

**Supply Services to Arctic Offshore Operations;
Macro-environment, Market Demand, and
Business Potentials**

– The Case of Maersk Supply Service

Authors:

Linnea Sonesson
Patrik Torstensson

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– The Case of Maersk Supply Service

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ABSTRACT

Title: Supply Services to Arctic Offshore Operations; Macro-environment, Market Demand, and Business Potentials
– *The Case of Maersk Supply Service*

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Issue of Study: A forecasted increase in energy demand and consumption, together with a decrease of existing oil and gas reserves, has led the oil and gas producers to new areas beyond the conventional oil and gas regions. The Arctic, an area mainly located north of the Arctic Circle, is believed to hold very large potential of the world's yet-to-be discovered oil and gas reserves. In addition, the Arctic is relatively unexplored and therefore qualifies as a new area. The harsh conditions and sensitive environment, together with the opinions and requirements from a number of affected stakeholders, bring new and unknown challenges to companies interested in operating in the Arctic region. In step with increased exploration and production activities in the Arctic, there is an increased demand for service providers such as the Offshore Supply Vessel (OSV) industry to be able to operate in the area. However, some questions remain to be answered. For example, which stakeholders have an influence on the development of the Arctic petroleum industry, what OSV

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services does the market demand, what are the main challenges in providing the required services, and what is the potential for and within the Arctic OSV industry?

Purpose: To contribute to the knowledge regarding the Arctic offshore oil and gas industry in general and the business potential for the OSV industry within the waters of the Arctic region in particular.

Objectives: The objectives of this thesis are;

- To describe the general conditions and challenges associated with Arctic oil and gas operations and to identify the industry stakeholder characteristics.
- To investigate the market demand for OSV services to Arctic exploration and production activities.
- To analyze the business opportunities and risks for OSV services in the Arctic and to evaluate the business potentials for one of the traditional OSV operators; Maersk Supply Service.

Method: This study is basically performed in a three-step-process, which can be illustrated by a funnel, where the first step includes a general analysis of the Arctic oil and gas industry, which gradually will be narrowed down to a case study on a single company, on which the general aspects are applied. This thesis employs mainly a qualitative method with a mix of both analytical and systems approaches.

Conclusions: The stakeholder analysis indicates a complexity within the Arctic oil and gas industry and different stakeholders are of different opinions. However, there are business potentials for Arctic OSV services, due to market demand and the current low state of competition. The case company, Maersk Supply Service, has good potential to benefit from these business potentials. There are however many risks and challenges associated with a market entrance and commencing operations in the region.

Key words: Arctic, Oil and Gas, Offshore Supply Vessel, Offshore Drilling, Risk, Strategy Analysis.

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LIST OF ABBREVIATIONS

DP – Dynamic Positioning system
EER – Emergency, Evacuation, Rescue
E&P – Exploration and Production
MSS – Maersk Supply Service
NGOs – Non Governmental Organizations
OSV – Offshore Supply Vessel
RBV – Resource Based View
ROV – Remote Operating Vehicle

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1 INTRODUCTION

This chapter will give the reader an introduction to the thesis. The background and issue of study will be presented, which in turn will lead to the purpose and the objectives of the study. Additionally, delimitations, target group and chapter disposition will be established.

1.1 Background

It is certain that the oil and gas eventually will be running out, the question is when? In the *Statistical Review of World Energy 2009*, the petroleum producer BP calculates that the global proved oil reserves counts to 1258 billion barrels in 2008. The remaining reserves of oil are thereby equivalent to consumption in additionally 42 years and the global proved reserves of natural gas will last for an additional 63 years (BP Statistical Review of World Energy, 2009).

Moreover, the world's population is expecting to grow by 50 % over the next four decades (U.S. Census Bureau, 2010) and the world energy consumption is expected to increase by 44 % from 2006 to 2030 (U.S. Energy Information Administration, 2009a). The demand of oil has peaked in developed countries but is increasing in countries like China (New York Times, 2009), which is the second largest energy consumer after the United States (U.S. Energy Information Administration, 2009b). The energy consumption in non-OECD¹ countries is estimated to annually grow by 2.3 % compared to 0.6 % for countries within the OECD and in 2030 these countries will account for around 40 % of the energy consumption. Non-OECD countries in Asia will increase their energy use by over 100 % over the next two decades; China and India for example are growing very fast and will account for 28 % of the world's consumption in 2030. The economic growth measured in terms of GDP is increasing in the world, which also increases the demand and use of energy (U.S. Energy Information Administration, 2009a).

Even though oil prices are high and the demand of renewable energy sources has increased, oil and natural gas are expected to remain the world's most important energy source for decades to come, with an expected share of more than 50 % of total energy demand in 2030 (U.S. Energy Information

¹ OECD is the Organisation for Economic Co-operation and Development including 30 member countries (OECD, 2010).

Administration, 2009a). The fear of living without energy and that renewable energy sources will not manage to fill the gap that the running out oil and gas will leave behind is high. This has made the producers turn their attention towards new areas where oil and gas can be extracted.

1.2 Issue of Study

A highly potential new area for the offshore industry to commence prospecting activities for commercial oil and gas production is the Arctic. The U.S. Geological Survey (USGS) has shown that the potential is high, since 90 billion barrels of oil, 1669 trillion cubic feet (500 trillion m³) natural gas, and 44 billion barrels of natural gas liquids may remain to be found north of the Arctic Circle (USGS, 2008a). These numbers are equivalent to 30 % of the world's undiscovered gas and 13 % of undiscovered oil (Science, 2009). Approximately 84 % of these resources are expected to be found offshore. (USGS, 2008a).

One of the major concerns about operating in Arctic waters is the ice conditions, (Eliasson, 2010) but controversial or not, the global climate change will modify the circumstances for operations in Arctic waters, since many areas may no longer be totally covered by ice all year around. Furthermore, technology is becoming more advanced, which enables operating activities in the harsh conditions of the Arctic region (Interview with Tolstrup).

Exploration and production (E&P) activities in the Arctic are challenging, although not untested. The first successful well was drilled in 1968 on the north slope of Alaska. The finding, which was the largest oil field in the U.S. and the 20th largest ever discovered in the world, started an exploration spree in the Arctic. But due to decreasing oil prices and the special environmental conditions, which aggravated the operations in the region, the exploration remained limited, until today (Energy and Capital, 2009).

Recently various companies have begun exploration and production activities in the Arctic, among others; Cairn Energy on the west coast of Greenland, Gazprom, Total and Statoil in the Shtokman field north of Russia, and Shell and ConocoPhillips are planning to drill in the Beaufort and Chukchi Seas off Alaska. A comparison between the total number of offshore exploration wells in the U.S. Gulf of Mexico alone and in the entire Arctic region counts to approximately 10 000 versus 500. This indicates that the Arctic is a fairly new and unexplored area (Noble, 2010).

The environment in the Arctic is sensitive and there are concerns that E&P activities in this region will have unknown effects on both the biological and social environment (Interview with Zolotukhin). Hence, there are strict regulations that environmental aspects must be taken into consideration and extensive Environmental Impact Assessments² (EIA) has to be performed (Interview with Burgaard). In addition, remote areas with undeveloped infrastructure, harsh climate, ice coverage etc. put high demands on all companies operating in the Arctic region. These questions are highly on the subject not to mention BP and the Deepwater Horizon's current oilrig explosion, in the Gulf of Mexico (Rigzone, 2010a). Despite the challenges associated with Arctic operations, development of advanced technologies that facilitates the process of finding oil and gas in remote areas with extreme conditions and deeper waters makes it possible (Interview with Madsen).

In steps with increased E&P activities in the Arctic, there is an increasing demand of services provided by specialized companies, e.g. drilling companies and logistic providers. An important sector of service providers is the Offshore Supply Vessel (OSV) industry, which provides services to the offshore industry in terms of transportation of equipment, anchor handling duties, towage of offshore structures etc.

The market development within Arctic regions put high and new demands and expectations on the OSV industry and its services in matters of ice breaking capabilities, extreme condition durability of equipment and crew member health and safety (Gallagher, 2010). One company, an established actor in the traditional OSV industry that is interested in commencing activity in the Arctic region, is Maersk Supply Service (MSS).

1.3 Purpose

The purpose of this project is to contribute to the knowledge regarding the Arctic offshore oil and gas industry in general and the business potentials for the Offshore Supply Vessel (OSV) industry within the waters of the Arctic region in particular.

1.4 Objectives

By achieving the objectives presented below the purpose will be achieved.

The objectives of this thesis are;

² The EIA Directive is a EU legislation (European Commission, 2010a)

- To describe the general conditions and challenges associated with Arctic oil and gas operations and to identify the industry stakeholder characteristics.
- To investigate the market demand for OSV services to Arctic exploration and production activities.
- To analyze the business opportunities and risks for OSV services in the Arctic and to evaluate the business potentials for one of the traditional OSV operators; Maersk Supply Service.

1.5 Delimitations

Due to the limited time frame a couple of delimitations are set. Quantitative market aspects regarding value and growth will not be addressed neither will profitability be discussed. Furthermore the required services will only be identified and hence the amount and combination of this demand will not be acknowledged.

1.6 Target Group

The target group for this thesis is first and foremost Academia. Another important group is professionals with an interest in the Arctic exploration and production development and all the stakeholders that are affected by Arctic operations. Some examples of stakeholders are oil and gas companies, the local communities and organizations of the Arctic region, NGOs, governmental agencies, contractors, and the case company Maersk Supply Service.

1.7 Chapter disposition

Chapter 1: Introduction – This chapter will give the reader an introduction to the thesis. The background and issue of study will be presented, which in turn will lead to the purpose and the objectives of the study. Additionally, delimitations, target group and chapter disposition will be established.

Chapter 2: Method – This chapter aims to present the work process and explain why certain methods have been chosen. Several different approaches, research strategies, and research methods will be discussed in order to explain and motivate the methods used. Furthermore, the credibility, and criticism of sources will be emphasized.

Chapter 3: Theory – This chapter presents the theories that will be used in order to analyze the empirical data. The emphasis lies within the strategic

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field, including macro-environment, industry, and firm specific theories and frameworks. In addition corporate social responsibilities and risk management theories are presented.

Chapter 4: Macro-Environment – This chapter constitutes parts of the empirical result. The reader will be introduced to the basics of the oil and gas industry, why the Arctic is an interesting region for oil and gas exploration and production, as well as the operational challenges within the Arctic region. Furthermore, the different stakeholders of the Arctic offshore oil and gas industry will be identified, and their characteristics related to the industry's key drivers of change will be discussed.

Chapter 5: Market Demand for Supply Services – This chapter will firstly give the reader an introduction to the traditional OSV industry. Secondly, the required services for Arctic operations will be identified, and the challenges and opportunities regarding these services will be discussed.

Chapter 6: Business Potentials in the Arctic OSV industry – This chapter will present the business potentials for an OSV company in the Arctic. First the competition will be identified and the market attractiveness will be discussed. Secondly the risks that are associated with Arctic operations will be elucidated and lastly the business potentials for the case company Maersk Supply Service will be presented.

