensive search for relevant theory has given us a valuable discussion of rival explanations concerning internationalization phenomenon, followed by theoretical propositions. Thirdly we develop an expert interview guide and conduct data from interviewees as a foundation for discussion analysis of the propositions. In conclusion we offer implications for managers, policy makers and researchers based on an assessment of findings. We hope we are able to offer the reader new insight and specific actions to undertake in order to reach the Southeast Asian LNG-market.

1.3 Structure of the thesis

To make it easier for the reader to collect relevant information we have structured the thesis into nine chapters. Each chapter serves different purposes:

- Chapter 1: Introduction to the research question, the goals of the thesis, its structure and its case company
- Chapter 2: A review of the Southeast Asian countries and its gas markets
- Chapter 3: Presentation of the global natural gas market and the bunker fuel market, specifically directed towards Southeast Asia

- Chapter 4: A literature review of relevant internationalization theory and belonging theoretical propositions
- Chapter 5: A summary of theoretical propositions and the method of analyzing them
- Chapter 6: The research design and methodology of the thesis
- Chapter 7: Presentation of highlights from the interviews
- Chapter 8: Analysis of theoretical propositions
- Chapter 9: A chapter where implications for managers, policy makers and future research is put together alongside with our concluding remarks

1.4 Limitations

The scope of this master thesis is limited to internationalization of Norwegian LNG-technology to the Southeast Asian market. The chosen focus is related to time and resource constraints. Nevertheless, the Norwegian market for small-scale LNG shipping and distribution is by far the most mature across the globe, and one of the most relevant exporters of LNG-technology. Furthermore, Southeast Asia has several properties which make LNG especially suitable as an energy source. Consequently, to analyze the trade of LNG-technology between Norway and Southeast Asia appears to be a logic unit of analysis.

1.5 The case company: Rolls-Royce Marine

Rolls-Royce is a Multinational Company, MNC, providing power solutions for customers in civil and defense aerospace, marine and energy markets. They have a worldwide presence, with offices, manufacturing and service facilities in more than 50 countries. Rolls-Royce has established a strong brand name, delivering highly technological products since the foundation in 1906. Today Rolls-Royce is listed on the London stock Exchange, and as of March 2012 it had a market capitalization of £15.3 billion. The announced order book of 2011 was £62.2 billion, an annual increase by 5 %.

Rolls-Royce

Employees	39 000
Order book firm and announced	£62.2bn
Founded	1906
Industry	Aerospace, Defence, Marine and Energy
Revenue	£11.277
Operating income	£1.189
Net income	£543

The company started as an engine manufacturer in UK, but through several acquisitions the company now delivers products and services worldwide in four different segments: Civil aerospace, defense aerospace, marine and energy. Rolls-Royce has total 39000 employees. This thesis will focus on the marine unit, but still emphasize possible synergies from the other divisions and the presence in Southeast Asia.

Structure

Rolls-Royce has a comprehensive tradition of mergers and acquisitions, and only in 1999 the company spent £1.063billion on different acquisitions. In the same year, Rolls-Royce increased its involvement in marine activities, with purchase of Vickers plc. Vickers had earlier acquired different subsidiaries with a broad experience from producing marine waterjets, steering gear and stabilizers, including the Norwegian company Ulstein, a major marine propulsion and engineering company.

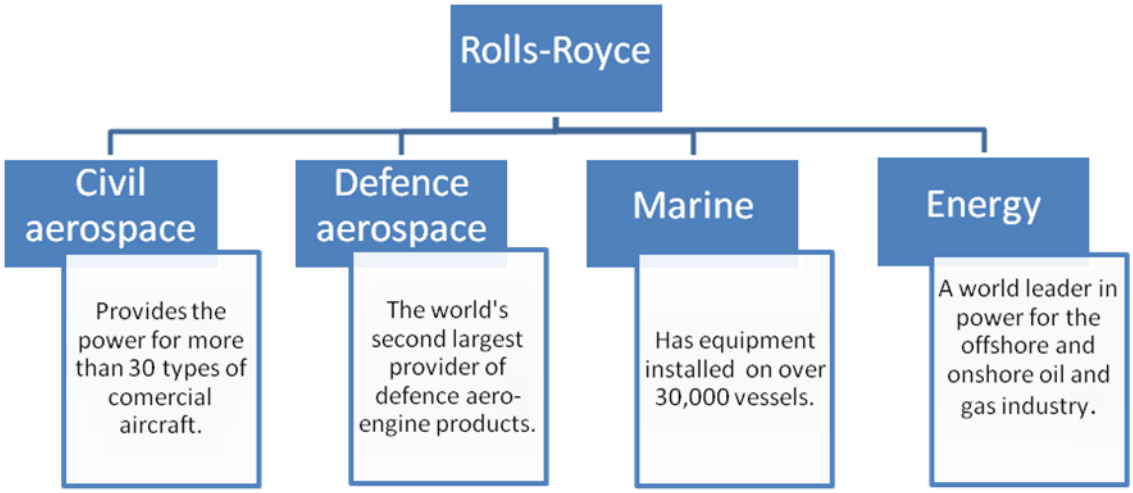


Figure 1: The organizational structure of Rolls-Royce and the Marine division's role

As of today the group is governed by President John Rishton in London, while the Marine unit is headquartered in Ålesund, Norway. The Marine activities resulted in £2,271 million, with a share of 20.1% of the total revenue in 2011. Organic growth alone has been the main strategy the past decade, alongside with a massive R&D program. Rolls-Royce has a range of capabilities in the marine market, encompassing vessel design, the integration of complex systems and the supply and support of power and propulsion equipment (Rolls-Royce Marine, 2012). The marine division is serving customer worldwide with 9000 employees in 39 countries and only in Norway the division counts 3400 employees.

Business

Rolls-Royce Marine delivers products and service for merchant vessels, naval surface ships, submarine and offshore vessels. The merchant sector includes tugs, workboats, cargo lines and cruise ships as well as car and passenger ferries.

Figure 2: A map showing the locations of Rolls-Royce Marine

Rolls-Royce has experience with LNG engines; they have now delivered 19 ships with LNG engines. In January 2012 they signed a contract to deliver the world's first gas powered system for tugs, ordered by Bukser and Berging in Norway. Rolls Royce has by a proven strategy chosen not to deliver Smoke Scrubber, Dual-Fuel engines, and only some SCR-solutions. Currently they try to establish a strong position in the global LNG market (Stensaker, 2012).

With a strong focus on research and development, Rolls-Royce has become a pioneer of many important marine technologies that includes aero derivative marine gas turbines, controllable pitch propellers and waterjets (Rolls-Royce, 2012).

Internationalization

The head quarter in Southeast Asia is at the central hub in Singapore. Regional sales offices are present in Vietnam, Indonesia, and Malaysia. The Singapore office is the main hub for all operational activities in Asia, and the port is of particular importance due to its central geographic position (Stensaker, 2012).

> "A global support network underpins all activities and ensures contracts can be undertaken, and Rolls-Royce support is at hand anywhere in the world" - (Rolls-Royce Marine, 2012)

Market and Competitors

As the LNG market is currently emerging globally, many motor producers are competing to get market share. In order to comply with the IMO Tier III restriction of 2016, an environmental solution is necessary. A technological battle between Smoke scrubbers and LNG-engines as the preferred future solution in the maritime sector has arisen, and the engine manufacturers are competing with different LNG-propulsion solutions (Løset & Tveten, 2011). It is a complex market, with the major engine designers, Mitsubishi, Wärtsila, MAN Diesel & Turbo and Rolls-Royce, are all engaged in the technical development of LNG-fueled engines. Today, Rolls-Royce has its main LNG-propulsion sales in the Norwegian market.

2. Southeast Asia

Southeast Asia is a sub-region of Asia, consisting of the ten countries that are geographically south of China, east of India, west of New Guinea and north of Australia. A more precise definition of the consisting countries is not evident, but in a political context Southeast Asia is defined as the countries with ASEAN membership. The ASEAN, the Associations of Southeast Asian Nations, is a geo-political and economic organization consisting of ten countries. Malaysia, Indonesia, Thailand, Singapore and The Philippines founded the organization in 1967, with the purpose to accelerate the economic growth, social progress and cultural development among the members. Today ASEAN-countries, also includes Brunei, Burma, Cambodia, Laos, Myanmar and Vietnam (ASEAN, 2012). The region Southeast Asia has traditional been a gas-supplying region for North Asia's LNG markets, but encouraged by the regions rapid economic growth; the region is expected to be a significant consumer of natural gas (Hashimoto, 2011). In the further investigation in the master thesis we will draw attention to the gas supplying and maritime countries, the ASEAN-six plus Vietnam as shown in Figure 3.

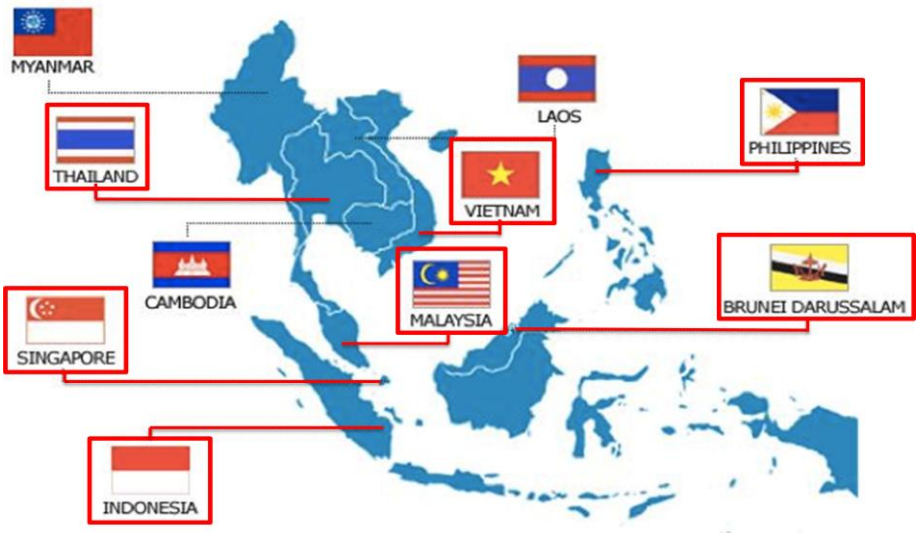


Figure 3: A map of Southeast Asia with the ASEAN six plus Vietnam marked in red (Scand, 2011)

2.1 Economy

Agriculture has been Southeast Asia's primary industry for a long time, but the region's economy now depends more on manufacturing and services. The region has huge gas reserves, and with a decline in the oil extraction, gas is predicted to play a central role for the growth and development in the region. Over the last decades the energy consumption and the economy in the ASEAN region have seen an incredible growth, and the trend is expected to continue.

With many different countries with its own strengths and vulnerabilities, each country is positioned differently. Indonesia, still considered as an emerging market, is the largest economy in the region, has a high growth, low government and external debt burdens and is the only member of G-20 major economies. Together with Brunei, Singapore is ranked as a highly developed country and has one of the best business environments in the world. Singapore has a stable political system, and is one of the least corrupt countries in Asia. Malaysia, Thailand and The Philippines have seen a strong economic growth the last decade, and are considered as newly industrialized countries (CIA, 2012).

Table 1: Real GDP growth (Annual Percentage [%] change) in ASEAN countries (Masson & Mimura, 2011)

	2010	2011	2016	Average 2012-16
Indonesia	6.1	6.3	6.9	6.6
Malaysia	7.2	4.6	5.6	5.3
Philippines	7.3	4.5	5.1	4.9
Singapore	14.5	5.6	4.8	4.6
Thailand	7.8	2.5	4.9	4.5
Vietnam	6.8	5.9	6.7	6.3
Average of six countries	7.6	5.0	5.9	5.6

After a struggling period with global uncertainties and natural disasters, Southeast Asia will have a solid growth performance till 2016, and the growth is projected to be 5.6 % during 2012-2016 (Masson & Mimura, 2011). External trade and foreign direct investment, FDI, have traditionally played a major part of the growth, although the global recession has declined the growth in exports. ASEAN economies are now turning towards domestic drivers of growth in the medium term. Large-scale investment in infrastructure and private consumption will play a more important role in Southeast Asian economies. The region is also beginning to explore “green growth” as an alternative strategy for long-term sustainable development. The ASEAN-six account for approximately 85 % of region’s gross domestic product (OECD, 2012).

AFTA, ASEAN Free Trade Area, is a trade bloc agreement by the ASEAN countries. The purpose of the agreement is to increase economic growth within the ASEAN, through reduction in tariff barriers and attracting more FDI. The free trade area covers all manufactured and agricultural products, and has provided more efficiency in production and long-term competitiveness (ASEAN, 2012).

2.2 Energy mix

Over the last decade, the energy mix is about to change in the ASEAN region. The current energy mix in the region is still dominated by oil, but the role of coal and gas is increasing. With a massive growth in energy demand, declining oil reserves is a challenge for the region. Governments are currently working to secure future energy demand through regional cooperation, increased participation of foreign companies in extraction and production activities, and investing in Oil & Gas infrastructure.

Natural gas will probably play a substantial part of the energy mix in the future, with an increasing role in power generation, environmental advantages, combined with huge gas resources in the region. More than 60% capacity of the power generation in Thailand and Malaysia is now gas based (Shirodkar & Kunal Rana, 2009). Low prices of coal will still make the energy source essential in the energy mix in the future, though environmental regulations will force adaption of clean coal technologies. Without major policy interventions, renewable energy, like wind and solar, are not expected to be cost effective in the region. As of today, there are no nuclear power facilities in ASEAN countries, and the Fukushima Daiichi disaster will probably limit the development in the area with seismic risk like Thailand and Indonesia.

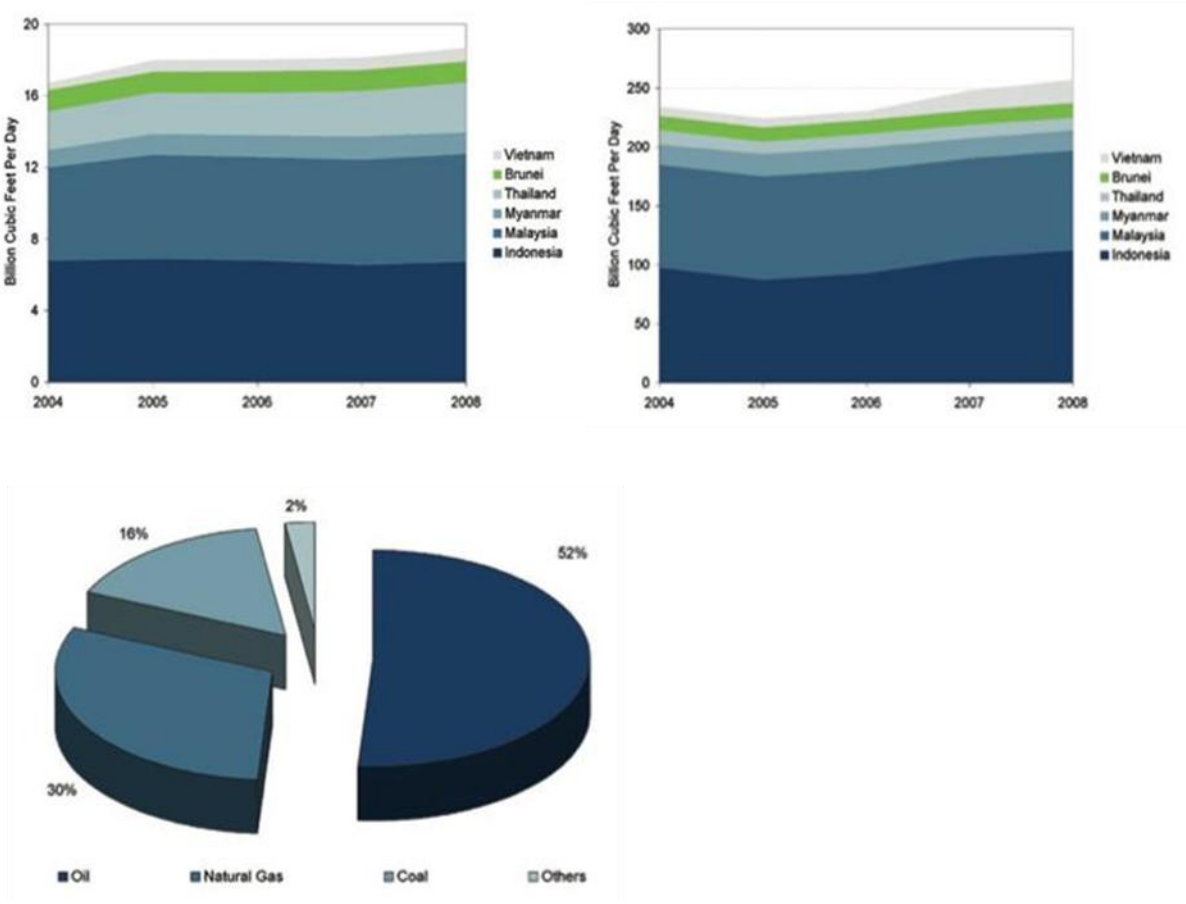


Figure 4: Upper left corner shows gas production, upper right shows gas reserves, and the pie chart shows energy mix in the region (Shirodkar & Kunal Rana, 2009)

Still, Vietnam, Indonesia, Thailand, Malaysia and Philippines are known to have plans for nuclear power generation. In total, LNG will increase its share in the energy mix.

2.3 Regulations, policy and environmental demands

The region, Southeast Asia, enforces various energy policy- and regulatory framework, but much work still remains to stimulate green growth in the region. To balance short-term economic needs and long-term environmental obligations is a big challenge, especially for the lower-income ASEAN countries (Masson & Mimura, 2011). Regulations, monitoring and supervision are compiled differently in the region; Malaysia provides tax exemption and allowances for companies providing energy conservation, while the Philippines do not provide any financial subsidies for efficient improvements (DNV Clean Technology Centre, 2010).

Compared to OECD-countries, the CO_2-emissions in ASEAN countries are still smaller, but the emissions are growing fast, by 5.5 % a year between 1990 and 2010 compared to 0.7 % in the OECD (Masson & Mimura, 2011). As a fast growing and developing economic region, ASEAN-countries will definitely make a certain contribution to global CO_2-emissions (Shirodkar & Kunal Rana, 2009).

Despite the region's increased environmental focus, measures are still essential to meet global requirements. *Better use of environmental tax instruments, access to green technologies, more public-private partnerships in energy conservation and taking part in the global carbon market, will all be determining tools, a recent OECD-study concludes* (Masson & Mimura, 2011).

2.4 Elections and disputes

With a total of 124 conflicts, the region of Asia and Oceania accounted for nearly a third of the world's conflicts. Southeast Asia is considered a semi stable region, but some conflicts have arisen concerning sub-national predominance, followed by resources, national power, autonomy and secession. The shortage of oil in the region has also provoked some territorial disputes, which have inhabited the development of high potential oil and gas reserves. As of today, most tension is related to South China Sea territories. China claims most of the South China Sea, which is believed to contain huge oil reserves, but The Philippines insist the territory belongs to them. Up to now, the conflict has been diplomatic and threat-oriented between Beijing and Manila, but worries are growing about the possibility of greater conflicts as China asserts its power and influence to claim resources (Asia Pacific News, 2012). Another border conflict between Thailand and Cambodia escalated to highly violent level in the start of 2011, but after the election in Thailand their relationship has improved (Heidelberg, 2011). Other recent, unsolved conflicts are in the Gulf of Thailand (Cambodia, Thailand), Baram Delta (Brunei, Malaysia) and East Kalimantan (Indonesia, Malaysia) (Shirodkar & Kunal Rana, 2009). The International Court of Justice has at some occasions taken imitative and actions to solve the disputes. This is a step in the right direction, but years of negotiation remain to fully resolve the disputes (Strachan, 2009).

Figure 5: Ongoing conflicts in Southeast Asia in 2011 (Heidelberg, 2011)

2.5 Country Risk Assessment

A country risk assessment is a tool to map a country's context (Cavusgil, et al., 2008). In this section we have compared different data regarding population, economy and politics to get a picture of the countries in the ASEAN gas consuming countries. The background information presented will be used in the discussion and analysis part, when we are going to identify which countries Norwegian companies could launch LNG-technology in.

Table 2: Country Risk Assessment with facts from CIA World Fact Book

	Singapore	Indonesia	Philippines	Malaysia	Vietnam	Thailand	Brunei
Population	4.7	246.6	101.8	28.7	90.5	66.7	0.4
GDP per capita (PPP), $	59900	4700	4100	15600x	3300	9700	49400
Total GDP, billion $ (PPP)	314,5	1121	393,4	447	229,2	609,8	21,1
Economic growth, real growth rate 2011	5.30 %	6.40 %	4.70 %	5.20 %	5.80 %	1.50 %	2.80 %

Table 2 clearly shows how the ASEAN countries are dissimilar in terms of size of population and economy. Singapore has almost 15 times the GDP per capita compared to The Philippines. And The Philippines have more than 20 times the population of Singapore. Accordingly, it is useful to investigate the distribution of GDP across the ASEAN gas consuming countries as in Figure 6. As we can see Indonesia, Thailand and Malaysia are the three largest economies. However, a decision of foreign market entry cannot be made based on market size alone; we must investigate other factors such as political structure, stability and labor markets.

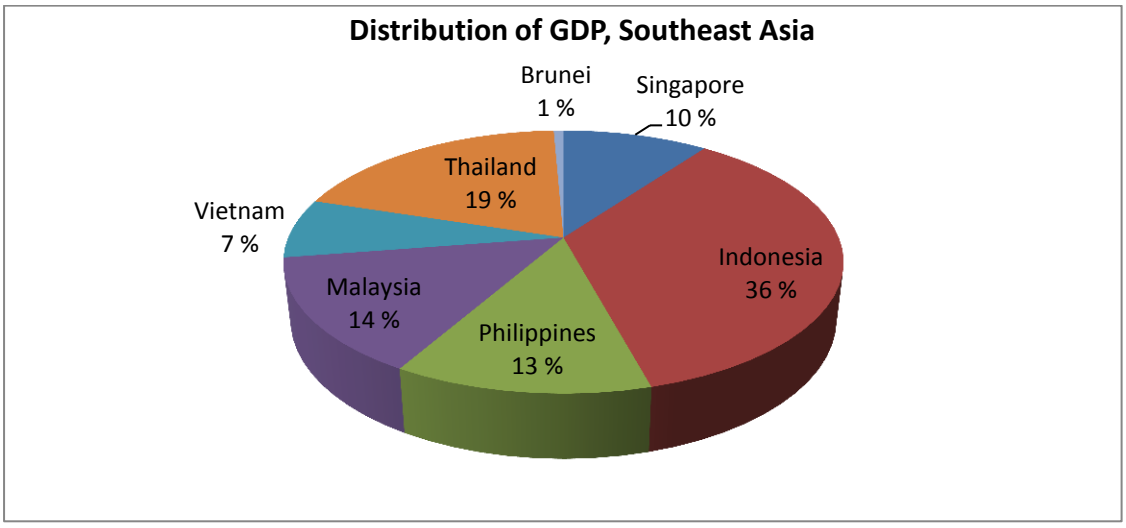


Figure 6: The distribution of GDP across the ASEAN gas consuming countries (CIA, 2012)

Table 3 summarizes different factors concerning governance structure, political structure and *Corruption Perception Index* rank. This assessment extends the analysis of the ASEAN countries. Singapore is an extremely modern country, also in a Western perspective. It is a stable country with a good legal system and protection of property rights. Indonesia, which is the largest market, has poor protection of property rights and a weak legal system. Accordingly, a foreign entry into Indonesia might yield higher profits, but for sure involves a larger risk. It is necessary to map the country's context even deeper throughout our data collection in order to recommend appropriate countries to enter.

Table 3: Political structure and safety for property rights in ASEAN-countries

	Government type	Political structure (CIA, DNV)	Corruption Perception Index[1]
Singapore	Parliamentary republic	Singapore has a stable political system, and is one of the least corrupt countries in Asia. The law system has its foundation in the English common law system.	5
Indonesia	Republic	Indonesia is a republic, with an elected legislature and president. Indonesia is a member of AFTA, ASEAN's free trade area, and thereby committed to lower tariff and non-tariff barriers.	100
The Philippines	Republic	The Philippines is a constitutional republic with a president that is elected. The membership in AFTA, ASEAN free trade area, has resulted in increased flow of FDI from North America and Western Europe.	129
Malaysia	Constitutional monarchy	Malaysia is a federal constitutional elective monarchy. The head of the state is elected every five year. Malaysia's legal system is based on English Common Law.	60
Vietnam	Communist state	Vietnam is a single-party state. With the Communist Party controlling key administrative and executive functions, the political structure is considered stable.	112
Thailand	Constitutional monarchy	Thailand is a constitutional monarchy. The Prime Ministry is the head of the government and a hereditary monarch is head of the state.	80
Brunei	Constitutional Sultanate (locally known as Malay Islamic Monarchy)	The political system in Brunei is governed by the constitution and the tradition of the Malay Islamic Monarchy. The same family has ruled Brunei for over six centuries. Brunei became a British protectorate in 1888, and still the legal system is based on English common law.	44

Chapter 4 will present additional literature on how to map a country's context. The purpose will be to combine the risk assessment in this section with literature to make a thorough analysis of the most ideal countries to target for export of LNG-technology. It is necessary to investigate specific systems for supporting environmental friendly technology, infrastructure for LNG and similar factors in order to get a sufficient overview. When this analysis is carried through, we will recommend countries to enter in Section 8.1.

In the next chapter, we will present the market of natural gas and the bunker fuel market. Chapter 3 will start by introducing the natural gas market before it is focusing on Southeast Asia. It will continue by focusing on the worldwide bunker fuel market, and narrow towards the Southeast Asian region. The purpose will to understand the potential of LNG in the region as a foundation for further analysis.

[1] Measures the perceived levels of public sector corruption in 183 countries (Transparency International, 2012)

3 Fundamentals of Natural gas and the bunker fuel market[2]

Natural gas is an energy source that is expected to grow substantially in the future, because it is widely available and offers many advantages compared to petroleum and coal. Environmental footprint is a key driver in Western countries, while scarcity of energy is the main driver in Southeast Asia (Kidnay, et al., 2011). In this chapter we give a brief introduction to natural gas and LNG, presenting the characteristics, the market, available resources and outlooks for future demand. Furthermore, we put emphasis on the bunker fuel market and the shipping market in Southeast Asia to get an overview of the market.

3.1 Natural gas definitions and chemical compositions

The natural gas composition varies from field to field, but consists mainly of 80-90 % methane (CH_4), and heavier hydrocarbons such as ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) (Rojey & Jaffret, 1997). The value of natural gas is determined by the combustion properties of methane, which is a colorless, odorless, non-toxic and non-corrosive gas. Natural gas is the cleanest burning fossil fuel, producing mostly just water vapor and carbon dioxide (Chandra, 2006). The primary use of natural gas is to supply gas-fired power plants and residential use such as heating and stoves. It is also used as a cleaner alternative to gasoil and diesel in the transportation industry, as compressed natural gas, CNG. Natural gas is an important available source of hydrocarbons for petrochemical feedstock and a major source of elemental sulfur (Kidnay, et al., 2011).

3.1.1 Natural gas reserves

Natural gas appeared for decades as a form of energy that was difficult to exploit, particularly due to high investment and transportation costs towards the end user. This resulted in a slow development throughout the world, and a lot of gas was flared as a bi-product of oil production. Today gas discoveries have been made at all continents, making natural gas more available. Six countries, Russia, Iran, Qatar, Saudi Arabia, USA and Abu Dhabi possess approximately two-thirds of the world's gas reserves, with 50% of the reserves are located in Iran, Qatar and Russia. According to geological data, the world has 187.5 trillion cubic meters (tcm) of proven conventional reserves, which are sufficient to meet 58.6 years of global production (BP, 2011). It is impossible to know exactly how much natural gas resources that are left in the ground, and estimates vary among different sources. In recent years improvement in exploration and the discovery of unconventional resources, have increased the total reserves. It is estimated that the recoverable unconventional gas resources are over 400 tcm, and that half of them are shale. With the discovery of shale-gas, United States has almost doubled its proven resources, and now their total reserves amount to 7.7 tcm (BP, 2011).

The US shale gas revolution will influence the LNG-market (Ito, 2011). More LNG will be available for Europe and Asia, and it will change the investment pattern in the US from import to export. At the same time it is important to notice that the shale gas revolution in the US has not yet been quantified. There are uncertainties on how much of the gas that is actually recoverable, and if it the process is easily repeated elsewhere. Critical success factors have been ideal geology, interested companies, support amongst politicians, environmental issues and the pricing of gas.

[2] Major parts of Chapter 3 are replicated with permission from Løset & Tveten (2011). Løset & Tveten (2011) carried out an extensive analysis of the natural gas and bunker fuel market which is relevant to this thesis, during the autumn 2011.

Unconventional gas reservoirs are without a doubt a game changer, and contribute to cover the growing demand for natural gas.

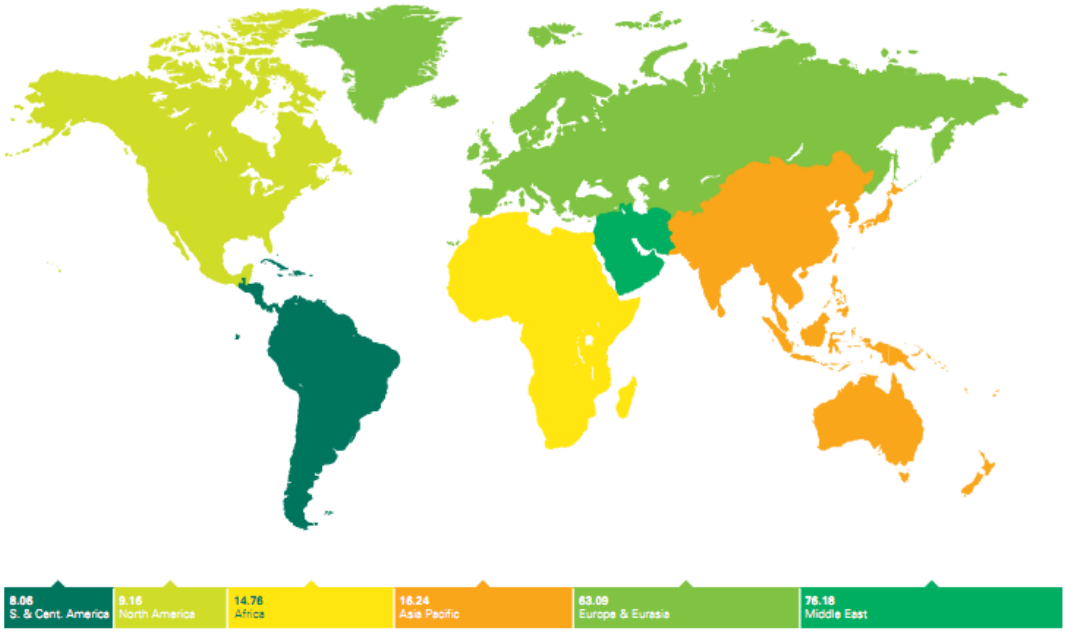


Figure 7: Proven reserves of natural gas by the end of 2009 in trillion cubic meters (BP, 2011)

3.1.2 Natural gas production and consumption

In 2010 the global demand for natural gas increased by 7.4 % to 3284 bcm. The main drivers of the development of natural gas are lower emissions of greenhouse gases, as OECD is enforcing stricter regulations regarding energy sources. Natural gas offers half the carbon emissions for the same amount of energy produced as coal, which is the main alternative as a power feedstock in many regions. The global gas resources are also vast and widely dispersed geographically, making natural gas available and affordable for many countries.

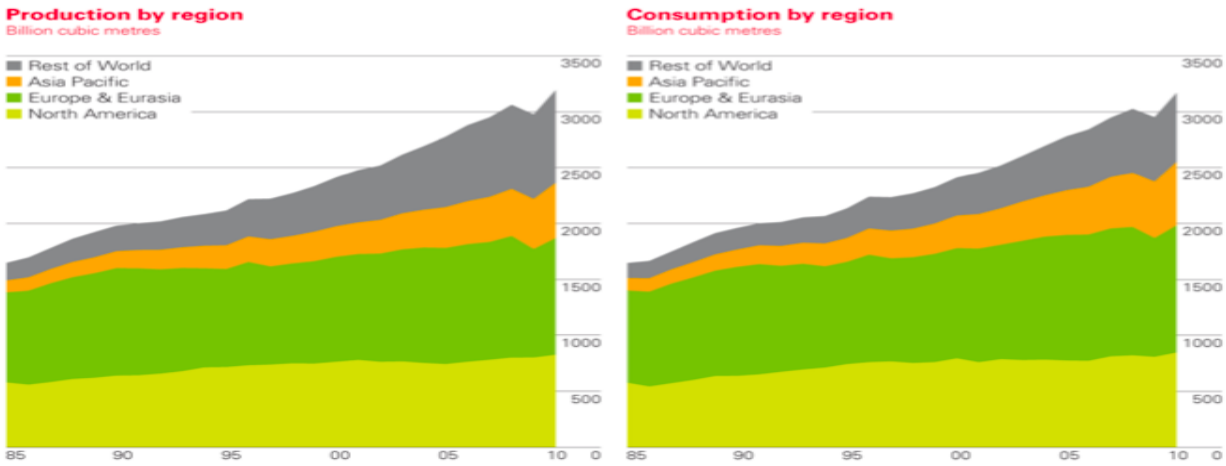


Figure 8: Production of natural gas to the left, consumption to the right, by region in billion cubic meters (BP, 2011)

China's gas consumption in 2010 reached 107 bcm, more than any European or other Asian country. They are now investing in domestic shale and tight gas projects, as well as securing supply with new

long-term LNG contracts and new pipelines from Turkmenistan (Ito, 2011). Japan's demand for LNG is expected to increase, to meet their energy demand after the Fukushima nuclear disaster (Thorvaldsen, et al., 2011). In November 2011, only 13 out of Japan's existing 54 nuclear reactors where operating and the number are expected to decrease (Global LNG Argus monthly, 2011). Before the Fukushima disaster, 30 % of the energy came from nuclear power, implying a large demand for alternative energy supply (BBC Asia, 2012). As a consequence of the disaster the German government announced a shutdown of their nuclear power plants within 2022. Germany had 140 TWh of nuclear power, representing 23 % of their total supply, which will now be supplemented by other types of energy. Consequently, the demand for natural gas will increase, and by 2030 IEA predict it will have the same market share as coal and oil (Rühl, 2011). Production of gas depends on both gas prices and development in exploration and production. An increased gas price will incline the production even in economical marginal fields.

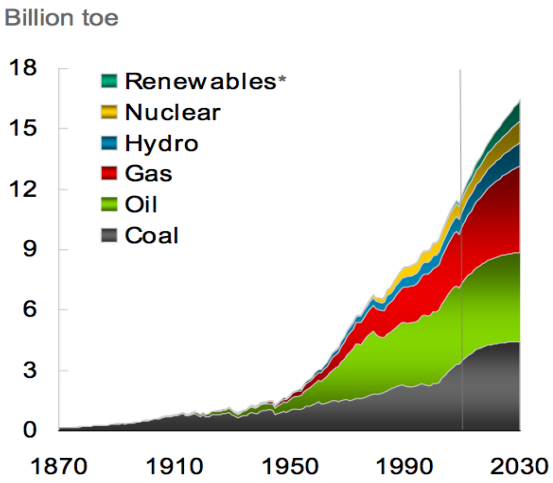


Figure 9: The world's energy demand dispersed by energy source (Rühl, 2011)

3.2 The fundamental principles of LNG

Natural gas fields are generally located far from residential and industrial consumers, so-called stranded areas. The most efficient way to transport natural gas in circumstances where the gas market is far from the reserves is in the form of LNG. It is estimated that approximately 60 % of the world's gas resources are considered stranded, and which makes LNG-technology attractive (Huber, 2011). LNG is natural gas that has been cooled and condensed to liquid. At atmospheric pressure LNG has a temperature of about -162°C, and only takes 1/600th-part of the volume natural gas has in gaseous state. The liquefaction process involves removal of oxygen, carbon dioxide, sulfur and water from the natural gas, and thus LNG is almost pure methane (Pettersen, 2008).

LNG supply chain and relative costs

In the early years of LNG-trading, the business was characterized by self-contained projects of large-scale facilities. They required huge capital investments, and complex long-term contracts between suppliers and buyers to share the large up-front investment risk. A certain volume of LNG from a given production site was transported to a fixed market location at a known price. As gas price rose and production cost fell, LNG became more economically feasible, even in small-scale. The LNG-market has become more dynamic, flexible and adjustable in respect to demand fluctuations, delivering location and shipping arrangement. Today the LNG supply chain consists typically of an upstream sector that develops the natural gas resources and liquefies the gas, a midstream sector that transport and store the LNG, and a downstream sector that re-gasifies and distributes the gas to the end-user. A trend is that companies involved in the LNG-trade have opted to own more of the value chain from upstream production of gas, till downstream towards the market place (Kidnay, et al., 2011).

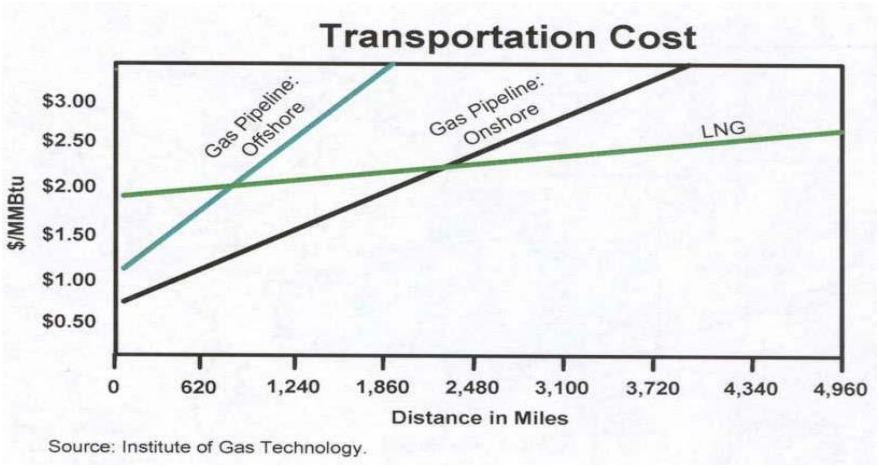


Figure 10: The economic viability of natural gas relative to distance (Gudmundsson, 2011)

Depending on where the natural gas is found, its composition, distance to the market and size of the field will determine if the gas is transported in its gaseous state in a pipeline, or if it shipped as LNG. The large investment in production facilities, ships and receiving terminals gives high initial cost for LNG, but when the transportation distances increase, transportation by LNG become beneficial. When building liquefaction and transport facilities one also need to consider the size of the reserves justifies the capital investment of a base load LNG-plant (Kidnay, et al., 2011).

Figure 11: The value chain of LNG production upstream and downstream with % of total costs (Pettersen, 2008)

As Figure 11 illustrates, the LNG supply chain involves a number of steps:

1. First, energy companies do exploration and production. This stage involves the supply of gas and condensate from the well, either in offshore or onshore facilities, through a pipeline into the processing facilities.
2. The second step is production of LNG from the raw product. This involves gas treating, liquefaction, and removal of mercury, CO_2, H_2S and heavy hydrocarbons. Liquefaction is done to increase the energy density of the gas for storage or transportation. At the plant heavy hydrocarbons are removed by purification and separation techniques for safety reasons, in compliance with environmental regulations and product specification.
3. After LNG is made, it can be transported. Shipping is the most profitable solution when distances increase, but also transport of LNG by rail or trucks are possible. Due to economies of scale the LNG carriers are increasing their capacity and the largest carriers in use hold 266 000 m^3. The LNG is kept cooled during transportation by utilizing a fraction of the evaporated LNG.
4. The LNG is sent to receiving facilities, which include unloading, storage, re-gasification and distribution. The LNG is re-heated and vaporized to its original gaseous state.
5. At the last stage the LNG is sent to gas fired power plants, the domestic gas grid or the final customers.

The steps and processes in the supply chain will depend on the specific case, and may differ. When LNG is used as fuel, it is directly delivered from the liquefaction facility to the end-user and no re-gasification takes place. The supply chain is criticized for being costly and that 2.5-10 % of the energy is lost during the production and re-gasification of LNG (Hovland, 2011).

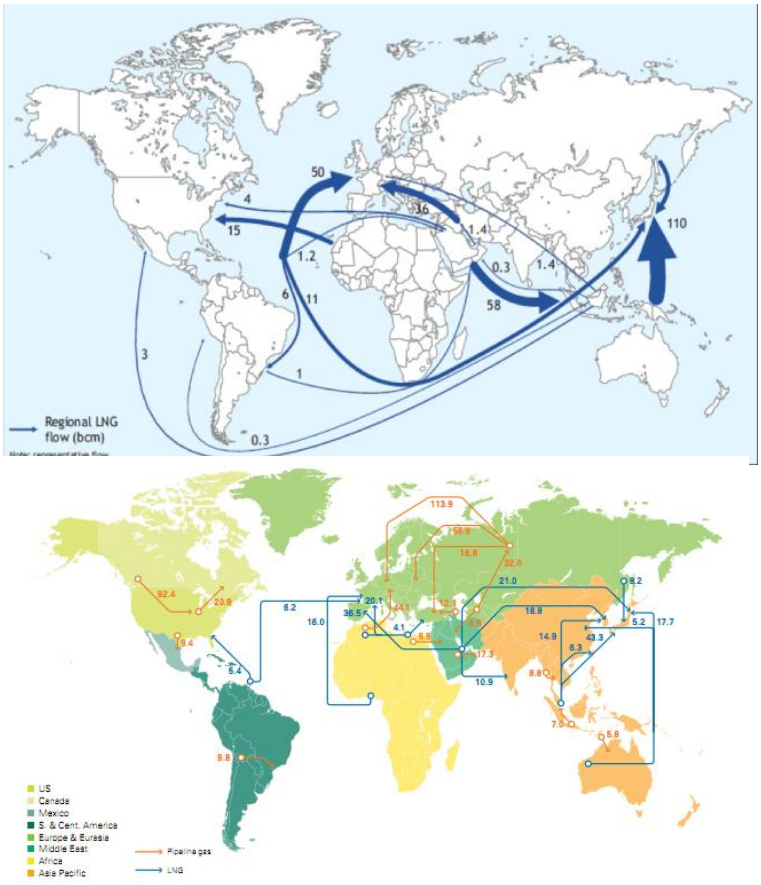


Figure 12: The upper picture showing major trade movements of LNG (Ito, 2011), the lower the major trade movements of natural gas (BP, 2011).

Natural gas trade grew by 10.1 % in 2010, driven by a 22.6 % growth in LNG shipments (Ito, 2011). Qatar, the world's largest LNG-supplier, increased its export with 53.2 %, representing 25 % of global LNG-supplies alone (BP, 2011).

The major trade movements came from Indonesia, Malaysia, Qatar, Algeria and Nigeria, which accounted for 66 % of the world's export. Asia, led by Japan and South Korea, accounted for 66 % of the world's imports. LNG now accounts for 30.5 % of global gas trade. The utilization of stranded reserves is increasing, with several projects under construction or in the planning stage. Australia will pass Qatar as the leading exporter of LNG, if they manage to complete and materialize the projects with the estimated capacity (Kidnay, et al., 2011).

3.3 Natural gas and LNG in Southeast Asia

The forecast for natural gas is bright, and IEA predict the next decade to be the golden age of gas (IEA, 2011). The global natural gas demand grew by 7.4 % in 2010 (BP, 2011) and the majority of the growth came from non-OECD countries. Southeast Asia experiences increased investment in gas infrastructure for domestic and intra region energy security. Increased LNG production capacity and LNG availability has turned gas into a less costly alternative energy source. A 50 % liquefaction capacity expansion is expected global in the period from 2009-13 (Hashimoto, 2011).

Southeast Asia's shift from a gas supplier to also be a significant consumer of natural gas is expected to last and the construction of LNG receiving terminals support this claim. To complement Singapore's gas supplies from Malaysia, a 4.1 bcm LNG terminal is under construction in Jurong Island. In Thailand a 7.3 bcm re-gasification facility is under construction and in Indonesia pipelines and LNG terminals are being built to secure supplies. Indonesia and Malaysia will also use floating

storage and re-gasification units, FSRU, frequently (Shirodkar & Kunal Rana, 2009). The numerous LNG projects and various infrastructure projects in the region will probably link the individual markets together, give market security and a stronger relation with global gas markets (Hashimoto, 2011).

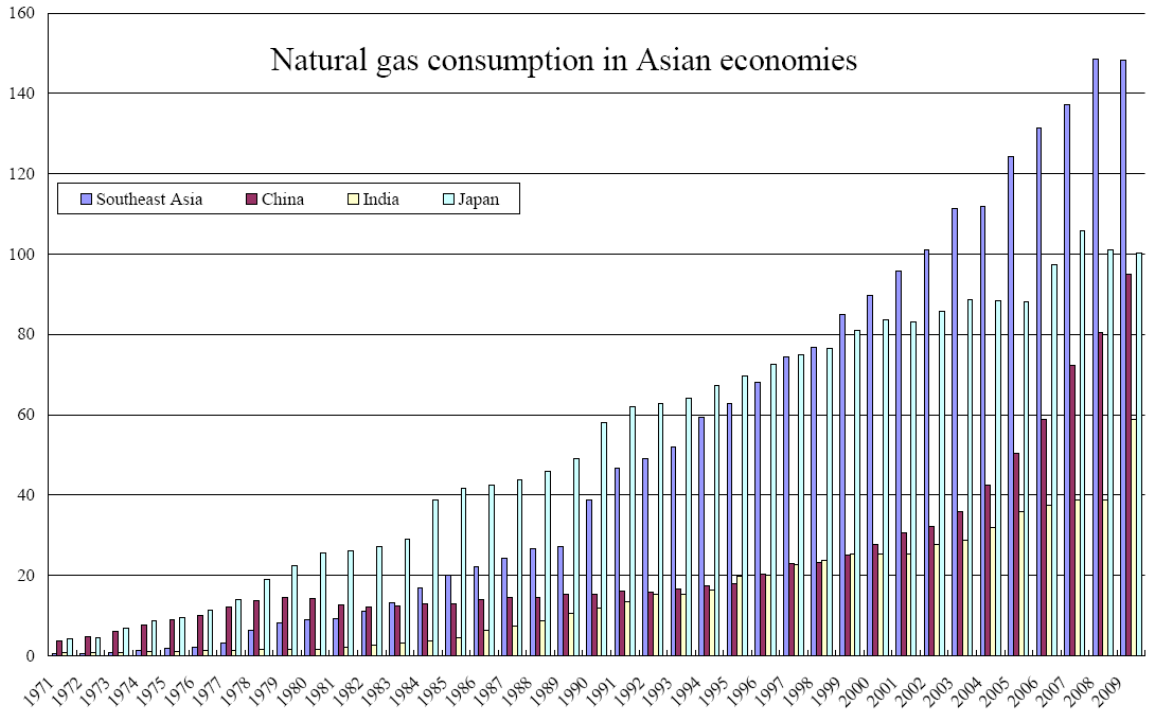


Figure 13: Comparison of Gas Market Consumptions [bcm] in Asia (IEA, 2010)

With a wide range of applications, including the use of gas-fired combined heat and power plant and efficient distributed power systems, Hashimoto states that Southeast Asia could take advantage of the contemporary gas market that have developed over time. Figure 13 is a comparison of Gas Market Sizes in Asia. Energy and environmental policies will probably determine the future for natural gas in the region.

Table 4: List of flows in the ASEAN gas market (CIA, 2012)

Natural gas [bcm]	Singapore	Indonesia	Philippines	Malaysia	Vietnam	Thailand	Brunei
Production	0	82.8	3.2	58.6	9.4	30.9	11.5
Consumption	9.7	40.5	3.2	29.1	10.3	39.2	2.7
Imports	9.66	0	0	1.3	0.9	8.3	0
Exports	0	42.3	0	30.8	0	0	8.81
Proved reserves	0	3001	98.5	2350	192.5	312.2	390.8

Today Indonesia is the second largest LNG exporter in the world behind Qatar. They have 3001 bcm of proven reserves, with the current production rates the reserves will last for approximately 40 years (BP, 2011). Indonesia and Malaysia counts for 2.82 % of the world's total proven reserves, and are by far the main contributors to the gas reserves in the Southeast Asia.

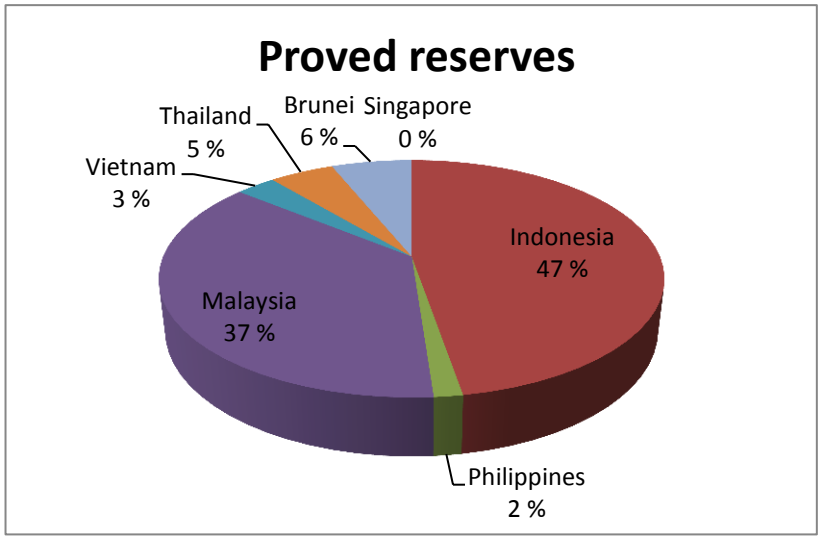


Figure 14: Distribution of proved reserves in Southeast Asian countries

Infrastructure

To improve energy security there are plans to further develop the gas pipeline network and to transport LNG with ships (DNV, 2010). Gas pipeline networks are not well established in the region. Development of the TRANS ASEAN Gas pipeline, connections between gas importing (Thailand, Philippines, Singapore) and exporting countries (Indonesia, Malaysia, Brunei, Myanmar) have been delayed due to challenges with varying technical standards and agreements. The nine countries participating also have different perspective of regulatory frameworks, cost sharing and environmental concerns. There is now only about 2300 km, 16000 km under development of bilateral pipeline, compared to 7975 km in Norway (Shirodkar & Rana, 2009). The LNG investments are strongly related to the gas price, but with the current gas price LNG projects are likely to increase in the medium term. With the Tanguh LNG project, Indonesia will start to export 10.3 bcm of gas.

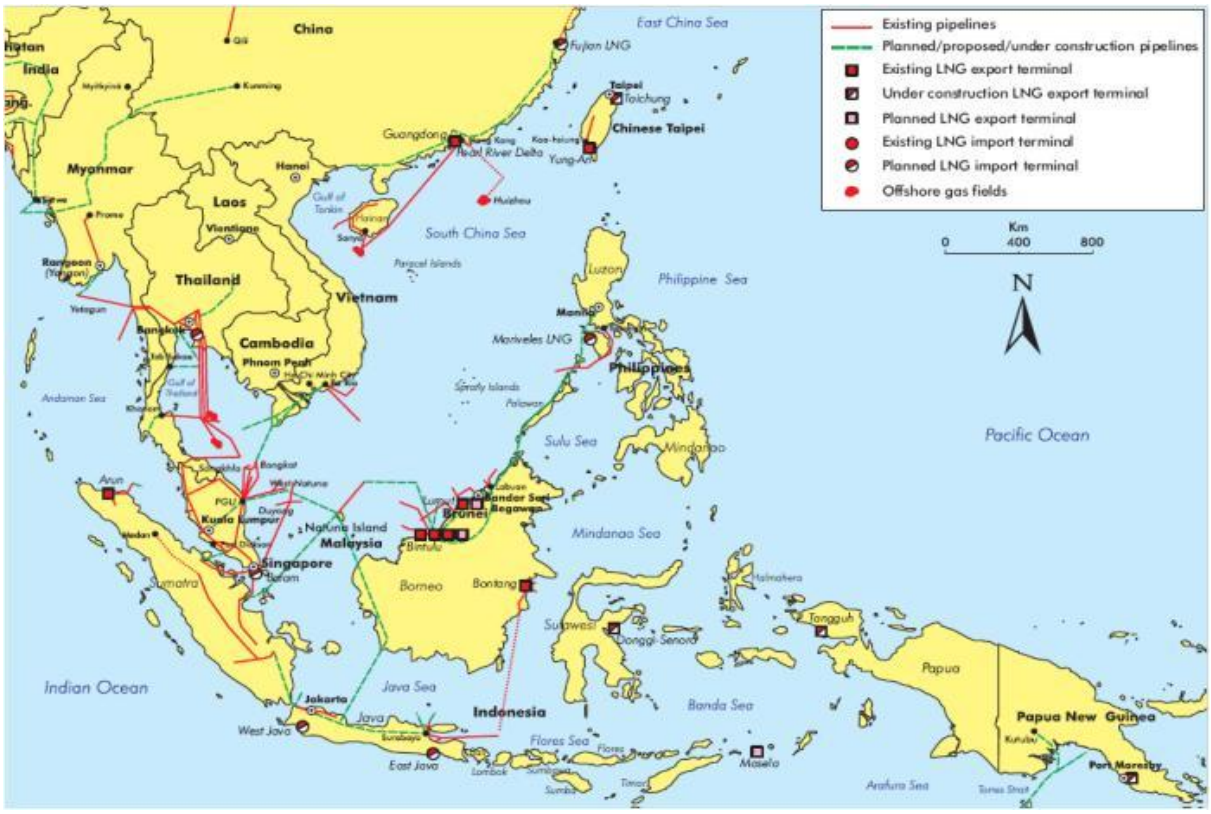


Figure 15: LNG terminals (IEA, 2010)

3.4 The bunker fuel market

Southeast Asia, and specifically Singapore, is one of the busiest ports on the globe. Shipping is a true global industry as it is serving 90 % of the global trade. Bunker fuel is one of the most important cost components for the shipping industry. The bunker fuel market is currently estimated to approximately four million barrels per day and $100 billion per year (Abadie, et al., 2011). The choice of propulsion system is accordingly a key decision among ship owners as it affects profitability, operations and environmental footprint. Since the focus on environmental regulations is compiled differently around the world and there are uncertainties regarding the future price on bunker fuel, each factor needs to be assessed with respect to the market analyzed.

From a technical perspective, LNG is a well-suited fuel both for trucks and ship vessels (Stenersen, 2011). It has a high combustion factor, engine technology is available and it imposes high operational reliability. Today, the use of LNG as a bunker fuel is limited except from LNG-carriers and short sea shipping in Norway (Løset & Tveten, 2011). However, in Europe and USA, environmental regulations make LNG the best alternative. In Southeast Asia, a green focus has not arisen in the same scale. In this section, we will thoroughly present the effect of the regulations and the technological alternatives ship owners have in order to meet the requirements, and how these affect Southeast Asia.

Regulations

Due to the international orientation in shipping, ship owners can register their fleet in almost any country regardless of where they are in traffic. Furthermore, the fleets move between different jurisdictions during their entire life cycle, which make national regulations hard to impose.

Figure 16: A map showing present and future Environmental Control Areas (ECAs) (DNV, 2010)

The need for universal international regulations has been recognized for decades. In turn, this led to the establishment of the International Maritime Organization (IMO) in Geneva, 1948 (IMO, 2011). Today, IMO is working to promote health, safety and environment in shipping. This includes prevention of pollution, which is controlled through MARPOL. The latest Annex VI entitled "Regulations for the Prevention of Air Pollutions from ships" has decided to drastically reduce

emissions of NO_X, SO_X and particles (DNV, 2010). Different emission standards from IMO are commonly referred to Tier I, Tier II and Tier III. There are global requirements and more stringent requirements applicable in a geographical limited area, ECAs, as shown in Figure 16. From 2015, the first very strict emission limits of sulfur will enter into force in the ECAs. All new restrictions are outlined in Table 5. The last two requirements will first come into force in ECA, but be put into effect globally from 2020 or 2025.

Table 5: New international legislation on maritime engine emissions for 2010-2020, IMO Annex VI regulations, modified from DNV (DNV, 2009)

Date	Reference	Regulation	Area	Target	Consequence	Ships owner's position
1.7.2010	IMO Annex VI	Sulphur content in fuel < 1 %	ECA	Sailing ships and new buildings	Equipment adaption, exhaust gas purification or higher voyage cost	1) Use bunker < 1 % sulphur 2) Use scrubbers 3) Use LNG as a fuel 4) Use fuel-water emulsion
1.1.2011	IMO Annex VI	Reduction of NO_X to Tier II lever, 20 % below Tier I	Global	New buildings	Special engines or exhaust gas purification. Higher voyage and capital costs	1) Use low NO_X-engines 2) Existing engines with SCR or EGR 3) Use LNG as fuel 4) Use fuel-water emulsion
1.1.2012	IMO Annex VI	Sulphur content in fuel < 3.5 %	Global	Sailing ships and new buildings	Higher voyage costs	1) Use bunker < 3.5 % sulphur 2) Use LNG as a fuel 3) Use fuel-water emulsion
1.1.2015	IMO Annex VI	Sulphur content in fuel < 0.1 %	ECA	Sailing ships and new buildings	Higher voyage costs, equipment adaption or exhaust gas purification	1) Use bunker < 0.1 % sulphur 2) Use scrubbers 3) Use LNG as a fuel 4) Use fuel-water emulsion
1.1.2016	IMO Annex VI	Reduction of NO_X to Tier III lever, 75 % below Tier II	ECA	New buildings	Improved engines or exhaust gas purification	1) Install SCR 2) Use LNG as fuel 3) Use fuel-water emulsion

Furthermore, some of the biggest ports in Europe have introduced their own environmental requirements. The Port of Antwerp Authorities has established port-specific emission regulations where those ships vessels that meet them will get a 10 % reduction in port fees (Løset & Tveten, 2011). Similar arrangements have been introduced in the ports of Dunkirk, Zeebrügge, Rotterdam and Oslo to mention some of them. Consequently, there exist monetary incentives as well as regulations that demand new technology to meet the requirements. In Norway specifically, the government has imposed a tax on emissions from NO_X (Næringslivets Hovedorganisasjon, 2011). Ship owners pay a price per kilogram emitted NO_X. The income from this tax finances environmental friendly investments such as installation of LNG-fueled machinery. This has proven to be an effective tool as Norway has established a short sea fleet running on LNG, with the infrastructure available and positive ship owners.

In Southeast Asia, there are uncertainties regarding the environmental regulations. IMO has so far not specified or signaled any ECA in the region. This claim will be thoroughly assessed in our data analysis in Chapter 8. As described in Section 2.3, much work remains to stimulate to green growth in the region and balancing short-term economic needs and long-term environmental liabilities. An ECA will probably weaken the competitive power to the major ports in Southeast Asia, and is therefore opposed by many governments. In Section 9.2 the recommended markets to target are

assessed further, and the section gives a good impression of how established actors in the region consider the environmental aspects.

3.5 Technological alternatives for the shipping industry

With the upcoming regulations in ECAs, the ship owners will be the first to feel the impact, then refiners, marketers and ports. The dominant marine fuel today is high-sulfur HFO or MDO/MGO (Abadie, et al., 2011). Several possible actions can be taken to meet the requirements, but the consequence of choosing a sub-optimal strategy may be costly in a long-term perspective.

In addition to meet the environmental regulations the fuel has to be technological feasible, commercially available and economically justified. Bio-fuels and hydrogen are not expected to be commercially available in the shipping industry in large scale until after 2030. The use of nuclear reactors on board is not anticipated to be an interesting option for international shipping, due to environmental, political and safety reasons (IMO, 2009). Substitution of HFO with MDO is a possible solution, but it is more expensive because the oil-gas differential is increasing. The refining industry would also struggle to supply an extra 4 mbd of gasoil because of limited production (Abadie, et al., 2011). Compressed natural gas (CNG) or LNG is less carbon intensive, but need new engine design, larger tank volumes and rely on better infrastructure. Since a LNG-tank will require only half the volume compared to CNG, LNG is the most likely alternative. This analysis gives us two plausible solutions that comply with the ECA-regulations, are technological feasible and economically justified: Installment of smoke scrubbers to clean HFO on existing machinery and LNG-fueled ships. In terms of costs, LNG is the only alternative to HFO.

3.5.1 Smoke scrubbers

Smoke scrubbers are extended systems of exhaust gas cleaning. The basic principle with the scrubber is to use alkalinity to neutralize the dissolved sulfur dioxide from the exhaust gas. Seawater, caustic soda (NaOH) and limestone ($CaCO_3$) are used as absorbent for different types of scrubbers. Motor producers, MAN BW and Wärtsila, states that their best smoke scrubbers reduce SO_X-emissions by 90 % (CleanTech, 2011). The downside with scrubbers is an additional power consumption of 0.5-1 %, expensive investment cost and the scrubber water requires large spaces (Heim, 2008). The sulfur regulations from IMO is based on engine emissions, not the content of the fuel itself, meaning that ships can continue to use higher sulfur bunkers as long as the exhaust gases are cleaned sufficiently. Smoke scrubbers could be the preferred short-term solution, since scrubbers are technically mature and available.

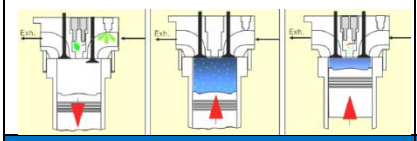
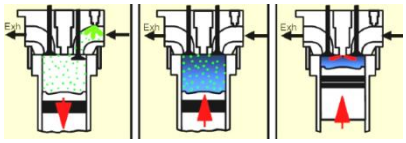
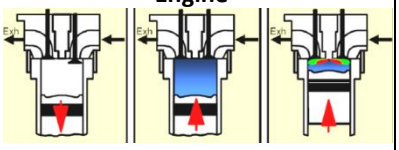
To reduce NO_X-emissions engine manufacturers have developed selective catalytic reduction technologies (SCR) and fuel water emulsion (FWE). In SCR the exhaust gas is treated with ammonia or urea. A catalyst is placed in the exhaust gas channel, where the reduction agents react with the nitrogen oxides forming nitrogen and water, reducing the NO_X with 90-99 % in the exhaust gas. The basic engine design does not need any changes for applying SCR, but the solution is expensive and requires space for a urea tank. With FWE, the fuel is mixed with water on board the ship, causing local cooling of the combustion in the cylinder. The lower temperatures lead to less NO_X from the combustion chamber and a reduction rate up to 30 % (MAN, 2012).

3.5.2 LNG-fueled engines

LNG was applied as a fuel as early as in 1960, when LNG-carriers started to utilize boil-off gas in the engines. The first working prototype of a pure LNG-fueled ship was “MF Glutra” operating from year

2000 propelled by a LNG-engine from Mitsubishi. The current fleet with LNG-engines counts 26 ships, with an additional 37 under construction (World Trade LNG Database, 2012). LNG-fueled ships have been tested and applied with great success in ferries, platform support vessels (PSVs), coast guard vessels and LNG-tankers in Norway. Various engine manufactures have now entered the market, with Rolls-Royce, Wärtsila, MAN BW and Mitsubishi upfront. This has resulted in three main engine concepts available in the market: Spark ignited lean burn engine, dual fuel engine, and high pressure direct injection engine (Stenersen, 2011). The various concepts for utilizing LNG as a fuel have some unique characteristics, which makes them suitable in different environments and ships.

Table 6: Different LNG-engines available in the market today, modified from Stenersen (2011)

Spark Ignited Lean Burn Gas Engine	**Dual Fuel Engine**	**High Pressure Direct Injection Engine**
		
Single fuel (LNG)	Dual fuel capability (LNG or MDO)	Multi-fuel capability (LNG, MDO or HFO)
Otto cycle	Combined Otto/Diesel cycle	Diesel cycle
Low gas-pressure supply, 4-5 bar	Low gas-pressure supply, 4-5 bar	High-pressure gas-injection, 300-350 bar
High energy efficiency and lower emission than a diesel engine	Flexible and has back-up fuel	Need NO_X-reduction techniques to meet IMO Tier III
Emits some methane, but 20-30 % GHG reduction compared to HFO	Emits methane, and that is hard to limit by combustion process control	No methane emissions, and 30 % GHG reduction compared to HFO
Not sensitive to gas quality	Sensitive to gas quality	Not sensitive to gas quality
Not suitable for retrofitting of existing engines	Possible to retrofit in existing engines	Suitable for conversion of existing engines, simple process

All the three LNG-engines have low emissions, with a GHG-reduction potential in the range of 20-30 % compared to HFO. Lean burn gas and dual fuel engines emit un-burned hydrocarbons, mostly methane, from the engines exhaust which reduces the net effect to about 15 % reduction of CO_2 equivalents (IMO, 2009).

A technical challenge with LNG is finding the necessary space for storage of the fuel. For the same energy content more volume is required compared to HFO-tanks. This will influence ship design and require substantial modifications if retrofitting is considered (CleanTech, 2011). The ability of LNG and the need for infrastructure is also vital questions, but these challenges will be discussed in detail in Section 9.1.

LNG-tankers have been operating from early in the 1960, and have an incredible safety record, with no major accidents. The excellent safety record is due to the combination of very robust vessel design, port state precautions and well-executed vessel operations (DNV, 2004). For gas-fueled ships it also exist rules and regulation from IMO, different class companies, and from authorities. The current IMO-requirements are minimum two separate engine rooms, redundancy of fuel storage and power generation and double piping of all gas pipes inside the ship. A new IMO-code is in

progress, and will be valid from 2014. As long as rules, requirements and guidelines are met, LNG does not involve a higher risk than other combustible fuel (Stenersen, 2011).

3.6 Environmental emissions

The main sources of pollution from ships are, CO_2, NO_X, SO_X and particles. This section compares the environmental emissions associated with LNG, low sulphur fuel, conventional fuel with smoke scrubbers and conventional fuel without cleaning.

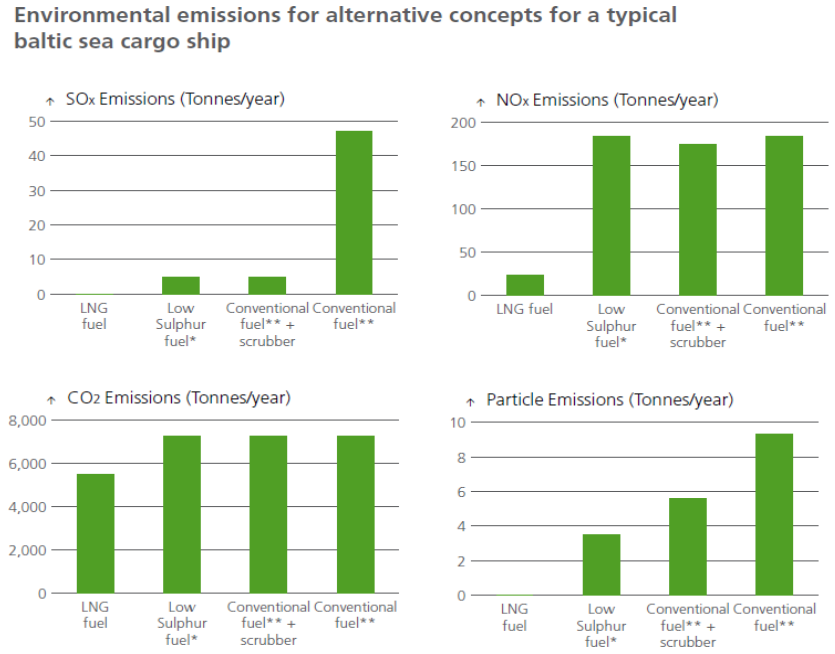


Figure 17: The environmental consequences of the most plausible technical fuel systems on a typical Baltic Sea cargo ship (Blikom, 2011). This data stems from a DNV-study and compares LNG-propulsion with conventional engines.

Figure 17 stems from a DNV-study, illustrating environmental emissions for alternative concepts for a typical Baltic Sea cargo ship (DNV, 2010). The study indicates that LNG offers the lowest emissions and gives the best environmental solution among the options, and meets the new IMO-requirements. NO_X emissions are reduced by 85-90 %, whilst emissions of SO_X and particles are nearly eliminated.

Different sources and research support these calculations from DNV. A new study from MARINTEK confirms that the emissions are less with LNG-engines, and that there are huge local and global environmental benefits (Stenersen, 2011). By taking the problem of related methane emission into consideration the research from MARINTEK, shows the net GHG reduction with best available technology is 15-20 % when comparing LNG to MDO-operation. LNG-fueled ships would be particularly attractive in NO_X-ECAs, since they can meet Tier III emission levels without after-treatment of the exhaust gases. Scrubber technology and low sulfur fuel would both need an additional system to reduce emissions of NO_X sufficiently, with SCR and WFE as a possible option (IMO, 2009). It is important to consider the entire value chain of the fuel to assess its fully environmental impact with a LCA-analysis. Consequently, emissions related to extraction, processing, transport and final combustion to produce energy must be assessed. A NTNU-report states that LNG-production is more CO_2-intesive in the production phase compared to MDO, but with lower combustion emissions LNG is still a better alternative (Hansen, et al., 2010).

3.7 Economic analysis

The economic perspective of LNG engines compared to the alternative solutions would be crucial for the ship owners to estimate. With the current market situation, without comprehensive infrastructure available and most of the ships are built as highly customized ships, it is hard to do this estimate and the calculations are diverging. The costs are depending on both uncertain investment and operational costs, and it is obvious that different actors have huge own incentives. In this section we will assess different economic analysis and discuss their reliability.

The selection of an engine solution to meet the environmental requirements will influence revenues, investment costs, maintenance and operating costs. LNG-tanks require today more space for fuel tanks, compared with MDO/HFO (Martinsen, 2011). This will be a big challenge for vessel designers, because the increased volume requirement from LNG-tanks will cause less cargo capacity, which might lead to a decrease in revenues. The actual decrease in revenue depends on the size of the ship and what kind of cargo that is carried. The capital costs will also be approximately 10-15 % higher than using HFO, according to a MARINTEK-study (Stenersen, 2011). The capital cost will depend on what kind of ship, the LNG tanks, safety and bunkering systems and what kind of engines that are built. In the MARINTEK study from Stenersen, he emphasize that the increased capital costs can be offset by reduced operational expenditures, such as lower fuel costs and lower maintenance costs. These calculations are challenged by another NTNU-study (Saga, et al., 2010). They show that for an LNG-propelled OSV there will be approximately 30 % higher CAPEX, but agree that they will be offset by reduced OPEX.

Since 2000, higher oil prices have resulted in higher operating cost in the maritime sector. Bunkers represent between 25-50 % of the vessel operating cost (Stopford, 2008), and small changes in the oil-gas price differential will therefore have major impacts on the total profitability. Calculations show that during 2015-2030 the use of HFO with an installed scrubber will save 35 %, and the use of LNG up to 60 %, compared with the use of MDO as a primary bunker in a European price scenario (Abadie, et al., 2011). This is yet another argument to focus on smoke scrubbers and LNG, and not focus on MDO. Based on current prices in Europe, still the only market where LNG is applied as bunker, fuel cost of LNG is approximately 20 % less than HFO (Stenersen, 2011).

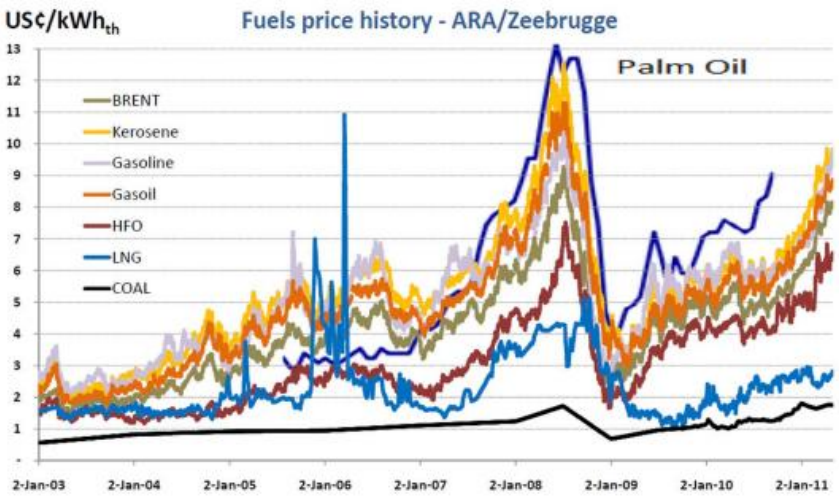


Figure 18: The oil and gas price differential (Stenersen, 2011)

The payback time will depend largely on the future of the oil-gas price differential. Figure 18 shows prices on different bunker at Zeebrûgge. These price differentials currently generate substantial savings to ship owners that use LNG instead of MDO. The global supply of LNG is currently great with huge available reserves and is expected to grow substantially in the future. This compared to higher cost for low sulfur fuel and MDO indicates that this oil-gas price differential probably will last (Nysæter & Aadland, 2011). Since the infrastructure is not available global, a challenge for the industry will be to agree on specific standards for bunkers, so the ship owners know that they have available fuel.

Today it is established infrastructure for fueling LNG primarily in the Nordic and Baltic ECA. Moreover, there is significant geographically differences in the LNG-price due to three price regimes in the world. There is an American, European and Asian pricing system for LNG making it hard to estimate future fuel costs for a ship owner who is operating globally (See Appendix 2 for more information).