Chapter 7: Contributions and Final Remarks – The contribution that the thesis results in will be presented in this chapter. Final conclusions from chapter 4, 5, and 6 will be elucidated and furthermore final remarks in terms of whether the result meets the purpose will be discussed. Finally, suggestions to further studies will be identified.

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2 METHOD

This chapter aims to present the work process and explain why certain methods have been chosen. Several different approaches, research strategies, and research methods will be discussed in order to explain and motivate the methods used. Furthermore, the credibility, and criticism of sources will be emphasized.

2.1 Work Process

With regards to the objectives established in 1.4 the work process has been formulated, illustrated in Figure 1. To be able to perform this study an understanding for the offshore oil and gas industry in general is first and foremost required. Step 0 indicates a pre-study with the aim to gain a general understanding for the Arctic oil and gas industry. This step will not be treated in writing in this report, but will rather work as a general understanding for the authors.

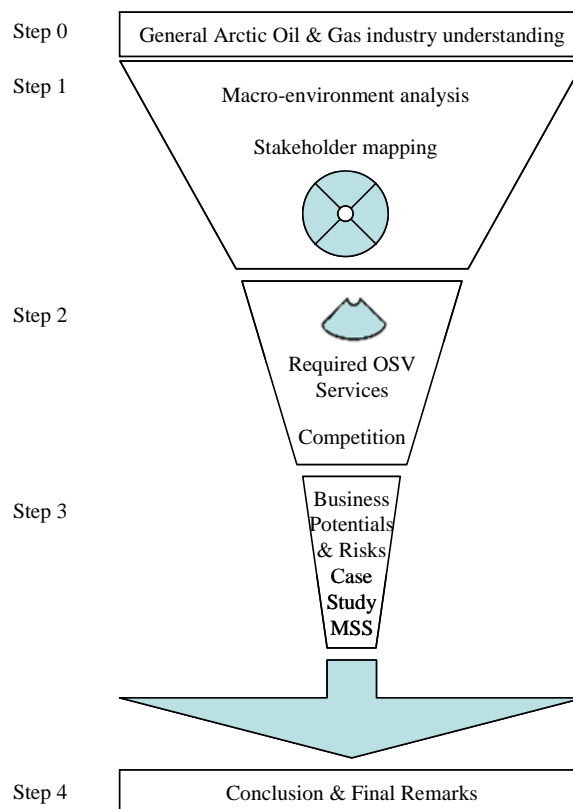


Figure 1 - Work process

Step 1 will result in chapter 4, where the Arctic offshore oil and gas industry will be analyzed from a macro-environmental perspective. The Arctic oil and gas potential will be identified, and the special conditions in the Arctic regarding the environmental and local conditions will be described as well as the general challenges that operators in the region are facing. Furthermore the stakeholders and the relationship between them will be mapped out and discussed in a stakeholder analysis. Finally the key drivers of change that affects the industry will be analyzed in relation to the stakeholders.

In step 2, which will result in chapter 5, a broader introduction to the OSV industry will be presented. Furthermore the market demand for Arctic OSV services will be identified and described.

Chapter 6 will constitute the outcome of the third step, where the business potentials for OSV services in the Arctic will be discussed by evaluating the competition, identifying the key success factors and the risks associated with Arctic operations. The business potentials for the case company Maersk Supply Service will then be evaluated by identifying their strategy and internal resources and capabilities to investigate whether they are in line with the key success factors.

Step 4 will include final analysis and contributions, where findings from the earlier steps are concluded as well as final remarks. This final step will result in chapter 7.

2.2 Methodological Approach

A research's objective may be different depending on the researcher's basic view on knowledge. There are three different methodological approaches; analytical, systems, and actors approach (Björklund & Paulsson, 2003).

Analytical View

With an analytical approach the researcher strives to explain the reality as objectively and completely as possible (Björklund & Paulsson, 2003). It is presumed that the whole is equal the sum of its parts and that knowledge is independent of the observer (Arbnor & Bjerke, 1997). Causal relations are explained and the greater number of proven causes the stronger the explanation is. The scientific ambition is to come up with explanations from a general point of view, to find patterns, regularities, similarities and representative models. A hypothesis is often formulated, which will later on either be confirmed or rejected. The researcher is using existing theories to

verify or falsify the hypothesis. The results in the analytical view show pure cause-effect relations, logical models, and representative cases (Arbnor & Bjerke, 1997).

Systems View

When using the systems approach the researcher tries to explain the reality objectively, but unlike the analytical view the whole differs from the sum of its parts. The parts are related to each other, which creates positive or negative synergies and the relationship between the parts is as important as the parts themselves (Arbnor & Bjerke). The researcher is trying to investigate the connection between the parts in a system to understand the underlying factors (Björklund & Paulsson, 2003). With this approach the researcher is using existing system theories seeking to explain the finality relations. The results will be typical cases and classification mechanisms (Arbnor & Bjerke, 1997).

Actors View

The actors approach assumes that the reality is a social construction, where the knowledge depends on individuals including the observer (Arbnor & Bjerke, 1997). The description of the reality is therefore dependent on the researchers' earlier experiences and handlings (Björklund & Paulsson, 2003). The researcher is using metatheories and is trying to understand and describe the relation between the interpretations made by various actors. The relations explain how various interpretations mutually and in transformation influence each other in a continuous developmental process (Arbnor & Bjerke, 1997).

Chosen Approach

Both a systems and an analytical approach will be used in this thesis. The procedure will somewhat consist of an analytical approach, since the outcome of this project depends on the cause-effect relation of the results from the different parts. A systems approach will however be used in order to understand the Arctic oil and gas industry, its stakeholders, and the relationship between them and how they are affected by e.g. environmental conditions.

The analysis will be based on the theory combined with the empirics collected from both primary and secondary sources. During the work process the authors have realized the complexity of the industry. This complexity regarding the stakeholders' impact on each other and the development of the industry has been illustrated in a framework developed by the authors.

The final result will hence consist of parts which are analyzed with the systems view, where the whole differs from the sum of its parts. These parts will in turn contribute to the outline of this thesis that thus is based on an analytical view. The actors view will not be used due to the fact that the authors will not have an impact on the result of this study.

2.3 Research strategies

There are four potential research strategies; *survey*, *case study*, *experiment*, and *action research*. A *survey* signifies a gathering and description of the present situation and the aim is often to describe a broad question. If the population that is intended to be investigated is too big a smaller sample is chosen. The sample's answers are then extrapolated on the whole group and conclusions can be made (Höst, Regnell, & Runesson, 2006). A *case study* is an investigation on a smaller distinct group. Case studies are often used when processes or changes are studied. A case study proceeds from a holistic perspective with the aim is to get as much information as possible (Patel & Davidson, 1994). The specific case is often chosen with a specific purpose and the conclusions are not generalized for other cases. An *experiment* is in turn a comparable analysis of two or more alternatives with the aim to explain causality and explain the dependency between different phenomena. Finally, *action research* is a controlled and documented activity that aims to solve a problem. An action research starts with an observation to identify the problem. Additionally a solution will be presented and finally the solution will be evaluated by observing it in its context (Höst et al., 2006).

Chosen Strategy

A case study will be performed in order to describe the Arctic oil and gas industry, its stakeholders and the Arctic OSV industry. Furthermore the business potentials within the OSV industry will be identified. Consequently the results will be generalized for all companies that are operating or have an interest of operating in the region, among others Maersk Supply Service (MSS). Moreover the business potentials for MSS will be identified by conducting an additional case study, which only will be applicable on the case company.

2.4 Research Method

Usually, the methods applicable in scientific research are categorized in two: *quantitative* and *qualitative* methods. The reason for which to choose is based on the information that is under investigation, and the biggest difference

between the two methods is whether or not the reality, to a great extent, is explained by numbers and statistics (Holme & Solvang, 1997).

Quantitative methods use measurements, mathematics and statistics as a central part of the analysis. The method, thus, is formalized and structured and is embossed by researchers' control (Holme & Solvang, 1997). Examples of quantitative methods are: experiments, tests, questionnaires etc. (Backman, 2008).

Qualitative methods do not use numbers or statistics. Instead, formulations are verbal, either written or spoken, and are therefore considered less formalized and structured (Backman, 2008). The primary purpose is to receive a deeper understanding of a supposed problem, and to be able to describe the entirety of its context. The method is primarily characterized by close interactions between the researcher and the sources of information (Holme & Solvang, 1997) and examples of qualitative methods are; interviews, observations etc. (Backman, 2008).

Chosen Research Method

A qualitative research method is used in this thesis to get a deeper understanding of the Arctic oil and gas industry and the Arctic OSV industry in order to identify the business potentials for the Arctic OSV industry as an entirety as well as for the case company.

2.5 Data Collection

There are different methods of collecting data and the data itself can be characterized into two main categories: *primary* and *secondary* data. Primary data implies such data that is collected by the researcher himself, whereas secondary data already has been collected and is to be found in existing documentation. A problem with secondary data is usually that the data was collected for a different purpose than that of the study being conducted; resulting in a difficulty of validating the quality and the usefulness of the data (Lekvall & Wahlbin, 1993).

According to Yin (1994) there are six different sources of information, which are specifically relevant when conducting case studies: documentation, archival records, interviews, direct observations, participant-observation, and physical artifacts. A well performed case study uses as many sources as possible in order to complement each other, and there is no single source that is more advantageous than the other.

With above methods in mind, the authors of this thesis choose to divide the following sections in *primary data collection* and *secondary data collection*, describing the sources that are intended to be used and how the data will be collected. This study will consist of both primary and secondary data in order to get a result as accurate as possible.

Primary data collection

The primary data collection will consist of what Yin (1994) describes as interviews, observations and participant-observations.

Interviews

Interviews may be conducted in different forms and are considered an important source of information when conducting a case study. The most frequently used form of interviews are *open-ended*, where the interviewee can report facts as well as an own opinion and insights, which in turn may result as the basis for further questions on a specific subject, and the interviewee is to be considered more as an informant than a respondent. Identifying key informants is a critical task for a successful result in a case study (Yin, 1994).

When the purpose of an interview is to substantiate certain known facts, the interview is *focused*. The interview is often performed by following a template of beforehand set up questions, linked to a delimited subject. The questions have to be carefully formulated and a common pitfall is that the questions are leading, which undermines the corroboratory purpose (Yin, 1994).

The third and last interview form is *surveys*, which through structured questions is to be considered as formal. Surveys are usually conducted on a larger population than the two other types, and the result is to be considered as qualitative in a quantitative manner (Yin, 1994).

Observations

As stated by Yin (1994), there are two different types of observations: *direct observations* and *participant-observation*. The former simply referring to a field visit at the site of the study, enabling conditions, behaviors, etc. to be documented. Participant-observations differ in matters of the observer taking an active, rather than a passive, role in the events that are being studied. The greatest advantage with observations is the ability to gain access to information that otherwise is inaccessible (Yin, 1994).