Stopford (2008) offers a framework for analyzing marine economics. He has taken into account the most important cost elements for different ship types, categorized them and made an average factor of the size of each cost. Figure 19 summarizes his framework.

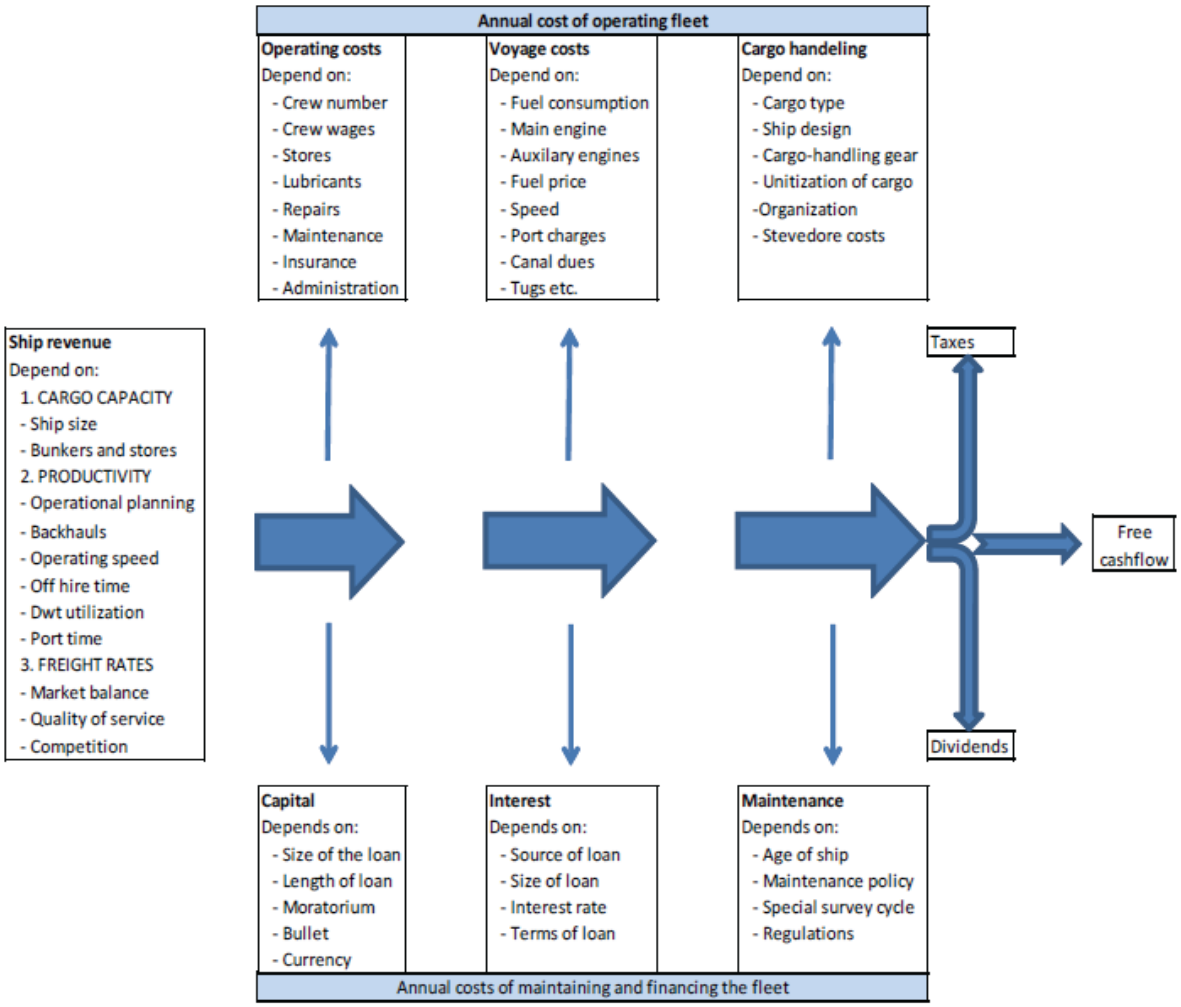


Figure 19: Cost components related to marine shipping (Stopford, 2008)

As we can see Stopford (2008) presents detailed cost elements for capital expenditure, operational expenditure and off course ship revenue. A number of factors will be affected by the choice of engine and fuel. Various conclusions on increased capital expenditure due to investment in LNG-fueled ship vessels probably can be explained by different weighting of the cost factors presented. Table 7 is summarizing intervals on increased costs by investing into LNG-technology, and which factors that cause uncertainty on the exact rise in investments costs and exact decline in operational expenditure.

To do an objective economic analysis of LNG-engines is difficult, especial because many ships have been produced as highly customized ships, and an efficient LNG bunker market affecting the operation cost does not exist. Anyhow, in Section 9.1 we have compared different cost factors presented in the framework by Stopford, and outline different cost scenarios for LNG. The fuel cost is probably not directly comparable, the market relies on some agreements and developments of standards for bunkering are still to come. We have assessed different calculations from different sources, and summarized this estimates in Table 7.

Table 7: A summary of CAPEX and OPEX related to LNG-propulsion

	Capital Expenditure (CAPEX)	Operational expenditure (OPEX)	Ship revenue
Interval	[8-30] % increase compared to HFO-vessels	[5-20%] decrease compared to HFO-vessels	[0-5 %] reduction compared to HFO
Uncertainty factors	- Engine costs - Fuel system - Arrangement and structure (cargo space) - Design costs	- Fuel price (oil-gas differential) - Maintenance costs - Port charges - Lubricants - Insurance - Taxes	- Productivity - Off-hire time - Cargo space
Assessment of most likely	Engine costs and connected fuel system will be the main driver of increased CAPEX. Ships freighting cargo will be most exposed to this, meaning that the most likely added cost is in the higher part of the interval	Fuel cost is between 25 and 50 % of the OPEX. Consequently, the oil-gas differential will be the single most important factor. Taxes, port fees and repairs are also significant. A modest estimate can give 10 % reduction	OSVs and RO-ROs rely heavily on cargo space. Ferries a little less. At the same time, off-hire time is worst case related to ship revenues. Higher operational reliability with LNG means little reduction in ship revenues.

A recurring element is uncertainty regarding the economic viability in LNG-propulsion. As for today, machinery equipped for LNG-fuel demands significant increased CAPEX (Løset & Tveten, 2011). The increase in CAPEX might be offset by reduced OPEX due to lower fuel costs, reduced port fees and decreased maintenance costs (Saga, et.al, 2010). However, there is uncertainty regarding the level of the oil-gas differential in Asia (Nysæter & Aadland, 2011). It is highly beneficial in favor of LNG today, but there are different opinions concerning how it will evolve in the future. Pricing is very important for new technologies, and consequently this issue should be analyzed. A more thorough economic analysis of LNG-propulsion in Southeast Asia is carried out in Section 9.1.

3.8 Shipping in Southeast Asia

With more than 4300 registered ships engaged in carriage of goods or commercial traffic, the marine market in the Southeast Asia is huge. Singapore is one of the busiest ports in world and with its central geographic position it is a natural hub for the maritime cluster. The aging and renewal of the fleet will have major impacts on the development, since LNG is not economical attractive for retrofitting, but for new builds. An old fleet, with a short renewal time will favor the development of LNG. As of today the fleet in Southeast Asia is considered as young. According to a DNV study the average age of the container feeder fleet is 10.7 years, while the OSV fleet has an average on 13.2 years in the region. As much as 66 % of the OSV fleet has less than 5 years age (DNV Clean Technology Centre, 2010). Figure 20 shows how the fleet is distributed across the ASEAN-countries.

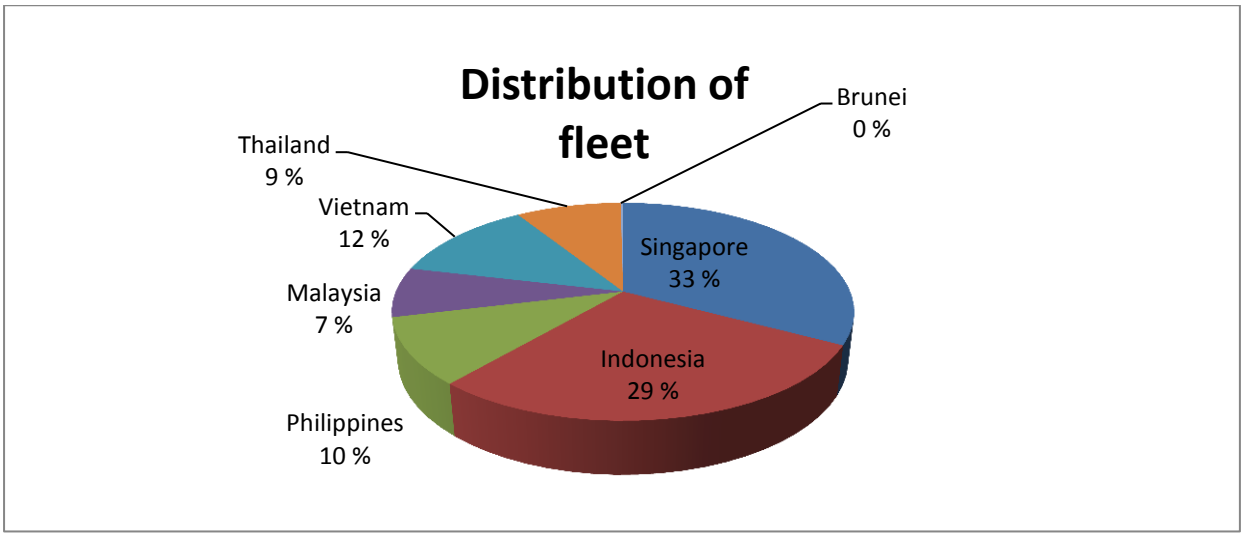


Figure 20: The distribution of the ASEAN-fleet across the countries

An ageing fleet is not in itself enough to initiate LNG-propulsion. Table 8 summarizes different factors that are stimulating development of LNG as a bunker fuel. Some factors favors LNG, but there are still regulatory changes needed before ship segments can adapt to LNG. Experience from Norway indicates that LNG as a bunker is possible for different types of ships; offshore supply vessels, passenger ferries, container feeders, cruisers and tugs (Løset & Tveten, 2011). We will in Chapter 8 discuss what kind of ship that have the largest potential for LNG in Southeast Asia.

Table 8: A framework for which factors that will encourage development of LNG

Factor	Factors favoring LNG	Factor present in Southeast Asia
Voyage routes	Regular, repetitive and high frequency	Regular, repetitive and high frequency
Infrastructure	Proximity to LNG distribution	Infrastructure is not available
Ageing of fleet	Old fleet - LNG is beneficial on new builds more than retrofitting	Young fleet - Containers feeder 10.7 years - OSV 13.2 years
Renewal	High degree of new builds	Medium degree
Environmental focus	Significant better than HFO	Weak environmental focus
Environmental regulation	ECA	ECA is not considered in the region
Oil/gas differential	Huge, price differential	Small, in favor of LNG

LNG-projects in Southeast Asia

As of today there are 7 LNG marine projects in operation in the Southeast Asia, but still an absence of small LNG receiving facilities. With expected increase in both liquefaction and re-gasification capacity around the world, increased domestic consume, indicates a return to regional LNG-markets and shorter distance voyages in the future. The building of small-scale terminals, where pipeline connections have been difficult to implement, supports this development (Hashimoto, 2012). The large geographical price differences prevent this, but many experts expect the price differences to decrease, due to one global market. But difficulties in production, shortages of skilled labor and higher material and engineering cost, in combination with market uncertainty have resulted in delays in several comprehensive LNG-projects.

3.9 Norway's role as a pioneer in the Southeast Asian LNG-market

As of today Norwegian ship owners controls the world's third largest fleet, thus making Norway a major maritime power. The maritime industry involves a large number of activities from shipbuilding, ship design, technical solutions and equipment manufacturing industry (Ministry of Trade and Industry, 2012). The last 50 years, the European dominance of the industry has shifted towards East Asia. In 2009, Japan, South Korea and China had approximately 80 % of the total world orders. The increased competition from Asia has lead focus on specialized high-tech vessels in the western maritime clusters (Amland & Espelid, 2010).

Norway has in recent years experienced an increased use of LNG as a fuel in shipping. Within the maritime cluster a number of companies have been involved in LNG-projects for several years, ranging from ship classification societies, engine manufacturers, ship builders, ship designers and LNG-distributors. Norway is the only country where infrastructure for LNG is widely available and LNG-fueled ships will represent about 15 % of the market in 2020 (Einang, 2009). As the knowledge and expertise about LNG has increased, the skepticism towards gas as fuel has decreased (Løset & Tveten, 2011).

Actions from policy makers can largely affect choice of technological standards (Løset & Tveten, 2011). The development of the LNG-industry has been in a unique position in Norway. Government support and subsidies to R&D, innovation, infrastructure and regulations has resulted in creation of a LNG-market with both retail availability and LNG-propelled ships. Norway could use it unique competence and experience to transfer knowledge about LNG-technology to other markets.

In Chapter 4 we review internationalization literature within emerging markets, entry modes, alliances, profitability and government trade initiatives. The purpose is to establish theoretical propositions, in which we can analyze based on pattern matching of our data analysis. On the basis of this analysis we will suggest how the Norwegian maritime industry can successfully establish export of LNG-technology to the Southeast Asian market. The potential of LNG as a bunker fuel is large across the globe, but it takes careful strategizing to capitalize on the development. Accordingly, this thesis aims to outline a thorough strategy for how Norwegian companies and government agencies can stimulate the development of LNG-propulsion in Southeast Asia, and make profits from selling technology.

4 Literature review

This chapter is a review of literature regarding internationalization processes, entry strategies and performance of international alliances. Our project thesis emphasized strategic maneuvering in battles for technological dominance, and how sponsors of LNG as a bunker should position themselves in order to become the preferred propulsion technology. In the master thesis we extend the problem statement by investigating how the Norwegian maritime sector can succeed in internationalizing LNG-technology to the selected market Southeast Asia. The multinational company (MNC) Rolls-Royce is chosen as case company.

The ASEAN-countries are thoroughly presented in Chapter 2. Southeast Asia is a region consisting of eight emerging economies and two developed countries, with a rapid economic growth and even more increasing energy consumption. We have chosen to focus on the gas producing and consuming countries in the region, Indonesia, Singapore, Malaysia, Vietnam, Thailand, Philippines and Brunei, given our focus on LNG-propulsion. The literature reviewed is targeted towards these specific markets.

4.1 Internationalization theory

International business refers to the performance of trade and investment activities by firms across national borders (Cavusgil, et al., 2008). From a strategy perspective *internationalization theory* explains the process by which a firm acquires and retains one or more value chain activities inside the firm, minimizing the disadvantage of dealing with external partners and allowing for greater control over foreign operations. Numerous researchers and scholars have investigated the subject of firm internationalization. It is a complex process consisting of several phenomenons, which has been studied from multiple disciplines. Within most disciplines rival explanations exist for each phenomenon. In total, this is a much researched topic in which demands a thorough review in order to gain sufficient input to create analytic and useful theoretical propositions.

Due to the author's academic specialization within *Strategy and international Business Development* we will primarily focus on literature from strategic management scholars, although we have reviewed articles from economists and political scientists. Moreover, we have chosen the Southeast Asian gas economies which consist of most emerging economies except from Brunei and Singapore which are advanced economies. Emerging economies are low-income, rapid growth countries having economic liberalization as a key component in economic growth (Hoskisson, et al., 2000). As developed economies throughout the world have reduced pace of growth, densely populated fast-growing markets are becoming increasingly important for further growth of Multinational Corporations (London & Hart, 2004). To enter such markets demand tailored strategies due to a number of reasons. Political instability, lack of regulatory systems and specialized intermediary firms make it harder for Western firms to achieve profits by applying international strategies directed towards other Western economies (Khanna, et al., 2005). Accordingly, we will focus on entry strategies addressed towards emerging economies.

In questions of international expansion firms are motivated to form alliances in order to reduce investment risk, share technology, improve efficiency and strengthen global competitiveness (Tse, et al., 1997). The formation of alliances is a key component of entry strategies in foreign markets. As with other aspects of entry strategy, the choice of alliances have particular dimensions when the host country is an emerging economy. Consequently, we will focus on general theory on alliance and

performance of them, but also specific theory towards choice of alliance partner and entry timing for emerging markets. To complement the review of literature regarding alliances and performance, we have undertaken additional theory on learning effects of organizations, and the potential of government trade promotion programmes. It is our assessment that review of the mentioned strategic management literature will enable us to offer valuable theoretical propositions.

4.2 Strategy that fit emerging markets

In this section we will introduce strategies that fit emerging markets. Until the end of the 1990's, traditional internationalization theory had focused on the entering firm's capabilities and its need for minimizing transaction costs (Meyer, et al., 2009). However, emerging markets have slowly developed legal infrastructure, which is a barrier to effective governance (Hoskisson, et al., 2000). Together with constant economic and political shocks risk and uncertainty increases for foreign investors in emerging economies. These circumstances demands tailored strategies. Strategy formulation and implementation in emerging economies are examined from three theoretical perspectives in the work by Hoskisson et al. (2000) as shown in Table 9.

Table 9: Theoretical streams within strategies that fit emerging markets

	Institutional theory	Transaction Cost Economics (TCE)	Resource-based view (RBV)
Characteristics	Emphasizes the influences of the systems surrounding organizations that shape social and organizational behavior. The aim of institutions in an economy is to reduce uncertain and enhance stability, in order to reduce transaction and information costs.	Consider the costs associated by a firm's interface with other actors through contracts and exchange of services. The rationale governance choice relies on a trade-off between the transaction costs associated, a firm's need of control and costs of governance structure.	Treats the fact that heterogeneous capabilities give firms unique characteristics. In the early 1990s there were established analytical tools to better identify such capabilities (Barney, 1991). Consequently, each firm needs a unique international strategy.
Particular relevance in emerging economies	Firm growth is limited by institutional constraints, and network-based growth strategy is proven more viable in such countries. However, there is a demand for more longitudinal studies.	Institutional voids might lead to extensive transaction costs. Network strategies and hybrid structures are often recommended in emerging markets, but these perspectives are missing in TCE.	Many competitive advantages in emerging markets are relational based on business or government ties. It is harder to acquire such resources in these markets, which require further research.
General implications	The heterogeneity and the slowly developed institutions of emerging economies are crucial for firms to understand in order to gain profits from foreign market entry. Such knowledge can be acquired through working with all the theoretical streams mentioned.		

Hoskisson et al. (2000) suggested that internationalization strategies are affected by the characteristics of the market context in which firms operate. Hoskisson et al. define an emerging economy by two criteria: Rapid economic development, and government policies favoring economic liberalization and the adoption of a free-market system. Indonesia, Malaysia, Philippines, Vietnam and Thailand follow this definition. Singapore and Brunei are advanced economies, but the others are developing economies.

The article by Hoskisson et al. (2000) is very much cited, and the research needs addressed are largely covered during the last decade. More recent work point out that the transnational model of national responsiveness, global efficiency and worldwide learning may be insufficient to succeed in emerging economies (London & Hart, 2004). The same research indicates that success in low-income markets by acknowledge that Western-style strategies are unsuitable for these economies. Profitable investments require relationship building with new partners, customization must be reinvented and local capacity building is crucial.

A combined McKinsey & Harvard study of foreign market entries into emerging markets carried out by the largest MNCs throughout the world show evidence of low profits (Khanna, et al., 2005). Many firms underestimate the cost of absence from specialized intermediaries performing distribution and support services as in the home market, and the increased uncertainty and risk from lack of regulatory system. Despite this, some MNCs have succeeded in emerging markets by identifying such institutional voids as described above, and avoided them. Khanna et al. (2005) have developed a framework for mapping country specific firm challenges that will help firms to enter foreign markets more smoothly. By solely rely on composite indices countries with large differences can appear to be similar. The framework shown in Table 10 aims to map a country's context and enable firms to make appropriate strategic choices.

Table 10: Framework for mapping a country's context based on Khanna et al. (2005)

	Political and social systems	Openness	Product markets	Labor markets	Capital markets
Description	Identification of political system and power centers	Degree of international orientation and transparency	Developing economies are absent of customer data	The access for skilled labor are limited, and hard to identify	The raise of equity and debt can be challenging
Typical questions	What type of governance structure is applied? How effective are regulatory institutions?	Which are the attitudes towards foreign investments? What is the quality of bureaucracy? Family ties?	What is the reliability of customer data? Can consumers obtain neutral market information?	How strong is the educational system? What are the spoken languages? Can people switch work?	How effective are the countries banks? Does venture capital exists?

The purpose of the country context mapping outlined in Table 10 is to help firms capitalize on the strengths of different locations (Khanna, et al., 2005). However, before entering a market a firm must compare the expected benefits with additional coordination costs that will apply. The completion of this analysis will lead to three strategic choices that are further explained in the following paragraphs:

1. **Adapt your strategies**
2. **Change the contexts**
3. **Stay away**

The first strategic choice, *adapt your strategies*, involves modifying your strategy based on the countries context. Companies must keep their core business propositions even though the business model is adapted. An example of a successful company pursuing this strategy is Dell entering China.

With a business model based on customization and internet retail, the sales outlook in China with absent internet infrastructure, were limited. This was solved by offering fewer and completed computer models based on sales through retail shops.

The second strategic choice, *change the context*, relies upon the premise that MNCs are powerful enough to affect the contexts in which they operate. This includes change of regulations, creation of new business and institutions. Suzuki provoked a quality revolution when entering India in 1981. The largest audit companies in the world, the big four, decreased the uncertainty and risk by investing into Brazil after establishing branches there. In itself this triggered foreign investments, which in turn led to increased revenues for Deloitte, Ernst & Young, KPMG and PwC.

The third strategic choice is simply to *stay* away. An example of such is Starbucks who until recently has avoided the large coffee consumers in the Nordic countries, and still only has a few branches. A more frequent example is retail chains that avoid emerging markets such as Home Depot staying out of Mexico. Institutions have an essential role in a market economy to support the functioning of market mechanism, and hence it plays a crucial role in international strategy (Meyer, et al., 2009). As Figure 21 shows, the strength of institutions is strongly correlated to the level of the economy. According to the theory, Singapore has a strong economy and a strong institutional framework, and the opposite with Vietnam, whilst Indonesia has a medium degree of both.

Figure 21: Correlation between institutional framework and economy with country specific examples (Meyer, et al., 2009)

> ***Proposition 1:*** *A critical success factor in the Southeast Asian markets is to identify institutional voids by mapping the country's context, and make strategic choices based on this analysis. LNG-propulsion is an immature technology and a pure market analysis may ignore government initiatives. A MNC can adapt its own business strategy, it can try to change the operational context or it can stay away from the market.*

With the increasingly important effect of institutions as a theoretical foundation it is fruitful to investigate the actual entry strategy. We also know that both transaction costs economics and the resource-based view can be applied in order to assess a firm's strategic choice. In the next chapter we will elaborate on entry strategy with these reviews in mind.

4.3 Entry strategies for emerging markets.

Entry strategies describe the entire formulation and implementation of actions related to expand into new markets (Cavusgil, et al., 2008). This section will deal with a central aspect of such strategies, the choice of entry mode. Moreover, we will discuss which of the theoretical streams presented that are most suitable for the purpose of the thesis. At last, we will introduce formation of alliances, which will be further investigated in Section 4.4.

The appropriate choice of entry mode is investigated in light of different theoretical approaches, transaction cost economics, resource-based view and institutional theory. Institutions of the host economy significantly shape entry strategies (Meyer, et al., 2009). Meyer et al. (2009) also emphasizes the importance of analyzing a firm's resources and capabilities. However, the much applied perspective of transaction cost economics has a micro-analytical level, which is insufficient in accounting all the macro-level factors that is associated by foreign market entry. Hoskisson et al. (2000) requested more research on this matter. Several researchers have covered the need, and results from the study by Meyer et al. (2009), Khanna et al. (2005) and London & Hart (2004) clearly indicates that institutional theory and the resource-based view are most relevant in finding the optimal entry strategy. In Table 11 different entry modes are listed.

Table 11: List of different entry modes (Cavusgil, et al., 2008)

Entry mode	Characteristics
Acquisition	Direct investment into an existing company or facility
Exporting	To produce goods or services in one country, often home country, and to sell and distribute into other country's markets. **Direct exporting** is performed without intermediaries in the particular export market
Franchising	An organizational structure where the focal firm allow another firm to use their entire business model in exchange for a royalty, fees or other compensation
Greenfield Investment	Direct investment to a build a new manufacturing, marketing or administrative facility, as opposed to acquisition of existing facilities
International Joint Venture	A collaborative form where two or more firms across borders create a jointly owned enterprise
Licensing	An organizational arrangement where the focal firm allow another firm to use their property rights in exchange for a royalty, fees or other compensation

Several empirical studies have examined the choice between the various entry modes. However, it is quite recently that global strategic relations for multinational companies were incorporated in analyzing choice of appropriate entry mode (Kim & Hwang, 1992). Their study revealed that considerations regarding global concentration within a market, global synergies by expansion and global strategic motivations play a crucial role in determining the entry mode. Country risk is another significant factor influencing the choice. Another study in this period stated that market diversification largely affected MNCs financial performance (Geringer, et al., 1989). In total, the entry strategy is largely affected by the choice of country to enter.

The increased focus on expansion into emerging economies has brought back the traditional issues from the first internationalization theory, regarding importance of physic distance and entry costs (Buckley & Casson, 1998). Buckley & Casson (1998) have performed an integrated analysis of the different entry modes in order to map which entry mode that is preferred under various conditions. They revealed the following relevant specifically for emerging markets:

- Factors like a high cost of learning about the foreign market through experience, and monopoly market situations, encourages acquisition, licensing and franchising
- Factors like high level of technology with the entrant, and high costs of building trust, greenfield investments are preferred over acquisition
- In general, subcontracting, is not an attractive foreign entry market mode, and is left out of our analysis

- In general, the market context in a country, is crucial to determine whether to acquire or to make a greenfield investment or acquisition

Meyer et al. (2009) builds upon the work carried out by Buckley & Casson (1998) and Hoskisson et al. (2000), among others, and integrate the strength of country's institutions and the need for resources in order to determine the appropriate entry mode. By combining survey and archival data from four different emerging economies, India, Vietnam, South Africa and Egypt, they have created a strong entry mode framework with empirical support as shown in Figure 22. *Local resources required* denote the demand for qualified personnel of different kinds, while *institutional framework* denotes the demand for a strong law system, stable currency and a predictable political regime. Meyer et al. (2009) underlines the importance of mapping institutional voids and identifying resource demands.

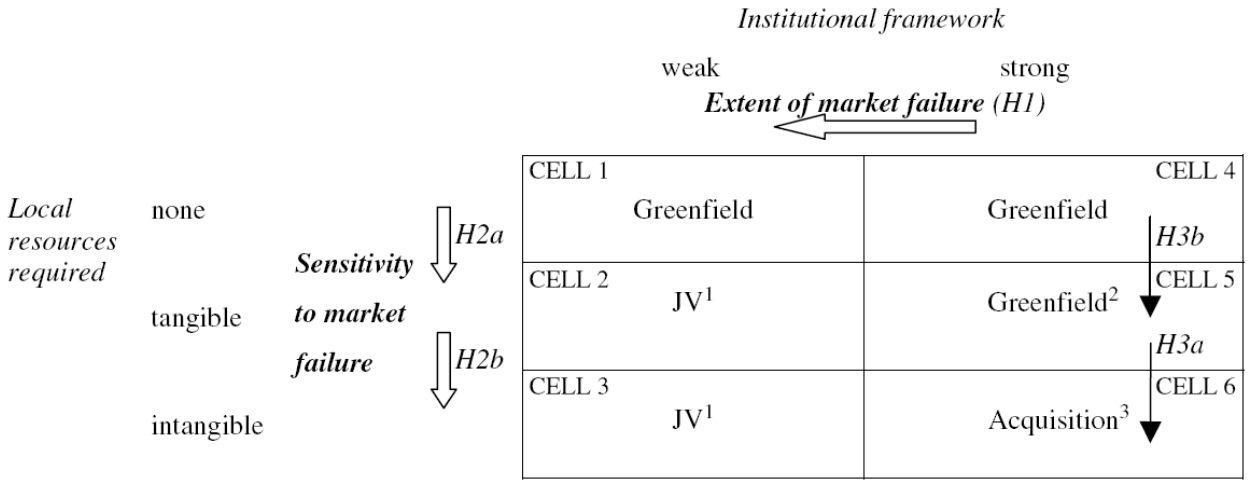


Figure 22: Preferred entry mode under different resource constraints and institutional frameworks (Meyer, et al., 2009)

> ***Proposition 2a:*** *In Southeast Asian markets firms are most likely to select the optimal entry mode by analyzing the country specific context. There is a risk that firms are overemphasizing the analysis of transaction costs associated with the foreign market entry, at the expense of analyzing institutional voids and the required resources needed to manage them.*
>
> ***Proposition 2b****: Based on the theoretical framework by Meyer et al. (2009) and our country risk assessment, appropriate entry modes can be outlined. Companies requiring access to local resources and mature markets can only do acquisitions in Singapore, while joint venture is recommended for all other markets in Southeast Asia. Where local resources are redundant Greenfield entry is recommended in all markets.*

After assessing the preferred entry mode it is useful to investigate how the process of choosing one is carried out. The entry mode must be seen in connection with formation of alliances (Tse, et al., 1997). Tse et al. (1997) incorporated the choice of entry mode with the alliance strategy and outlined a generic model as described in Figure 23. The model shows policies outlined by governments are important to attract foreign investors, and that firms are motivated and encouraged to engage in strategic alliances when entering emerging markets in order to reduce uncertainty and risk. However, the study has some weaknesses. The empirical data builds solely on foreign market entries into China, and there are regional differences in performance of alliances.

Nevertheless, it is useful to perform a further review of formation of alliances and performance of them.

4.4 Formation and performance of alliances

In circumstances where an international joint venture is of interest, an alliance must be created. Regardless of chosen entry mode, most MNCs have some degree of alliance collaboration through joint projects in their portfolio. This section review literature on formation of alliances, with a particular focus on internationalization processes and entry strategies. Moreover, we will link the form of alliance to performance of the chosen organizational form. The aim is to identify preferred strategic alliances.

Firms are motivated to create strategic alliances with other foreign firms to reduce investment risk, to more easily capitalize on fast-growing markets and to facilitate their operations in the chosen market (Tse, et al., 1997). There are basically three choices of whom to form an alliance with:

1. A foreign firm can form alliance with a home country firm
2. An investing firm can gather an alliance with a firm from another country
3. A non-Asian firm can form an alliance with an Asian firm

The model in Figure 23 by Tse et al. (1997) emphasizes the impact from host country factors such as experience with attracting foreign investor, home country factors such as cultural dimensions and industry specific factors such as scale of operations, in performing this choice. It claims that most MNCs will engage with a non-Chinese business partner, but form an alliance with a home country company, another international partner or an Asian based, most probably from Hong Kong.

The model is designed for Chinese investments, but the findings can be applicable for other countries in the Southeast Asian region. As we are focusing on the ASEAN countries, Singapore can be seen as a parallel to Hong Kong with economic freedom and strong institutional frameworks. However, in cases where the host country specifically wants to attract foreign investors, a less equity based approach with a local partner is preferred. The choice of alliance partner follows the same pattern as with the entry mode, the specific investment case before determining the formation.

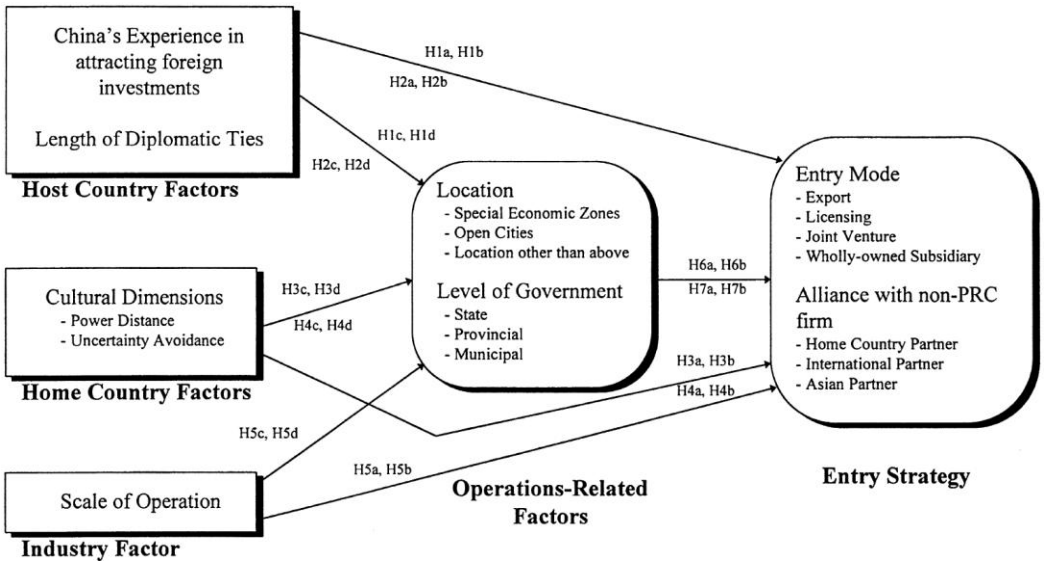


Figure 23: Factors shaping the choice of entry mode and alliances in China based on empirical evidence (Tse, et al., 1997)

Proposition 3a: *In China, the choice of collaborative design of an alliance relies on the specific investment case, with variables such as level of government, scale of operation, cultural dimensions and the host country's experience with foreign investments. The model is applicable for the Southeast Asian region.*

Although alliances are relevant on many levels in internationalization processes, it is useful to assess the performance of MNCs compared to international network alliances and markets regarding cross-border knowledge building (Almeida, et al., 2002). MNCs play a central role in transferring technology and other knowledge between countries. This fact supports the article by Khanna et al. (2005) who referred to the fact that large enterprises actually can change the context in which they operate. Consequently, an analysis of the most effective way of building knowledge is useful. By using data from the semiconductor industry, Almeida et al. (2002) have investigated knowledge transfer between USA, Japan, Taiwan and Israel. This pattern can be viable for the Norway, Singapore and other ASEAN countries. They conclude that MNCs are superior to network alliances and markets in transferring knowledge. Although network alliances can be a good substitute, the transfer is often slow, uncertain and superficial. However, network alliances are proven more efficient than markets. Accordingly, managers of international network alliances and MNCs should be concerned with designing organizations and culture capable of sharing knowledge.

International expansion is resource demanding. Several researchers have therefore investigated the correlation between degree of internationalization (DOI) and financial performance. Organizational learning is closely related to the internationalization process of MNCs, which in turn affect profits (Ruigrok & Wagner, 2003). This argument is widely acknowledged, but the exact relation between DOI and return on assets (ROA) is much debated. The first studies indicated a linear relationship between a linear relation between DOI and ROA (Johanson & Vahlne, 1977). During the 1990s the risk of failure was incorporated into studies of this particular relation, and several researchers indicated that costs exceeded benefits at high degrees of internationalization following an inverted J-curve (Geringer, et al., 1989). More recent study has revealed more complex cost-benefits trade-offs. Ruigrok & Wagner (2003) found that MNCs through an organizational learning process characterized by internal adaption allows superior firm performance at high levels of DOIs as shown in Figure 24. Findings across all studies of DOI and ROA indicate that firms should pay close attention to organizational learning in planning internationalization to achieve satisfying financial performance.

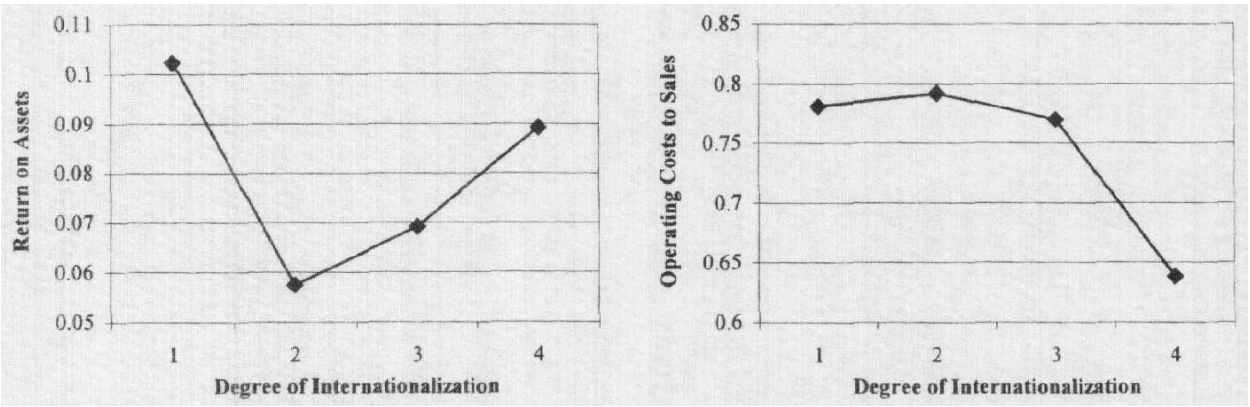


Figure 24: Correlation between degree of internationalization (DOI) and financial performance (Ruigrok & Wagner, 2003)

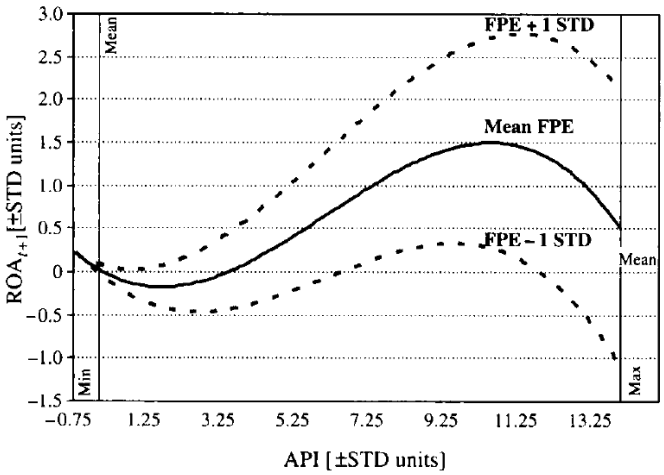


Figure 25: Correlation between alliance portfolio internationalization (API) and financial performance (Lavie & Miller, 2008)

Organizational learning in the process of internationalization can be achieved in multiple ways. A popular method is to collaborate with a local partner in some kind of organizational arrangement. If a MNC chose to collaborate, it is useful to see if the degree of internationalization with the partner affects financial performance (Lavie & Miller, 2008). Lavie & Miller (2008) have measured the correlation between alliance portfolio internationalization (API) and financial performance. Their empirical study of this relation indicates that financial performance follows an inverted U-curve correlated with API. As Figure 25 shows, this means that the relation between API and financial performance carried out by Lavie & Miller (2008) is the opposite of DOI and financial performance proved by Ruigrok & Wagner (2003). However, the joint recommendation is to pay close attention to organizational learning, and be aware of challenges related to national differences and collaboration.

It will be useful to investigate how knowledge sharing can be optimal managed given the uncertainty of its relation to ROA. Johanson & Vahlne (1977) presented one of the first widely acknowledged models of internationalization describing process as incremental and linear. In a more recent study the authors stated that it has lost its validity as new and improved models have arisen (Johanson & Vahlne, 2003). In the same study, they use modern research to present a new model describing the internationalization process. Johanson & Valne (2003) highlights experimental learning as a critical issue to succeed by international expansion. This is the same conclusion given by Ruigrok & Wagner (2003) and Lavie & Miller (2008), but as those models leave confusion regarding when a MNC can expect great financial performance, the network model by Johanson & Vahlne (2003) can enrich our understanding of knowledge management.

> ***Proposition 3b:*** *There is disagreement in the literature on which degree of internationalization that gives the highest return on assets. A weakness of the research is a missing link to timing of market entry. There is however agreement upon the positive effect between the ability to share knowledge with business partners and profitability.*

In Johanson and Vahlne's (2003) improved model they reconsider the importance of physic distance and chosen entry mode, and increase the significance of trust and relations. Lack of knowledge about operations in foreign markets is the main barrier to internationalization, and this knowledge can mainly be achieved through experience from those particular markets. By being present and

operate in a specific country you learn how intermediaries, customers, policy makers and competitors cope with different situations. Unique experience from foreign operations is accordingly a core competence in which can be a competitive advantage for a firm (Barney, 1991). There are three types of business network learning.

1. Through customer-supplier relationships knowledge of culture and coordination
2. By interacting in a relationship two firms learn skills that can be transferred to other relations
3. Through a business relationship you learn to manage coordination across a business network

All barriers related to internationalization are connected with the establishment and development of business relationships, and is regardless of borders (Johanson & Vahlne, 2003). To some extent, this might be a plausible statement, but it can be challenged by the entry mode literature. If a country lacks a financial system and property rights to protect investments, it is hard to overcome the associated risk and uncertainty by relationships without facing corruption. In such cases, formal agreements must be made to protect the investment of the focal firm. However, it might be useful to investigate the roles of relations in alliances.

The effects of relational-based versus contractual-based governance structure on overall market performance reveal helpful knowledge (Lee & Cavusgil, 2006). Lee & Cavusgil (2006) have measured the effect of governance structure on performance in terms of sales, ROA, profits and partnerships satisfaction. They have also seen how environmental turbulence influences these variables. The conclusions are significant. Relational-based governance as opposed to governance-based yields greater market performance and the difference enhances during periods of environmental turbulence. Trust is a more effective instrument to achieve strength, stability and knowledge sharing in an alliance and the benefits are listed in Table 12.

Table 12: Benefits of trust in relational-based governance

Benefits of trust in relation-based governance in contrast to governance-based governance
• Mutual trust reduce transactions- and negotiations costs • Overemphasizing contracts easily implies conflicts regarding interpreting them • Trust is a foundation for learning and knowledge sharing between business partners • I times of environmental turbulence, dependence on contracts alone is risky

A general limitation of the literature investigating the link between strategic alliances and performance of them is the restricted focus on emerging markets. A much cited study suggests that firms in developed markets use selection of local partners in emerging markets to acquire lack of market knowledge (Hitt, et al., 2000). The suggestions by Hitt et al. (2000) are nevertheless criticized by London & Hart (2004). London & Hart (2004) states that emerging economies demands reinvention of traditional strategy, whilst Hitt el al. (2000) focuses on how strategic alliances can cover the gap between the two business environments in anticipation of a more Western-style economic pattern to be developed. It is our consideration that the criticism from London & Hart is relevant, but the formation of alliances is nevertheless required. Consequently, it will be useful to investigate the process of partner selection in emerging markets.

Proposition 3c: *Business networks and alliances will give the highest return on investment if they are managed by relational-based governance involving trust, instead of focus on contractual factors. Asian business culture emphasizes long-term relations more than the European culture.*

Internationalization requires significance efforts from a MNC. Entering an emerging market carries particular attention to strategy, alliances and organizational learning. An alliance is required, informal or formal, and consequently the organization must focus on experimental knowledge building. The correlation between degree of internationalization, alliance portfolio internationalization and return on assets is much debated, but the significant importance of knowledge sharing, relationships development and building of trust is unquestioned.

Analysis of correlation between return on assets and DOI and API miss a link to market entry timing. Timing and speed of entry is an extremely important strategic decision, a success criterion. Consequently, in the next section we will assess the importance of market entry timing.

4.5 Timing of market entry

Technology for LNG as a marine fuel is not an established market in Singapore, unlike the situation in Norway. However, several competitors in the marine supplier industry, amongst them Rolls-Royce, strongly believe such a market will arise. This section deals with the important strategic decision of market entry timing. Market entry should be timed to balance the risk of premature entry against the missed opportunity of late entry (Lilien & Yoon, 1990).

Lilien & Yoon (1990) was one of the first researchers to investigate entry timing empirically. They found that the decision of entry time was both a strategic, qualitative decision and a tactical, quantitative decision. Empirical evidence indicated that a potential new product pioneer should spend time building expertise in R&D, production, engineering and marketing before entering the market. These investments yield returns that offset the expenditures. An early follower must hasten its new product entry. To capture rapid market growth tends to be more profitable than additional R&D. The same logic applies for late followers. Lillien & Yoon (1990) also found evidence for when pioneering is beneficial over being an early follower. When the expected returns are high, pioneering offset the reduced risk of being an early follower.

Proposition 4: *The timing of market entry is significantly related to the return on assets. Early market entry is preferred when the expected returns offset the risk associated, and laggard entrant strategy is applicable when the expected returns are uncertain. Timing is more important for return on assets than degree of internationalization and alliance portfolio internationalization.*

Emerging economies are important for growth of Western MNCs. At the same time, the uncertainty in these markets is greater. This creates two critical issues: Should a firm be an early mover into new, unexplored markets or await competitors move, and should a firm launch pioneer technology in emerging markets or invest into more traditional technology? A survey of 220 Japanese JVs targeting the Chinese market shows increased financial performance of both early entry and high technological commitment (Isobe, et al., 2000). The rationales for these results are interesting. First, the higher importance the firm considered an entry into China, the higher was the degree of technology transfer and early move. Consequently, success in emerging markets may depend on the

firm's commitment. Second, the degree of a foreign firm's control over a JV was inversely to the degree of early entrants. Accordingly, even though dominance in a JV seems logical in a risk perspective, the firm might fail to benefit from the local firms market knowledge.

Despite extensive research on the topic, the empirical evidence for correlation between early market entry and financial performance are debated (Gaba, et al., 2002). Gaba et al. (2002) created a framework to explain the timing of entry based on a number of factors:

- Firm-specific factors: DOI, firm size and product scope
- Industry/market factors: Competitor behavior, product market growth
- Host country factor: Risk conditions involving institutional framework

Based on an extensive study of entry data from U.S. Fortune 500 firms entering China in a 20-years period, Gaba et al. (2002) have established an explanatory framework for entry timing as showed in Table 13.

Table 13: Explanatory framework of entry timing

Explanatory framework of entry timing					
Firm-specific factors		**Industry/market factors**		**Host country factor**	
DOI	High DOI increase probability of early entry	Competitor behavior	Early entry by competitors force firms to enter	Risk conditions such as institutional framework	Favorable risk conditions, involving a strong institutional framework such as a legal system and financial market, accelerate market entry
Firm size	Large firm size increase probability of early entry	Product market growth	High market growth does not initiate early entry. It is more likely that expected market growth is initiating factor.		
Product scope	Large product scope increase probability of early entry				

The strategic decision of market entry timing is very important, and there is correlation between entry timing and financial performance. Research also reveals which factors that increase the likelihood of early entrants. I n the next section we will focus more on how partners are selected, and what a MNC should emphasize in choosing partners.

4.6 Partner selection

Given the crucial importance of alliances, the process of selecting a partner becomes equally important. This section presents literature dealing with the subject of partner selection, with a particular focus on emerging markets. Firstly general research on the topic is presented, before specific determinants relevant for emerging markets are presented.

The preferred partner in an IJV can influence the composition of available skills, resources, operational experience, and consequently the viability of the alliance. Due to this fact, it is crucial to understand the partner selection process and the variables affecting it (Geiringer, 1991). An IJV-partner should complement a firm's task-related capabilities. More precisely, this means a focal firm must decide on which task-related skills and capabilities it needs from its partner, and rank the

relative importance of them. This process may help a firm to fill its capability gaps when entering a new market. Moreover, research reveals that the use of external sources in analyzing and identifying required resources and skills are beneficial in the process of choosing capabilities. By using strategic frameworks or expert panels, the probability of identifying the critical success factors increases. The study by Geiringer (1991) was the first of its kind, and still has validity. For our purpose, it is however necessary to look at studies which focuses on selecting partners in emerging markets specifically.

Hitt et al. (2000) developed a framework to identify differences in partner selection between emerging markets and developed economies. They state the purpose of a strategic alliance to establish and maintain a long-term collaborative relationship in order to compete more effectively than firms outside the alliance. Joint ventures are the most popular entry mode used by MNCs in emerging markets. But as many alliances dissolute, the decision of entering an alliance and select partners is a critical one. Hitt et al. (2000) have compared the differences in partner selection criterions from emerging to developed markets, and the findings are presented in Table 14.

Table 14: Differences and similarities in partner selection between emerging and developed markets

Partner selection criterions in emerging and developed market contexts		
Similarities in both markets contexts	**Differences between the market contexts**	
	Emerging market firms	**Developed market firms**
• Firms in both markets equally emphasize managerial capabilities as a criterion • Firms in both markets equally emphasize complementary capabilities as a criterion	• More strongly emphasize financial assets • More strongly emphasize technical capabilities • More strongly emphasize intangible assets	• More strongly emphasize local market knowledge and market access • More strongly emphasize the possession of unique competencies

Table 14 shows that there are differences how criterions are weighed. Emerging market firms more strongly emphasize financial and intangible assets, and technical capabilities. Weak institutional framework is a characteristic of emerging economies, and a demand for such assets is not surprising. Likewise, developed market firms request local market knowledge and access. MNCs may lack necessary relations in a particular market, and seek a partner that may give them access. However, as discussed, emerging economies demands reinvention of traditional strategy and an alliance alone is not sufficient to overcome the gap between the business environments (London & Hart, 2004).

> ***Proposition 5****: A MNC must take differences in partner selection criterions between emerging and developed market contexts into account when choosing alliances abroad. Where emerging market firms demand financial, technical and intangible assets, developed market firms demand local market knowledge and unique competencies.*

The work by Hitt et al. (2000) complements the work by Geiringer (1991). A MNC should not only rank the significance of different task-related capabilities among potential partners. A MNC must also take into account what the potential partner requests back. And what a partner may request varies across market contexts. To target new partners are a complicated task, and in the next section we will investigate how governmental trade promotion may help MNCs to enter a new market.

4.7 Political barriers and trade promotion

Internationalization and the choice of entry mode is not solely a business decision. Political barriers are often present and limit the potential of expansion in a specific country or region. On the other hand, most governments in developed countries have trade promotion initiatives where they by different means help firms to enter new markets. This section discusses political barriers and the effect of government trade promotion.

Countries tend to protect industries that are weak, on a decline and political important (Lee & Swagel, 1997). This pattern is outlined by a research project using data from trade flows, production and trade barriers for 41 countries, including several ASEAN-countries such as Thailand, Indonesia, Philippines, Singapore and Malaysia. Accordingly, political barriers are very relevant to our countries of study. A ranking of trade protection shows that Singapore has a very high degree of free trade, whilst the other ASEAN-countries have a medium degree of trade protection. However, the research by Lee & Swagel (1997) does not link the degree of protection to countries and industries, but to the structure of non-trade barriers across the particular countries and industries. Consequently, as countries participate in bilateral trade agreements, the free trade increases.

Industries that are political important and at the same time on a decline tends to be most protected. Food products and beverages are most protected, explained by the political importance of food self-supply (Lee & Swagel, 1997). Electric machinery, transport equipment and other manufacturers are less protected. This can be explained by their significant importance in economic growth and industrial development. Often it will be more important to access innovative technology than protecting existing industry.

> ***Proposition 6a**: Countries tend to protect industries that are weak, on a decline and political important. Gathered data indicates that the LNG-market is strong and growing, but political important. Consequently, the LNG-market will not be protected, but still affected by government politics.*

Trade promotion initiatives aim to help host country firms to internationalize. However, many of the initiatives follow the outdated incremental step model of internationalization by Johansson & Vahlne (1997). This leads to outdated trade promotion activities by governments (Crick & Jones, 2000). Many high-technology firms are international from the start-up, and the purpose of internationalization might as well be expansion and growth as export in itself. Consequently, government trade agencies should consider employing specialists on international business in addition to export advisors. Crick & Jones (2000) have made a model outlined in Figure 26 showing how government trade support is only factor affecting the internationalization pattern and process, and take more motivation factors for internationalization into account than the old incremental models.

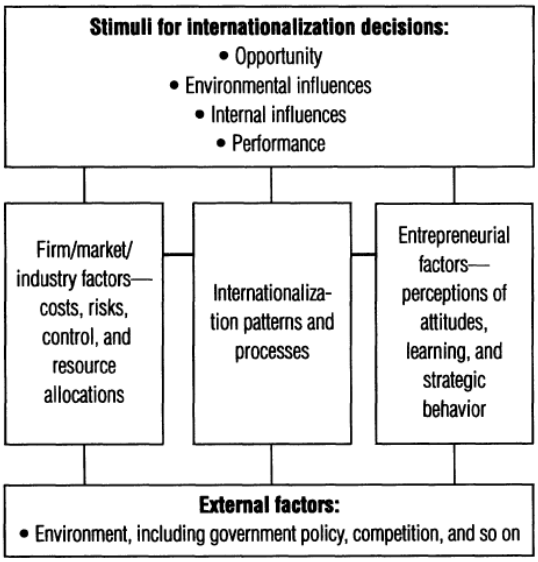


Figure 26: A modern internationalization model showing the limited effect of government policy and trade promotion initiatives

***Proposition 6b**: Norwegian government trade promotion programs in Southeast Asia rely on outdated models of internationalization. A MNC in the region will benefit from international business development specialists more than the available national export advisors.*

Political barriers and trade promotion initiatives are important aspects to consider for a MNC. Institutional voids can be avoided with help from government specialists. They might have experience from doing business in a foreign market where the firm wants to enter, or they might have useful relations that can be exploited. Government policy must be incorporated into a successful internationalization strategy.

In the next section, which is the last in this chapter, we will assess the literature review and the relevance for our research question. In Chapter 5, we will summarize the theoretical propositions, which will function as our analytical starting point when discussing the gathered data.

4.8 Strengths and weaknesses of reviewed literature

How the Norwegian maritime sector can succeed in internationalizing LNG-technology to the Southeast Asian region is a complicated research question. However, a review of the strategic management literature has been useful in creating an analytical framework. This section assesses the strengths and weaknesses of the review, by using on relevance of the readings, maturity of the research and methodology among the research presented.

The starting point of our review has been general strategic management internationalization theory. Due to our export related research question, the selected topics to review have been strategy formulation, entry mode, alliance performance, partner selection, government trade promotion and entry timing. In reviewing these topics we have emphasized internationalization theory with a particular focus on studies of MNCs situated in advanced economies entering emerging economies, especially in Asia. Enormous amounts of research exist within the field of internationalization, and we have only reviewed a niche. Nevertheless, in total, we consider the reviewed to be highly relevant given our research question.

To ensure generalizing of theoretical propositions we have reviewed several research articles within each topic. Rival explanations strengthen a research field. Based on comparison of research we aspired to outline theoretical propositions that build on commonalities across multiple studies, even though they might have diverging findings. However, in some cases we have introduced propositions which builds on the most acknowledged research, and which might diverge existing theory. A general challenge by the literature is the use of small and geographical limited samples in empirical research. Several published research findings are associated with a high degree of uncertainty, and several theories are rejected throughout the latest decades. Falsification of theory is an important part of research dynamics, but there are still a lot of debatable issues regarding internationalization of firms.

As a final consideration of our literature review we have looked into the research methods applied in the articles, and presented them in Table 15. No research method is superior to another, which means absence of specific methods will lead to a poorer theory development within a research field (Wacker, 1998).

Table 15: Overview of the main applied research method in articles reviewed

Overview of the main applied research method in articles reviewed		
Research method	**Articles**	**Total number**
Statistical analysis of survey or empirical data	(Almeida, et al., 2002), (Buckley & Casson, 1998), (Crick & Jones, 2000), (Gaba, et al., 2002) (Geiringer, 1991) (Geringer, et al., 1989) (Hitt, et al., 2000) (Isobe, et al., 2000) (Kim & Hwang, 1992) (Lavie & Miller, 2008), (Lee & Cavusgil, 2006), (Lee & Swagel, 1997), (Lilien & Yoon, 1990), (Meyer, et al., 2009), (Ruigrok & Wagner, 2003), (Tse, et al., 1997)	16
Case study	(Barney, 1991),(Johanson & Vahlne, 1977), (Johanson & Vahlne, 2003), (Khanna, et al., 2005), (London & Hart, 2004)	5
Archival analysis	(Hoskisson, et al., 2000)	1

Table 15 clearly indicates that statistical analysis is a preferred method in theory development. It is interesting however, that three of the four most cited articles in our literature review, (Hoskisson, et al., 2000), (Khanna, et al., 2005) and (London & Hart, 2004) are either a case study or an archival analysis. As the study by Wacker (1998) states no research method is superior. Consequently, the predominance of empirical studies in our literature review is a weakness in developing the theoretical propositions. However, our sample reflects the research methods in the research field in general, which implies that the composition of articles in our review is similar to other researchers within this field.

In total, we consider our literature review to serve as a good foundation for analysis. In the next chapter we will summarize and categorize the theoretical propositions. Our gathered data will be analyzed based on the propositions we have identified, and either be confirmed or rejected. This analytical tool is important when we will present findings and implications of our research.

5 Theoretical propositions

This chapter aims to summarize and categorize theoretical propositions presented throughout Chapter 4. Based on the literature review we have outlined a total of 10 propositions. They all serve as an analytical tool when gathered data are analyzed, but they different properties. Therefore we have chosen to categorize the propositions into which analytical level they belong. Some propositions concern the firm specifically, while others regard alliances or macro-levels such as government-related issues or country-specific issues. Table 16 presents our categorization.

Table 16: Categorization of theoretical propositions

Theoretical propositions			
Firm-specific	**Alliance related**	**Market related**	**Country specific**
Proposition 1: *A critical success factor in the Southeast Asian markets is to identify institutional voids by mapping the country's context, and make strategic choices based on this analysis. LNG-propulsion is an immature technology and a pure market analysis may ignore government initiatives. A MNC can adapt its own business strategy, it can try to change the operational context or it can stay away from the market.* ***Proposition 2a:*** *In Southeast Asian markets firms are most likely to select the optimal entry mode by analyzing the country specific context. There is a risk that firms are overemphasizing the analysis of transaction costs associated with the foreign market entry, at the expense of analyzing institutional voids and the required resources needed to manage them.* ***Proposition 2b:*** *Based on the theoretical framework by Meyer et al. (2009) and our country risk assessment, appropriate entry modes can be outlined. Companies requiring access to local resources and mature markets can only do acquisitions in Singapore, while joint venture is recommended for all other markets in Southeast Asia. Where local resources are redundant Greenfield entry is recommended in all markets.*	***Proposition 3a:*** *In China, the choice of collaborative design of an alliance relies on the specific investment case, with variables such as level of government, scale of operation, cultural dimensions and the host country's experience with foreign investments. The model is applicable for the Southeast Asian region.* ***Proposition 3b:*** *There is disagreement in the literature on which degree of internationalization that gives the highest return on assets. A weakness of the research is a missing link to timing of market entry. There is however agreement upon the positive effect between the ability to share knowledge with business partners and profitability.* ***Proposition 3c:*** *Business networks and alliances will give the highest return on investment if they are managed by relational-based governance involving trust, instead of focus on contractual factors. Asian business culture emphasizes long-term relations more than the European culture.*	***Proposition 4:*** *The timing of market entry is significantly related to the return on assets. Early market entry is preferred when the expected returns offset the risk associated, and laggard entrant strategy is applicable when the expected returns are uncertain. Timing is more important for return on assets than degree of internationalization and alliance portfolio internationalization.* ***Proposition 5****: A MNC must take differences in partner selection criterions between emerging and developed market contexts into account when choosing alliances abroad. Where emerging market firms demand financial, technical and intangible assets, developed market firms demand local market knowledge and unique competencies*	***Proposition 6a****: Countries tend to protect industries that are weak, on a decline and political important. Gathered data indicates that the LNG-market is strong and growing, but political important. Consequently, the LNG-market will not be protected, but still affected by government politics.* ***Proposition 6b****: Norwegian government trade promotion programs in Southeast Asia rely on outdated models of internationalization. A MNC in the region will benefit from international business development specialists more than the available national export advisors.*

Each proposition has its unique characteristics. Accordingly, different interview data has been applied. Our case company Rolls-Royce Marine also has a deviating role in the pattern matching of the various propositions. By interviewing several companies, additional features such as the effect of government trade initiatives are tested. In total, we get a reliable and valid analysis subject to replication from other researchers. In Table 17 we have summarized how each proposition will be approached.

Table 17: Analytical approach to each theoretical proposition

Proposition	Specific analytical strategy
1	This is a proposition that aims to identify which countries firms exporting LNG-technology should target, and by which strategy. Accordingly, we use data from all interviewees and does not focus particularly on Rolls-Royce
2a	Proposition 2a aims to sort out if Norwegian MNCs are overemphasizing transaction costs on behalf of institutional voids. Rolls-Royce Marine is thoroughly assessed in this proposition.
2b	This proposition tests if a framework for choosing entry mode is applicable for Southeast Asian countries. Data from Rolls-Royce is used to test the validity.
3a	Proposition 3a tests the validity of a model suggest collaborative agreement in alliances from China. Data from several interviewees are used to test the claim.
3b	Proposition 3b seeks to test the causality of an empirical link between return on assets and internationalization data. All export companies from Norway are used to assess the claim.
3c	This proposition tests the claim of which alliance governance structure that is the best. Data from several interviewees are applied to ensure replication.
4	Proposition 4 investigate the link between timing and profits. Data from Rolls-Royce Marine is used in a large scale as a qualitative approach.
5	Data from all interviewees are used to assess how partner selection processes should be carried out
6a	Macro data from Singaporean interviewees and an analyst are used to investigate the political importance of LNG and propulsion specifically
6b	Data from Norwegian companies established in Singapore and Innovation Norway are used to investigate how government trade initiatives can be most efficient

We have theoretical propositions within both micro-level and macro-level perspectives. This strengthens the probability of outlining an internationalizing strategy that takes the most important considerations into account. By analyzing these propositions with gathered data, we are able to offer a comprehensive strategy that is likely to be successful. In the next chapter we present our methodology, with research design, strengths and weaknesses. The methodology chapter is important to enable the reader to evaluate and control our research.

6 Methodology

Our master thesis has the purpose of suggesting an internationalization strategy for exporting LNG-propulsion technology to the Southeast Asian market by doing an in-depth study of Rolls-Royce Marine. This chapter describes our research method, and how we have worked towards presenting a proposed strategy for how and where the Norwegian maritime sector can succeed in the given market.

The research question of the thesis is "*How can the Norwegian maritime sector succeed in internationalizing LNG-technology in South-East Asia"?* By analyzing this research question we have selected an appropriate research method. It is a *how*-question that indicates three relevant research methods: Experiment, historical study and case study (Yin, 2009). The research question do not requires control of behavioral events, but it focuses on a contemporary phenomenon within its real life context. Accordingly, a case study approach appears to be the most beneficial research method. The chosen case study method strengthens our thesis as it relies on multiple sources of evidence which increase the construct validity.

6.1 Research design

Yin (2009) refers to a definition of research design as *a plan that guides the investigator in the process of collecting, analyzing, and interpreting observations*. *It is a logical model of proof that allows the researcher to draw inferences concerning causal relations among the variables under investigation.* A more simple way of describing research design is as *a logical plan for getting from here to there*. This section describes key decisions in how we built our research design.

A key distinction in designing case studies is the choice between single- or multiple-case designs (Yin, 2009). Both designs have its advantages and limitations, but we chose a single-case design of Rolls-Royce Marine. There are practical and theoretical reasons why we made this choice. A practical matter was a significant interest from Rolls-Royce Marine to collaborate and contribute into our diploma thesis. From a theoretical perspective, Rolls-Royce Marine as a single case has several advantages:

- Rolls-Royce Marine represents a critical case as the company is a multinational company with extensive international experience, enabling us to match data from the firm towards theoretical propositions
- Rolls-Royce Marine has a unique relevance to our research question as they are headquartered in Norway combined with an extensive focus on marketing of LNG-propulsion towards Southeast Asia
- Conversely, regarding the focus on general internationalization theory, Rolls-Royce Marine can be viewed as a typical case representing MNCs

An advantage of multiple-case design would be replication to predict similar results across the cases. We have met this issue by interviewing several experts on respectively LNG and internationalization towards the Southeast Asian market. In the analysis of propositions, an industry perspective is first undertaken before the case specific focus on Rolls-Royce is presented where it is relevant.

A strongly related case design decision is the chosen units of analysis, where one can chose to focus on single-unit or embedded units of analysis (Yin, 2009). Our research question implies two units of

analysis. We have a focus on internationalization processes from a strategic management perspective, but we have a particular on export of LNG-propulsion technology. Consequently, our units of analysis are *internationalization processes* and a product specific focus on *export of LNG-propulsion*.

To logic link the data to the propositions and interpret findings we have an analytic strategy and technique (Yin, 2009). Our analytic strategy is to rely on theoretical propositions. This is the first and most preferred strategy in case design. We have built our interview guide on the outlined theoretical propositions, and this strategy is adequate to answer the research question. As an analytic technique we are doing pattern matching. By testing the theoretical propositions with collected interview data, we assess their validity. In total, our research design is built as described in Table 18.

Table 18: Research design

Exploratory research design		
Time	**Case study component addressed**	**Research actions**
Start ↓ End	- Research question	- Attending workshop with Innovation Norway on the topic - Establishing boundaries of study
	- Propositions	Literature review: - Theoretical background, both academic and industry relevant - Literature discussion: Developing theoretical propositions Data collection: - Building on project thesis (Løset & Tveten, 2011) - 11 expert interviews of Asians and Norwegians
	- Units of analysis	Embedded single case study of Rolls-Royce Marine: - The internationalization process of the firm - Product specific study of LNG-propulsion and associated technology
	- The logic linking the data to the propositions - Criteria for interpreting the findings	- Analytic strategy: Relying on theoretical propositions - Analytic techniques in discussion of findings: o Pattern matching of data collection to the outlined theoretical propositions o Identify characteristics from cases
	Results from research:	Conclusions: Key findings and implications for managers, literature and future research

6.2 Data collection

One of the advantages of the case study method is that it relies upon multiple sources of evidence. This section examines the thesis' data collection. We have exploited this opportunity and collected data from a number of sources:

- Academic articles and books
- Industry reports and project thesis
- Industry workshop
- Interviews
- News articles and other secondary data

To classify and more thoroughly assess the data collection it can be divided into two groups. Firstly we collected data to establish theoretical propositions, the *Academic and industry specific literature*. Secondly we performed several expert interviews with LNG-experts, international business specialists in Southeast Asia, mainly in Singapore, and in Norway.

Academic and industry specific literature

After establishing the research question and the units of analysis, a thorough literature review was carried out. Three major data types have been assessed. Firstly a *country risk assessment* where presented based on key economic and geographical data collected from reliable sources. Secondly industry reports where analyzed. Thirdly a major literature list where reviewed in order to establish the theoretical propositions.

A central part of the assessment of industry reports included a review of our project report "*The future potential of LNG"* (Løset & Tveten, 2011). Major parts of Chapter 3 are reproduced from the project thesis since we already last autumn gathered a comprehensive material on the natural gas market and the bunker fuel market including LNG. Accordingly, it was natural to reproduce parts of the material and update some of the models we established in the project thesis, in this master thesis.

The academic literature of international business and internationalization processes is almost endless, as many researchers within several special fields study it. We have searched for relevant literature in the library database at the website of NTNU and at Google Scholar. The process of selecting articles is described in Table 19.

Table 19: Structure of literature search

Process	Content
Search strings	Internationalization process, entry mode, emerging markets, timing of entry, international alliance, performance of alliances and trade promotion programmes
Sorting criteria	• Number of citations • Relevance to the strategic management research field with a particular focus on multinational companies • Relevance to the targeted markets in Southeast Asia, where the majority is emerging market • Relevance to the maritime industry
Number of academic articles gathered	35
Number of academic articles cited in thesis	21

The combination of literature, academic, industry relevant and our project thesis, constitutes a strong literature review as a foundation for analyzing the research question. In-depth industry analysis and a thorough literature review enable us to establish well-founded theoretical propositions which serve as our analytical tool. The literature review and the theoretical propositions are also the basis for developing the applied interview guide (Appendix 1), whereas the expert interviews are more described in the next section.

Expert interviews

To analyze the theoretical propositions in order to answer the research question, several expert interviews were carried out. Firstly we had an interview with the case company Rolls-Royce Marine in Bergen, Norway. The remaining interviews were carried out in Singapore on a field trip in the period from 19th of March to 28th of March. Selected interviewees were chosen based on experience relevant to our research question. The interviews have an open-ended structure with only a few general questions on each topic. The purpose with this structure is to avoid leading question and get trustworthy answers (Yin, 2009). A generic interview guide was developed based on the theoretical propositions (Appendix 1). However, we made small adjustments to each interviewee based on the

interviewee's special competence. The complete list as outlined in Table 20 of interviewees complements each other and covers the research question sufficiently.

Table 20: List of interviewees

Industry	Company	Expertise
Maritime equipment industry	Rolls-Royce Marine Norway, Rolls-Royce Marine Singapore	Internationalization, LNG-propulsion
Ship owner	Masterbulk Ltd, Tian San Shipping, Höegh LNG, PSA Marine, North Sea Container Lines	The maritime industry, selection of ship equipment, Southeast Asia, international business
Trade advisor	Innovation Norway	International business, LNG-propulsion, exporting from Norway to Southeast Asia
Oil service	Aibel	Internationalization
Finance	DNB Bank	LNG-market, shipping market
Classification and consulting	DNV	LNG-propulsion, internationalization

In total, our data collection represents a unique and comprehensive source of information relevant to our research question. It is more than sufficient to answer the research question and analyzing the theoretical propositions. In order to evaluate the methodology, we will assess four different criteria for judging the quality of research designs.

Figure 27: The thesis' authors in the field conducting interviews at PSA Marine, Singapore

6.3 Evaluation of methodology

A case study is a complex research method requiring a good research method to provide new knowledge. Whatever research method is applied, trustworthiness and credibility are important to ensure quality of the study (Yin, 2009). Yin (2009) presents four criteria upon the quality of a case study can be assessed and judged: Construct validity, internal validity, external validity and

reliability. The different criteria are associated with different research phases and have different belonging tactics. In this section, an assessment of the criterions is carried out.

Construct validity

Construct validity has to do with identifying suitable operational measures for the concepts being studied (Yin, 2009). This is a particular challenge in case studies and critics claim data is subjective collected. To meet this challenge this thesis contains multiple sources of evidence. Our most important source of information is interview data, and hence the interviewees are both Norwegian and Singaporean from several industries and with different perspectives. All interviewees are on a higher management level including several CEOs, whereas all have confirmed the citations. In total, the interview data as presented in the thesis gives an honest picture of the LNG-industry in Southeast Asia. As a last tactic, we maintained a chain of evidence linking the case study questions to the case study report in order to enhance construct validity.

Internal validity

To achieve internal validity it is important to establish causal relationships, *whereby given conditions lead to other conditions* (Yin, 2009). This has particular importance in the phase of data analysis. To test theoretical propositions this thesis has the tactic of pattern matching. Collected data from interviews and other sources of evidence are matched towards the intended outcome outlined in theoretical propositions. Further, the propositions are either confirmed, rejected or more research is requested on the topic to ensure internal validity. In our chapter concerning implications, the result of the pattern matching of theoretical propositions lead to recommendations for respectively managers, policy makers and future research based on the nature of the analysis.

External validity

External validity is to which degree the thesis' findings can be generalized (Yin, 2009). This is a giant challenge in case studies the findings are analytical instead of statistical. In single case studies, such as this of Rolls-Royce Marine, the use of theory is important to ensure generalization. It is the same theory helping us to develop theoretical propositions that can help us to generalize. If the findings in the case study are strongly deviating existing theory, and the results cannot be explained by the theory's suggested limitations, the study should be replicated. We have examples where the theory and the collected data are incoherent, and in such cases we recommend further research to reveal the missing link. In other cases where we confirm existing theory, general recommendations are deducted. In this thesis, theoretical propositions are developed on behalf of several theoretical studies within each topic. Although strategic management literature is the main focus, the literature review is strengthened by elements from economics and political science. A thorough theoretical study alongside with extensive data collective enables this study to generalize findings in a larger sense.

Reliability

If the operations of a study, in this case primarily the data collection procedures, can be repeated with the same result, the reliability is high (Yin, 2009). The most important step to undertake in order to increase reliability is to document all procedures undertaken in the study. To increase reliability, we have thoroughly described our methodology and research design, and we have documented the dates in which interviews are conducted. Moreover, we have a comprehensive case study protocol with all notes, drafts, time schedules, meeting logs and academic articles are

collected. The case study protocol is available on a case study database, which we have duplicated. It is stored on a hard drive, as well as online at Dropbox. In total, we consider the case study database to ensure reliability as other researchers can repeat our procedures to validate the presented results.

6.4 Summary and key learning

Researchers will probably study internationalization processes in all times. LNG-propulsion is an immature technology and the LNG-industry is growing, implying an increased focus in the next few years. Therefore, for the sake of thesis' authors as well as further research on the topic, self-examination of the research design is necessary to improve future studies of the issues addressed.

The strengths of this study are a comprehensive literature review, many interviewees in the relevant markets and a methodological correct data analysis. The literature review contains several rival explanations of internationalization phenomenons enabling us to not only offering solid theoretical propositions; we are also enabled to recommend areas of further research. The interview list has given us input from the entire LNG-propulsion value chain, and we have spoken to actors in both Norway and Singapore, which is very useful in an internationalization thesis. Not least, the data analysis allows to correctly addressing the theoretical propositions with the collected sources of information.

Nevertheless, the thesis has its weaknesses. The study is conducted in a limited time span, which has made it impossible to repeat the research method on a different time. Moreover, it would be interesting to consider a multiple case design to follow more Norwegian enterprises within the LNG-industry that is targeting the Southeast Asian market. It would also be interesting to have more quantitative numbers to justify foreign market entries with technological immature products. The immatureness of the LNG-propulsion market forces us to use similar industries and products as references, which is a challenge when the research design is developed.