Chosen Method for Primary Data Collection

Primary data will be collected by both open-ended and focused interviews depending on the purpose of the interview. Interviews in the beginning of the work process and particularly internally within the case company will have more of an open-ended character in order to get as much knowledge as possible and get a general understanding for the industry. Further on, focused interviews will be held with people that possess specific knowledge regarding the subject. To get an understanding for the oil and gas industry and its stakeholders, people working for the major oil and gas companies with a special interest in the Arctic will be interviewed. Additionally, stakeholders with an objective opinion of the industry such as Academia will be interviewed. In order to identify the required services interviews will be held with employees at big oil and gas companies that possess knowledge within Arctic exploration and production activities. Finally, focused interviews with people at MSS and other OSV companies will be conducted in order to understand the competition within the Arctic OSV industry and identify the business potentials.

When the interviewees allow, record devices and notes will be used in order to assure correct data collection from the interviews. It is however always important that the interviewee feels comfortable in the situation.

In total 18 different people have been interviewed, some of them have been interviewed several times in order to get as accurate information as possible. 3 of the interviewees are working at the case company, 6 interviewees have been conducted with potential customers, 4 have been performed with competitors and the remaining interviews have been accomplished with contractors, brokers, suppliers, authorities, and academia. To get a total list of the interviewees and their titles see references in chapter 8.

The Arctic exploration and production industry is quite new and operators in the region have often been restrictive in their sharing of information. Hence it has been difficult to get comments from all companies that are active in the region. Additionally the people that have been interviewed have often been of a positive opinion towards operations in the region.

Secondary data collection

Extensive secondary data has undergone thorough investigation and consist in what Yin (1994) divide in: documentation, archival records, and physical

artifacts. Secondary sources are also used in purpose to corroborate and augment information provided from primary sources (Yin, 1994).

Documentation

There are many different types of documentation: letters, agendas, written reports, studies, articles etc. A systematical search for and a review of relevant documents is important when conducting case studies. Sources of references are often extensive and hold different valuable information, such as local libraries, the Internet as well as internal documents of the organization(s) being studied. It is of importance to not over rely on documents and understand that the documents often have been established with a different purpose with a different target group in mind than that of the study being conducted. With this in mind, the risk of being misled by the documentary information is mitigated, and the interpretation of the information is more likely to be correctly critical in its view (Yin, 1994).

Archival records

Examples of archival records are service records, organizational records, maps and charts, survey data, personal records etc. The information gathered in archival records is often highly quantitative and in contrast to documentary information, the use of archival records varies, depending on the case study and which type of information that is of importance. As in the case of interpreting documentary information it is important to understand the purpose and the target group that the information addresses (Yin, 1994).

Physical artifacts

The last source of information is physical or cultural artifacts such as technological devices, tools, art etc. This form of information sources are unusual and are almost solely used in anthropological studies (Yin, 1994).

Chosen Method for Secondary Data Collection

Secondary data will be collected from documentation in terms of written reports, studies and articles. With the intention of getting a broad knowledge in the early stages of the work process articles and studies about the oil and gas potential in the Arctic, the oil and gas industry, and the Arctic environmental conditions will be used. Furthermore, internal documents will be studied to get knowledge about the industry and the case company. Finally, documents from and homepages of oil and gas companies, governments and non governmental organizations such as Greenpeace will be studied.

2.6 Deduction, Induction, and Abduction

A researcher is producing theories that should be as close to the reality as possible. The focus is hence to relate theories and reality to each other (Patel & Davidsson, 1994). There are three alternative methods to be used in order to get to a conclusion; *deduction*, *induction*, and *abduction*. (Eriksson & Wiedersheim-Paul, 2001)

A *deductive* approach means that the work process is based on theories. Thereby an existing theory decides which information that will be gathered, how the information will be interpreted, and how the results will be related to the already existing theory (Patel & Davidson, 1994). Moreover this approach means that conclusions are based on logical reasoning (Eriksson & Wiedersheim-Paul, 2001).

When using an *inductive* approach the researcher starts with the collection and analysis of data from which hypothesis or theories can be formulated (Backman, 2009). These may later on be tested against new data (Becker & Bryman, 2004). When using an inductive approach conclusions are based on empirical data (Torstensson & Wiedersheim-Paul, 2001).

Abduction is a hybrid between deduction and induction, where the researcher switches between theory and empirics (Björklund & Paulsson, 2003). Conclusions are first based on the deductive approach where a conclusion is built on reality. This conclusion is then tested against empirical data; hence empirics and theory have been united (Eriksson & Wiedersheim-Paul).

The work process is based on theories, it will however be developed over time depending on the outcome of the different steps. Hence theories and empirics will be mixed in an abductive approach.

2.7 Credibility

Validity, *reliability*, and *objectivity* are all measurements on a study's credibility. A high validity means that the measure method really measures what is intended to be measured. A high reliability on the other hand means that the measurements will be more or less the same when measuring several times (Lekvall & Whalbin, 1993). Objectivity indicates how opinions affect the study (Björklund & Paulsson, 2003).

A high validity will be achieved by using several different sources of data and clear, not biased questions when interviewing. The reliability will be

guaranteed by having follow-up questions when interviewing to assure that the answers are correctly perceived. An increased objectivity will be assured by no factual errors or biased collection of sources when referring to sources.

The Arctic oil and gas industry is related to many risks and hence there are many different opinions about operations in the region. The operators are of one opinion, which also may differ from person to person, governments, local people, and non governmental organizations may be of another opinion. With the intention of getting an objective view of the situation as many as possible of the different stakeholders' opinions will be studied.

2.8 Criticism of the Sources

Focus has been on interviewing people within the oil and gas and OSV industry. Opinions from other stakeholders that are affected by the operations are therefore not equally emphasized. The people we have been in contact with are also the ones that are passionate about the Arctic petroleum development. The interviewees are however aware of and respect other stakeholders' opinions. Since the Arctic market is quite new, it has been difficult to get in contact with companies, who want to share their opinions and knowledge for confidential reasons. Hence it has been impossible to have a conversation with all companies that have an interest in the region. The result had probably been different if more stakeholders, such as governments, NGOs, additional oil and gas companies and OSV companies, had been interviewed.

3 THEORY

This chapter presents the theories that will be used in order to analyze the empirical data. The emphasis lies within the strategic field, including macro-environment, industry, and firm specific theories and frameworks. In addition corporate social responsibilities and risk management theories are presented.

3.1 Stakeholder Theory

From the system perspective, the stakeholder theory has been developed; sharing the view of an organization as an open system that takes influences from the surrounding environment as well as the organization itself has an impact on the environment, mostly through the organization's stakeholders. One of the early developers of the stakeholder theory is Eric Rhenman, who through many of his studies (1964a, 1964b, 1965, 1970) has discussed the view of a company as serving a higher purpose to the society than just maximizing its profitability towards the shareholders as later debated by Friedman (1970) among others.

A distinguished stakeholder theorist is R. Edward Freeman, who corroborates with Rehnman in regards that an organization has a relationship and responsibility to all its stakeholders and not just its shareholders (Freeman, 1984). Rhenman (1964a) as well as Freeman (1984) identifies a number of stakeholders, either as individuals or as groups; owners, employees, board members, suppliers, customers, governments and authorities etc.

Freeman state the following definition: "...a stakeholder in an organization is any group or individual who can affect or is affected by the achievement of the organization's objectives..." (Freeman, 1984, p.46).

Both Rehnman (1964a) and Freeman (1984) put the organization in the center, where each stakeholder is dependent on the organization as well as the organization is dependent on each of its stakeholders to survive. The dependency is explained by the demands each of the stakeholders put on each other to be able to reach their own goals as well as how the behavior of one stakeholder affect another. The dependency can generate both positive as well as negative effects in terms of joint or conflict of interest. The positive effects are obvious when coordination of stakeholders' interests is successful, which not entirely gains the organization itself, but the stakeholders as well.

Negative effects may arise when interests are contradictory, e.g. a firm wants to have high margins but its suppliers charge high prices for their products or services and the firm's customers want low prices. Hence, the stakeholder theory suggests that organizations must take all stakeholders' influence into consideration to be able to acknowledge the corporate democracy that is necessary in order to balance the different interests among the stakeholders (Rhenman, 1964a).

The definition by Freeman (1984) has been widely adapted and takes a "landmark" position in contemporary stakeholder theory research (Andriof and Waddock, 2002; Clarkson, 1995; Rowley, 1997). However, the definition is criticized as being too wide because everyone can be addressed as a stakeholder and therefore, within stakeholder theory, Phillips (2003) argues for a distinction between the stakeholders who have the ability to affect a decision and those who are just affected by a decision. Donaldson and Preston (1995) also addresses the issue and separate stakeholders from influencers, meaning that some actors have influence and a stake, whereas some just have a stake and some just an influence. Hence, the last category is identified as influencers. An example of an influencer is media, which is corroborated by Olander and Landin (2005) since media does not necessarily have a stake, but could have significant impact on an organization and its activities.

The identification of stakeholders is sometimes difficult and much of the recent research within the field of stakeholder theory lacks a proper definition of stakeholders (Achterkamp and Vos, 2008). One definition used is "a stakeholder is an individual or organization with a vested interest in the project (i.e. outcome, success)" (Bryde & Robinson, 2005; Olander & Landin, 2005; Wright, 1997). Another is much like the definition by Freeman (1984) and states "a stakeholder is an individual or organization that can affect or is affected by the achievement of the organization's objectives (Boonstra, 2006; Kolltveit & Grønhaug, 2004). Some also use a definition by combining the two (Achterkamp & Vos, 2008).

However, before identifying the stakeholders, e.g. by name, it is an advantage to classify different stakeholder groups and Mitchel, Agle and Wood (1997) and, Vos and Achterkamp (2006) both present different methods and models for such a classification.

According to Johnson, Scholes and Whittington (2008), it is not enough to solely identify the stakeholders, they should also be mapped. There are several

ways of mapping stakeholders, but the authors propose a method of evaluating the level of interest and the power of influence. The power is graded on one axis and the level of interest on another, forming the power/interest matrix. In addition to evaluate the level of interest and power of the stakeholders, consideration should be taken to whether the stakeholders are opponents or proponents of a specific outcome. McElroy and Mills (2000) present five levels of stakeholder positions: active opposition, passive opposition, not committed, passive support and active support and these positions set the direction for the impact of each stakeholder on a specific project.

3.2 An Industry's Key Drivers of Change

It is most likely that some of the factors mentioned above are interrelated. For example, a law concerning pollution may affect the technological development to a certain direction, which in turn has an impact on the economy in terms of expensive equipment or processes. Instead of identifying all relationships, it is of importance to distinguish the *key drivers of change* since many other factors are likely to depend on these key drivers as well. The key drivers of change are factors that are likely to change and whose impact on the industry is high (Johnson et al., 2008). These driving forces formulate how competitors, customers, and suppliers adjust their actions. Furthermore they have big influence in restructuring the competitive landscape (Thompson, Strickland & Gamble, 2008) When the key drivers of change are known, organizations can construct potential scenarios of the future in order to alter their strategies to meet different changes in the business environment (Johnson et al., 2008). Moreover it is of importance to assessing the impact of the key drivers of change and to establish whether the driving forces will be to increase or decrease market demand, make competition more or less concentrated, and lead to higher or lower profitability (Thompson et al., 2008).