Another weakness is the lack of interview data from firms headquartered in emerging markets. We have only visited Singapore, which is the only developed economy in the region. By travelling to another sample country, we could have enriched our data collection significantly. We strongly recommend future researchers on this topic to visit emerging markets.

In total, we can justify our chosen method. The internationalization literature is often based on quantitative data sets without any additional case studies. Accordingly, a case study design can complement existing literature rather than limit it. In the next chapter, we present our expert interviewees and their opinions.

7 Expert interviews

In order to establish an overall understanding of the industry and its market dynamics, the authors have completed a series of 11 expert interviews. Ten were conducted during a field trip to Singapore. The last extensive, interview with the case company, Rolls-Royce Marine, were conducted in Bergen, Norway, before the field trip. The purpose is to map the current situation for LNG-technology and the business environment in Southeast Asia. The published content will be an important source of evidence for further discussion and analysis.

Table 21: Classification of interviewees

Interviewees	Presence	Industry	Experience with LNG
Rolls-Royce Marine Norway	Global	Engine manufacture	High degree
Rolls-Royce Marine Singapore	Singapore	Engine manufacture	Medium degree
Innovation Norway	Global	Government trade advisor	Medium degree
DNV	Global	Classification and consulting	High degree
Höegh LNG	Norway, Singapore	Ship owner	High degree
Masterbulk Ltd	Singapore	Ship owner	Medium degree
North Sea Container Lines	Norway	Ship owner	High degree
Aibel	Norway, Singapore	Oil service	Little degree
DNB Bank	Global	Finance	Medium degree
PSA Marine	Global	Ship owner	Little degree
Tian San Shipping	Singapore	Ship owner	Little degree

The interviews have an open-ended structure with only a few general questions on each topic. The purpose with this structure is to avoid leading question and get trustworthy answers (Yin, 2009). A generic interview guide was developed based on the theoretical propositions (See Appendix 1). Moreover, all the interviewees work on a higher management level, and have given written approval for their answers.

The interviewed firms have different special competences and are established in several industries. However, they all have experience relevant to our research question; either internationalization processes or experience with LNG technology. For our analysis a broad perspective was important. Not all the interviewees had experience with LNG, but still their opinions about LNG were important to study. Some ship owners provided us with important information about local factors that are essential for them when considering new technology, while other interviewees gave an account for support schemes and data about the most relevant factors for Norwegian firms when establishing business in Southeast Asia.

The interviewees were able to provide us with updated information about the industry status and the current business environment for the region. We have included quite extensive parts of the interviews in this chapter to provide the reader with sufficient background and insight. In Chapter 8, data from the interviews are analyzed and compared to the theoretical propositions as a step to answer the research question.

7.1 Rolls-Royce Marine, Norway

Name:	Petter Stensaker
Position:	General Manager, System Sales & Marketing Campaigns
Company:	Rolls-Royce Marine AS
Industry:	Ship designing and supplier of ship systems, and provider of engines

Rolls-Royce divides their projections of the future outlook for LNG-technology in Southeast-Asia into a short-term view and a long-term view. In a short-term perspective you must invest time and resources to access the market. In a long-term view Southeast Asia will be one of the most important maritime markets on the globe. Rapid economic growth, central geographical location and their role as trading spot make this a key market.

The strategic considerations to enter a new market may vary depending on whom you ask. In general however, new market entries rely upon a market opportunity, preferably identified before the potential is executed. It is important to work in parallel with new markets and competing in existing ones. Moreover, a reliable political framework is important for Rolls-Royce. And specifically for LNG as a marine fuel, the government must be willing to invest into new bunkering infrastructure.

The first ship segment for Rolls-Royce to target in Singapore is tug boats. LNG-propulsion are suitable for such vessels and it will be economic viable with only a three years payback time. In turn, all types of short sea shipping vessels can install such machinery; cargo ships, passenger ferries and cruise ships. The reason why Rolls-Royce have invested heavily into marketing and sales of LNG-solutions in Singapore is the LNG import terminal on Jurong Island and an initiative from the Maritime Port Authority (MPA) giving financial support to set off green shipping and environmental friendly technology. It can be compared to the Norwegian NO_X-fund, although in a smaller scale. Singapore is probably the only country in the region that has such an arrangement. Moreover, Singapore has an ambition to become an LNG-hub, and in total this made it clear that Rolls-Royce wanted a campaign towards this market with their green technology.

Rolls-Royce has a mix of investments in new markets. Within the Marine Division, acquisitions have been the main strategy, but Rolls-Royce is also participating in several international joint ventures. The level of knowledge in the labor market where Rolls-Royce invests is not the most important due to amount of knowledge the company possess, but quality of the products and among partners are vital.

Rolls-Royce use alliances actively, and enters into industry alliances that can be profitable to them. Within the LNG-segment alliances are especially important. Due to the lack of a complete value chain offering distribution of LNG as a marine fuel, it is important for Rolls-Royce to be a part of alliances which contribute to complete the LNG value chain. As an example Rolls-Royce work together with SLNG to duplicate the systems available for bunkering in Norway. Moreover, they recently signed a memorandum of understanding with Liquiline, which offers collaboration on marketing and relations. Liquiline's system is also complementary to Rolls-Royce technology.

Rolls-Royce also attends less resource-demanding alliances such as *Joint Industry Projects* (JIP). Such collaborative arrangements are committing, but they are cost efficient and at the same time they push technology development.

Figure 28: Interview with Petter Stensaker, General Manager, System Sales & Marketing Campaigns

Rolls-Royce collaborative partners are chosen based on market conditions and complementing capabilities. As an example Rolls-Royce recently acquired MTU together with Daimler. MTU offers high-speed engines, which Rolls-Royce did not produce. This acquisition was a strategic decision to extend Rolls-Royce own product range. In general, acquisitions are controlled from the headquarters in Aalesund and administrated on a higher executive level. Mr. Stensaker emphasizes that alliances are especially necessary to succeed in Southeast Asia.

When Rolls-Royce is making investments in new markets the potential for revenues are the most important. Nevertheless, infrastructure and the possibility to run the business after international standards are of great importance. The mapping of institutional frameworks and market conditions in new markets are also performed on a higher executive level in the firm. The significance of a stable political regime is almost crucial. Rolls-Royce has high ethical standards regarding policies and institutions. These can never be challenged for the sake of profits.

The absence of corruption in Singapore makes it an easy market to target. Moreover, infrastructure and well-runned intermediaries are beneficial. To Rolls-Royce, logistics is a core business function. Punctual deliveries are important to Rolls-Royce customers, and frequent strikes or other instabilities can impede reliability.

Rolls-Royce relies on high-skilled labor that speaks English. It is not that important with local workers due to the amount of knowledge in the firm. In Singapore, the CEO is an Englishman, but in Vietnam and Japan they are local.

Norwegian authorities can provide Rolls-Royce with useful contributions to their international operations. Eksportfinans is an example where companies can get help with financial needs. An

independent research institution such as MARINTEK is very important in product presentations. Moreover, Innovation Norway, DNV and MARINTEK are useful door openers in new markets where Rolls-Royce does not have the same relations established.

In Norway the development of a LNG-propelled fleet has been driven by political measures. Singapore on the other hand, is not an ECA and they will probably not impose NO_X-tax. The driver of LNG as a marine bunker fuel in Singapore and Southeast-Asia is simply commercial interests. LNG is available in large quanta and is applied in industry and households. An additional bunkering infrastructure and distribution will strengthen Singapore's position as a LNG-hub and bring along profits. The Port of Singapore will probably offer reduces port fees to environmental friendly ships rather than impose taxes. Other ASEAN-countries view Singapore as a pioneer, as they got both capital and technology.

> "If you are going to succeed in Southeast Asia, you must succeed in Singapore" – Petter Stensaker, Rolls-Royce Marine

As mentioned, Rolls-Royce attends two JIPs in Singapore. MPA has taken the initiative to one technical and one commercial. The technical JIP, *Assessment on LNG-bunkering in Singapore*, is led by DNV. A total of 20 stakeholders, both industry actors and authorities are represented. Rolls-Royce was asked to participate, and contribute by personnel and knowledge. The JIP maps the risk associated with LNG-bunkering, and consists of a quality group, a steering group and a working committee where much of the work is carried out. The commercial JIP focuses on implementation of technical features concerning LNG as a marine fuel.

To operate in emerging markets, which constitutes a major part of the Southeast-Asian region involves specific challenges. Cultural differences can be large, and must be managed. For Rolls-Royce it is also important to emphasize and implement a global perspective in all their new offices. This can be challenge in markets that is emerging, and has limited international trade experience.

7.2 Rolls-Royce Marine, Singapore

Name:	Jay Chia
Position:	Customer Relationship Manager
Company:	Rolls Royce Marine AS
Industry:	Design and supplier of ship systems, and provider of engines

Mr. Chia highlights that today; the price of LNG is significant higher in Southeast Asia than in Europe and USA offering only a 10 % reduction compared to oil. In short-term this could kill the business case of LNG because the payback time will be longer and the investment more risky. The government needs to take initiatives towards green shipping, and MPA is giving up to 2 million SGD per project, which is a start. But still this is only a fraction of the investment. Gas engines are the only solution to meet IMO's Tier 3 requirements, without using scrubbers or gas treatment systems. Consequently, Rolls-Royce delivers lean burn gas engines that will be compatible in terms of price with smoke scrubbers and SCR. Nevertheless, Mr. Chia states that Singapore will probably not be an ECA in the next 10 year, due to the importance for Singapore to stay competitive on price levels in a global industry.

Rolls-Royce has LNG-engines for almost all types of vessels. In Singapore they focus on smaller segment such as tugs, which serves as a good starting point for LNG bunkering in Singapore. Container liners need available LNG also outside Singapore to be viable. In about three years' time, Rolls-Royce predicts a commercial market for LNG in the region. The main barriers against such a market is the uncertainty regarding LNG as a fuel; procedures for bunkering and refueling, available infrastructure and general knowledge about LNG.

Mr. Chia points out Norway as a frontrunner of LNG-technology proving that the solution is viable. Knowledge and expertise from Norway has to be spread to Southeast Asia. Norwegian companies need to demonstrate that LNG is safe and could be applicable in this region. An independent information campaign and an information brochure could be helpful in communicating the safety aspects to the market and end-users.

Rolls-Royce is a part in multiple JIPs, and contributes with human capital. The company gets enormous value from the cooperation, in terms of business relations, responsiveness on market trends and knowledge sharing. Rolls-Royce is also in the position to influence decision makers directly.

In Asia, ship owner's main concern is price. Rolls Royce's brand is known for good quality, reliability and customer service, but LNG-engines will require a greater investment cost. They also target the aftermarket to increase competitive advantage. Rolls-Royce's main competitor in the LNG-segment is the engine manufacturer Wärtsila. But the two companies focus on different solutions for LNG-engines. Wärtsila offers dual fuel that is able to run on diesel and LNG, while Rolls-Royce has four-stroke lean burn engines. With different acquisitions Rolls-Royce has built up and extended their product portfolio. Rolls-Royce acquires companies that have complementary products with a good reputation and high quality.

Opportunities for LNG-technology outside Singapore are huge. Countries look into LNG as price of fossil fuel continue to increase, and not to mention that the World's supply of gas is far more than oil. The economic growth for the ASEAN region allows this development to happen fast. When Rolls-Royce considers investments in new countries, they first assess the market potential. A sufficient market is essential for a market entry. Rolls-Royce also focuses on the barriers to entry, like a stable political and legal system. Especially corruption is widespread in the region; furthermore this prevents investment and development.

Rolls-Royce believes Indonesia probably will be the next country to adapt to LNG-technology. Indonesia has the biggest market potential in the region. With Singapore as a reference point in technological development, LNG as a marine fuel must be proven viable there first before Indonesia adapts.

Figure 29: Interview with Jay Chia, Customer Relationship Manger in Singapore

7.3 Innovation Norway

Name:	Egil Rensvik and Una Skram
Position:	Special advisors, South- & Southeast Asia
Company:	Innovation Norway
Industry:	Government

Innovation Norway has a strong position in Southeast Asia, with offices in Malaysia, Thailand, Singapore and Vietnam. Their main activity is to help Norwegian companies by establishing business in the region. With local knowledge, presence and long experience from Southeast Asia, many Norwegian companies have used Innovation Norway for special advising and relationship management with local partners.

Currently, approximately 200 Norwegian companies are established in Singapore. Innovation Norway has worked closely with the shipping sector and observes increased activity by oil and gas companies in the region. Regarding LNG as a marine fuel, they have recently done some initial studies, arranged workshops and conferences on the topic. About 20-25 Norwegian companies have been involved in these projects. In June 2012, Innovation Norway will establish a new office in Jakarta in Indonesia. A promising gas and LNG market in the country is one of the reasons for this, with a potential establishment of many Norwegian companies.

Innovation Norway expects the market of LNG in Southeast Asia to be large. The energy consumption in the region has increased drastically and the area is in a desperate need for energy, especially Indonesia, The Philippines and Vietnam. LNG is also an environmental friendly and economically viable energy source compared to other fossil fuels such as coal and oil. Indonesia, a country with huge gas reserves consisting of many small islands with limited gas pipeline infrastructure, particular in the east, will be suitable for LNG. There are planned some small-scale LNG projects in Indonesia, and two re-gasification terminals are under construction. This will increase the development and the domestic consumption of the country's huge gas reserves. In Indonesia, foreign investors cannot have the largest share post; however silent partnership can solve this. Some Norwegian companies have already established business in the country.

As a marine fuel, Innovation Norway sees the biggest potential for LNG in short sea shipping. Smaller vessels are most promising, like ferries, RoPax and medium container ships. With the new import terminal for LNG on Jurong Island, Singapore has the potential to distribute LNG in small-scale from 2013. Still some standards and regulations are missing, but a JIP led by the classification company DNV are working with this topic. Another barrier towards implementation is still the common chicken and egg problem: Who is willing to take the first step? In Southeast Asia the knowledge about gas is very limited, and people are in general afraid to use gas. The JIPs are very important to increase the understanding and to share experiences from Norway with the Southeast Asian market.

The region, Southeast Asia, is at the moment not a potential ECA, and consequently the financial upside in choosing LNG will probably be more important in Asia than in Europe. The financial considerations are hard to predict, as the LNG-price is higher in the Southeast Asian region compared to prices in USA and Europe. But the difference in costs between oil and gas in favor of LNG will reduce OPEX and initiate LNG as a marine fuel. With huge gas reserves in the region, gas will be available and extensively used when the infrastructure is established.

International strategy: To succeed in Southeast Asia it is vital to be established in the region. Norwegian companies operating from Norway are generally not responsive enough and do not show enough commitment to win contracts. This is enhanced by factors as different time zones, long geographical distance and language barriers. In general, personal relationships, meetings and to use enough time on partners, are more important than in Europe. If the LNG-market booms, the Norwegian companies must be established in the region with strong relationships built on trust to be preferred by local partners.

Figure 30: Interview with Innovation Norway at the Royal Norwegian Embassy, Singapore. From the left: Una Skram and Egil Rensvik

In particular, Singapore is a strategic important hub; with good infrastructure, skilled employees, a stable political regime and suitable legal system.

There are no particular requirements to the number of local employees, but unique for Singapore is an *Economic Development Board* that in some cases gives support to companies with special R&D-projects or local employees. For instance, DNV got support with the establishment of the *Clean Technology Center* with its Singaporean location and Singaporean recruitment.

A strategy to get cheap and skilled labor is to select local partners or agents; however they need to be evaluated carefully. It is both time consuming and requires a lot of resources, but it is extremely important to find a company matching your business. A typical problem is lack of product knowledge, as agents representing too many companies or having interest conflicts among clients, which can be a costly affair. Innovation Norway can help Norwegian companies with this screening to find relevant and suitable partners. Even more risk is involved with merger and acquisitions, but acquisitions could be a solution to enter a market fast or to get complementary products into the product line.

The huge network of Norwegian companies operating from Singapore bring along many synergies. The tax regime between Singapore and Norway is very beneficial for the companies. And the stable and predictable business environment in Singapore is hard to find elsewhere. For the maritime cluster in Norway it is useful that the engineering capacity in the region is skilled and available.

Each year, 10-12 Norwegian companies establish in Singapore. Already, in March 2012, 6-7 companies have internationalized to the region. The most common mistake associated with doing business in Southeast Asia is to not establish presence in the region. Several comprehensive meetings are often necessary as well as long-term relations and trust are emphasized much higher in the Asia business culture compared to the European. To be considered serious, presence in the region is vital. Specifically, Mr. Rensvik is very optimistic to the future potential for LNG and the economic development in the region: **“You must establish before the market booms”.**

7.4 DNV

Name:	Geir Fuglerud
Position:	Head of Solutions
Company:	DNV Clean Technology Center Singapore
Industry:	Classification and consulting

Det Norske Veritas (DNV) is an independent foundation and classification society, serving industries across the globe. They are working with classification, verification, certification and advisory in multiple industries including maritime, energy, aviation, automotive and information technology. DNV is positioning and investing huge sums to ensure safe and reliable LNG value chains. It is a global firm with 300 offices in more than 100 countries and 10.000 employees. In Southeast Asian their offices are located in Singapore, Malaysia, Indonesia, Vietnam and Thailand.

Singapore has a position as one of the busiest ports in the world, and approximately 20 % of all the global bunkering is conducted in Singapore. DNV has therefore been present in Singapore for 40 years, and considers Singapore to be a strategic and important hub for the region. DNV has currently 400 employees located in the country, in which about 20 of them are Norwegian.

DNV has taken a strong and proactive position in the emerging LNG-market in Southeast Asia. They consider the potential for LNG in the region to be huge. Indonesia has increased their energy consumption dramatically the last decade and need additional energy supply. They have huge gas reserves, while their oil resources are limited. Coal is not well suited for distributed power production in small-scale, since it require significant investments. The underdeveloped infrastructure in East-Indonesia with lack of gas pipelines and roads makes small-scale LNG a suitable choice. Regarding Singapore, DNV underlines the need of energy security, and with the new import terminal on Jurong Island, LNG will probably play a vital role in their future energy mix. Eventually, Singapore will be the LNG-hub for the region, and because of increased demand the terminal has been upgraded already before its opening.

The most important factor for the development of the LNG-market in Southeast Asia is economic considerations. The price of LNG is uncertain and currently more expensive in Asia than in Europe and USA. Shale gas is a game changer, with a lot of extra gas in USA that could affect the LNG-price and result in a spot market if it is exported. Anyhow, the LNG-price is significantly lower than the oil price, and DNV predict that oil will be traded to a premium of gas also in the future. As more LNG is coming to the market when Australia becomes a major LNG-exporter and Brunei's long-term contracts to Japan expire, the LNG-price will stay low.

DNV expects that when the market for LNG as a marine fuel becomes established; the development will be very rapid. Mr. Fuglerud believes many conservative ship owners in Asia will be surprised by the market change. They are currently not prepared for the introduction of LNG as a marine fuel. A key factor to capitalize on the change in the fuel mix will be to get a strong market position, be proactive and forward-looking, like many of the Norwegian maritime enterprises currently are doing.

In Singapore, DNV predicts that LNG-propulsion are most interesting for ships operating on fixed routes with large tanks like VLCCs, bulk, feeder and container ships. OSVs probably need more flexibility. They are often operating on relatively short time contracts in areas with very limited infrastructure. DNV works closely with yards, governments and ship owners in different Joint Industry Projects to develop the marine fuel market for LNG. DNV is experiencing increased interest for LNG trough the JIPs, where they have identified different barriers to solve. Standards and procedures need to be aligned, and investment into infrastructure is required. Exhaust scrubbers are the only real alternative to LNG in the ECAs, because a fuel switch to MDO/MGO will be too expensive for ship owners that operate a considerable amount of their time in ECAs. DNV do not think Singapore will be an ECA, but global environmental regulation will definitely also influence Southeast Asia in the long run.

Figure 31: The authors and Geir Fuglerud in front of DNV Clean Technology Center Singapore

Many Norwegian companies have experience, knowledge and operational skills from different parts of the LNG value chain. Innovation Norway can help these Norwegian enterprises with export and establishment in the region. Since commercial aspects are prevalent, tax agreements are also efficient tools. But for the foreseeable future DNV thinks a NO_X-found not will be applicable in this region.

As stated, many countries in the region will probably apply LNG in shipping in the future. When DNV consider the different countries, they first assess the market potential, than the business environment. Specifically, they look into how the labor market and the political stability work in the country. Indonesia has the largest market potential in the region, but extensive use of red tape and corruption is a major problem. Vietnam has a lot of shipping and shipyards, but business is time consuming and demanding which is a barrier to development of LNG as marine fuel. Singapore does not have any own resources, but is anyhow a natural hub for the region.

DNV strongly believe LNG will be an important marine fuel in Southeast Asia. However, the driver will not be environmental regulations as in Europe. Profit is the reason to change to LNG as bunker fuel. Mr. Fuglerud finish: **“Ship owners better be prepared, because the development is happening now.”**

7.5 Höegh LNG Asia Pte Ltd

Name:	Ragnar Wisløff and Thomas Fiskaa
Position:	Managing Director and Business Development Manager FPSO
Company:	Höegh LNG Asia Pte Ltd
Industry:	Ship owner

Höegh LNG is a pioneer in LNG transportation with almost 40 years of experience. Ten years ago, the company decided to enter other business areas within the LNG value chain and launched downstream offshore receiving terminals. Later, an upstream production unit for LNG was also developed. Today Höegh LNG is a fully integrated ship-owning company offering long-term floating production, transportation, re-gasification and terminal solutions for LNG. Their unique technology is produced with parts from the entire globe, but is developed in Norway. The businesses areas have high entry costs and hence high entry barriers for competitors. The main office for Asia is in Singapore with 12 employees, whereas three of them are Norwegian.

The last decade, Höegh LNG served the Asian market from Oslo, Norway. When the market opportunities within upstream and downstream LNG-production became very promising, they decided to establish in Singapore. To serve the market properly and to be considered serious, you have to be present in the region. Today Singapore is a hub for the entire LNG-industry and Höegh LNG runs all their market activities for Asia east of Suez from the country. Customers, lawyers and financial services can all be found in Singapore, and it is easy to bring along families. Höegh LNG's project in Indonesia will also be engineered from the Singapore office, while the technology is developed and composed in Norway.

In Southeast Asia diesel and other oil based fuels are mainly used as fuel for power plants. These are both polluting and costly compared to LNG. Among the decision makers in Southeast Asia, it is primarily the financial gains that are important, and not the environment. Large power plants can be converted to run on natural gas offering a 15 % price discount on fuel, better energy efficiency and a total saving of hundreds of millions of dollars each year.

Regarding LNG as a marine bunker fuel, Mr. Wisløff is more skeptical. They are sure small-scale LNG will arise, but are not sure about the time perspective. The building of receiving and export terminals in the region will create more spot trading, which will have a favorable effect on the LNG market. Anyhow, the main barrier towards bunkering of LNG on ships is infrastructure. Someone must take the huge investment cost. Mr. Wisløff does not believe any companies will invest alone, but a government is more likely. Moreover, they point at the need of several bunkering stations around the world to make it more plausible for ship owners, alongside with safety standards and a price discount. To succeed with LNG as a marine bunker fuel you need a complete value chain with distribution.

Concerning the driver of LNG as a marine bunker fuel, Mr. Fiskaa underlines that commercial feasibility is the only possibility for growth. In Norway ECAs and the NO_X-fund have been additional drivers, but similar services is less likely in Southeast Asia. Höegh LNG's carriers have used boil off LNG for fuel in 30 years with no serious problems and low maintenance costs. Mr. Fiskaa does not

understand the skepticism concerning the safety aspect with LNG, and refer to an excellent track record.

Höegh LNG recent new builds have installed Wärtsila's Dual Fuel engines. Duel fuel offers better energy efficiency which offsets the higher CAPEX, but the crew requires more training. Consequently, the staff on LNG-carriers is among the most expensive in the shipping industry.

International strategy

Höegh LNG claims it was an absolute necessity to establish in Singapore to succeed in Southeast Asia. Personal relations are much more important according to Mr. Wisløff. Decision processes take more time in this market, and the culture must be learned by living here, not by travelling to the region by airplane from Europe. If a firm commutes round trips to Singapore from Norway they are not considered as a serious market player. Höegh LNG emphasizes that one must be able to held physical meetings in only a few hours' notice. They underline that e-mail is not sufficient as meetings are most effective in an office, and consequently presence in Singapore is required.

A challenge for Norwegian companies by establishing in Singapore is to get qualified personnel from Norway that is willing to move. Besides that, there are very few obstacles Mr. Wisløff reports. Singapore is the easiest country in the world to establish within. In other countries in the region, communication is a greater problem than language.

Figure 32 Höegh will deliver the first FPSO for the east cost of Sumatra, Indonesia

There are some synergies across countries in the Southeast Asian region, but each country is quite unique. They are proud and concerned with culture. Presence in the region is probably the most important synergy. Vietnamese people can travel to Singapore, but not to Norway.

Höegh LNG can report that it is not harder to do business in the Southeast Asian region. Corruption and political involvement is a challenge in Southeast Asia, but on the other hand, business cases are

executed as planned. USA and England can be harder in that manner. Höegh LNG has no formal alliances, but they have important relations to local partners. Local partners can be very useful in accessing new markets.

In Southeast Asia, Höegh LNG says that the Norwegian government's international activities are very important. Höegh LNG has undertaken beneficial help from the Norwegian Royal Embassy, Innovation Norway and INTSOK. Officials can be helpful in establishing relations and meetings on a high-level, political and business wise. In short, the diplomacy is more important in Southeast-Asia than in Western markets.

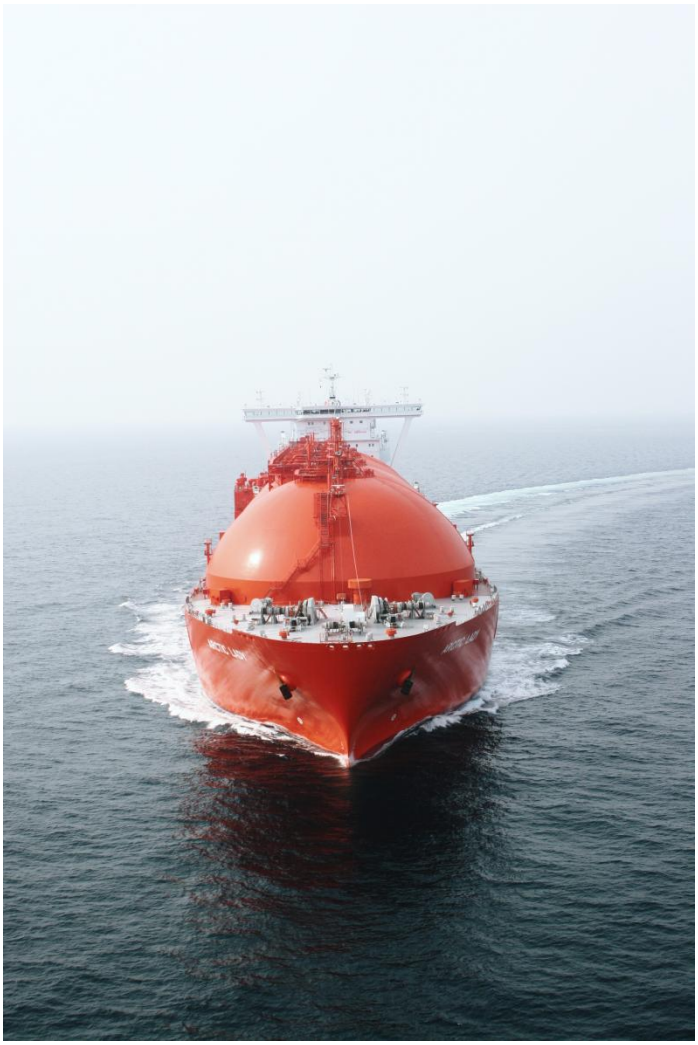


Figure 33: Artic Lady is one of Höeghs major LNG carriers

7.6 Masterbulk

Name:	Rune Sten
Position:	CEO of Masterbulk
Company:	Masterbulk
Industry:	Ship owner

Masterbulk was established as a ship owning company in Singapore 1995 as a spin-off from Westfal-Larsen based in Bergen. The company has an office in Shanghai, and extensive in-house crew training on The Philippines. Masterbulk has a crew retention rate on 95 %. The fleet consists of 23 Open Hatch Gantry Crane vessel, and operates in the dry bulk segment, freighting much cellulous worldwide.

Figure 34: Interview with Rune Steen, CEO of Masterbulk

Masterbulk has been looking into LNG as a propulsion fuel. DNV and Oshima Shipbuilding have made an assessment of the Open Hatch segment running on LNG, and they concluded it is an appropriate technology for Masterbulk's fleet. The Open Hatch segment consists of high standard ships with a life expectancy on 30 years. Mr.Steen describes a segment with high entry barriers, where entrants invest in new builds due to absence of second-hand sales, and new build programmes could be up to ten ships. These conditions make ship owners open towards new technology, in contrast to typical asset players. Mr. Steen can tell that Masterbulk will probably not be the first to contract LNG-propulsion. Short sea shipping such as ferries or supply ships in Norway are more suitable, but Masterbulk is positive towards the technology and will consider LNG in the future.

In discussion on barriers towards implementation of LNG as a marine fuel, Mr. Steen directs the attention towards bunkering infrastructure, standards for operating with LNG, CAPEX and expensive staff. Bunkering facilities must be established in the region. Masterbulk is doing heavy triangulation between the spot market and given routes to minimize ballast voyages without cargo, and the destinations can therefore vary. Due to this fact, bunkering availability is very important. Moreover, necessary standards for the bunkering procedure are crucial to ensure safety.

Other barriers are cost-related. LNG-carriers have the most expensive crew due to extensive training. Also, the CAPEX could increase by around 20 %. On the positive side, LNG-price is presently lower than oil. Mr. Steen underlines the need for the LNG-price to develop from the situation today where three price regimes co-exist. Both the shale gas revolution, huge gas reserves in Australia and Indonesia, and environmental considerations may affect the price in a positive direction. Masterbulk strongly believes LNG will be a preferred solution as a marine bunker fuel over time, and when the market first is established, the development will go fast.

Regarding what will be the driver of LNG as a marine fuel, Mr. Steen highlights profitability as the single most important factor. Governments can work towards SECAs and ECAs with lower sulphur emissions, but it is unlikely that Singapore will become an ECA in a short-term perspective. However, Singapore is a technological frontrunner, and if LNG turns out to be profitable because lower OPEX offset the increased CAPEX, the development will go fast. LNG will come, and a paradigm shift will arise, states Mr. Steen.

In Masterbulk's case, the fleet has an average age of 13 years, which is quite young given the high life expectancy. They have no new builds today, and no planned, due to the difficult market conditions. But new builds will be contracted in the future, and LNG is an alternative if bunkering facilities are established, and some pioneers such as in Norway have showed that it is possible.

International strategy

Mr. Steen describes why Singapore is a good place to do business. They have a beneficial tax system, and a lucrative geographic position within shipping. Masterbulk is present in Singapore, but it is not only large companies that will benefit from establishing in Singapore. In Asia, Singapore is considered as the preferred country to establish within, given their stable law system, large and well-functioning shipping industry. Moreover, international schools are available which makes it easier to carry family along. On the other hand, Singapore is expensive.

The CEO of Masterbulk points at a good business culture in Singapore. There is virtually no corruption, and you are very central located with the possibility of to fly everywhere easily. Hong Kong and Shanghai are very Chinese focused, but in Singapore you have more varied cultures and works as a hub for the entire Asian region.

Success in the Southeast Asian region relies upon the recognition of some distinct features. Asian business culture is more long-term, and relations must be established to make deals. In that respect, local presence is crucial. There are many formal network events, and recurring meetings are important to develop trust and business relations.

As a Norwegian linked company, Masterbulk points out that Innovation Norway can be door openers for new entrants in Singapore. New entrants often use Norwegian actors to internationalize, especially within the maritime industry. It is important to be on a ship owner's makers list, which are the specifications for ship equipment. Ship owners, yards and designers often want experienced suppliers to ensure availability of service and spare parts in the future. As a small company, relations are crucial to open doors into makers list, since trust is a central decision variable in choosing equipment.

Before making a foreign market entry, a potential market must be present. Also, political stability is important according to Mr. Steen. That is an advantage in Singapore, where the law system is reliable. In other countries, contractual disagreements can be very challenging for international ventures.

7.7 North Sea Container Line AS

Name:	Tom Preststulen
Position:	Chairman
Company:	North Sea Container Line AS
Industry:	Ship owner

North Sea Container Line AS (NCL) is a Norwegian operator with seven self-loading/-discharging container feeders. Quality, punctuality and service are the company's philosophy, as they serve clients primarily to and from the Norwegian West coast. NCL is now considering changing from gas oil to liquefied natural gas for their future North Sea feeder fleet, as well as entering into a similar service in Southeast Asia with joint venture partners.

Tom Preststulen is an entrepreneur and investor with experience from inters alia the oil and gas sector in Asia. Mr. Preststulen predicts that the strong economic growth which has been experienced over the last two decades in Asia will continue also in the years to come, especially within the energy sector, albeit with some intermittent cyclical corrections. In China, they have already upgraded the number of planned LNG import terminals from 6 to 20 in order to meet the growing demand for energy, although this number may be scaled down in view of a recent decision to exploit China's onshore shale gas. Moreover, discovered stranded areas of gas can be developed for extraction of natural gas and production of LNG in Southeast Asia by using new small-scale technologies.

The potential market for use of LNG in the region is huge, as fuel in small and medium sized power plants, for industrial use, on-land transportation, as well as for commercial vessels as a replacement for marine diesel or heavy fuel oil. The import and consumption of LNG will boom in Singapore and the rest of Southeast Asia as well. Mr. Preststulen is optimistic towards LNG because he predicts that today's substantial geographical price differences cannot be sustained and will sooner or later start to converge. Massive gas resources in Qatar and Australia, in addition to shale gas production in USA and China will cause a global surplus of natural gas, and the price of LNG will stay low compared to oil. Today, because LNG import terminals in USA are still under conversion to become export terminals, the price difference between North American gas and Asian gas is simply too high. In USA, statistics show that the price ratio of energy equivalent of oil to gas averaged 11 to 1 during the past 10 years, whilst the current ratio is 53 to 1. On the one hand, the shale gas development will give USA an important competitive advantage in re-industrializing, particularly in the chemical sector. On the other hand, it will also enable North America to become a competitive exporter of LNG which should contribute to balancing global LNG prices, assuming that the US Congress will allow a free trade of U.S. gas.

LNG is also a clean and environmentally friendly product compared to crude oil and its derivatives. Since shipping is global in nature, the effects of IMO Tier 3, will force changes and restrictions on release of NO_X and other gases and substances considered harmful to the environment, not only in North America and Europe, but probably also in parts of the Asian region.

Mr. Preststulen furthermore underlines that experience from Norway has demonstrated that many types of ships can be converted or built to use LNG as a bunker fuel, and that small-scale distribution

of LNG also benefits industrial and transportation sectors at large. The development in Southeast Asia will probably follow the same path. It will start out with short sea shipping, due to closeness to planned bunkering facilities; initially servicing ferries, supply vessels, and tugs, and will then gradually expand to include deep sea vessels. It is expected that the LNG import and export facility under construction in Singapore, due to be commissioned in the second quarter of 2013, will act as a regional catalyst for the change from fuel oil to the use of LNG. Important barriers to LNG as bunker fuel are lack of international standards and regulations, as well as inadequate infrastructure. However, these issues are currently being looked into. The maritime authorities in Singapore will engage in agreements on common standards and safety issues. In Norway, there are two companies operating LNG bunkering facilities, namely Gasnor and Scangas. Gasnor is owned by Statoil, while Scangas is a private independent company. However, Scangas has to buy LNG from Gasnor, which therefore currently controls the price of LNG in Norway, which is another unsustainable and undesirable situation. International free trade of gas will enhance its usage to the benefit of the environment and consumers.

It will probably be vital to facilitate and provide LNG as a marine fuel in Singapore first, before entering other countries in the region. Singapore is the center point of Southeast Asia and the world's largest bunker port. Still, Indonesia has the largest potential in the region with respect to the use of LNG with numerous islands with rich resources, but undeveloped infrastructure. Also Vietnam, The Philippines, Malaysia, Myanmar and Thailand have huge potential. The need for additional and environmentally friendly energy is the key when entering Southeast Asia with small-scale LNG projects, serving power plants, certain industry sectors, and terrestrial transportation.

Norway can contribute with several years of experience and know-how to the development of required infrastructure for the use of LNG in Asia. Network projects will stimulate to further development of relevant technologies, although substantial investments will naturally be required. Typically though, a double-digit return on investments can be expected, if properly organized. Corruption represents a general problem in the region, and is causing complications and delays in developments. Other cultural differences to Western practices may also represent hindrances when doing business in Asia. However, these issues may be resolved by education, proper ethical guidelines, adhering to a moral code of conduct, and by using local expertise.