The most common key drivers of change stated by Thompson et al. (2008) are:

-
- The Internet and the new e-commerce
 - Increasing globalization
 - Changes in the long-term industry growth rate
 - Changes in who buys the product and how they use it
 - Product innovation
 - Technological change
 - Marketing innovation

- Entry or exit of major firms
- Diffusion of technical know-how
- Changes in cost and efficiency
- Demand for differentiated vs. commodity products
- Regulatory influences and government policy changes
- Changing societal concerns, attitudes, and lifestyles
- Reduction in uncertainty and business risk

3.3 The Five Forces of Competition Framework

Without proper knowledge regarding the industry's competitive landscape, many organizations are not likely to create a successful strategy. Hence, it is of importance to analyze the characteristics of the competitive landscape by identifying the main sources of competition and discover the strength of each competitive force. An accepted framework for analyzing the competitive structure within an industry is Michael Porter's (1980) Five Forces Framework (Johnson et al., 2008), see Figure 2.

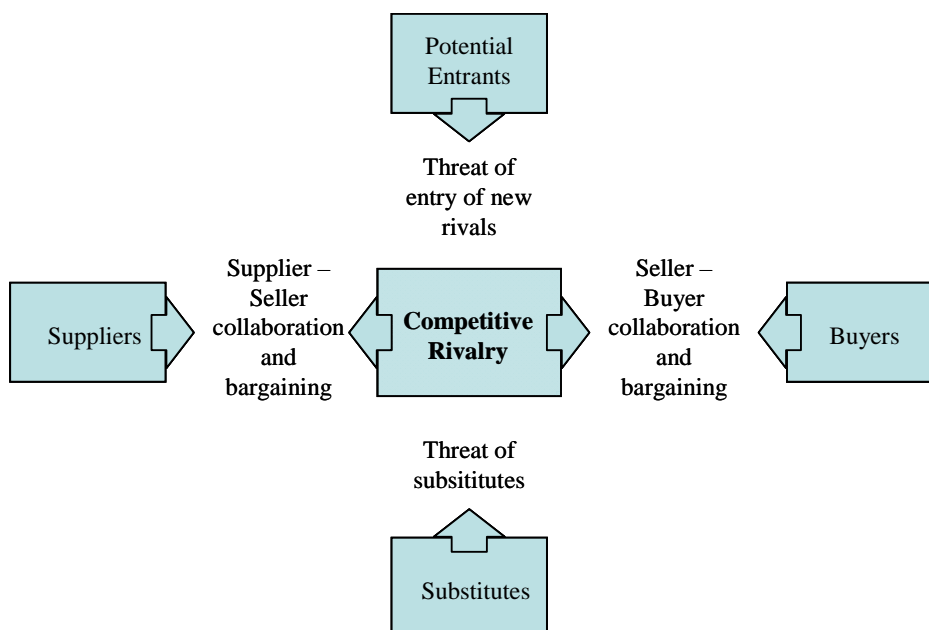


Figure 2 – Porter's (1980) Five Forces of Competition Framework

Porter (1980), with his framework suggests that an industry faces five categories of competitive forces:

1. The threat of new entrants into the industry.
2. The threat of substitutes to the industry's existing product or services.
3. The bargaining power of suppliers.

4. The bargaining power of buyers.
5. Competition between existing firms in the industry.

The threat of new entrants is described by how likely new firms are to enter an industry and what obstacles the potential entrants are to overcome in order to make an entry possible. The threat of new entrants is considerable lower when the market/industry is associated with (Thompson et al., 2008):

- Economies of scale.
- High capital and investment requirements.
- High customer loyalty.
- High customer switching costs.
- Limited access to advanced technology.
- Regulatory policies, including licenses etc.
- Existing firms' ability to block new entrants.
- Difficulties of building a distribution network.

As the existing of above factors obstruct for new firms to enter an industry, the lack of the same is contributing to the industry being more attractive for a prospective firm. It is noticeable that when a new market segment or new geographical areas occur, the potential for new entrants increase as well as existing actors are likely to establish their presence since they already have the resources, competencies and competitive capabilities to overcome the barriers of entering the new market segment or area (Thompson et al., 2008).

The threat of substitutes occurs when a closely surrounding industry's products are viewed as possible substitutes by customers, e.g. subscribers of a newspaper move towards using the Internet as a source of information rather than reading the newspaper. The threat of substitutes is mainly depending on three aspects (Thompson et al., 2008):

- Is the product available to a reasonable price?
- Is the quality of the product comparable or better than the original product?
- How high are the switching costs?

The level of competition from substitute products intend to increase when a substitute product is more attractively priced than the original, the quality and performance is comparable high and the buyer's switching costs are low (Thompson et al., 2008).

The bargaining power of suppliers can be of competitive impact when suppliers have leverage in dictating terms and condition of the product they are supplying. The degree of bargaining power among suppliers is depending on (Thompson et al., 2008):

- The concentration of suppliers – Are there few dominant suppliers and many buyers?
- The costs of switching supplier.
- The demand and supply for certain items – Can suppliers charge high prices for short supply products?
- The role and quality of the product.
- Supplier capability of integrating forward into the industry.
- Buyer capability of integrating backward into the supply chain.
- If the industry is a key customer group or not.
- The strength of the supplier's brand.

Creating strategic partnerships between supplier and buyer can be of competitive advantage and is becoming more and more practiced. It is a win-win situation, where the buyer can reduce inventory and logistics costs by a more agile supply of products, get pre-access to new products and be able to increase the quality of their products by enhance the products being supplied, and where the supplier get a loyal customer. By internet technology applications, partnerships can easily be established and maintained through effective communication and data sharing (Thompson et al., 2008).

The bargaining power of buyers is very much like the conditions for suppliers' bargaining power in reverse, that is, when buyers have leverage to acquire favorable conditions in terms of prices etc. The bargaining power of buyers depends on (Thomson et al., 2008):

- The concentration of buyers – Are there few dominant buyers and many suppliers?
- The costs for buyers of switching supplier.
- Differentiation vs. commoditized products.
- Threat of integrating backward and forward in the supply chain.
- The role and quality of the product.

As in the previous section, establishing strategic partnerships between seller and buyer is becoming increasingly important in gaining competitive advantages with regards to cost effectiveness, more agile and responsive supply chains etc (Thomson et al., 2008).

Competition between existing firms in the industry is usually referred to as the strongest force of the five, due to firms' moves to gain market shares, strengthen their position and increase profitability. The competitive pressures stemming from rivalry among existing firms is highly dynamic because firms shift strategies in order to outperform their competitors, who are to respond with an offensive or defensive countermove (Thomson et al., 2008). Competition is absolutely strongest among firms that possess similar strategic dimensions. A group of firms that emphasizes a similar strategy is also called a strategic group (Hitt, Ireland, & Hoskisson, 2009). The competition among existing firms depends on (Thomson et al., 2008):

- The structure of competition. Rivalry intensifies when the number of competitors (equal in size and capability) increase.
- The market dynamics. In a slow-growing market, competition is usually stronger than in fast-growing.
- The industry cost structure, e.g. scale economics.
- The degree of product differentiation vs. commoditization.
- Strategic moves among rival firms.
- Switching costs for the buyer.
- High exit barriers.

Competition among existing firms can be characterized at different levels. When price wars or other aggressive tactics are used, the rivalry is brutal, whereas the rivalry is moderate to weak when the majority of the firms earn good profits and the situation is accepted among the competing firms (Thomson et al., 2008).

Is the industry competitively attractive or unattractive?

Once each of the five competing forces has been evaluated, the next step is to determine if the sum of the competitive forces is conducive to good profitability or not. Important questions to ask are; if the competition is stronger than normal, if there are forces that might undermine industry profitability and if companies can expect to earn reasonable profits despite the current state of competition (Thomson et al., 2008).

The expected profits within an industry depend on the strengths of the competitive forces. The stronger the forces, the lesser the profit is a rule of thumb. However, all forces do not necessarily have to be strong to undermine profitability. Usually it is enough if two or three forces exert strong pressure on the industry, forcing some companies to an exit. For the market to be

attractive, the collective impact of the competitive forces should be moderate to weak in order to expect good profits. When competition is weak, the bargaining power of suppliers and buyers are weak, there are no good substitutes, high entry barriers and existing sellers do not pose a competitive threat to one another (Thomson et al., 2008).

3.4 Key Success Factors

By using the five forces of competition framework an industry's potential profitability can be determine. However, it is of great interest to establish how these profits are divided between the competing firms within the industry. A company that succeeds to get a competitive advantage in comparison with its rivals will be the most profitable within the industry. Hence one must identify the sources of a competitive advantage, which could be done by establishing the industry's key success factors (KSF) (Grant, 2005). An industry's key success factors are the competitive factors that have the greatest impact on future competitive success and hence they clarify the difference between being a strong or weak competitor. It can be product attributes, competencies, competitive capabilities, and market achievements. The KSFs can be divided into two types; strategic necessities and strategic strength. A strategic necessity does not guarantee an advantage since other competitors have them, but the absence of the success factor indicates a weakness. A strategic strength is on the other hand an asset or competence that is superior its competitors and that creates a competitive advantage (McLoughlin, D. & Aaker D. A., 2010) In order to identify an industry's key success factors the following questions should be answered (Thompson et al., 2008);

1. What aspects are important when a buyer chooses a specific brand? That is, what product attributes are critical?
2. What resources and capabilities does a company need in order to be competitively successful?
3. What shortcomings give a company a significant competitive disadvantage?

To be a competitive player within the industry a company's strategy should incorporate the intent to be distinctively better than the competitors in at least one key success factor. If they succeed to be better than rivals in one or two key success factors they normally have a competitive advantage (Thompson et al., 2008). An industry's KSFs may however change and hence it is of great importance to identify emerging success factors (McLoughlin & Aaker, 2010)

3.5 SWOT and the importance of finding a strategic gap

A SWOT-analysis summarizes a company's strengths, weaknesses, opportunities and threats in comparison to its competitors. The aim is to identify the key issues from the business environment and the strategic capability of the organization, which can be of help when formulating the company's strategy (Johnson et al., 2008). The strategy should be based on the firm's assets and competences, since it is harder for a competitor to imitate these factors than duplicate what the company does (McLoughlin & Aaker, 2010). Moreover, the objective is to reduce the identified threats and take advantage of the opportunities in order to strategically respond to the environment. To become successful and get a competitive advantage companies should strive to find a strategic gap, an opportunity that is not fully exploited by its competitors. These opportunities can be in terms of substitute industries, in other strategic groups, in targeting markets, for complementary products or services, in new markets, or over time (Johnson et al., 2008).

3.6 Resource-Based View (RBV)

The Resource-Based View implies that an organization achieves a competitive advantage by possessing capabilities that its competitors do not have or can obtain (Johnson et al., 2008). Hence, the focus is on the internal organization of the firm which in terms of RBV is defined as a bundle of resources and capabilities (Eisenhardt & Martin, 2000). The key to profitability is to formulate a strategy that is based on differences from its competitors (Grant, 2005). Sustainable competitive advantages can be achieved when firms have resources that are valuable, rare, inimitable, and organized (Barney, 1991). Furthermore a firm should assemble a set of complementary and specialized resources and capabilities that are scarce, durable, not easily traded, and difficult to imitate to be more profitable than the competitors (Amit and Schoemaker 1993).

VRIO-analysis

An organization that wants to achieve a competitive advantage that is sustainable over time its capabilities have to be evaluated. According to Barney (1991) resources with a potential to create a sustainable competitive advantage have to fulfill the criteria of value, rarity, inimitability and organization, all defined below.

- *Valuable*: A company can utilize opportunities and respond to external threats with their resources and capabilities.
- *Rare*: Is associated with the number of competitors that possesses the valuable resource, which hence should be unique.

- *Inimitable*: The valuable and rare resource should not be easily replicated by competitors.
- *Organization*: The firm needs to be organized to efficiently benefit from their valuable, rare and inimitable resources and capabilities.

3.7 Corporate Social Responsibility

The European Commission's definition of Corporate Social Responsibility (CSR) is:

A concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis.
(European Commission, 2010b)

For an organization that approaches and practices social responsibility the goal is to maximize its contribution to sustainable development (ISO, 2009). Business activities that are in line with CSR are not mandatory, but rather voluntary and a firm that practices social responsibility can benefit from e.g. increased sales and market shares, a stronger brand, and an increased ability to attract, motivate and retain employees (Kotler & Lee, 2005). CSR covers the relationship between the firm and the society including all stakeholders that have an interest in the organization's operations. The social responsible company has economical, legal, ethical, and discretionary responsibility towards its stakeholders (Werther & Chandler, 2006) The International Organization for Standardization (ISO, 2009) has developed guidance in social responsibility and established seven principles that an organization should follow. The principles are listed below;

An organization should;

1. be accountable for its impacts on society and the environment
2. be transparent in its decisions and activities that impact on society and the environment
3. behave ethically at all times
4. respect, consider and respond to the interests of its stakeholders
5. accept that respect for the rule of law is mandatory
6. respect international norms of behavior, while remaining to the principle of respect for the rule of law
7. respect human rights and recognize both their importance and their universality

3.8 Business Risk

There are two types of business risks; traditional non-entrepreneurial and entrepreneurial risks. The first one is associated with for instance fire, pollution, and fraud and the latter is related to situations where a company for instance builds a new plant, launches a new product or buys a company. Protection for the non-entrepreneurial risks may be assured by using insurances. Whereas entrepreneurial risks are harder to protect oneself against, but they may however be reduced by using different tools (Sadgrove, 2005). Risk is a future event that results from actions made today and all companies are exposed to business risks. The business environment changes, for instance, an increased competition or development of new production technologies. (Crouhy, Galai & Mark, 2006). These risks can be managed and hence should the options for a problem and its consequences be evaluated in any management decision. It is important to get evaluations right, otherwise a company risks to lose money. Companies that are not expecting risks are often prone to suffer. Risk is however needed in all companies, without risk there will be no innovation and without innovation the company will fail (Sadgrove, 2005).

3.8.1 Enterprise-wide Risk Management (ERM)

Risks are events that may have a negative impact, or may even prevent an organizations value creation or erode existing value. Enterprise-wide Risk Management (ERM) is an approach for how organizations can protect their businesses from different risks that may affect the creation of value in an organization (COSO, 2004).

The Committee of Sponsoring Organizations³ (COSO) defines ERM as follows (2004):

Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.

³ COSO is a voluntary professional private sector organization, which is recognized for providing guidance to executive management on critical aspects of organizational governance, business ethics, internal control, enterprise risk management, fraud, and financial reporting (COSO, 2010).

The objectives of ERM are to establish measurable strategic objectives, identify the risks that can hinder achieving the objectives and identify proper actions in order to mitigate those risks (Francis & Richards, 2007). COSO categorizes, in their report (2004), organizations' objectives in four: *Strategic* (high-level and aligned with the mission), *Operational* (how to use resources), *Reporting* (reliability) and *Compliance* (with laws and legislation).

COSO (2004) presents a framework consisting of eight interrelated components that found a multidirectional, iterative process where all components have an influence on another. The components are derived from managerial business practice and they should be closely integrated with the management process. The components are:

- *Internal Environment* – an organization's general perception of risk, including risk management philosophy, ethical values etc.
- *Objective Setting* – before an organization can identify potential risks, it must establish proper objectives.
- *Event Identification* – the process of identifying events (distinguish between risks and opportunities) that may affect the organization. Opportunities are used in the objective setting process.
- *Risk Assessment* – impact and likelihood of occurrence are analyzed, contributing to the basics of how the risks should be managed.
- *Risk Response* – developing a set of actions; avoiding, accepting, reducing, or sharing, in line with risk tolerance.
- *Control Activities* – establish and implement policies and procedures in order for the risk responses to be performed effectively.
- *Information and Communication* – information is identified and communicated across, down, and up, enabling employees to perform according to their responsibilities.
- *Monitoring* – the risk management is monitored and necessary modification are made.

The Casualty Actuarial Society⁴ (CAS) presented a similar enterprise risk management framework in 2003 and defines ERM accordingly:

Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify

⁴ CAS is a professional organization, which provides knowledge in actuarial science applied to property, casualty, and similar risk exposure.

potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.

However, CAS discusses more thoroughly different types of risks that an organization may be exposed to and categorize the risks in four (2003):

- *Hazard Risks*
 - fire and other property damage
 - force major
 - theft and other crime
 - personal injury and disease

- *Financial Risks*
 - price of assets value, interest and exchange rates, commodity
 - liquidity, e.g. cash flow etc
 - credit
 - impact of inflation/purchasing
 - hedging

- *Operational Risks*
 - business operations, e.g. human resources, product development, capacity, supply chain management etc.
 - empowerment, e.g. leadership and change willingness
 - information technology, e.g. relevance, availability etc.
 - information/business reporting, e.g. budgeting, planning, accounting, investment evaluation, taxation etc.

- *Strategic Risks*
 - reputational damage, e.g. brand erosion, fraud, negative publicity
 - competition
 - customer needs
 - demographic and socio-cultural trends
 - technology innovation
 - capital availability
 - regulatory and political trends

Burnaby and Hass (2009) outline a process on how to implement ERM in an organization and stress the importance of risk management in order for an organization being able to achieve their objectives. ERM consume both time and costs, but is out-weighed by the result and knowledge, gained in all levels

of the organization, by identifying, assessing, and monitoring risk, which contributes to both short- and long-term success of the organization.

3.8.2 Business Continuity Planning (BCP)

Developing a business continuity plan will help a company that has been exposed to a disaster, either force major or man-made, to get back to business as fast as possible. The planning should result in methodologies, structures, disciplines, and the procedures needed to recover from the catastrophe (Doughty, 2001). Before preparing the business continuity planning there are a couple of questions that should be answered (Green & Mark, 2010);

- How long can operations be into abeyance, before the business is too affected to be able to recover (and what is be into abeyance to the company)?
- How much would a stand-still cost?
- How long of an interruption would customers be able to accept before going to a competitor?
- How much business is possible to conduct if computers are down, if access to the office is denied for safety reasons, if important personnel goes missing etc?
- Are there any regulations that require a business continuity plan?

When developing a business continuity plan the following steps should be elucidated (Green & Mark, 2010).

1. Define the potential disasters that may occur to the company
2. Identify the impact the disasters explained in step one would have on the business. This step should result in a comprehensive matrix illustrating the impact of each disaster on each specific business process.
3. Define and prioritize resumption scenarios of each business process for each disaster. The result should be a matrix describing the solution and its cost and time frame.
4. Template the plan with sections according to each scenario and resumption process in step 3. Evaluate whether enough has been considered to mitigate the disasters identified in step 1 and that the level of resumed operations are likely to occur after implementing the resumption strategies that are identified in step 3. This step should elucidate if there are any resumption procedures that are missing.
5. Implement the resumption solutions and test the plan

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6. Finalize the plan. Involve all employees in establishing the procedures and building awareness and responsibility. The plan should be a living document, and hence it should be updated when needed.

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Demand, and Business Potentials

4 MACRO-ENVIRONMENT

This chapter constitutes parts of the empirical result. The reader will be introduced to the basics of the oil and gas industry, why the Arctic is an interesting region for oil and gas exploration and production, as well as the operational challenges within the Arctic region. Furthermore, the different stakeholders of the Arctic offshore oil and gas industry will be identified, and their characteristics related to the industry's key drivers of change will be discussed.

4.1 Hydrocarbons – what are they?

Fossil fuels such as oil, coal or natural gas is derived from so called hydrocarbons, which are organic compounds (plants and algae, animals and bacteria) only consisting of hydrogen and carbon. Hydrocarbons emerge when nature decomposes organic matter that is trapped and preserved in sedimentary deposits. Through a thousand year process with increasing temperature and pressure, the matter in the deposits transform to what is known as fossil fuels and can be of solid, liquid or gas form (UBS, 2004).

Oil and gas fields evolves when compounds, typically rocks (source rocks), containing small amounts of oil and gas, which is exposed to gravity and pressure, which forces the oil and gas to move through sedimentary layers until it reaches an overlaying barrier of rock (impermeable layer of rock). However, oil and gas only accumulates if the environment surrounding the oil and gas are shaping a perfectly structured entrapment (UBS, 2004).

4.2 Oil and Gas Industry Stages

The oil and gas industry can be divided into five different stages; *licensing, exploration and appraisal, development, production, and finally decommission*. Generally, the industry is divided into two main sectors, referred to as *upstream* and *downstream*, where the former includes activities of exploration and production (E&P) and the latter includes processing/refinement, export and marketing (DTI, 2001). Figure 3 shows the industry stages as well as an overview of activities.