To succeed with business in the region, Mr. Preststulen highlights the importance of having access to appropriate, efficient and experienced networks and relationship in order to obtain the necessary licenses and approvals to operate. Such relationships and connections can partly be built through the assistance of Norwegian Embassies and Consulates, including support from Innovation Norway, and through joint venturing with the right local partners, like gas partners in Singapore. Acquisitions and joint ventures will be essential solutions when employing local labor, and to bridge cultural differences, with the objective of fast-tracking entries into these booming markets.

7.8 Aibel Pte Ltd

Name:	Øyvind Vigeland
Position:	Senior Manager – Business Development
Company:	Aibel Pte Ltd (Singapore & Thailand)
Industry:	Oil service

Aibel is a leading supplier of services related to oil, gas and renewable energy. They are owned by Norwegian investors and are headquartered in Stavanger, Norway. The last decade Aibel has expanded their business area from mainly operating in the North Sea with oil and gas to be a highly global firm with a broader focus. In Southeast Asia, Aibel has experience by operating from both Thailand and Singapore. Their first office in the region was opened in Thailand in 1999 to give Aibel in-house capability and to deliver competitive priced offshore modules. After success and increased activity in the region, Aibel Singapore was established in 2007. Currently the office has more than 400 local and regional engineers, cooperating closely with Aibel Norway to provide Engineering, Procurement and Construction (EPC) projects.

Aibel is present in multiple markets which are aligned with their superior strategy. They are targeting several markets, because the company reduce risk by not depending on one single region. It is also an important part of Aibel's international strategy to serve and work closely with their customers. In the last decade the Southeast Asian offshore market has seen a substantial growth. Aibel has built up their organisation in the region step by step with organic growth following the market demand. When Aibel decided to extend their investments in Southeast Asia, three factors was vital, infrastructure, skilled resources and a strategic location.

Singapore is an easy and convenient location to operate from with good infrastructure. The region provides considerable skilled engineering resources and compared to Norway the labour cost is low. Work permits are easy to acquire, it takes often just one day. In general, Aibel employ high-skilled competence from all over the region: India, China, Malaysia, Philippines and Thailand. The government in Singapore is also stable, effective and facilitates for international business with a beneficial tax regime and subsidies to new ventures. With Singapore´s central geographical position, it is easy to serve customers in the entire region.

Personal relations, mutual trust and loyalty are vital elements to consider in order to successful business in Southeast Asia. Compared to the European business culture, it is more time consuming and usually involves a lot of meetings and activity together with the customers in Asia. The same factors are applicable when choosing subcontractors and partners. Aibel is also working through alliances and collaboration with partners. Their customers demand competitive prices and quality, and Aibel therefore normally cooperates with companies that have the same perception of quality. By operating from Southeast Asia, Aibel make this customization possible to a reasonable price. They choose primarily partners that can expand Aibel's capacity and expertise, and in addition give complementary synergies. Strategic alliances are usually settled by the top management, but relations and knowledge sharing with partners are often present in joint projects. Aibel do not use agents, mainly because Aibel does not want other companies to represent them. Agents could also have multiple and different agendas.

When doing business in other countries in Southeast Asia, certain pitfalls are more evident. Indonesia, The Philippines, Vietnam and Malaysia can be bureaucratic, with local regulations and transparency challenges. In general, business in Southeast Asia is more time consuming. Aibel use a lot of resources on local management, coordination and comprehensive supervising. But overall Aibel use the same codes of conduct as in the rest of the world.

Figure 35: Interview with Øyvind Vigeland

A number of organizations and institutions set up by the Norwegian government are present in the region. Their presence is important not only for new establishment, but also for existing businesses, knowledge sharing and experiences, networking and relations. Aibel is currently working closely with Innovation Norway and INTSOK for advisory and to assess new market opportunities. INTSOK is a network-based organization, where the organization establishes dialogue between oil companies, technology suppliers, service companies and governments.

7.9 DNB Markets, Singapore

Name:	Erik Bergöö
Position:	Senior shipping analyst
Company:	DNB Markets
Industry:	Finance

DNB is Norway's largest financial service group and one of the largest in the Nordic region in terms of market capitalization. Shipping, offshore and logistics are priority areas within DNB's international strategy. DNB Markets has a global presence with offices in New York, London, Oslo, Shanghai, Athens and Singapore. The Singapore office has served the Asian market since 1970, and is the leading bank for Norwegian businesses in Asia.

The DNB shipping analyst Erik Bergöö underlines the enormous popularity of LNG in Southeast Asia. By applying LNG, the region is diversifying the energy mix. This creates several business opportunities, such as Höegh LNG building a FSRU to serve an Indonesian client, and likewise with Golar LNG. There is an endless demand for LNG, and the market is only restricted by supply of LNG.

Regarding the price, Mr. Bergöö points at different aspects concerning LNG. Historically, there has always been an oil-gas differential, and oil will always trade on a premium compared to gas. The oil is easy to handle, store and transport. As for today, there are large price differences across the world due to the shale gas revolution in the USA, making the trade price of LNG at Henry Hub a quarter of the Asian price. How this difference will evolve is uncertain. Mr. Bergöö says USA wants to export LNG, but they want to be independent of energy as well, which implies production for own use. If USA chose to export, the price of LNG will decrease, but for the next two years, the arbitrage will continue. Europe will probably build up import capacity of LNG, to be less dependent on gas from Russia.

In a discussion with Mr. Bergöö on the future price of LNG compared to oil, he elaborates on different factors affecting the price and creates uncertainty. The Southeast Asian region and China grows 10 % a year, but the energy consumption 30 % a year which put pressure on the price. On the other side, China has found shale gas. If they have the same development of the resources as USA, the price might fall. But again, if they close down coal plants and replace them with LNG, DNB Markets expects higher gas prices.

On a question of the impact from increased LNG-shipping, Mr. Bergöö argues that it is not that important. Transportation cost is only 1 dollar of the price on LNG, and reduced freight fees will affect a rather small proportion of the LNG-price. But what will affect the price is the fact that many countries build LNG import terminals, because of arbitrage possibilities and to get more energy security. This may lead to a larger spot market and reduction in the LNG-price.

However, Mr. Bergöö explains that the spot market never will be like oil or coal. The exploration and production of the Gorgong field in Australia has an estimated cost of 52 billion dollars. To finance such an investment, long-term contracts are required. They can easily accept a LNG-price of 12-13 dollar on 10 year contracts, instead of selling it on a spot market.

As a marine fuel, Mr. Bergöö is more skeptical towards LNG. The cost of LNG is roughly 4 dollars on cooling, 1 dollar on transportation and 1 dollar on re-gasification, a total of 6 dollars. With a historical oil-gas differential on 2/3 in favor of LNG, the potential fleet saving is rather small, and the future price of LNG is quite important.

Another significant problem highlighted by Mr. Bergöö is the investment cost of infrastructure, and that it is hard to see who will invest into distribution. No one in shipping makes money today, so who will invest into retail availability? He gives an example: Take a player like Maersk, a future-oriented high-tech firm, and they do not even consider LNG. Nevertheless, Mr. Bergöö is more positive towards dual fuel because of the flexibility.

To map which ship types that are relevant for LNG, Mr. Bergöö suggests looking into the cost structure of different ship segments. Within bulk freight, fuel is 2 % of the cost, and it is the customer that carries the bunkering expenses. Consequently, there is no incentive for the ship owner to take higher CAPEX when they cannot add the saving to their own bottom line, not in today's market at least.

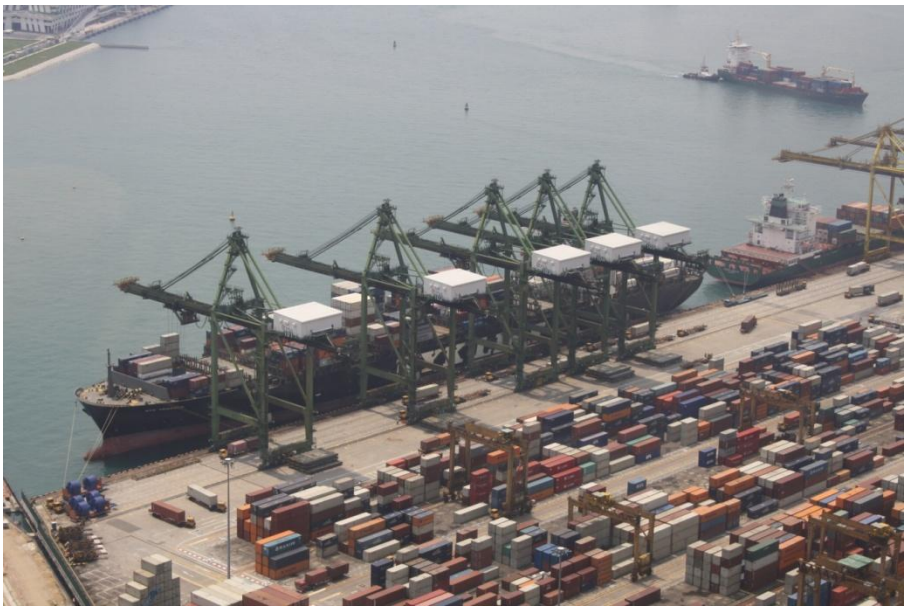


Figure 36: Harbour view from DNB Markets Singapore

When the rates are low and the market is tight, it is hard to get paid for better technology. Shipping, at least bulk, is a commodity industry with pure cost competition. Ship owners do not keep arbitrage from lower fuel costs. Moreover, it is hard to foresee any industry growth the next few years. The possibility of LNG will however arise by government subsidies like in Norway, but that is less likely in the Southeast Asian region. A global CO2-tax will also be beneficial, but again, that is not likely in a short-term perspective.

International strategy

DNB has established in Singapore primarily to follow customers abroad. Mr. Bergöö tells there is not much difference in how to do business in Singapore, since the tools within the financial industry are much the same. However, there are stronger effects of hierarchy in Asia, and cultural differences can be present.

Mr. Bergöö has belief in the region, and especially Indonesia. They will have growth, but the country must sort out the comprehensive red tape. To succeed in this region, a firm must establish with an office to be considered as a potential business partner.

7.10 PSA Marine

Name:	Joseph Tay
Position:	Marine Consultancy, Safety & Compliance Manager
Company:	PSA Marine
Industry:	Ship owner

The core businesses of PSA Marine are pilotage and towage in the Singapore harbor. They perform more than 200,000 jobs annually with around 49 harbor tugs. PSA Marine has also established towage presence in India, China, Hong Kong and other countries in Southeast Asia. The company is owned by PSA International, which is one of the leading global port groups. With its flagship operations in PSA Singapore Terminals and PSA Antwerp, PSA participates in 29 port projects in 17 countries across Asia, Europe and America. Their towage business extends beyond Singapore through various subsidiaries and joint venture companies operating in India, China, Hong Kong and Southeast Asia. In the Marine Consultancy is a team of veteran marine professionals, capable of providing consultancy services on port planning, terminal expansion, and other marine-related offshore projects.

Figure 37: A PSA tug in the Singapore port

PSA Marine operates 49 tugs in Singapore. The most used engines are primarily Niigata medium speed and Caterpillar high-speed engines running on Marine Gas Oil. Mr. Tay can tell that the primary consideration is reliability and maintenance costs when engines are chosen. Off course, fuel cost and consumption are also important parameters. With the IMO Tier II and Tier III regulations entering into force, PSA is going green and is considering alternative fuel. A study of the green alternatives is carried out, and diesel electric propulsion and LNG is both possible solution for their tugs. The government in Singapore has signaled some increased focus on the environment in the recent years, but has yet to fund any green ships. A reason for this is that Singapore has very limited natural resources, and the fact that Singapore must stay competitive and to maintain its leading

position as favorable port in the future. On the other hand, the government has established Green Iniative that could support up to 50 % of the investment costs on ships with environmental friendly solutions.

The main barrier towards implementation of LNG as a marine fuel is the lack of bunkering stations. Timing will much depend on when bunkering of LNG is possible. The tugs are rather small, space efficient boats and the increased volume of LNG-tanks or scrubbers could be a problem. For LNG to be a viable solution, they cannot lose significant operational time due to more frequent bunkering, and the localization of the bunkering tanks must be clarified. There is also a need to train their crew sufficiently to handle LNG. Since LNG is still an immature technology, the crew's knowledge and experience are very limited. Consequently, too many potential problems could occur and PSA Marine will probably not be a first mover in the market for LNG powered tug.

Figure 38: Interview with PSA Marine at Singapore Harbor

Although the investment cost is higher, PSA Marine sees favorable financial benefits on the LNG-price compared to MGO. The additional investment cost is therefore not the major concern, but the operational considerations are crucial. With support up to 50 % of the additional investment cost from MPA, LNG could definitely be an economic competitive solution. They have an open tender system, where PSA Marine set the required standards, the appropriate specifications and the propulsion system. This makes it possible and easy for PSA to choose the best suppliers. With a lifespan of a tug on approximately 17 years and a renewal programme of around 3 tugs each year, a rapid change of propulsion system is possible for their new builds.

7.11 Tian San Shipping Ltd

Name:	Ho Sow Wah
Position:	Director and General Manager
Company:	Tian San Shipping Ltd
Industry:	Ship owner

Tian San Shipping is one of the largest harbor craft operators in Singapore and has been operating in the country for more than 40 years. Their fleet consists of passenger ferries, Ro-Ro carriers, passenger launches and flotsam services. The company has its main hub in Singapore, and has an own shipyard where they can dock the fleet, perform repairs, maintenance and bunkering.

Tian San Shippings main business is to operate passenger and vehicle ferries. The company also operates boats on the behalf of the government and large multinational companies across a range of industries. Their entire fleet is running on high-speed engines using diesel as propulsion fuel. Tian San Shipping believes it will take time before we see conversion to LNG as a marine fuel. The use of LPG on vehicles has not been a success in the region. Tian San Shipping believes the same trend will be applicable concerning LNG as a marine fuel and therefore it will take some time before conversion to LNG.

Figure 39: A Tian San Shipping ferry

Mr. Wah means green initiatives are good, but the government must take the lead. Tian San Shipping has a strong focus on the environment and ensures that their vessels are catered for low emissions. Moreover, it is crucial to ensure supply and availability through distribution of LNG. This must be communicated, before Tian San Shipping could do any investment. Also, safety comes first,

and the use of LNG as a marine fuel must be safe and reliable. Tian San Shipping has always been focused on safety, and has received multiple safety and service awards. The company was the first local ferry operator to integrate safety and quality management systems in the region. Although Tian San Shipping continually upgrade their fleet to keep abreast of the latest maritime regulatory requirements and technological advances. As a consequence of the constraints, Tian San Shipping will not be a first mover.

Tian San Shipping believes Singapore is too small to be viable for LNG. Safety is extremely important, and Singapore cannot have the risk of any explosions in the densely populated areas. Norway is much larger, and it is safer to use LNG over there. Another limitation of LNG is the pricing of the fuel. A success factor in the region is commercial prices and not any fixed long-term prices.

Tian San Shipping strongly believes Indonesia and Japan are better markets for LNG as a marine fuel. Indonesia has a lot of gas production and reserves, and it is a large country consisting of many islands. Japan is also a suitable country for LNG as it has the size and already imports a lot of LNG for power supply.

The increased CAPEX on the engine is not a huge problem, but for Tian San Shipping availability, no lost time due to more frequent bunkering or limited available bunker points is crucial. The company strongly emphasizes the vessel's operations and costs, in addition to maintenance when choosing engines. If distribution comes in place in Southeast Asia, it is possible for Tian San Shipping to consider this LNG engines in the future.

In conclusion, Tian San Shipping believes any vessel has the potential to use LNG as long as the retail availability and safety are put in place.

Figure 40: The authors and the interviewees at the Tian San Shipping's own dock

8 Discussion of theoretical propositions

This section discusses the theoretical propositions outlined in Chapter 4. The basis for the discussion is the extensive data collection from expert interviews presented in Chapter 7 alongside with empirical data from the country risk assessment. In addition, news articles and conference proceedings have been used to gain valuable insight. The purpose of the analysis is to clarify appropriate strategic choices for the internationalization processes of LNG-technology. In the next chapter, we will use this analysis to compose a comprehensive export strategy for the Norwegian maritime industry towards Southeast Asia. Table 22 summarizes the interviewee's attitudes on different issues relevant for this chapter.

Table 22: Summary of interviewee's opinions

Interviewees	LNG-propulsion	Recommended Southeast Asian countries	Preferred entry mode	Business advise in Southeast Asia
Rolls-Royce Marine Norway	Positive	Singapore	Case specific	Build personal relations
Rolls-Royce Marine Singapore	Neutral, worried about price	Singapore, Indonesia	Case specific	Build personal relations
Masterbulk Ltd	Positive	Singapore, Philippines	Contractual	Networking
Tian San Shipping	Negative	Singapore, Malaysia	Greenfield	Trust
Höegh LNG	Negative	Singapore, Indonesia	Joint Ventures	Be present in the region
PSA Marine	Neutral, worried about technical aspects	Singapore, Thailand,	Greenfield	Trust
North Sea Container Lines	Positive	Singapore, Indonesia	Case specific	Learn how to avoid corruption
DNV	Positive	All nations	Greenfield	Build personal relations
Innovation Norway	Positive	Singapore, Indonesia	Case specific	Be present in the region
Aibel	-	Singapore	Greenfield	Build personal relations
DNB Bank	Negative	-	Greenfield	No specific

8.1 Proposition 1

A critical success factor in the Southeast Asian markets is to identify institutional voids by mapping the country's context, and make strategic choices based on this analysis. LNG-propulsion is an immature technology and a pure market analysis may ignore government initiatives. A MNC can adapt its own business strategy, it can try to change the operational context or it can stay away from the market.

A critical success factor in emerging markets is to identify institutional voids by mapping the country's context, and make strategic choices based on this analysis (Khanna, et al., 2005). We early addressed a study from London &Hart (2004) stating that Western-style strategies are unsuitable for undeveloped economies. Based upon the expert interviews and the country risk assessment, we will in the following section use the framework to Khanna et al. (2005) to discuss which countries in Southeast Asia Rolls-Royce should target, and the belonging appropriate strategic choices.

The LNG-propulsion market is immature, and this affects the strategic decisions (Løset & Tveten, 2011). The thesis recommends to *target the point of attack* and *to assemble the innovation force*, which is an analogy for launching new technology in a niche market. Converted to the LNG-propulsion market this means that supporters of LNG need to focus attention towards specific countries rather than the entire Southeast Asian region. We will therefore start this section by drawing attention to what countries Rolls-Royce Marine should target.

Gas-producing Southeast Asian countries

Indonesia, Malaysia, Thailand and The Philippines have seen a strong economic growth the last decade and the growth is projected to last throughout 2016. With a total population of 466 millions, long coastlines and 55 % of the ships in the region, the market is huge. Indonesia and Malaysia are also the main contributors to the gas reserves in the region, with approximately 84 % of the region's total proven reserves. Although the country risk assessment and the market analysis presented in Chapter 2 gave us valuable insight about the Southeast Asian market, quantitative data is not enough to get a comprehensive and sufficient view of a country. According to Khanna et al. (2005), political and social systems, openness, product markets, labor and capital markets are all factors that need to be assessed. The wide range of interviews enables us to carry through such an analysis to see how companies are affected by operating in different countries in the region.

Framework for mapping a country's context (Khanna, et al., 2005)				
Political and social systems	Openness	Product markets	Labor markets	Capital markets

We primarily interviewed Norwegian firms established in Singapore. They all thought presence in the region is an absolute necessity to do business in Southeast Asia. In general, companies operating from Norway are not responsive enough and do not show enough commitment to succeed in the region (Rensvik & Skram, 2012). In the Asian business culture, personal relations, mutual trust and loyalty are vital elements in business. It is more time consuming and usually involves a lot of meetings and activity together with the customers to do business in Southeast Asian (Vigeland, 2012). Therefore presence in the region is highly emphasized by all the interviewed firms.

Singapore

Singapore is a very attractive country to establish business in, not only because of its central strategic location, but mainly because of a good business environment. The government in Singapore is stable, but also effective and facilitates for international business with a beneficial tax regime and subsidies to new ventures. By being centrally located in Singapore you could easily serve the entire region as a hub (Steen, 2012) (Wisløff, 2012). Compared to Norway they have low labor costs combined with skilled engineering resources are available in the region, and work permits are easy to acquire (Vigeland, 2012). It will probably be vital to facilitate and provide LNG as a marine fuel in Singapore first, before entering other countries in the region. Only when the Singapore authorities are convinced, the development could boom (Preststulen, 2012).

With the new import terminal on Jurong Island, Singapore will be the LNG-hub for the region. It is a huge investment, but LNG will play a vital role in the energy mix as they establish energy security for the future (Fuglerud, 2012). The terminal will also facilitate for LNG as a bunker fuel, but the development could only start when LNG is available (Rensvik & Skram, 2012). Khanna et al. (2005) consider that MNCs are powerful enough to affect the context in which they operate. MNC's like

huge oil and gas companies, shipping operators, environmental organizations and engine manufacturers could change regulations, support schemes and initiatives towards green shipping.

Not surprisingly, the interviewees confirmed the country risk assessment, which pointed out Singapore as the easiest country to operate within. The country is highly developed, has a stable political system and corruption is almost absent. We recommend LNG supporters to affect and *change the context* in Singapore. The government has initiated JIPs on technical and commercial aspects on LNG-fuelling where companies are invited to attend. This is an opportunity to form the standards and progress of LNG as a marine fuel.

Indonesia

The CEO of NCL, Tom Preststulen, states that Indonesia has the largest potential in the region for small-scale LNG-projects in power plants and as a bunker fuel. The country consists of a many islands with a limited gas pipeline infrastructure and the country has the largest gas reserves in the region. The underdeveloped infrastructure in Eastern Indonesia, lack of gas pipelines and roads, make small-scale LNG suitable (Fuglerud, 2012). Huge stranded areas of gas are ready for extraction and production of LNG using new and available technology. There are now planned some small-scale LNG projects in Indonesia, and two re-gasification terminals are under construction. This will increase the development and the domestic consumption of the country's huge gas reserves (Rensvik & Skram, 2012). Rensvik also emphasizes that some Norwegian companies have already established business in Indonesia, and Innovation Norway will establish an office in Jakarta in June 2012. The environmental focus is also increasing, Indonesia has committed itself to cut greenhouse gas emissions by 26 % from the business as usual level by 2020 (Shirodkar & Kunal Rana, 2009).

Extensive red tape and corruption is anyhow making huge investments more risky for a MNC. Since Rolls-Royce has strong focus on avoiding corruption, this can prevent investment and the development in potential huge markets. In Indonesia, foreign investors cannot have the largest post; however silent partnership can solve this issue (Rensvik & Skram, 2012). We consider Indonesia as a business opportunity, because corruption can be avoided by *adapting your entry strategies* and having strong focus on ethical guidelines. Tailored strategies could also reduce uncertainty, and the effects of economic and political shocks (Preststulen, 2012).

Malaysia, the Philippines, Thailand and Vietnam

Malaysia, the Philippines, Thailand and Vietnam have huge potential (Preststulen, 2012), the countries are all in desperate need for energy. As presented in the country risk assessment, they have seen a strong economic growth. In other countries in the region, contractual disagreements can be very challenging for international ventures (Steen, 2012). The Philippines is a republic with a weak legal system. Property rights are poorly protected and they are ranked as 129th in the world on the Corruption Perception Index (Transparency International, 2012). Vietnam has a lot of shipping and ship yards, but business is time consuming. Extensive red tape and corruption, makes the business environment demanding (Fuglerud, 2012).

As for today, we recommend Rolls-Royce Marine to stay away from these countries. However, the potential is huge, and timing will be a crucial factor. Consequently, to enter Malaysia, The Philippines, Thailand or Vietnam with LNG-propulsion technology might be relevant in the future.

Table 23: A summary of mapping of relevant countries in the Southeast Asian region

Country	Key facts	Recommended strategy for LNG-propulsion	
Indonesia 	Population: 247 millions GDP: $1121 billion (PPP) Economic growth: 6,40 %	***Adapt your strategies***	Indonesia is by most interviewees highlighted as the most promising market for LNG-technology, but it takes adaption of traditional strategy to enter the country due to red tape, poor property rights and corruption.
Malaysia 	Population: 29 millions GDP: $447 billion (PPP) Economic growth: 5,20 %	***Stay away***	Only one interviewee pointed at Malaysia as a potential market. Lack of government initiatives towards LNG as a marine fuel combined with limited shipping implies to stay away.
Philippines 	Population: 102 millions GDP: $393 billion (PPP) Economic growth: 4,70 %	***Stay away***	The Philippines were not mentioned by any interviewees as the government takes few green initiatives, and the technological development is slow
Singapore 	Population: 4,7 millions GDP: $315 billion (PPP) Economic growth: 5,30 %	***Change the context***	Singapore is probably the first market to adapt LNG as a marine fuel. A LNG-terminal is finished in 2013; the government has taken a green initiative and initiated a JIP on LNG-propulsion, implying that a market will arise. There is an opportunity to define how this market will evolve through participation in government JIPs
Thailand 	Population: 67 millions GDP: $610 billion (PPP) Economic growth: 1,50 %	***Stay away***	Thailand were highlighted by only a few interviewees as the shipping market is relatively small, and the government has taken few green initiatives
Vietnam 	Population: 91 millions GDP: $229 billion (PPP) Economic growth: 5,80 %	***Stay away***	Vietnam has extensive red tape and corruption, and a demanding business environment. LNG might be a part of their energy mix in the near future, but for ethical reasons, this market is a challenge

According to Hoskisson et al. (2000) the internationalization strategies are affected by the characteristics of the market context in which firms operates. It has been evident how institutions can facilitate for development of technology, by reducing uncertainty and enhance stability like authorities in Singapore. Consequently, Indonesia which has the largest market potential is not the most profitable market in a short-term perspective. This is because Singapore has a proactive and stable government, with reducing the transaction and information costs.

Proposition 1 can be confirmed by our data analysis. A pure market potential analysis would ignore government initiatives in Singapore, which makes it a far more attractive market than any other country. Moreover, the three choices – adapt your strategies, change the context, and stay away – seem reasonable, however extremely simplified. In Section 8.3, we will clarify appropriate strategic choices for the internationalization of LNG technology.

8.2 Proposition 2a

In Southeast Asian markets firms are most likely to select the optimal entry mode by analyzing the country specific context. There is a risk that firms are overemphasizing the analysis of transaction costs associated with the foreign market entry, at the expense of analyzing institutional voids and the required resources needed to manage them.

The theory presented in Section 4.3, about entry strategies for emerging markets, indicated that institutional theory and the resource-based view are most relevant in finding the optimal entry strategy. Mayer et al. (2009) states that the entry strategy is largely affected by the host country, and that transaction cost economics are insufficient in accounting all the macro-level factors. This is even more evident for MNCs operating in emerging countries, where country risk is major factor. A challenge for the MNCs operating in several different markets could be to adjust and have different entry modes in different markets. By using the interviewed data we will in this section examine if Norwegian firms is overemphasizing the analysis of transaction costs associated with foreign market entry.

Rolls-Royce considers the market potential for LNG in Southeast Asia to be huge. They have now invested heavily into marketing and sales of LNG solutions in Singapore. Rolls-Royce is targeting Singapore as the first country in the region, mainly because of the market opportunity. Specifically for LNG as a marine fuel, institutional voids are extremely important. Singapore has a strong institutional framework, Vietnam the opposite, while Indonesia has a medium degree. The authorities in the region must be willing to invest into new bunkering infrastructure to create the market opportunities for LNG (Stensaker, 2012). In Singapore the Maritime Port Authority (MPA) gives financial support to green shipping and environmental friendly technology. LNG infrastructure is being built and JIPs are working with bunkering standards. The government in Singapore has with these actions created favorable conditions for LNG in a long-term perspective.

In Indonesia, Rolls-Royce has not yet invested in marketing of LNG technology, although the market potential is considered the largest in the region. Stensaker argues that a stable political regime is almost crucial. Rolls-Royce has high ethical standards for our business, and these could prevent investment and development (Chia, 2012). Nothing indicates that Rolls-Royce does overemphasize the micro level factors. In the many emerging countries in the region, they have not done any investment targeting the LNG market so far. Although these countries have huge market potential, there are major uncertainties with the institutional factors, the timing and the progress in these projects. An example is the planed small-scale LNG terminals in Indonesia, which one of our interviews doubted (Wisløff, 2012). Even if institutional voids might lead to extensive transaction costs, we consider the potential in Indonesia to be great. Several uncertainty factors are present, which demand tailored strategies.

DNV emphasizes micro level factors higher, but still institutional theory and resourced-based view are highly evident. When DNV consider different countries, they first assess the market potential, than the business environment (Fuglerud, 2012). DNV also considers Indonesia to have the largest market potential, but the degree of institutions and stability, inhabit the development. In Aibel's case, the main reason for the entry in Southeast Asia was skilled resources. In Singapore and Thailand, Aibel employs high-skilled competence from all over the region to a reasonable price. The strategic location combined with macro levels factors, favored Singapore.

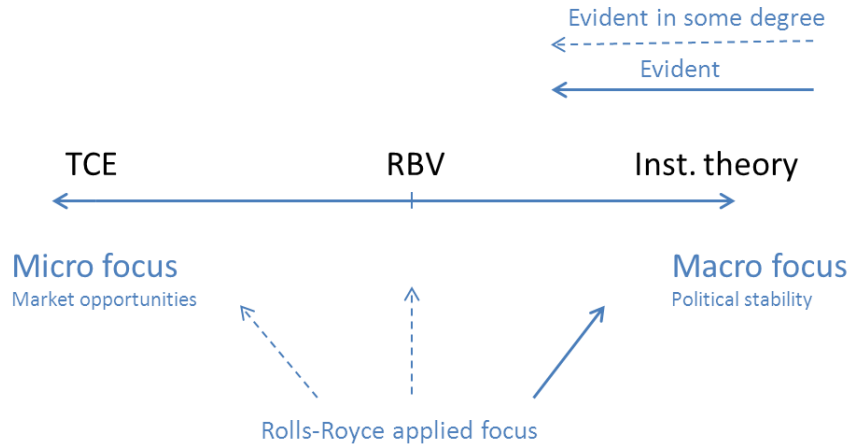


Figure 41: The theoretical focus of Rolls-Royce Marine in internationalization

The proposition addresses the concern that firms are overemphasizing the country specific context and the analysis of transaction costs in emerging markets. Our assessment of Rolls-Royce Marine's activity in Southeast Asia, demonstrates that their activity is balancing micro and macro factors well. The actions are consistent with the theory, both country specific, resource-based and institutional view are clearly evident in Rolls-Royce assessment when they consider entry modes.

8.3 Proposition 2b

Based on the theoretical framework by Meyer et al. (2009) and our country risk assessment, appropriate entry modes can be outlined. Companies requiring access to local resources and mature markets can only do acquisitions in Singapore, while joint venture is recommended for all other markets in Southeast Asia. Where local resources are redundant Greenfield entry is recommended in all markets.

Meyer et al. (2009) have developed their framework by combining survey and archival data from four different emerging economies, India, Vietnam, South Africa and Egypt. There is different risk and different level of control associated by various entry modes. To determine the appropriate one, the framework suggests to first analyzing the strength of the country's institutional framework which implies the extent of market failure. Secondly the need for local resources should be determined to map the firm's sensitivity to market failure. By combining these variables the framework suggest Greenfield entry, Joint Venture or acquisition. This section tests the validity of the framework.

To investigate Proposition 2b, the strength of the institutional frameworks for the different countries assessed, has been classified. Singapore has a strong institutional framework as argued in Section 8.1. Indonesia, Philippines, Malaysia and Thailand have medium institutional frameworks, each of them with its particular challenges. Vietnam, as shown in the last section, has significant challenges related to corruption implying a weak institutional framework. To assess the validity of the model by Meyer et al. (2009), we have used the case company Rolls-Royce Marine and mapped their need for local resources.

Rolls-Royce Marine has their Asian headquarter and hub for aftermarket services in Singapore. In this market they have a high need for local resources (Stensaker, 2012). In other countries where they primarily want to increase revenues through sales, Rolls-Royce Marine has enough competence

within its organization which implies a low need for local resources. The exception is Indonesia which is a large market where local personnel is required in order to get the license to operate (Rensvik & Skram, 2012). Accordingly, Rolls-Royce Marine has a medium resource need. This analysis is presented in Figure 42.

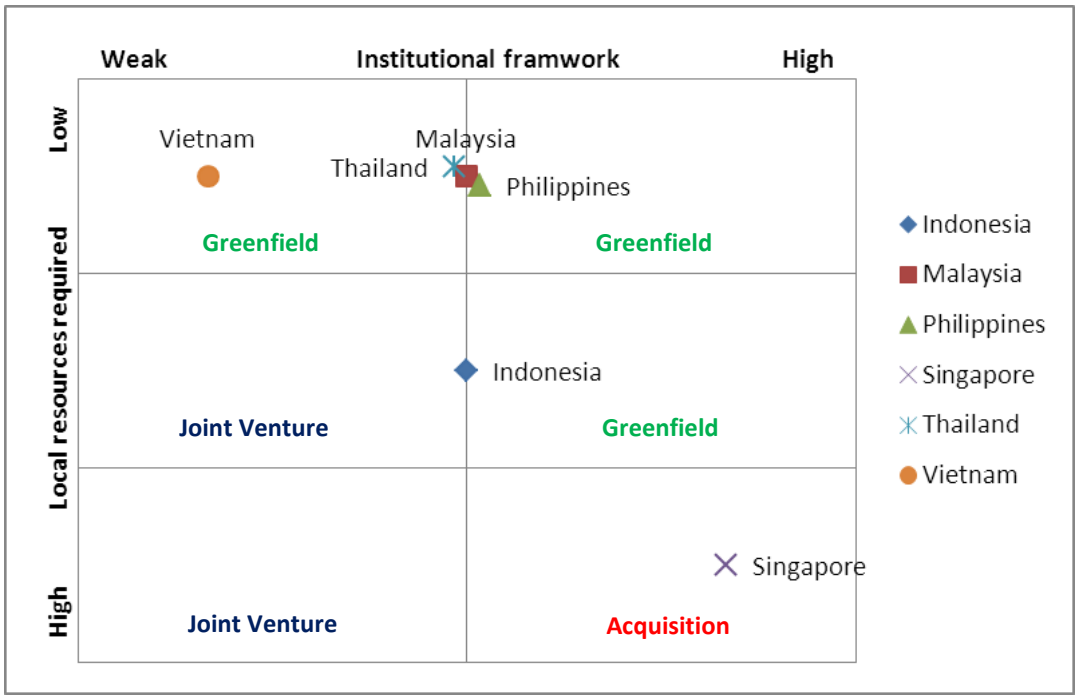


Figure 42: A classification Rolls-Royce's need for local resources combined with the region's institutional framework

By placing the Southeast Asian countries combined with the resources needed by Rolls-Royce in each market, in the framework by Meyer et al. (2009), we get appropriate entry modes for each market. According to the framework, the following entry modes are recommended:

- **Greenfield:** Indonesia, Malaysia, Philippines, Thailand, Vietnam
- **JV:** Indonesia
- **Acquisition:** Singapore

Rolls-Royce varies the chosen entry mode across the entire enterprise (Stensaker, 2012). However, the Marine division that is our case has mainly applied acquisitions. In contrast, the framework by Meyer et al. (2009) focus on Greenfield entry in all markets with low resource needs. It does not necessarily have to be a contradiction as the Marine division strongly varies on the extent of internationalization through foreign market entries. Nevertheless, it is reason to believe that firm specific routines and experiences will deviate from the model, as it does with Rolls-Royce Marine.

The model by Meyer et al. (2009) also recommends Greenfield entry and Joint Ventures when entering into Indonesia. According to Indonesian law, foreign companies are not allowed to do such entries as an Indonesian partner must be the majority share owner (Rensvik & Skram, 2012). This means only Joint Ventures can be applied when entering Indonesia. It might be the thesis author's assessment of the Indonesian institutional framework that is wrong, but it is fair to say that Meyer et al.'s model will be invalid for some countries where specific laws determine the entry mode.

Data analysis of Proposition 2b can tell us primarily two things. Firstly Rolls-Royce Marine can without any significant risk consider using other entry modes than acquisitions in emerging markets. By mapping a country's context as suggested by Khanna et al. (2005) other relevant entry modes can be identified assisted by the framework of Meyer et al. (2009). The second learning of this data analysis is a large uncertainty related to the accuracy of Meyer et al.'s model. Accordingly, the model should be used as an instructive tool, not a decisive one – unless it is extended and improved by new research.

8.4 Proposition 3a

In China, the choice of collaborative design of an alliance relies on the specific investment case, with variables such as level of government, scale of operation, cultural dimensions and the host country's experience with foreign investments. The model is applicable for the Southeast Asian region.