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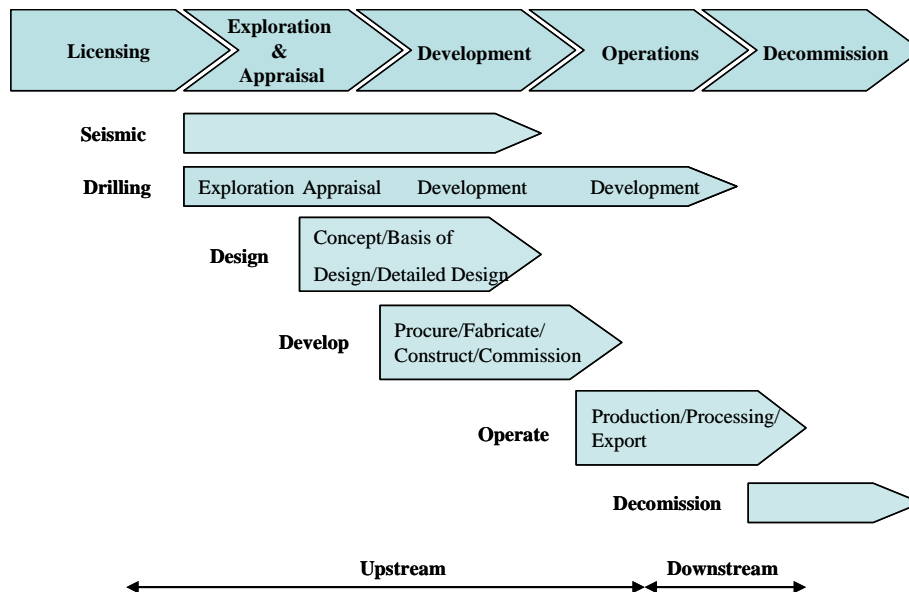


Figure 3 - Exploration and development stages and activities of the oil and gas industry (DTI, 2001)

Licensing

Exploration and production of oil and gas fields is regulated in terms of licensing systems. Usually, oil and gas assets are owned by the country in which the assets are found. Hence, a petroleum company does not own the area of prospecting or any potential findings. They acquire the rights to commence E&P activities in a specific area. Such a right is called a license and is provided by the government of the country in which the E&P is performed (DTI, 2001). Within the EU, countries issuing licenses for exploration and production of oil and gas must follow strict regulations given by the European Commission (European Commission, 2009). In addition, every country has organizations that set rules and guidelines of how the licensing is regulated, e.g. the DTI Oil and Gas Directorate's Licensing Branch in U.K. (DTI, 2001).

There are two different types of licenses; *exploration* and *production* licenses. To receive an exploration license, the oil company has certain commitments of conducting seismic⁵ investigations and drilling. Usually these licenses are for free but occasionally, the oil company has to pay a fee to the government, which may occur when several oil companies compete for the same license. If

⁵ Seismic investigation is a type of survey where the geology of an area is mapped. The survey is conducted by specialized vessels, towing hydrophone streamers that release pressure waves, which reflects from the bottom of the sea. The reflections is interpreted and the geology can be explained (DTI, 2001).

the exploration phase results in a discovery of oil or gas, the license becomes an exclusive production license, which involves for the oil company to pay royalties to the country in which the findings are extracted (DTI, 2001).

Exploration and Appraisal

This stage aims at finding reserves of oil and gas that are commercial viable. Identifying viable reserves can by no means be 100 % sure and the process is complex. By conducting seismic surveys, estimations of the probability that entrapments in the soil contain resources can be made. Once an area has been identified as likely to hold oil or gas, the next step is to drill in the area to be able to find out if the prospecting activities have given correct information. However, there are many concerns to be taken into consideration before developing drilling activities. Such concerns are very much economical, because of the high costs that oil and gas drilling generates. Further aspects are technology, governmental requirements, environmental etc., which all are considered in a decision. Basically, there are four types of drilling rigs: *Jack-up rigs* (often a tripod standing on the sea bottom, with the platform above sea level), *Semi-submersible rigs* (a floating rig on pontoons, with the platform above sea level. The rig has to be stabilized by either anchors moored to the sea bottom or use dynamical positioning (DP) systems), *Drill-ships* (a floating drilling facility in terms of a ship that in conformity with a semi-submersible rig needs to be stabilized by either anchors moored to the sea bottom or by using DP systems) (DTI, 2001), and *Submersible or Bottom founded rigs* (a mobile offshore drilling unit that is supported primarily on large pontoon-like structures submerged below the sea surface) (Interview with Noble (c)).

Field Development

Before a field is developed for production, there are several factors to consider and a set of activities to conduct. First, the field must prove economically viable, as well as infrastructure and export routes, technology, environmental impact etc. must also be assessed. Much of the field development processes take place onshore, including selection of options, design, planning and fabrication, whereas the construction/installation and commissioning takes place offshore. Export facilities are of great importance related to field developments, in order to transport the oil and gas to the consumer markets. This is mainly done by pipelines and tankers (DTI, 2001).

Production Operations

Once the field equipment has been installed and commissioned, the production can take place. The main purpose of the process is to separate the

extracted fluids into oil and gas phases and transform them into transportable compounds by separation of any water and solids (DTI, 2001).

In the production phase, consideration must be taken to a number of factors. Factors that mainly cohere to emissions and discharges from production processes. Another important aspect is logistics and support functions, providing supplies to and from the facilities (DTI, 2001).

Decommissioning

When the production in no longer economically viable has been completed (generally after 10-60 years of production depending on the size and the location of the field, in the Arctic for instance, projects under consideration will be 30-60 years (Interview with Noble (c))), the field facilities are to be decommissioned. These procedures follow requirements and regulations established by both national and international organizations. Floating installations are towed away and if possible, they will be used in another location. Sub-sea facilities will be removed, the wells abandoned and plugged with concrete and pipelines and other export facilities will be considered for removal if there is no need for them to remain commissioned (DTI, 2001).

4.3 Oil and Gas Potential in the Arctic

The Arctic is located north of the Arctic Circle and covers a total area of around 21.3 million m² whereof 8 million m² is land area. Since the area partly consists of volcanic lava, in which exploration and production activity is impossible, around 7 million m² of the total area could be of interest (USGS, 2007a). The area is the geographically largest unexplored potential area for petroleum remaining on Earth (USGS, 2008a). Furthermore, the water depths within this shelf area are less than 500 m which facilitates activities of E&P (USGS, 2007a). In Canada and Alaska for instance the most interesting areas are in less than 50 m (Interview with Noble (c)).

According to the USGS (U.S. Geological Survey) 90 billion barrels of oil, 1669 trillion cubic feet (500 trillion m³) natural gas, and 44 billion barrels of natural gas liquids may remain to be found in the Arctic, see Figure 4. These numbers are equivalent to 30 % of the world's undiscovered gas and 13 % of undiscovered oil (Science, 2009). Approximately 84 % of these resources are expected to be found offshore (USGS, 2008a). The Circum-Arctic Resource Appraisal (CARA) has examined 33 provinces in the Arctic. 25 of these were judged to have a 10-percent or greater probability of the presence of at least one undiscovered oil and/or gas field with recoverable resources greater than

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50 million barrels of oil equivalent (USGS, 2008a). Over 70 % of the undiscovered oil in the Arctic area is estimated to occur in five provinces; Arctic Alaska, Amerasia Basin, East Greenland Rift Basins, East Barents Basins, and West Greenland-East Canada. In addition, more than 70 % of the undiscovered natural gas in the Arctic is estimated to occur in three different provinces; the West Siberian Basin, the East Barents Basins, and Arctic Alaska (USGS, 2008a). By 2007 more than 400 oil and gas fields containing 40 billion barrels of oil, 1136 trillion cubic feet, and 8 billion barrels of natural gas had been explored and developed onshore north of the Arctic Circle (Science, 2009). The majority of the oil has been produced in Russia and Alaska (Shell, 2010). Most of the Arctic oil and gas fields are located near the coasts and the reduced areas of multi-year ice will facilitate the operations in the coastal areas (Sandven, 2007).

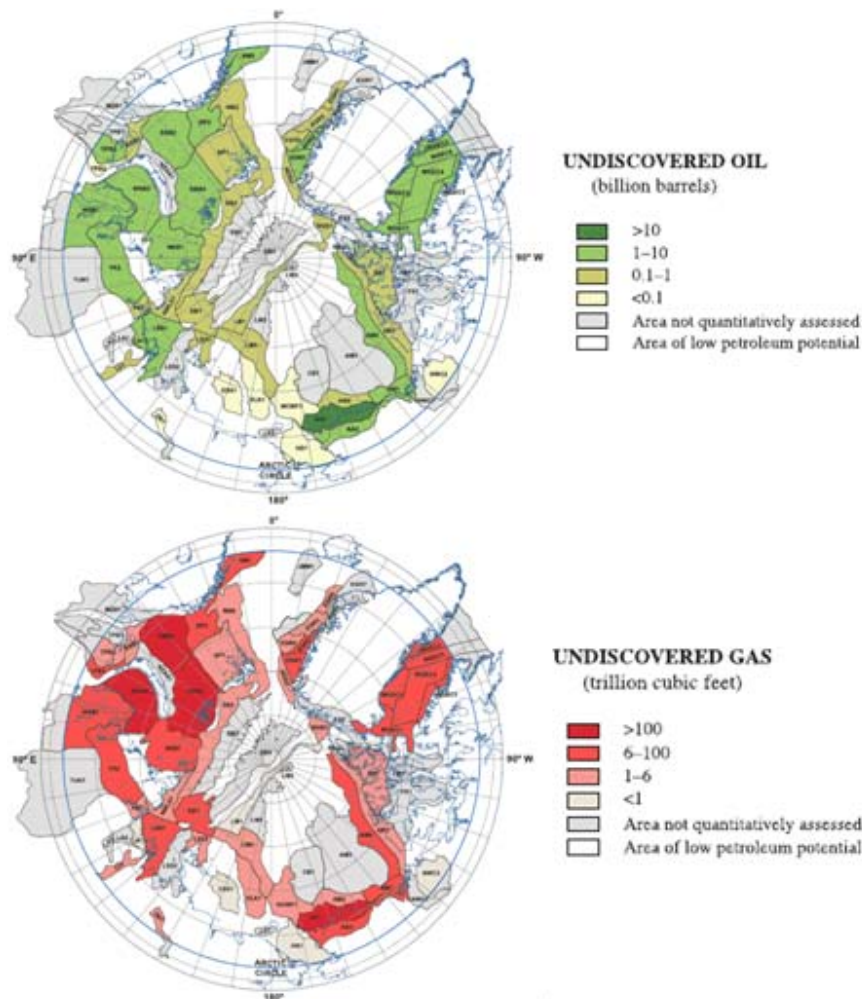


Figure 4 – The amount of undiscovered oil and gas in the Arctic is high (Science, 2009)

4.4 Environmental Conditions

The Arctic is one of the last, if not the only, remaining untouched region on the planet. The harsh climate, including strong winds and cold temperatures, the biological fauna, and remoteness makes the Arctic environment unique in its state. Furthermore, the environment is sensitive and the recovery from damage is slow and the actual impacts are unknown (Palmer, 2008; Interview with Zolotukhin).

The Arctic faces a potential damaging impact on fish, birds, and marine mammals through industrial activities such as noise from seismic surveys, shipping, drilling, increased pollution, and the risk of oil spill. In reverse, the environmental conditions affect the industry as well. People are affected by low temperatures, often below -40°C , total darkness in the mid-winter period, and blowing snow associated with storms, which results in low or zero visibility. Moreover, low temperatures and strong winds can lead to icing on platforms, vessels, and exposed evacuation systems if they are operating in exposed open waters at high latitudes (Huntington, 2009).

Ice conditions

The main difference between operations in the Arctic compared to operations in open waters is the presence of ice. The ice condition differs however from area to area within the Arctic and there are several ice characteristics that have to be taken into consideration. Some areas are covered by ice all year around and may have a mix of first-year ice, second-year ice, multiyear ice, and glacial whereas other areas are ice free during several months, where consequently only first-year ice is present (Timco & Dickins, 2005; Interview with Larsen; Interview with Madsen).

The sea ice is however shrinking and during the last 30 years it has decreased by 3 % per decade, see Figure 5. If this trend will continue, some time between the middle and the end of the 21st century, the summer ice in the Arctic could have disappeared (Sandven, 2007). However, the summer sea ice has increased in both 2008 and 2009.

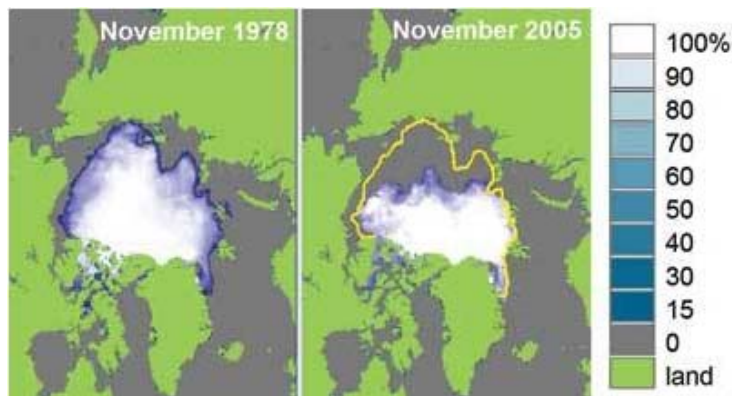


Figure 5 - The sea ice is shrinking (Sandven, 2007).

In addition to area coverage, the most important ice parameters are thickness and drift.

The average sea ice thickness has decreased during the last four decades, from about three meters to less than two meters, which equals more than a 30% decrease (Sandven, 2007). The ice concentration is expressed in tenths and the ice conditions can be divided into nine different stages⁶, where very light pack ice has a concentration of 1/10 to 2/10 and very heavy pack ice has a concentration of 9/10 to 10/10 (Timco & Dickins, 2005). Figure 6 shows the ice concentration in the Arctic.

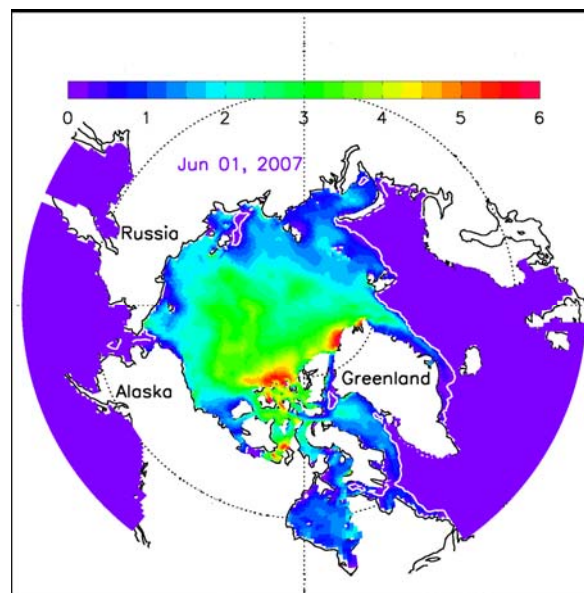


Figure 6 - The sea ice thickness differs from one area to another (Interview with Larsen)

⁶ The ice concentration is ranked from 1/10, which signifies that 10 % of the water surface is covered by ice, to 10/10, which implies that 100 % is covered by ice.

Another threat for offshore operations is drifting icebergs, which can be up to 100 meters high, have drafts of 350 m and have a drift speed of 20-30 km per day (Noble 2010c; Sandven, 2007). Icebergs are moved by sea currents, while sea ice is moved by wind and icebergs usually exist around the Greenlandic coast, particularly north of Disko Island and eastern Canada (Interview with Larsen; Noble 2010c). As a result of the global climate change, the increased melting and released ice from Arctic glaciers have increased the presence of icebergs in areas where they earlier have not been observed. Other effects of the climate change could be increased and stronger winds, precipitation, and waves (Sandven, 2007).

4.5 Environmental and Technological Challenges for Arctic offshore operations

There are several challenges associated with offshore operations in the Arctic region compared to offshore operations in ice free waters. As stated, the biggest difference as well as proposed challenge is the Arctic ice, which differs depending on region as well as season. Furthermore, long distances to shore facilities with very limited access to infrastructure, harsh climate with ultra low winter temperatures and winter darkness, and dangerous animals are aspects that state challenges that are unique for the Arctic (Interview with Jørgensen; Interview with Larsen; Interview with Noble; Interview with Simpson). These conditions derive new challenges in terms of developing new equipment and systems that are adjusted to suit the specific conditions (Interview with Madsen). Such a simple thing as neglected heating on footbridges and piping systems on a vessel may cause severe damage and machine failure due to the low temperatures (Interview with Rohlén). More advanced, special EER (Emergency, Evacuation and Rescue) systems may have to be developed uniquely for each area depending on ice conditions, water depths, and the proximity of support (Interview with Andersen; Interview with Marthinsen). Specialized oil spill recovery systems in ice infested waters also have to be taken into consideration (Interview with Tolstrup). Ice alert systems that can identify hazardous ice are necessary and ice management systems that can mitigate potential harmful ice are critical in order to protect the offshore installation (Interview with Madsen; Interview with Larsen; Interview with Rohlén).

Not only does the environment affect the activities conducted in the Arctic, but the environment in turn, is highly affected by the activities. Therefore, many areas need further technological development in order to minimize the negative impact on the environment. The knowledge on the environmental

impact is limited, and companies operating in the region have far reaching responsibilities regarding the technology they pursue (Interview with Madsen; Interview with Zolotukhin). It is crucial to foresee that the offshore operations do not interfere with traditional activities in the region such as whale, polar bear and walrus hunting or marine mammal and bird migration (Interview with Noble; Interview with Tolstrup).

An important aspect when commercializing oil and gas in the Arctic is the development of infrastructure, which may be highly dependable on the local communities' opinions due to the different views on civilization and globalization. The development of the petroleum industry in the Arctic does not just include drilling and production equipment, which can be decommissioned without leaving substantial footprint, but also includes pipelines, ship routes, storage areas, infrastructure etc., which all have a substantial impact on the Arctic environment. The distance to service ports and the harsh climate also contribute to difficulties in establishing the infrastructure (Interview with Zolotukhin).

There are other challenges connected to political and economical aspects which will be handled in the following section (4.6).

4.6 Stakeholders of the Arctic Offshore Oil and Gas Industry

Offshore oil and gas operations within the Arctic are highly dependent on the fact that oil and gas companies are active or see an interest in operating in the region. Without the interest from oil and gas companies to extract the resources, contractors will not have a purpose to operate in those areas, nor will governments or local communities be affected. However, as of today, offshore operations are established in some regions and there is an increasing interest in developing the petroleum industry in the Arctic, a development which will affect a number of stakeholders with different interests and opinions.

In accordance with the importance of categorizing the stakeholders as expressed by Mitchel, Agle and Wood (1997) and Vos and Achterkamp (2006) (without using their definitions on categories or groups), the possible stakeholders of the Arctic oil and gas industry has been categorized through a brainstorming session and through consultation with people within the industry. The result is illustrated in Figure 7.



Figure 7 –Stakeholders of the Arctic Offshore Petroleum Industry (Developed by the Authors After Consultation with Industry People)

Oil and Gas companies

The oil and gas companies can be referred to as *leaders* and other stakeholders as *followers*, when discussing the Arctic offshore industry. Most major oil and gas companies such as ConocoPhillips, BP, Statoil, Shell, and ExxonMobil among others, are interested in commencing, or have already established, operations in the Arctic. The development of the petroleum industry in the Arctic will be very slow without the interest from the major oil and gas companies, and their presence has an influence on the majority of the other stakeholders (Interview with Noble (a)). All activities associated with the offshore petroleum industry are specified and acquired by the oil and gas companies, which accordingly put them in a leading position (Interview with Madsen).

The oil and gas companies are driven by only one aspect in developing the Arctic. That is to maximize their profits (Interview with Zolotukhin). However, the main driver to develop the Arctic exploration and production industry is to secure reserves. Resources based firms, such as oil and gas companies, consume their asset base to produce products, unlike other industrial enterprises. Hence they must continually work on replacing used resources with new ones, which is finding and developing new oil and gas fields (Interview with Noble (c)). Since the Arctic is expected to be very potential in containing hydrocarbons, the oil and gas companies, accordingly, are an active intercessor in the debate of developing the Arctic resources (Interview with Zolotukhin).

The costs that Arctic exploration and production projects generate are enormous. For instant, the development of the joint project of Shtokman⁷ is estimated to need \$2.6tn until 2050 claims the CEO of Russian oil company Rosneft (Upstreamonline, 2008). This is equivalent to 2.5 times the Russian GDP or 6.5 times Swedish GDP in 2008. Put in relation to unit cost per produced ton, the costs of developing an offshore field in the Russian Arctic shelf is at least 10 times the cost for developed regions (Interview with Zolotukhin). Due to the high costs, it is required that the oil and gas companies drive collaborations with each other in such large projects as Shtokman (Interview with Marthinsen; Interview with Zolotukhin).

Contractors

A typical contractor is a drilling or a construction company and the contractors are a stakeholder group, which could be characterized as a *follower*. The contractors follow their customers, the oil and gas companies, in terms of providing the required services and have to commit to the same requirements as their customers in terms of sustainable operations (Interview with Andersen; Interview with Madsen; Interview with Noble (a)).

One interesting aspect is who carries the responsibility of a disaster. In the Deepwater Horizon catastrophe, the rig was under contract to BP and owned by drilling contractor Transocean. In this case, BP claims the responsibility and are committing to the costs the disaster generates and it is interesting how little there is said about Transoceans part in what has happened (Interview with Elmbo).

BP state that the contractors are to blame but Stephen Newman, Chief Executive Officer of Transocean says: *"All offshore oil and gas production projects begin and end with the operator."* He continues: *"BP had decided where and how its well was to be drilled."* (Rigzone, 2010a).

Service Providers

Service providers include offshore supply vessel (OSV) companies, tanker operators, and logistic providers etc. and they are in a similar position as the contractors. The service providers play an important role in terms of providing infrastructure for the resources to reach the consumer markets, transport of crew and equipment, due to the often distant locations where the fields are

⁷ The Shtokman project is operated by a consortium, Shtokman Development AG and is constituted by GazProm, Statoil and Total (<http://www.shtokman.ru/eng/about/>).

being developed, and assisting in keeping production free from interruptions (Interview with Madsen).

General Public

The general public is represented by a number of groups, e.g. media, academia, opinion leaders and of course the consumer.