Tse et al. (1997) developed a model showing key decision variables that determines the choice of collaborative design when entering China, based on empirical data. It suggests that experience with attracting foreign investor, home country factors such as cultural dimensions and industry specific factors such as scale of operations, affects the choice of entry mode. In most cases, Western companies chose to enter China with a home country partner or with a Hong Kong-based partner, while Chinese partners often were avoided. In this section we will see if the model is applicable for Southeast Asia by using interviewee information on alliances.

Alliances are established for many reasons, but always with an intension of mutual return from the collaboration. Most interviewees were familiar with alliances, but very few applied them. DNV is an enterprise based on intangible knowledge, and they enter most markets solely based on organic growth (Fuglerud, 2012). Rolls-Royce Marine has expanded either by acquisitions or organic growth in the region (Stensaker, 2012). Höegh LNG, Aibel and DNB entered the region by organic growth (Wisløff, 2012). Accordingly, there is obviously less fear in doing *Foreign Direct Investments* in Southeast Asia and rely on market transactions compared to China.

Even though our sample firms entered Southeast Asia and specifically Singapore without an alliance partner, they have entered into alliances on a product level. Aibel cooperate with partners that extend their own product line either by adding other capabilities or capacity they does not possess (Vigeland, 2012). Strategic alliances are settled on a top management level, and many of the contractual agreements are Joint Ventures with local partners in relevant Southeast Asian countries. Rolls-Royce Marine has several *Memorandum of Understandings* with partners that similar to Aibel, complements their product line (Chia, 2012). Such collaborative designs are made irrespectively of country origin, as long as it is without corruption or any other ethical disruptions. Consequently, firms seem less risk adverse in contracting with partners in Southeast Asia than in China.

Innovation Norway helps several Norwegian companies by finding appropriate partners in Southeast Asia (Rensvik & Skram, 2012). Local partners might be an easy way to access local knowledge and skilled resources, but they must be thoroughly assessed. Agents often have conflicting interests among clients, which can be a costly affair if a contract already is settled. According to Rensvik mergers and acquisitions are even more risky and costly, but are equivalently efficient in accessing the local market. The experience from Norwegian international business specialists indicates complicated partner selection processes, but at the same time partners are widely available. Again,

Southeast Asia seems to contrast China when it comes to number of available partners according to the model by Tse et al. (1997).

All features of Proposition 3a can be rejected according to our data analysis. The mentioned factors for deciding collaborative agreements with alliance partners are applicable, but no suggested outcome is relevant to the Southeast Asian market. The missing applicability of Tse et al.'s (1997) model can be explained two ways. First, the business environment in Southeast Asia deviates from the Chinese. Alternatively, Tse et al.'s (1997) model is outdated and need updated empirical data to be valid. In any case, the ideal collaborative agreement in alliances need more research.

8.5 Proposition 3b

There is disagreement in the literature on which degree of internationalization that gives the highest return on assets. A weakness of the research is a missing link to timing of market entry. There is however agreement upon the positive effect between the ability to share knowledge with business partners and profitability.

Multiple researchers have tried to identify correlations between Return on Assets (ROA) and different aspects regarding internationalization. Empirical data suggest there is highest ROA on low and high (DOI) degrees of internationalization (Ruigrok & Wagner, 2003). Other analytical findings indicate the highest ROA at low and high degree of (API) alliance portfolio internationalization (Lavie & Miller, 2008). More general findings imply that knowledge sharing is crucial for ROA in alliances and MNCs (Johanson & Vahlne, 2003). There is contradiction in some of this literature as high DOI and API often is correlated, as with Rolls-Royce that is collaborating with truly internationalized partners. It is the author's hypothesis that timing of the foreign market entry is more crucial to companies than DOI and API. In this section we will use our interviewees' experience and financial performance in order to test the claim.

It is hard to challenge this claim solely based on qualitative interview data. Therefore the ROA has been estimated for the four Norwegian firms in our sample that has internationalized towards Southeast Asia. Since the absolute number of ROA may vary across industries we have estimated the profit margin of the same companies as well, in order to analyze any differences and learning from the sample.

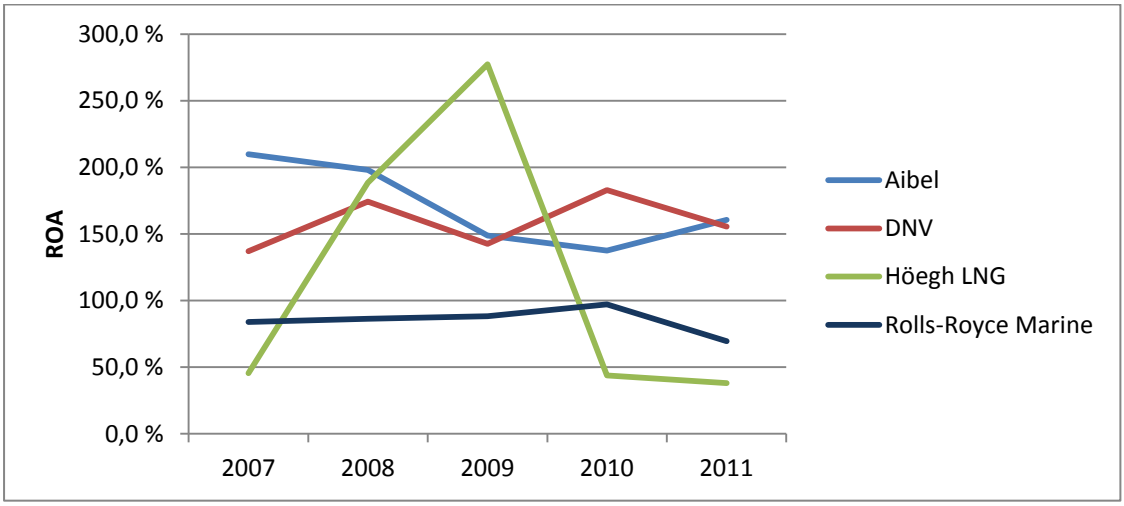


Figure 43: The ROA for Aibel, DNV, Höegh LNG and Rolls-Royce Marine the last five years (Proff, 2012)

Figure 43 shows that the ROA is deviating for Aibel, DNV and in particular, Höegh LNG. Höegh LNG is investing heavily into new assets as they are currently building a FSRU, which creates the strongly fluctuating curve (Wisløff, 2012). Aibel has expanded quickly the last years, but the ROA has been constantly falling from 2007 to 2010, which is corresponding to the curve outlined by Ruigrok & Wagner (2003). However, even though they expand in Singapore, 90 % of the sales are to the Norwegian market (Vigeland, 2012). Accordingly, the increased ROA during 2011 is probably explained by increased activity in the oil & gas market.

DNV and Rolls-Royce Marine have the most stable ROAs. This can be explained in multiple ways. Both enterprises are bigger companies in terms of revenues, and with a longer history. In any case, the curves outlined from DNV and Rolls-Royce Marine, are fluctuating around equilibrium, which is incoherent with both the relation between ROA and respectively DOI and API. Regardless of ROA, in a short-term perspective investors want the highest possible profit margin in order to maximize dividends or reinvestments into the firm. Our sample firms combined with interview data do not strengthen the relation between ROA, and DOI and API. Therefore, we will take a look into the profit margin to seek further knowledge on profitability and internationalization.

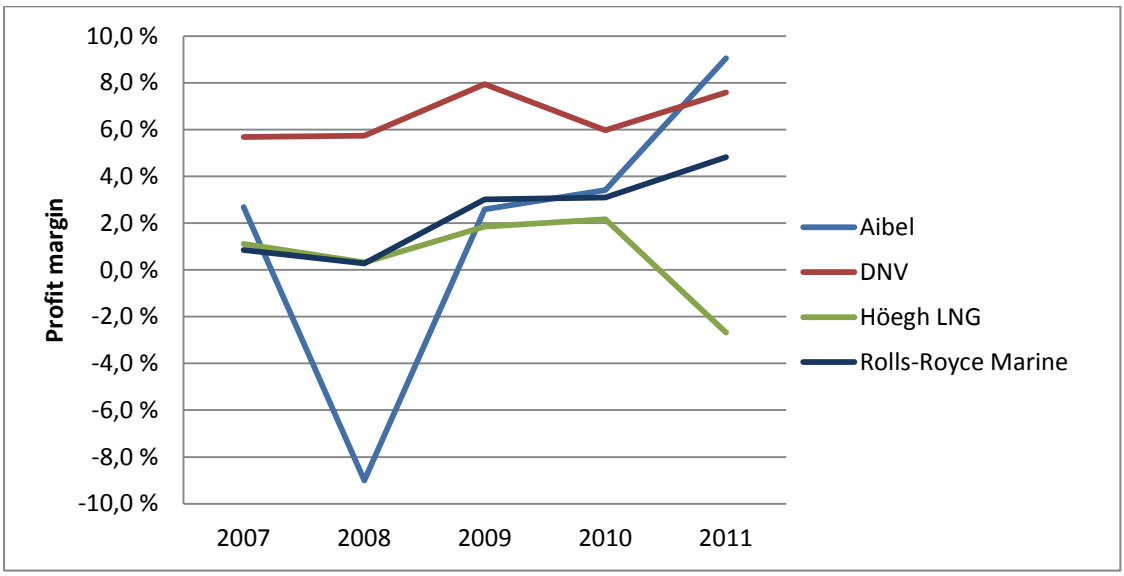


Figure 44: ROA for Aibel, DNV, Höegh LNG and Rolls-Royce Marine the last five years (Proff, 2012)

Figure 44 demonstrates the profit margins of our sample firms. DNV has a relatively stable profit margin that can be explained by the ownership structure. They are owned by a foundation that reinvests a certain amount of money each year, which stabilizes the financial performance (Fuglerud, 2012). Höegh LNG had a low and stable profit margin, but had a loss in 20011, which can be attributed to large investments (Wisløff, 2012).

Aibel and Rolls-Royce Marine have experienced large profit margin growth from 2008 until 2011. In the same periods, both companies have expanded internationally. Aibel established in Singapore to meet shortage of engineering competence in Norway, as well as a strategic location (Vigeland, 2012). 90 % of the Singapore office serves the Norwegian offshore market. Rolls-Royce Marine has increased sales into markets by expanding their organization into new countries. Knowledge sharing has been a key variable for Aibel and Rolls-Royce Marine in seeking internationalization success.

Proposition 3b can be confirmed based on our interview data combined with secondary data. Relations between DOI, API and ROA will deviate across industries and countries subject to the study. However, timing of foreign market entries and knowledge sharing tend to be very important for profitability in all cases. Consequently, the function of timing in internationalization processes should be further investigated.

8.6 Proposition 3c

Business networks and alliances will give the highest return on investment if they are managed by relational-based governance involving trust, instead of focus on contractual factors. Asian business culture emphasizes long-term relations more than the European culture.

In all alliances and MNCs the management seeks to find the most efficient governance structure. A comprehensive empirical study combined with interviews has suggested that relational-based governance structure is far more efficient in most perspectives than contractual-based governance (Lee & Cavusgil, 2006). Although contractual agreements often are foundations of alliances and collaborative agreements, relational-based governance has several advantages over contractual-oriented management:

- Mutual trust reduce transactions- and negotiations costs
- Overemphasizing contracts easily implies conflicts regarding interpreting them
- Trust is a foundation for learning and knowledge sharing between business partners
- In times of environmental turbulence, dependence on contracts alone is risky

This section deals with the issue of governance style in alliances. The theory suggest to emphasize developing strong relations as they are more resistant to environmental turbulence and reduce transaction costs. The process of selecting partners is complicated and time consuming (Rensvik & Skram, 2012). Innovation Norway has described the dilemma of agents with conflicting customer relationships. Consequently, although juridical solid contracts are signed, there is no guarantee the business relationship will be profitable.

Table 22 presented at the introduction of Chapter 8 summarizes key business advice specifically for Singapore and Southeast Asia. Physical presence in the region, building long-term relationships and trust, and attend networking events are the recurring message from all interviewees. It is a unison message that long-term relationship building, physical meetings and trust are more emphasized factors in the Asian business culture compared to the Norwegian. This indicates that Proposition 3c is valid, but we will analyze more data before we conclude.

Masterbulk points at a very good business culture in Singapore with almost complete absence of corruption. Nevertheless, long-term relations are required in order to make good deals (Steen, 2012). To enter into business deals are generally more time consuming in Asia (Vigeland, 2012). To succeed with business in the region, it is important to have access to appropriate, efficient and experienced networks and relationships in order to obtain the necessary licenses and approvals to operate (Preststulen, 2012). It becomes evident that business relations are crucial to get deals and to govern them, in Southeast Asia.

Proposition 3c suggest that business alliances should have relational-based governance. Moreover, it propose that long-term relations involving trust is more important to get business in Asian culture

compared to the European. Based on our data analysis, both claims can be approved. Consequently, Norwegian firms should establish in Southeast Asia in order to build necessary business relations.

8.7 Proposition 4

The timing of market entry is significantly related to the return on assets. Early market entry is preferred when the expected returns offset the risk associated, and laggard entrant strategy is applicable when the expected returns are uncertain. Timing is more important for return on assets than degree of internationalization and alliance portfolio internationalization.

The decision of entry time into new markets is a strategic, qualitative decision and a tactical, quantitative decision (Lilien & Yoon, 1990). Several firm-specific factors, industry and market factors and host country factors influence the timing decision. Moreover, the entry timing is correlated to financial performance (Gaba, et al., 2002). In this section, we seek to identify the awareness of timing among interviewees' foreign market entry decisions and the link to financial performance.

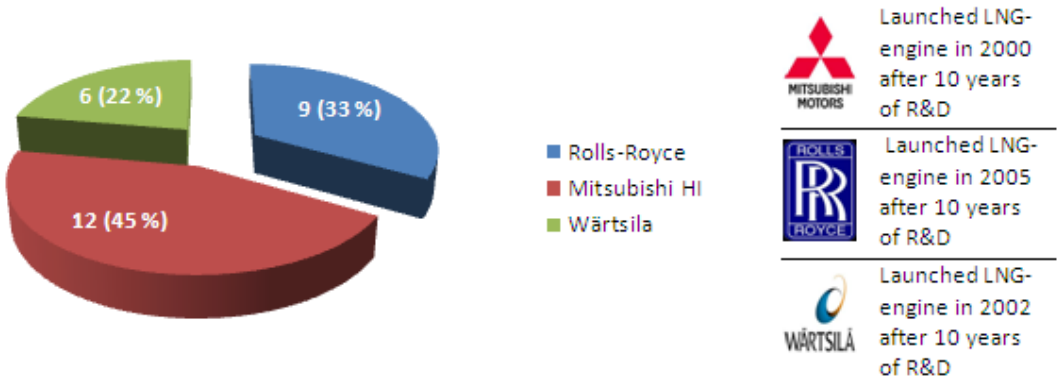


Figure 45: Number and share of total LNG fueled vessels in operations in Norway (DNV, 2010)

Figure 45 presents the market share in the Norwegian LNG-fueled fleet by DNV class. In terms of numbers, Mitsubishi Heavy Industries (MHI) has the largest market share followed by respectively Rolls-Royce Marine and Wärtsila. An explanation could be the early launch of Mitsubishis High-Pressure Direct Injection concept. The market really started to boom in 2006, but still MHI has most engines contracted. The experience from the Norwegian LNG-propulsion market clearly shows that it is important to be early in the market if the expected returns are high and the associated risk acceptable.

In Section 8.6 we verified the importance of building long-term relationships if a firm wants to succeed in Southeast Asia. That is a first sign that if a market starts to evolve a firm must be established already, in order to keep up with its competitors. Several interviewees confirmed the importance of being settled with an office in Singapore when the market for LNG-propulsion starts to grow. If the LNG-market booms, the Norwegian companies must be established in the region with strong relationships built on trust to be preferred by local partners (Rensvik & Skram, 2012). One of the reasons is that the development will go very fast ones the market is settled (Steen, 2012). It becomes evident that Norwegian enterprises that want to capitalize on LNG-propulsion in Southeast Asia must establish before the market takes off.

Rolls-Royce Marine has already invested resources in the Singaporean market for LNG-propulsion. However, the Indonesian market has been highlighted as a very promising as well. Indonesia has an ideal topography for LNG as well as the largest market potential (Fuglerud, 2012). This view is supported by NCL (Preststulen, 2012). Tian San Shipping headquartered in Singapore also believes Indonesia will be a stronger market (Wah, 2012). Rolls-Royce Singapore has already identified the Indonesia as the next potential market (Chia, 2012). Therefore Rolls-Royce Marine should launch an Indonesian campaign shortly. As discussed in Section 8.1, business in Indonesia is time consuming due to red tape, ownership rules and other bureaucracy. An early focus on Indonesia is recommended to ensure product availability in the market when LNG-propulsion becomes popular.

Proposition 4 claims that timing is more important for profits than DOI and API. Figure 44 in Section 8.5 showed a growing profit margin for Aibel and Rolls-Royce Marine from 2008 to 2011. As with the increased ROA showed in Figure 43, a boom in the oil & gas-industry has been beneficial to both companies. Rolls-Royce Marine has met increased demand from the OSV-segment due to flexible capacity. Aibel has grown in Singapore in times where access to sufficient competence and knowledge has been crucial (Vigeland, 2012). Although the interviews give qualitative indication that timing in a larger sense than internationalization ratios define profitability, we lack empirical data to support the claim.

It is clear that firms should focus less on its degree of internationalization and alliance portfolio with respect the return of assets. Proposition 4 contains three claims. Firstly, timing of market entry is strongly related to ROA, which can be confirmed. Secondly, early market entry is preferred when the expected return offset the associated risk, which is a valid claim. Thirdly, the proposition claim timing to be more important than DOI and API. Our data indicates that this might be true, but this should be supported by empirical data. Consequently, the relation between timing of foreign entry and ROA and profit margin should be further investigated.

8.8 Proposition 5

A MNC must take differences in partner selection criterions between emerging and developed market contexts into account when choosing alliances abroad. Where emerging market firms demand financial, technical and intangible assets, developed market firms demand local market knowledge and unique competencies

In general, firms seeking alliances and partners are focusing on complementary capabilities (Geiringer, 1991). Establishing business in emerging markets often require local knowledge, skills and special approval to operate. This could complicate business, and alliances and partners could be absolute crucial to overcome the obstacles. A study by Hitt et al. (2000) states that there are differences in partner selection between emerging- and developed market firms. Norwegian companies doing business in Southeast Asia should be aware this differences in order to optimize selections of partners. In this section we will test if Hitt et al.'s (2000) framework is valid in Southeast Asia, and test which factors that are important and apparent for partner selection in Southeast Asia.

To succeed with business in the region, Preststulen highlights the importance of having access to appropriate, effective and experienced networks. All the interviewed firms considered partners and alliances to be vital in business in Southeast Asia. Such relationships and connections could be absolute necessary to get licenses and approvals to operate. Preststulen also states that acquisitions

and joint ventures will be essential when employing local labor and to bridge cultural differences. This could be a good solution to fast-track entries into booming markets in the region (Preststulen, 2012).

Aibel choose primarily partners that can expand their capabilities and expertise, and in addition give complementary synergies. In joint projects, relations and knowledge sharing are common. Delivering products with assistance of local partners could also lower the price of Aibel's product, due to lower operating costs. In Southeast Asia the partner selection is usually more time consuming and involves a lot of meetings, compared to the European market (Vigeland, 2012). Although Höegh does not have any formal alliances, local partners is very useful for them in accessing new markets (Wisløff, 2012).

Interviewees	Emphasized/searching partner capability	Preferred entry mode
Rolls-Royce Marine Norway	Complement capabilities, expand expertise	Case specific
Rolls-Royce Marine Singapore	Knowledge sharing and business relations	Case specific
Masterbulk Ltd	-	Contractual
Tian San Shipping	Technical and intangible capabilities	Greenfield
Höegh LNG	To access new markets	Joint Ventures
PSA Marine	Technical and intangible capabilities	Greenfield
North Sea Container Lines	Fast track entry, approval to operate	Case specific
DNV	Influence and position	Greenfield
Innovation Norway	-	Case specific
Aibel	Expand capacity and expertise	Greenfield
DNB Markets	-	Greenfield

DNV is the only firm we assessed that did not use partners or alliances directly, as they are an industry expert, classification and certification company (Fuglerud, 2012). DNV therefore need to have all expertise in house. Anyhow, DNV use JIP actively. By determine industry standards and procedure, they influence the development of LNG and achieve an attractive position in the market.

Rolls-Royce has in the resent years used acquisitions mainly to expand expertise and access new market segments. In addition to this Rolls-Royce is a part in multiple JIP, and have used it actively to build business relations. Within the LNG-segment alliances are especially important, mainly because Rolls-Royce need to contribute to complete the LNG value chain. Through JIP, Rolls-Royce is also in the position to push technology development and influence decision makers directly (Stensaker, 2012).

Innovation Norway expresses how important the JIP will be for the supporters of LNG in the region. By sharing experiences from Norway with the Southeast Asia market, the development and understanding of LNG will increase. It is also necessary to establish relations and a strong position when the market starts to evolve. In some countries like Indonesia, partners are necessary to get license to operate (Rensvik & Skram, 2012).

Both PSA and Tian San Shipping operates from Singapore, which is a highly developed market. Still, they have business and activities in emerging countries, in addition to cooperation and alliances with firms operating there. Our data about criteria for partner selection among emerging market firms are limited. Both Tian San Shipping and PSA have an open tender system, where technical capabilities are one of the success criteria when ordering ships. Intangible assets, like knowledge and

expertise will probably be an important criterion for selecting partners for firms with limited experience with LNG.

Table 24: Differences and similarities in partner selection between emerging and developed markets

Partner selection criterions in emerging and developed market contexts				
Similarities in both markets contexts	**Differences between the market contexts**			
	Emerging market firms		**Developed market firms**	
Firms in both markets equally emphasize managerial capabilities as a criterion	More strongly emphasize financial assets	**Evident**	More strongly emphasize local market knowledge and market access	**Confirmed**
Firms in both markets equally emphasize complementary capabilities as a criterion	More strongly emphasize technical capabilities	**Evident**	More strongly emphasize the possession of unique competencies	**Evident in some degree**
	More strongly emphasize intangible assets	**Evident**		

The interviewed firms indicated some variances between the markets and economies in the factors influencing partner selections. The Norwegian firms confirmed Hitt el al.'s factors, and strongly emphasize the importance of market access, local knowledge and expand expertise. Especially in emerging markets are alliances and partners vital for them to get special approval to operate and bridge cultural differences. In general, the Norwegian firms also seek complementary capabilities, and fast track entry with alliances and partners. For LNG supporters, alliances and partnership will be extra important to increase knowledge and understanding of LNG. Norwegian firms have years of experience, which will also favor local operator in Southeast Asia.

8.9 Proposition 6a

Countries tend to protect industries that are weak, on a decline and political important. Gathered data indicates that the LNG-market is strong and growing, but political important. Consequently, the LNG-market will not be protected, but still affected by government politics.

By using data from trade flows, production and trade barriers for 41 countries, including several ASEAN-countries such as Thailand, Indonesia, The Philippines, Singapore and Malaysia, it is proven that countries tend to protect industries that are weak, on a decline and political important (Lee & Swagel, 1997). Data from Chapter 3 indicates that LNG is a strong industry. In this section we investigate the framework conditions for the LNG-market to validate or reject Proposition 6a.

LNG has an inclining popularity in Southeast Asia (Bergöö, 2012). There is an endless demand for LNG, and the market is only restricted by supply of LNG. There are several reasons why the market of LNG is so attractive. Firstly the economic growth in the region is up to 10 % a year, whilst the energy consumption growth is up to 30 %. The economic progress is limited by the access to energy, which makes LNG an attractive alternative as it is a flexible, transportable energy source. Secondly LNG is contributing to energy diversification. As an example, Singapore is completely energy dependent, and hence energy security increases by introducing LNG to the energy mix. Thirdly, and least important, LNG is a green alternative compared to coal. In total, the LNG-market is very promising as it ensures energy security, it is both emerging and political important.

For the purpose of this thesis it is important to determine of the consequences of LNG's political importance. LNG as a marine fuel is an immature technology in Southeast Asia with several important barriers towards implementation. There is no infrastructure to ensure distribution of LNG as bunker, and it is hard to see who is willing to take the cost of investment (Bergöö, 2012). Naturally, ship owners need assurance that retail availability will arise before investing into LNG-propulsion. Ship owners operating in Singapore point at the government as a necessary first pioneer (Wah, 2012). The government has established a *Green Initiative* to support environmental measures within shipping, and this must be extended to include contracting of a LNG-vessel. Rolls-Royce Marine hopes they will take a first step during 2014 (Chia, 2012). If the government takes the first step, it will be easier because very few wants to be the first mover (Tay & Menge, 2012). Consequently, the future of LNG-propulsion heavily depends on political measures, especially from the Singaporean government.

Other barriers concern safety, rules and regulations of bunkering and operations with LNG as a bunker fuel. There is a perception of LNG as explosive and dangerous (Wah, 2012). This fear is irrational as LNG has excellent operational record (Løset & Tveten, 2011). However, rules and regulations that ensure safety must be put in place before retail availability of LNG can be invested into. Rolls-Royce Marine is active within a government initiated JIP that addresses this issue, and that is an important channel (Stensaker, 2012). In total, the government has many different roles in the LNG-propulsion market as summarized in Table 25 and their actions are very important for the future market outlook.

Table 25: Barriers for LNG as a marine fuel and relevant political measures

Barrier towards implementation of LNG as a fuel	Relevant political measure
• **Contracting of a pioneer ship applying LNG as a marine fuel**	The Singaporean government can contract a harbor tug through its harbor tug shipping companies
• **Establishing retail availability for LNG as a marine fuel**	By establishing standards for fuelling of LNG, investments into retail infrastructure can be performed, either by the government itself or private investors
• **Applicable standards and regulations for bunkering and operations with LNG as a marine fuel**	The Singaporean government has initiated *Joint Industry Projects* to suggest standards and regulations for fuelling and bunkering. By enforcing the JIP-findings, the bunker fuel market can develop

The LNG-industry is strong and growing. It is also extremely political important due to the importance of LNG in questions of economic growth and energy security. Particularly for LNG as a marine fuel, political measures are crucial. The government, at least in Singapore, can determine the start of a commercial market by actions related to rules, regulations and investments. Proposition 6a can be confirmed and strengthened, LNG-propulsion market strongly relies on government policy.

8.10 Proposition 6b

Norwegian government trade promotion programs in Southeast Asia rely on outdated models of internationalization. A MNC in the region will benefit from international business development specialists more than the available national export advisors.

The Norwegian government has like most governments in developed countries trade promotion programs to help firms enter new markets. Political barriers can inhabit the development, implying that support schemes, tax agreements and political relation can be crucial. This section first highlights the effect Norwegian companies have of trade promotion programs in Southeast Asia, and second evaluate if they are appropriate for a booming LNG market.

Trade promotion initiatives aim to help host country firms to internationalize. A study of Crick & Jones (2000) state that trade promotion programs rely on outdated models of internationalization. They argue that many firms are international from the start-up, and do not follow incremental step of internationalization. Consequently, government trade support has to adapt to this change (Crick & Jones, 2000).

With a new office opening in Indonesia in May 2012, Innovation Norway could serve Norwegian companies establishing in a booming LNG and gas market. As of today, Innovation Norway has offices in Malaysia, Thailand, Singapore and Vietnam. In the previous years, Innovation Norway has arranged many workshops and written reports on how Norwegian firms could target specific markets in Southeast Asia. They are focusing on the knowledge transfer from Norway, and how Norwegian companies could use several years of experience with LNG to establish and influence in a possible booming market.

Chia (2012) states that Norway as a frontrunner of LNG-technology has to proof for the Southeast Asia market that the solution is viable. Knowledge and expertise after years of experience has to be spread to Southeast Asia. Chia suggests an independent information campaign and an information brochure to communicate the safety aspect to the market. PSA also emphasizes that their knowledge and experience with LNG is very limited, and due to uncertainties and absent guidelines from the government they are still very reluctant. To do any investments, the same measures are also critical for Tian San Shipping. Wah (2012) stated that green initiatives are good, but the government must take the lead.

In Southeast Asia, Höegh LNG experienced that officials from the government can be very helpful in establishing relations and meetings on a high political level. In many of the emerging countries in the region diplomacy could be absolute necessary, and definitely more important in Southeast-Asia than in Western markets (Wisløff, 2012). Höegh LNG considers the help from the Royal Norwegian Embassy, Innovation Norway and INTSOK beneficial in the startup phase. Also, Masterbulk points out Innovation Norway could be a door opener for new entrants in the region. To get the licenses and approval to operate, Preststulen points out the importance of relationships and connections. This can partly be built through the assistance of Norwegian Embassies and Consulates, including support from Innovation Norway.

Innovation Norway's major attention on LNG as fuel in power plants and as bunker fuel indicates that they have a forward looking and emphasis a growing segment. Their actions are certainly contributing and stimulate growth of the LNG and the gas industry. The Royal Norwegian Embassy

and Innovation Norway are contributing with vital relations, which the Norwegian companies need to get the right licenses to operate in the emerging countries in Southeast Asia. There are indications that Innovation Norway use appropriate tools tailored to new models on internationalization. The model seems also reasonable and valid for emerging technologies like LNG as a marine fuel. Anyhow, a necessary next step is to increase the understanding and get rid of the unreasonable skepticism towards LNG in the region. Innovation Norway and the Royal Norwegian Embassy could affect this, since Norway is a pioneer and have experience with the LNG technology. In Section 9.3 we will address inviting a delegation from the governments and authorities of Singapore to Norway for sharing experiences and knowledge. Although the potential and opportunities for LNG in the region are huge, it could only be realized with governments and authorities convinced. This action from the Royal Norwegian Embassy could influence and speed up the development of LNG as a marine fuel in Southeast Asia.

By inviting a delegation consisting of officials from the Government of Singapore and Port Authorities to Norway, the understanding of LNG as a fuel will increase and the potential of this technology can be visualized. Investors and ship owners will not undertake the investment until governments in the Southeast Asian region are convinced. With the suggested method, the Singapore government will also signal increased focus on the environment. The action will not inhabit Singapore's competiveness, and could contribute to maintain its leading position as a marine superpower in the future. If the invitation to the Singaporean authorities is accepted and the official delegation has positive effects, other nations in the region should be invited as well. According to Section 8.1, it is Indonesia that is most relevant to invite after Singapore.

In the next chapter we will discuss the implications of findings throughout Chapter 8. We will group findings relevant to respectively managers, policy makers and further research. At the end of Chapter 9 conclusions are presented and final remarks given.

9 Implications of findings

Chapter 8 presented a pattern matching of our data collection compared to the presented theoretical propositions. This chapter raises the horizon from the strategy of analyzing the propositions by doing pattern matching, and classifies and compares findings across the propositions. The purpose of this exercise is to identify appropriate strategic choices for the Norwegian maritime sector that will lead to successful exporting of LNG-technology to Southeast Asian market. The analysis of findings will focus on both product specific characteristics and the internationalization processes. The export strategy has been made with Rolls-Royce Marine as a single case, but the results can be generalized and applicable for other Norwegian companies that are targeting the LNG-market in Southeast Asia.

Table 26: A summary of findings in the analysis of theoretical propositions

Proposition	Result
1	MNCs should enter Singapore and try to change the context, and thereupon enter Indonesia by adapting its strategies. We have focused on the ASEAN-six + Vietnam countries, meaning Brunei, Indonesia, Malaysia, The Philippines, Singapore, Thailand and Vietnam
2a	By analyzing the interviewed firms, with a particular focus on Rolls-Royce and DNV, it appears that large MNCs balance the focus on institutional framework and transaction costs well.
2b	Meyer et al.'s (2009) model for deciding entry mode into emerging markets are too simplified and not applicable for foreign market entries in ASEAN-countries. Institutional voids need increased focus when deciding entry mode.
3a	The choice of collaborative agreement in alliances are case specific, and Tse et al.'s (1997) model is not valid for the ASEAN-markets
3b	Knowledge sharing is crucial in business alliances and MNCs. We find no causal link between the firm's degree of internationalization and alliance portfolio internationalization and return on assets. More research is needed to measure the effect of timing on return on assets.
3c	Relational-based governance structure is better than contractual-based governance in managing alliances. Relations and trust are crucial in the Southeast Asian business.
4	We have qualitative indication that timing is more important to return on assets than other measures related to internationalization.
5	Partner selection is a crucial task when selecting alliances in Southeast Asia and cultural differences must be taken into account in this process.
6a	The LNG-market relies on government politics in the ASEAN-countries, such as rules and regulations for bunkering and operations.
6b	Government trade initiatives have a positive effect for Norwegian companies in ASEAN countries. Innovation Norway has a crucial role as door openers and relational-builders.

9.1 Price will determine the future of LNG-propulsion in Southeast Asia

LNG as a marine fuel is a technology with an enormous potential. The bunker fuel market is large with a daily supply of four million barrels (mbd). A transition from Heavy Fuel Oil or Marine Diesel/Gas Oil to LNG will have spin-off effects for multiple suppliers; engine manufacturers, ship designers, marine equipment producers and tank manufacturers, as well as ship owners, producers and distributors of LNG. Consequently, if the market for LNG as bunker fuel takes off, many companies must be positioned to meet the demand. This section presents the key variables that will determine the technological development in the bunker fuel market.

Løset & Tveten (2011) outlined a model that described the two most important determinants that will shape the future potential of LNG as a bunker fuel. The data collection was primarily built on

European sources of evidence, which implies a need for revision in this thesis. From the model outlined by Løset & Tveten, the following two variables were the most important:

- **Enforcement of environmental regulations:** The uncertainty and at what degree IMO will enforce the new regulations or not is determining the expansion
- **Degree of standard agreements in LNG-technology:** There is a need for standards for bunkering, design and operations in order to achieve a well-functioning market

As several interviewees underlined, Singapore will not become an ECA in any near future (Rensvik & Skram, 2012). Therefore, the variable *enforcement of environmental regulations* is irrelevant. *Degree of standard agreements* however, is a major issue in Southeast Asia. The market for LNG-technology will not take off before rules, regulations and classes for bunkering and operations of LNG as a fuel are outlined (Stensaker, 2012). Several ship owners also await procedures regarding application of LNG (Tay & Menge, 2012; Wah, 2012; Steen, 2012). In total, *Degree of standard agreements* is still valid as a key decision variable.

There are many relevant key decisions variables that can be applicable in the model. Nevertheless, price of LNG is an important factor, which is highlighted by multiple interviewees. As for today, the price of LNG compared to oil in Asia can possible kill the business case of LNG-propulsion (Chia, 2012). Historically, there has been an oil-gas differential in favor of LNG (Bergöö, 2012). In Asia, it is smaller than in USA and Europe, but it is present. There are a number of uncertainty factors that will determine the evolution of the oil & gas price relation. If USA starts to export gas, the global price will be equalized and Asia will get cheaper gas. Likewise, if China exploits their shale gas reserves for production, the price will be reduced. And the limited crude oil reserves in the world will probably upheld the HFO-price. In total, *the oil-gas differential* will be a key determinant in affecting the market for LNG as a marine fuel.

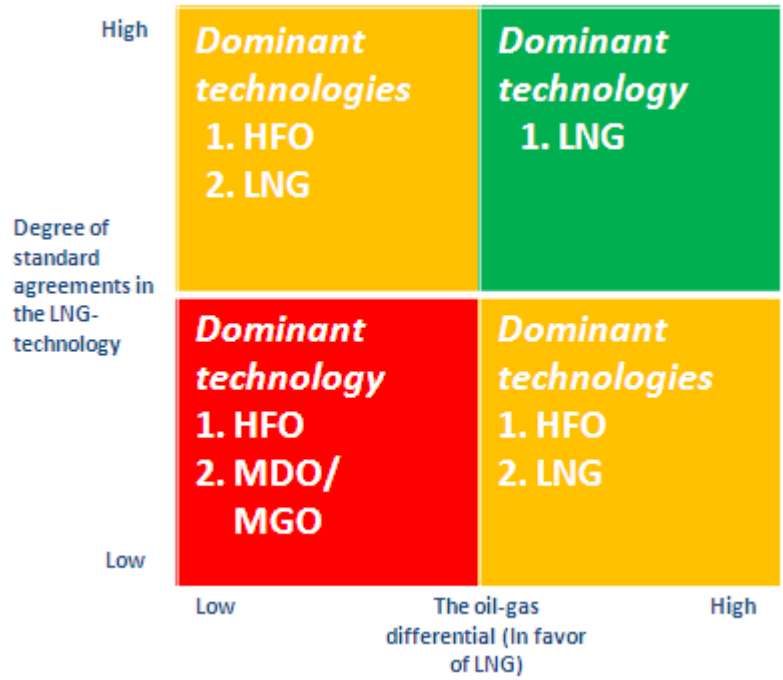


Figure 46: Future scenarios for the bunker fuel market in Southeast Asia

Figure 46 shows an updated version of Løset & Tveten's (2011) model for the future scenarios of the bunker fuel market, with a particular focus on the Southeast Asian region. It is the thesis' authors understanding that *the oil-gas differential* and *degree of standard agreements* will be the two most important determinants of the bunker fuel market. In contrast to the European market where environmental regulations will be enforced, smoke scrubbers are not a relevant alternative as there is no profit motive with this technology. Accordingly, HFO and MDO/MGO is the relevant alternatives to LNG as a bunker fuel.

Southeast Asia is a profit-oriented region (Stensaker, 2012). Therefore, it is useful to analyze the economic considerations regarding LNG-propulsion. Given the fact that LNG is cheaper than HFO, ship owners should have been very positive towards the new fuel. However, the capital expenditure (CAPEX) is 20-30 % with LNG-propulsion than traditional engines. Moreover, the tank requires three times the space compared to conventional fuel (Løset & Tveten, 2011). Accordingly, the economic case of LNG is a tradeoff between increased CAPEX and decreased operational expenditures (OPEX) such as fuel costs, operational reliability and maintenance costs.

Løset & Tveten (2011) presented a comprehensive framework with the purpose to indicate payback time on the investment into LNG-propulsion (Appendix II). Fuel cost is the most important component in determining the time it takes to offset the additional CAPEX. To PSA Marine, the increased CAPEX is not that important due to the extremely high demands attributed to operational reliability and maintenance costs on tugs (Tay & Menge, 2012). In this thesis, we have updated the framework by Løset & Tveten (2011) that was targeted towards OSVs, and incorporated maintenance costs. The payback-time for LNG-propulsion in harbor tugs operating in Singapore can be seen in Figure 47.

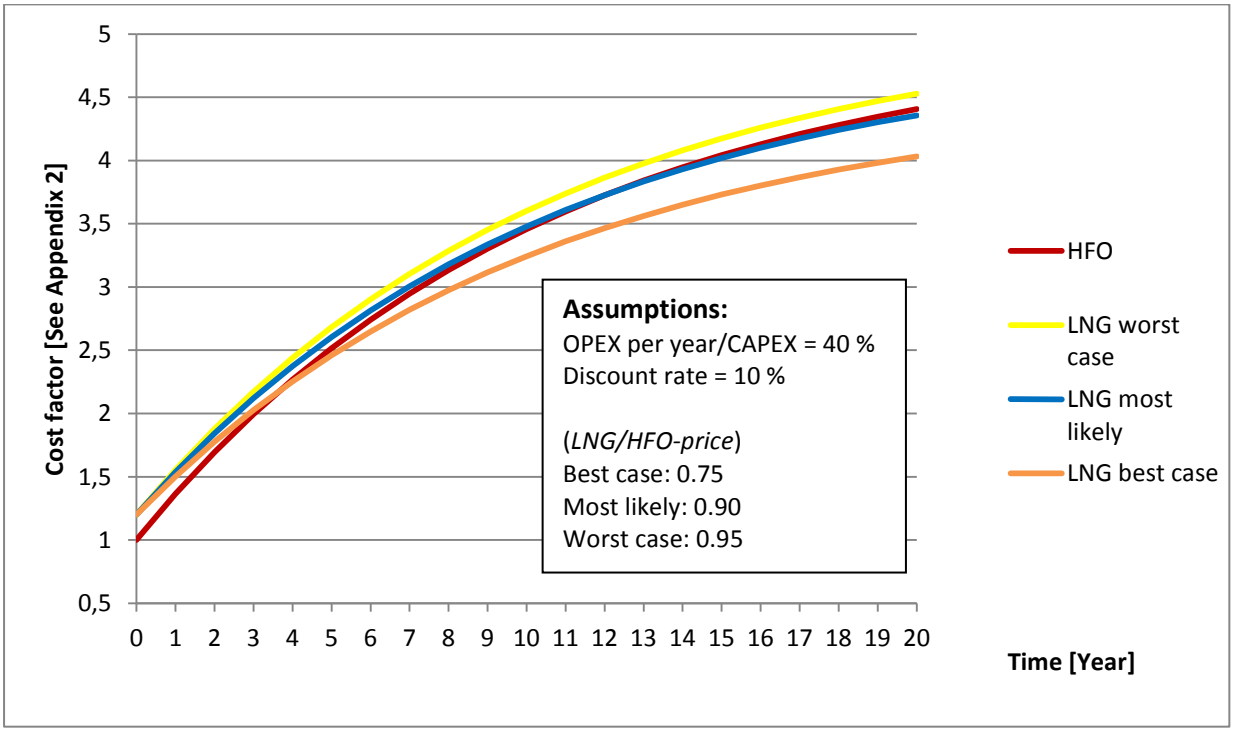


Figure 47: Economic analysis of payback-time by investing into LNG-propulsion with different oil-gas differential (See Appendix 2)

Figure 47 shows that LNG-propulsion will be profitable if the oil-gas differential increase, if we assume maintenance costs savings and excellent operational reliability. The oil-gas differential is bases on estimates of bunker fuel prices in Singapore. If the oil-gas differential stays at the level of today, LNG-propulsion will be profitable in a 12 years period. In the best case scenario, LNG will be profitable after only 4 years. This indicates how sensitive the calculation is concerning the future oil-gas differential. Experience from Norway indicates a high probability of increased operational reliability, and reduced maintenance costs and lubricant consumption. The evolvement in the oil-gas differential is somehow more uncertain, which might explain why ship owners await pioneers to contract ships with LNG-propulsion. Nevertheless, the business case of LNG is likely to be profitable within a reasonable time horizon.

9.2 Recommendations for managers

Chapter 8 revealed several optimal strategic choices for entering Southeast Asia, as well as recommendations for which countries that should be targeted and how. This section addresses the implications and recommendations for managers, by summarizing and grouping appropriate strategic choices for the internationalization processes of LNG-technology. In Chapter 8, we discussed the most important strategic factors regarding LNG-technology and the business environment in Southeast Asia. Appropriate entry mode, timing, alliances and partner selection was identified based on extensive data collection. In the following, the implications for managers are accounted for, and a comprehensive export strategy for the Norwegian maritime industry towards Southeast Asia is composed.

9.2.1 Enter Singapore and Indonesia

Section 8.1 clearly recommended targeting Singapore and Indonesia as the first markets to launch LNG-propulsion in Southeast Asia. The other markets in the region can be relevant in a long-term perspective, but it is important to narrow the focus in marketing of immature technologies (Løset & Tveten, 2011). Singapore works as a reference country concerning technology, and it is important to ensure successful launching of LNG-propulsion in the reference market before expanding into other markets. Indonesia is the largest market, which makes it an important country in terms of profits. This section reviews the strategic choices regarding targeted markets.

Singapore is the smallest country in the Southeast Asian region in terms of area, second smallest in terms of population and third smallest in terms of GDP. Nevertheless, it is the most important market to enter and to succeed in, with respect to LNG-propulsion. Singapore is a naval for the entire region and a premise provider when it comes to technological development within shipping. The most important factor with Singapore is that it is one of the busiest ports in the world with 20 % of the global bunkering volume. Accordingly, if retail availability of LNG is established and applied in some key segments, it is likely to diffuse into other ship types and ports in the region. The government has taken some initiatives through *The Maritime Port Authority* and established a technical and a commercial *Joint Industry Projects* to work on standards and regulations for bunkering and operations (Rensvik & Skram, 2012). It is a great opportunity for the industry to affect the government policy and *change the context*. Among ship owners and the population there is skepticism towards gas and LNG, and it takes government leadership to change this perception (Wah, 2012). **Early entry into Singapore is an important strategic decision if a firm wants to capitalize on LNG-propulsion, and such firms should work actively in order to change regulations so LNG as a bunker fuel becomes feasible.**

Indonesia does not share many geographical similarities with Singapore. It is the largest country in the region with an extreme landscape, and it is the largest in terms of population and GDP. The landscape consists of an endless number of islands, especially the east region, which makes it an ideal case for small-scale LNG (Rensvik & Skram, 2012). Several interviewees predict Indonesia to be the largest potential market for LNG-propulsion (Preststulen, 2012). However, there are challenges related to corruption and the fact that foreigners cannot have the majority share post in local companies. Accordingly, to succeed in Indonesia you must *adapt your strategies*. Corruption can be avoided if you learn how to do business in the country (Preststulen, 2012). Höegh LNG has recently signed a large contract for a FSRU by managing the business environment properly (Wisløff, 2012). **It is possible to succeed in Indonesia, but it takes adaption of traditional Western-style strategy to get market shares.**

Singapore and Indonesia are the key markets to target in order to succeed. The other gas consuming ASEAN-countries, Malaysia, Philippines, Thailand and Vietnam, have the potential of becoming markets for LNG-propulsion. But it is our assessment that the time horizon of LNG as a bunker fuel in these countries is significant longer than in Singapore and Indonesia. It is important to focus resources for immature technologies, and two countries are enough before the market booms.

Table 27: Market overview of Singapore and Indonesia

	Singapore	Indonesia
Market characteristics	Singapore has one of the busiest ports in the world with 20 % of the world's bunkering. It is naval in the Southeast Asian region and a technological frontrunner	Indonesia is the 4th most populated country in the world and the 16th largest economy, and the most important country in Southeast Asia.
Strategy to succeed	Singapore has one of the best business environments in the world. However, the government is very important and has a key role in determining the development of LNG-propulsion. Accordingly, firms should try to *change the context*	Indonesia has challenges with corruption and local rules stating that foreigners cannot have a majority share post. Nevertheless, this can be avoided by learning the business environment and *adapt your strategies*
Risk and uncertainty	Gas has a negative perception in Singapore, and the price of LNG is a little too high to offset the additional CAPEX within a reasonable time	The weak legal framework increase the risk of investment and increase the cost of doing business in the country

In the next subsection, we will describe more thoroughly the strategic choices to undertake. Timing, entry mode, alliances and partner selection are all factors that firms must consider. Section 9.2.2 describes appropriate strategic decisions under different circumstances.

9.2.2 Enter by acquisition or a joint venture within two years

Singapore and Indonesia are the recommended countries to first target in the region. We used the framework by Meyer et al. (2009) to assess proper entry modes in the countries. By analyzing the institutional framework and the local resources needed by the case firm, Rolls-Royce Marine, proper entry modes were identified. The results could probably be generalized and applicable for other Norwegian companies that will establish in the region.

As confirmed by the interviewed firms, presence in the region is absolute necessary to do business in the region. For Norwegian firms that has not established yet, Singapore is a natural place to first target with LNG-technology. With acquisitions companies could fast and smoothly establish business

in Singapore, with relatively little country risk involved. By operating from Singapore as a hub, companies could work with development and establishment of LNG technology in the entire region.

In Indonesia, Meyer et al. (2009) framework suggested joint venture or Greenfield entry. But according to Indonesian law, Greenfield entry is not possible. To get the license to operate an Indonesian partner with the majority share post is required. A well-established cooperation with local firms secures local market knowledge, overcome cultural differences and could be a proper strategy to prevent corruption (Preststulen, 2012).

We consider presence in the region to be vital for business success, but other entry modes than the proposed could be suitable. The most important consideration is that the entry mode fits the company that establish and their required needs. But as suggested, a proper way to target the LNG market in Southeast Asia is by doing acquisition in Singapore. You get a fast entry, access to skilled local resources, and could serve the entire region.

Timing

As stated in Løset & Tveten (2011) knowledge about gas safety is a crucial factor for the future of LNG as a bunker fuel. The skepticism towars the safety aspect by LNG-techology in Southeast Asia is a barrier as for today, and prevent the development. During the last ten years, LNG has been a well-tested technology in Norway. Years of experience and application on different ships has created a reliable and good reputation. While the understanding of LNG has increased, the skepticism has decreased; the relationship is described by the graph in Figure 48.

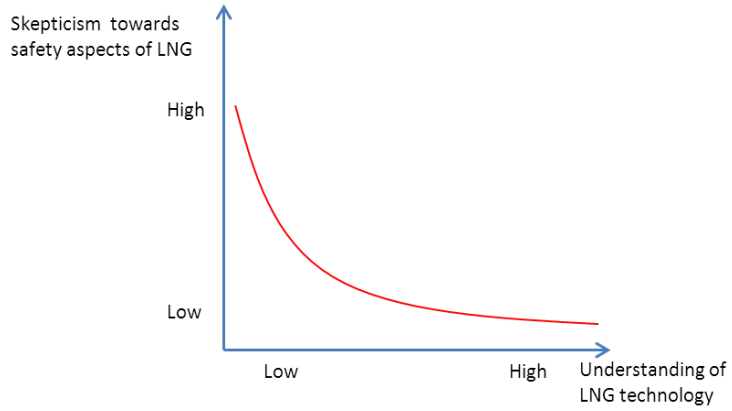


Figure 48: A curve showing the relation between skepticism towards LNG and lack of knowledge

In Singapore and Indonesia the market for LNG has to be considered as immature (Løset & Tveten, 2011). There is still no LNG bunkering terminals in the region and the knowledge is limited. Anyhow, as discussed we assessed the future potential for the technology to be huge. With the new LNG import terminal on Jurong Island, the understanding of LNG technology will increase in Singapore. If the development follows the same steps as in Norway, it is reason to believe that 2013 will be a good timing for entering the market. In Asia relationships are considered to be more important and the business more time consuming than in Europe. You should therefore be established in the region, before the LNG-market in the region booms. Many different companies are already looking at LNG as a future solution, and the development will get increased momentum with LNG available. As pointed out in Proposition 3b, there is a positive effect between the ability to share knowledge with business partners and profitability. The focus the first years should be mainly on expectation

management and establishment of relationships. Also *joint industry projects* will be an appropriate way to reduce risk, influence market agreements and build relations.

In Indonesia where the uncertainty is higher than in Singapore, we consider that the development and establishment of infrastructure will take more time. Singapore has usually been a first-mover into new technologies in the region, while the other countries use some time to adapt (Rensvik & Skram, 2012). Everything indicates that the same development will happen again. The uncertainty by entering into Indonesia, without knowing that LNG is a success in Singapore is probably too high and the entering barrier to costly. Accordingly, 2015 is a proper entry time into Indonesia.

Only by '*Crossing the chasm'* in Singapore, investors will be able target Indonesia (Moore, 1999). It will be essential to be established in Singapore with relations, local market knowledge and presence to succeed in the region. **For Norwegian companies, an early establishment will provide huge opportunities to influence the market and the standards that need to be settled to accelerate the development in all countries adopting LNG as a marine fuel.**

Alliances

Relations and trust are crucial to succeed in the Southeast Asian business environment. Alliances are widely used in foreign market entries to reduce uncertainty and risk, to acquire local market knowledge and to get market access. **Regardless of collaborative agreement, long-term relations are a key ingredient in well-functioning alliances in the Southeast Asian market.** Accordingly, the building of alliances with partners or customers is an important issue to address.

Within the market for LNG-propulsion, alliances and relations have a particular importance. In Løset and Tveten 2011, one important finding was the need for strategic alliances in order to speed up the development of LNG as a bunker fuel. Cooperation in the value chain is the preferred solution to solve the Chicken & Egg-problem, the problem with a lack of infrastructure and lack of users. The need for partners and allies is higher when the product is complex or multidisciplinary (Moore, 1999). We addressed the joint cooperation between Shell and Wärtsila as an important breakthrough on accelerating the LNG-technology in USA. Shell will offer retail infrastructure in certain parts of the American coast line, while Wärtsila will offer LNG-propelled engines. By working together, they share the risk of investing into expensive infrastructure and bunkering facilities.

In Southeast Asia, where still no LNG bunkering infrastructure is established, several of the interviewed firms pointed at the lack of infrastructure as a problem. To ensure the required investments to be carried out, alliances and network projects along the value chain will be essential. The LNG-sponsors need to establish and make market agreements on specifications for LNG as a bunker fuel (Løset & Tveten, 2011). Establishment of standards and cooperation in the value chain will reduce uncertainty and risk for investments made by both LNG-distributors and ship owners.

Partner selection and governance

In Section 8.6 we highlighted the importance of having access to appropriate, effective and experienced networks. All the interviewed firms considered partners and alliances to be vital when doing business in Southeast Asia. **Relationships and connections could be absolute necessary to get licenses and approvals to operate.**

A critical task in establishing collaboration in emerging markets is partner selection. Many companies chose to cooperate with agents to perform marketing and sales of their products. As described, this can be a viable solution for companies without a brand reputation. Nevertheless, agents may have several clients with competing products and services which create interest conflicts. Such conflicts are costly and time consuming and must be avoided by careful partner selection. Partner selection is a stepwise process where the internationalizing firm first must clarify its expectations and needs. Secondly, potential partners must be identified, assessed and interviewed before a selection is carried out. It is resource-demanding to perform this process on distant market, but Innovation Norway has extensive experience with assisting in partner selection processes. It is our recommendation to engage international business specialists in Innovation Norway when doing partner selection.

Concerning the management of alliances, business networks and alliances should be managed by relational-based governance involving trust, to give highest return on investment. Trust reduces negotiation and transaction costs, increase knowledge sharing and make it easier to handle conflicts. Relational-based governance strengthens alliances in economic turbulence, and should be preferred over contractual-based governance in all cases except those where only a simple market transaction is carried out.

9.2.3 Appropriate strategy a key to success in Southeast Asia

Two countries in Southeast Asia seem most promising. Singapore has one of the busiest ports in the world, and it is a technological frontrunner in the shipping industry and it functions as a reference market to other countries in the region. Moreover, Singapore has one of the best business environments in the world which helps Western companies to establish without worrying about corruption. Indonesia has the region's largest GDP and it has a geography ideal to LNG-technology. However, it is a demanding business environment which takes time to learn. A common feature between Singapore and Indonesia is a need to be present in the Southeast Asian region to be considered as a potential business partner. We recommend establishing presence, alliances and relationships early in Singapore, before the LNG-technologies booms in the region. When the market for LNG-propulsion arises in Singapore, a foreign market entry into Indonesia can be executed.

Profit is the most common motivation for internationalization. Specifically for emerging markets, MNCs might have additional motives such as counter-expansion as emerging economy's firms are expanding towards Western markets. Regardless of strategic rationale, profit is a necessity in a long-term perspective. Multiple researchers have tried to do empirical studies with the purpose to find correlation between profit and firms specific variables. Our study does not indicate that any firm specific factors are causal linked to profits, although they maybe correlated. However, we suggest that timing of market entry is an important decision that will determine level of profits. Timing is a decision where expected profits must offset the associated risk. In the case of LNG-propulsion, firms who wants to make profits in Southeast Asia should enter fast to be established before the market booms. Table 28 summarizes both strategic and timing-related issues covered in Section 9.2.

Table 28: Summary of strategic choices

Strategic choice	Singapore	Indonesia
Entry Mode	Acquisition	Joint Venture
Timing	2013	2015
Alliances	Joint Industry projects	Local partners required
Partner selection and governance	Relation-based governance	Relation-based governance
Recommended strategy for LNG-propulsion	Change the context	Adapt your strategies

The shipping industry in Southeast Asia is huge and 20 % of the world's marine bunkering takes places in Singapore. If a market for LNG-propulsion emerges there is a great potential to make profits from selling relevant technology to this market. However, it is not straightforward to succeed by internationalizing to this region. Accordingly, our recommendations concerning entry mode, timing, alliances and partner selection should be considered in order to maximize profits from exporting LNG-technology.

9.3 Recommendations for policy makers

The diplomacy has a particular importance in the Southeast Asian business environment. The Royal Norwegian Embassies, Innovation Norway and INTSOK are crucial institutions for Norwegian companies that want to establish in the region. This section suggests how government trade initiatives should be organized to help its country's businesses to succeed abroad, and specifically what the Norwegian diplomacy should do to stimulate the development of LNG as a marine fuel.

A general finding throughout our thesis is that the Norwegian diplomacy has a greater impact in Southeast Asia compared to Western countries. This is probably viable to other Western diplomacies as well. Innovation Norway, Royal Norwegian Embassies and other government initiatives have a crucial impact as door openers and relational-builders. Business and politics are more closely intertwined in Southeast Asia than in Western countries, which make policy makers very important to ensure business success in Southeast Asia. Specifically in the case of LNG-propulsion, there is a lot of effort the diplomacy can undertake to accelerate the prospects of the business case.

We have already described in Section 9.2.2 how Innovation Norway can assist with partner selection. This is a crucial task for companies seeking partners in Southeast Asia. Innovation Norway has extensive knowledge and experience with local firms and they are able to guide firms to select an appropriate partner without conflicting interests. Partner selection services should be strengthened and offered to future firms seeking to establish in the ASEAN-countries.

Section 8.8 verifies that the LNG-propulsion market strongly relies on government policies. The section also points out specific and relevant political measures the government in Singapore has undertaken to accelerate the development of the LNG technology. Examples of political measures are establishing *Joint Industry Projects* working on standards for bunkering and operations with LNG. But before this work is completed, a crucial next step will be to increase the knowledge about the fundamentals of the LNG-technology. Many decision makers still believe LNG is dangerous and therefore not feasible (Wah, 2012). Only with increased understanding among the decision makers, LNG can reach its potential as a marine bunker fuel in the region. Consequently, Norwegian governmental trade initiatives should contribute to increased understanding of LNG as a marine fuel.

9.3.1 Invite official delegations to Norway to observe LNG-propulsion

The Royal Norwegian embassies, innovation Norway and INTSOK should take initiative to share knowledge concerning the application of LNG as a marine fuel in Norway. A delegation from the government of Singapore and port authorities should be invited to Norway to increase the understanding of LNG. The first seminar should be targeted towards Singaporean decision makers, before other authorities in Southeast Asia are invited, preferably the Indonesian as the second. By inviting delegations to Norway, important knowledge and years of experience can be shared. This measure has several key objectives:

- LNG and natural gas are met with skepticism among many stakeholders in Singapore. By observing the LNG-solutions in Norway knowledge will be shared and the perception of LNG will face a favorable change
- An official delegation creates opportunities for Norwegian companies to build relations with stakeholders from Southeast Asia
- General diplomatic ties are strengthened

Singapore should be the first country to receive an official invitation to Norway as they are a technological frontrunner, and Indonesia the next. In a long-term perspective other ASEAN-countries can be invited. Such delegations could also stimulate development of similar standards across the ASEAN-countries. Besides organizing official delegations, several measures can be undertaken by Innovation Norway. They must continue and consider strengthening international business advising as more Norwegian companies establish in Singapore and the Southeast Asian region. Innovation Norway is important, and their crucial role must be acknowledged.

9.4 Recommendations for further research

Internationalization processes are thoroughly studied from many perspectives with the field of strategic management as a main contributor. We have focused on emerging markets which are rapidly changing politically, economically and socially. Consequently, research, maybe in particular empirical research, fast becomes outdated. During our thesis we have identified several issues which need further research.

A generic model built on an empirical study has been developed to suggest appropriate entry modes in foreign markets (Meyer et al., 2009). The model builds on data from foreign entries into four emerging economies whereas two are in the Southeast Asian region, which makes it very relevant to this thesis' research question. Nevertheless, collected data indicates that the model cannot be generalized to all emerging markets. Indonesia does not allow Greenfield entries because foreigners cannot have the majority share post in an investment. Accordingly, Joint Ventures are the only alternative. This indicates that the model can only be instructive, not decisive. Further research is required to develop more advanced and precise decision support models for foreign entries into emerging markets.

Tse et al. (1997) developed a complex model to describe which factors that decided the choice of alliance form by using export data to China. Our proposition stated that the model was applicable for Southeast Asia, but that was not the case. The rationale for choosing different collaborative agreements outlined in the model deviated from our data collection. This fact can be explained multiple ways: The data used by Tse et al. (1997) could be outdated, or it cannot be applicable

outside China. Anyhow, further research is needed to develop generic models for choosing different forms of alliances so that it may be applicable also in the Southeast Asian region.

Ruigrok & Wagner (2003) and Lavie & Miller (2008) have investigated respectively correlation between return on assets (ROA) and degree of internationalization (DOI) and alliance portfolio internationalization (API). Ruigrok & Wagner (2003) found the highest ROA at low and high levels of DOI, whilst Lavie & Miller (2008) found the lowest ROA at low and high levels of API. Our thesis suggests that these findings are contradicting as highly internationalized firms often have alliances with similar firms. Accordingly, there should be further research on which key variables that has causal links to ROA. Also, there should be more research on the role of timing in determining profitability for firms.

One of our propositions claimed that timing of foreign market entries had more significance on ROA than ROI and API. The analysis of data clearly states the great importance of timing, especially in foreign markets such as in Southeast Asia. We found qualitative evidence that timing was the most crucial determinant in deciding ROA. However, this study does not have quantitative data to support the claim in the proposition. Accordingly, we request further research on the impact from foreign market entry timing on financial performance in emerging markets in particular.

In Section 8.1 we have updated Løset & Tveten's (2011) 2x2-matrix and economic analysis for the business case for how LNG-propulsion will evolve in Southeast Asia. This model is subject to generalization, but it will deviate between regions and over time as prices change. We recommend other researchers who will use the model as a foundation for analyzing new markets to update the model based on a country risk assessment and price strategy analysis.

Internationalization processes are thoroughly studied. However, the world is constantly changing and research can quickly be outdated. Consequently, it is important to identify phenomenons that can be subject to further research. The next section will summarize the implications of findings and offer conclusions, as the strategy to succeed with export of LNG-technology from Norway to Southeast Asia is presented.

9.5 Conclusions

An increasing role of LNG in the Southeast Asian energy mix creates an opportunity of LNG as a marine fuel. As for today, Norway has the largest LNG-propelled fleet and several manufacturers of marine equipment serving this ship segment. Accordingly, it is interesting to do a market analysis of the future potential of LNG as a bunker fuel in Southeast Asia and how Norwegian sub suppliers can succeed in exporting relevant technology. Our research question for this thesis is:

- How can the Norwegian maritime sector succeed in internationalizing LNG-technology to South-East Asia?

The market for LNG as a bunker fuel is far more immature in Southeast Asia than in Norway and Europe. Coastlines of ASEAN-countries are not ECA-areas and the upcoming regulations from IMO setting a maximum sulphur emission level at 0.1 % from 2015 is not relevant in these markets. The most important determinant is profitability and reliable standards for bunkering and operations of LNG-fueled vessels. **Consequently, the probability of a growing market for LNG-propulsion depends on an increase in the oil-gas differential increase in favor of gas, and if a class for LNG-vessels is**

established. Throughout our thesis we have identified the most promising markets, strategies for how to succeed in them and how government trade initiatives can contribute to develop the LNG-market. We have also identified a need for future research. Our case company has been Rolls-Royce Marine, but our findings are subject to generalization for the entire Norwegian maritime industry, and probably other Western firms as well.

Chapter 8 has analyzed the pattern matching of data towards theoretical propositions. The analysis given clear indications of which countries Norwegian exporters of LNG-technology should target, what strategy they should pursue, what the government can conduce to, and what research needs this study have revealed. Figure 49 summarizes the findings for how the internationalization strategy towards Southeast Asia can be executed.

Countries to target	Strategic decisions
Singapore: Has one of the busiest ports in the world and a technological frontrunner. 20 % of all bunkering in the world takes place in the Port of Singapore, and success in this market is crucial to succeed in the region as well as in the global market ***Indonesia:*** The region's largest economy with an ideal geography for LNG. It is the 4th most populated country in the world, and 16th largest economy. By success, enormous profits await.	***Entry mode:*** Acquisitions and Greenfield Entry are recommended in Singapore, while a Joint Venture is a requirement in Indonesia ***Alliance:*** There is no indication that one collaborative agreement is better than another, it is rather case specific. However, JIP is widely used. ***Timing:*** It takes time to do business in Southeast Asia, and it is crucial to build long-term relations. An early entry, from 2013, is important to capitalize on LNG-propulsion ***Partner selection:*** Careful partner selection is required to reveal potential conflicts with other partners, and to ensure that the partner is appropriate
Trade initiatives	**Product analysis**
Innovation Norway: The diplomacy is more important in Southeast Asia than in Western countries. Presence from international trade specialists are crucial to act as door openers and relational builders with local partners ***Delegations to Norway:*** To build trust as well as marketing LNG-propulsion, delegations from the different targeted markets should be invited to Norway to experience a functional LNG-market	***Strategic determinants:*** The future of LNG as a bunker fuel will decided by: • *Degree of standard agreements for bunkering and operations with LNG as a fuel* • *The oil and gas differential* ***Economic analysis:*** With an LNG-price at 90 % of HFO, LNG give a payback time of 5 years to offset the additional CAPEX

Figure 49: A summary of findings from theoretical propositions

9.5.1 Final remarks

The market for LNG-propulsion in Southeast Asia is very promising. With a new import terminal for LNG coming up on Jurong Island in Singapore during 2013, the region's energy mix will contain more gas. This is a business opportunity for LNG-propulsion as the government wants more areas of application through distribution of small-scale LNG. With the right strategic decisions it is possible for Norwegian companies to make good profits from marketing and sales of LNG-propulsion technology to Southeast Asia.

First of all, to do business in the region is time consuming and demands careful attention to relational building and brand reputation. Accordingly, it is advantageous to narrow the focus of internationalization to a limited number of markets. We recommend starting with Singapore.

Singapore has 20 % of the world's bunkering and is a technological frontrunner in the region. Also, they have a lot of short sea shipping which is ideal as a first segment to adapt LNG-propulsion. Four tugs are built annually to cover the port needs, and such vessels are very suitable as they do not need LNG-bunkering outside Singapore.

A second market to target is Indonesia. It is the world's 16th largest economy and geographically ideal for small-scale LNG. However, it is a country struggling with corruption and rules preventing foreigners to hold share post majority. Therefore we recommend keeping focus on Singapore and Indonesia the next few years. It is too much risk associated by entering more than two countries with LNG-propulsion technology, that it cannot be offset by profit outlooks. A strict focus on Singapore and Indonesia will maximize the probability of success and hence profits.

Two distinct strategies must be outlined for Singapore and Indonesia. In Singapore, firms can try to change the context by contributing to create new guidelines for bunkering and operations for LNG through government initiated *Joint Industry Projects* that is working on this topic. Moreover, the open business environment makes the choice of entry mode and alliance agreements flexible. In Indonesia, firms must engage into *Joint Ventures*. If this is unfamiliar, firms must adapt their strategies. Corruption can be avoided, but it requires long-term relations to enter low-risk functional alliances.

A final remark is the significance of Innovation Norway in accelerating the technology of LNG-propulsion in the region. By organizing official delegations to Norway, knowledge can be shared, relations can be built, and the LNG as a marine fuel can become a reality faster than expected. A market for LNG as a bunker fuel will arise in Southeast Asia, and Norwegian stakeholders can speed up the technological development by first targeting Singapore and Indonesia, build long-term relations and chose tailored strategies.

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Appendix I – Interview guide

Questions regarding LNG:

1. We want to find out how the Norwegian maritime industry, and specifically, Rolls-Royce, the success of exporting LNG technology to Southeast Asia. But first, what is their assessment of potential markets for LNG technology in the region?
2. What is the potential of LNG as a marine fuel?
    a. Ships types
    b. Time aspect
3. What are the barriers towards implementation?
4. How are the financial considerations among alternative technologies? CAPEX and OPEX
    a. LNG vs HFO
    b. LNG vs scrubbers and SCR
    c. LNG vs MDO
5. How could help from the Norwegian government be useful?
    a. Innovation Norway
    b. NHD
    c. Maritim21
6. In Norway, the stringent environmental requirements and the ECA Area LNG technology in shipping. Which drivers will focus on LNG technology in Southeast Asia?
7. You are part of many joint Industry Projects. What is the effect of them and how much is invested in them?

Questions regarding international strategy of the company:

8. What are the synergies between the Southeast Asian offices?
9. What considerations apply before you decide to invest in a new market (country)?
10. Based on what he has told so far: why you invested in Singapore and Malaysia in the first place?
11. What type of investment are you willing to do in different countries?
12. What formal structures do you have on the alliance?
13. A partner may have many different properties that are useful. Local experience and presence, international experience in a market, etc. How voters you partners?
14. How do you manage alliances as you are part of? How to share your knowledge and get it to give effect to the company?
15. Is it relevant with new alliances and partners to succeed in Southeast Asia?
16. What factors are most important when you consider investments in new countries?
17. What is the importance of a stable political regime?
18. What is the significance of the country's experience in international business?
19. What is the importance of good labor market?
20. What is the importance of well-functioning financial markets?
21. How much time and resources do you use to identify conditions in the country you go into, and how much emphasis on them? Political system, legal system.
22. Challenges of emerging markets specifically?
23. Knowledge Sharing

Appendix II – Economic Analysis

This appendix shows how we have made our economic analysis of LNG versus smoke scrubbers. We also present some alternative scenarios to the one presented in Section 8.1.

Step 1: Firstly the relationship between the CAPEX for LNG and HFO are estimated. We have estimated LNG-CAPEX to be 1.2 times higher than smoke scrubbers as a mean between different estimates presented.

	CAPEX
HFO	1
LNG	1,2

(Saga, et.al, 2010; Stenersen, 2011)

Step 2: Secondly we have estimated the cost components in OPEX for an OSV based on Stopford (2008). We have also used other sources to estimate these, but we must underline that they will vary largely based on vessel type.

	OPEX
Fuel	45 %
Staffing	10 %
Port fees	17 %
General costs	28 %
Total OPEX	**100 %**

(Stopford, 2008; Stenersen, 2011)

Step 3: Thirdly the oil-gas differential between LNG-price and HFO are estimated. As for today, it is 0.5, but we have tested both 0.75 and 0.25. The oil and gas differential is currently high based on historical prices, but it is no signs of any factors that could bring them closer in the short run. The global supply of LNG is currently great with huge available reserves and is expected to grow substantially in the future, while oil reserves are scarce resources (Nysæter & Aadland, 2011).

	January 2012	Worst case	Best case	(Japan prices, 2011)
LNG-price / HFO-price	0,9	0,95	0,75	[$/kWh]

Step 4: The last step has been to estimate the relation between OPEX and CAPEX, set a discount rate and estimate the cost accumulation. The formulas are shown.

$$OPEX = \frac{1}{(1+Discount\ rate)^{Year}} * \left(\frac{OPEX}{CAPEX} * \left(\frac{LNG\ price}{HFO\ price} * Fuel + Staffing + Port\ fees + General\ costs\right)\right)$$

	OPEX/CAPEX	40 %	(HIS Cera, 2011)		
	Discount rate	10 %			
Time		LNG 1	LNG 2	LNG 3	HFO
0	CAPEX	1,2	1,2	1,2	1
1	OPEX	0,34	0,36	0,30	0,36
2	OPEX	0,31	0,32	0,27	0,33
3	OPEX	0,28	0,29	0,25	0,30
4	OPEX	0,25	0,27	0,23	0,27
5	OPEX	0,23	0,24	0,21	0,25
6	OPEX	0,21	0,22	0,19	0,23
7	OPEX	0,19	0,20	0,17	0,21

8	OPEX	0,17	0,18	0,16	0,19
9	OPEX	0,16	0,17	0,14	0,17
10	OPEX	0,14	0,15	0,13	0,15
11	OPEX	0,13	0,14	0,12	0,14
12	OPEX	0,12	0,12	0,11	0,13
13	OPEX	0,11	0,11	0,10	0,12
14	OPEX	0,10	0,10	0,09	0,11
15	OPEX	0,09	0,09	0,08	0,10
16	OPEX	0,08	0,09	0,07	0,09
17	OPEX	0,07	0,08	0,07	0,08
18	OPEX	0,07	0,07	0,06	0,07
19	OPEX	0,06	0,06	0,05	0,07
20	OPEX	0,06	0,06	0,05	0,06

Finally, the cost accumulation is estimated by adding the total costs for all the forgoing years:

$$Total\ costs_{YEAR\ n} = \sum_{n=0}^{N} Costs_n$$

Time	LNG most likely	LNG worst case	LNG best case	Smoke scrubbers
0	1,2	1,2	1,2	1
1	1,38	1,40	1,35	1,23
2	1,54	1,59	1,49	1,43
3	1,68	1,75	1,61	1,62
4	1,81	1,90	1,73	1,79
5	1,93	2,04	1,83	1,95
6	2,04	2,17	1,92	2,09
7	2,14	2,28	2,01	2,22
8	2,23	2,38	2,08	2,33
9	2,32	2,48	2,15	2,44
10	2,39	2,56	2,22	2,54
11	2,46	2,64	2,28	2,62
12	2,52	2,71	2,33	2,70
13	2,58	2,78	2,38	2,78
14	2,63	2,83	2,42	2,84
15	2,67	2,89	2,46	2,90
16	2,72	2,94	2,50	2,96
17	2,75	2,98	2,53	3,01
18	2,79	3,02	2,56	3,05
19	2,82	3,06	2,59	3,09
20	2,85	3,09	2,61	3,13