Media may not be interpreted as a stakeholder, but rather a channel for communication (Interview with Tolstrup). Media is useful when informing about projects' developments and progresses but may also be damaging to the business if the message is negative as it has a large impact on many stakeholders, including the public, authorities, NGO's etc. (Interview with Madsen; Interview with Tolstrup; Interview with Zolotukhin). One example, which got huge attention, is the Exxon Valdez oil spill, where a tanker in 1989 went aground and dispersed a substantial volume of oil into the waters of Prince William Sound in southern Alaska. Even today, the catastrophe is debated and constantly brought up as a counterargument on the development of the Arctic petroleum industry and indicates the important roll of media as a communication channel (Interview with Madsen; Interview with Tolstrup). Not to mention the recent oil rig explosion in the Gulf of Mexico that has been highly discussed in the media on a daily basis weeks after the disaster took place in April 2010 (Rigzone, 2010b).

Academia has an increasing importance in the Arctic petroleum development in order to fully understand the environmental impacts and establish both academic and industry collaboration across countries in order to develop sustainable technology (Interview with Zolotukhin).

The Consumer in general is of the opinion that a development of the Arctic is not preferable since it is one of the few still untouched areas of the world. However, the increased demand on oil and gas as an energy source makes the opinions contradictive (Interview with Tolstrup; Interview with Zolotukhin). On the other hand governments may have an impact on the consumer by increasing oil taxes (Reuters, 2010).

Governments

Governments and authorities have an important role in the development of the Arctic and the petroleum industry. Since governments issue licenses, the oil and gas companies are dependent on the support from the governments. Governments also regulate which activities that are required to be conducted

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in a license. Typical requirements are thorough investigations and assessments of the operations' impact on both the biological and social environment within the license area. These assessments are performed by the oil and gas companies in close cooperation with authorities and the local communities and their organizations related to fishery, hunting, tourism etc. (Buurgard, 2010)

The Arctic governments are mainly in favor of oil and gas operations as it creates revenues, jobs, and well being for the local communities. Additionally, thousands of employees often are required since the industry and the projects are very large and complex (Interview with Tolstrup).

There are however differences among the Arctic governments in terms of opinions, laws and legislations, and influence.

The U.S. for instance is resistant and bureaucratic (Interview with Madsen). Business activities within U.S. waters are affected by the Jones Act, which implies that all commercial vessels that are transporting cargo between two ports in the US have to be built, owned, operated and manned by U.S. citizens (Aker Philadelphia Shipyard, 2010). Another example on U.S. laws is the legislated limit on total air emissions, such as NoX and SoX, from a field, which applies to all companies that operate within a certain radius (Interview with Noble (b)). Furthermore the Obama administration proposed in the budget for 2011 to end some \$36.5 billion in subsidies for oil and gas companies with the purpose to decrease the use of fossil fuels (Reuters, 2010).

The U.S. governmental attitude towards petroleum products is however to supply the domestic oil demand (Interview with Madsen). An example of such influence is when the Obama administration in March 2010 reversed a ban of drilling for oil and gas offshore the east coast of the U.S. and in Alaska in order to reduce the reliance on foreign oil (Msnbc, 2010).

The Greenlandic government is on the other hand very much in favor of a development of the Arctic. Since oil and gas exploration and production can make them independent from Denmark. Then again the Russian government decides the development and the stakeholders will have to accept the decisions, whether they like it or not (Noble, 2010).

In both Norway and Russia, the governments have owner interest in the large oil and gas companies, Statoil and Gazprom respectively. Although the

governments have more than 50 % of the shares in both cases, they are operated as independent companies. However the shareholder distribution of course has an impact due to the governments' strong position in the two companies respectively, which has been realized through the successful Shtokman project in Russian parts of the Barents Sea. The project shows how international collaboration between companies, governments and local communities can be successful (Martinsen, 2010). Others are however arguing that it is too soon to determine whether the project is successful or not, whereas it in early 2010 got delayed for at least a year ahead (Interview with Noble (c)).

There are also intergovernmental stakeholders in the region, such as the Arctic Council, which is an intergovernmental cooperation between the Arctic governments⁸. Their purpose is to promote cooperation, coordination and interaction among these states and Arctic Indigenous communities regarding issues of sustainable development and environmental protection (Arctic Council, 2010). The Arctic Council is a neutral and objective cooperative and constitutes of several stakeholders with different interests and their opinions are therefore of importance in order to establish a sustainable development of the Arctic (Interview with Tolstrup).

Local Communities

One of the most important stakeholders is identified as local indigenous people, much due to land claim. However, their opinion, influence and respect, vary depending on the country that is put into context. Nevertheless, the most common opinion of the indigenous peoples is that their lives, land and culture are to remain untouched from commercial development such as the petroleum industry. The U.S. and Canada have come far in involving the local communities in the development of the Arctic petroleum industry, much thanks to the long presence of oil and gas companies in those countries. In Russia, the opinions of the indigenous people are less considered than that of the Greenlandic, U.S., and Canadian natives, mostly due to the position of the Russian government (Interview with Noble (b); Interview with Tolstrup; Interview with Zolotukhin).

The involvement of indigenous people does not only mean informing about developments, but also provide them with education in order to offer

⁸ Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States of America

employment in the industry. Oil and gas companies also depend on local experts regarding whale, polar bear, bird and fish population in the region where operations are taking place (Interview with Zolotukhin). The presence of e.g. whale watchers on site is a necessity and they are usually people from the local communities with expertise in the movements of the whales in the area. If a whale population is closing in on operations, the whale watchers may demand the entire operation to a stand-by for not disturbing or scare the whales off (Interview with Tolstrup).

An example of how exploration and production can bring benefits to the local population is the Sakhalin project⁹. Once, the region had the highest unemployment rate in Russia, now it has a rate of 1 %. Some indigenous people are positive of a development of the Arctic. Among those are the Greenlandic Inuits, which support the government in this question. The possibility of finding oil and gas offshore Greenland is high and a commercialization of such fields will result in the Greenlandic people getting one step closer to their independence (Interview with Tolstrup).

Non-Governmental Organizations (NGO)

There are several different NGO's such as Greenpeace and World Wide Fund for Nature (WWF) that are against operations in the Arctic. WWF states that arctic exploration and production shouldn't take place before companies and states have pinpointed how it can be done sustainable (Interview with Tolstrup). Furthermore, WWF consider the oil and gas development as a major threat in terms of new infrastructure and the risk of oil spill that can cause habitat destruction (WWF, 2010). Greenpeace confirms that an obvious concern is the risk for oil spill and other industrial accidents, since the effect of oil spills in these areas last for a longer period than in other areas (Greenpeace, 2010a). These concerns will probably be intensified after the Deepwater Horizon accident

Below is stated by Mads Christensen, Executive Director of Greenpeace Nordic, in their demands of realizing a ban on the Arctic development (Greenpeace, 2010b):

We are at a crossroads, the path we take is an intelligence test: do we drill and burn the fossil fuels reserves that are accessible only because climate change is causing the sea ice

⁹ Sakhalin is a Russian sub-arctic island (Interview with Tolstrup)

to melt? Or do we protect the Arctic and give it and the communities living there a chance to adapt to the already serious changes taking place?

According to Tolstrup (2010), the NGO's can be an obstacle to operations, especially the international ones due to their size and resources in collaboration with local or regional NGO's. One example on the strength of the NGO's is when Pacific Environment together with Alaska Native groups filed a law sued against Shell and their Alaskan drilling operations that were to take place in 2009. A federal appeals court approved the law sued and withdrew the drilling permission approved by the U.S. Department of the Interior's Minerals Management Service (MMS) due to inadequate environmental assessments (Pacific Environment, 2010).

4.7 Developing the Stakeholder Influence (SI) Framework

To be able to understand the complexity of the Arctic oil and gas industry and its stakeholders, the authors, in this section, aim at developing a framework in order to provide a tool for identifying the stakeholders as well as the major influences that affect the decisions for a development of the industry.

First, a definition on how the authors of this thesis address the notion of stakeholders should be clarified. Though criticized by some, Phillips (2003) among others, the definition used is "...a stakeholder in an organization is any group or individual who can affect or is affected by the achievement of the organization's objectives..." (Freeman, 1984, p.46) because it is interpreted to be viable, since much literature have acknowledged the definition (Andriof and Waddock, 2002; Clarkson, 1995; Rowley, 1997) among others.

As argued by Mitchel, Agle and Wood (1997) and Vos and Achterkamp (2006), before the stakeholders are identified, stakeholder categories should be established. This categorization has been conducted in 4.6 and influences have been taken from the original stakeholder model presented by Freeman (1984).

As suggested by both Rehnman (1964a) and Freeman (1984), a single company is put in the middle. However, in order to adapt the model to suit the analysis in this thesis, the model is widened, whereas the leaders of industry development are placed in the center (in this case, the oil and gas companies).

Notable is that the chosen model as foundation for the framework is the originally presented stakeholder model presented by Freeman (1984). Instead of evaluating the power and interest as suggested by Johnson et al. (2008), the authors of this thesis want to explore which interests and influences that have the ability to change the direction of the Arctic petroleum industry development as well as from which stakeholders these influences are stemming. In order to do so, the concept of an industry's *key drivers of change* as described by Johnson et al. (2008) and Thompson et al. (2008) (see 3.4) is added to the model, creating a framework for identifying the stakeholders' characteristics, how they influence the industry and if the influence can be identified as a key driver of change. The framework thereby also considers the issue regarding who is affecting and who is affected discussed by Phillips (2003).

The developed framework is named the Stakeholder Influence (SI) Framework. The stakeholder groups that are discussed in the previous section, 4.6, have been placed in the SI Framework together with the concept of key drivers of change and are illustrated in Figure 8.

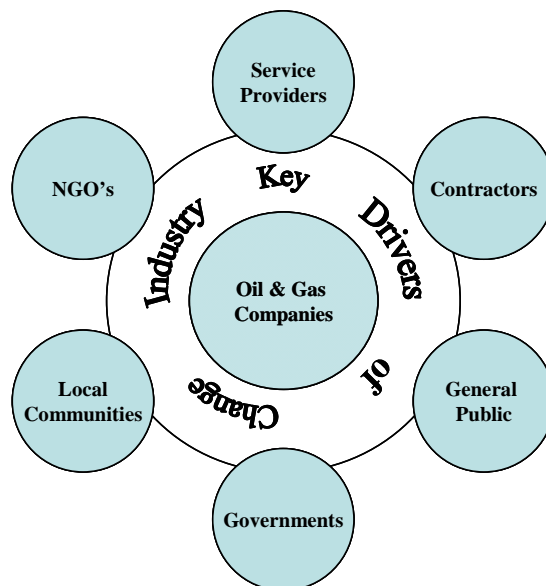


Figure 8 – The SI Framework (developed by the authors)

The framework, as earlier stated, takes a different approach in how the center of the stakeholder model is addressed, since a group of companies is placed in the center rather than a single organization as presented by Rehnman (1964a) and Freeman (1984). However, the framework is mainly developed with influences from the original stakeholder model presented by Freeman (1984).

Whether this approach is appropriate or not will be evaluated in the next section.

In addition, there are many different inter-relationships between the stakeholders, both direct and indirect. But instead of focusing on the opinions of individuals, the major influences are emphasized by identifying the key drivers of change described by Johnson et al. (2008) and Thompson et al. (2008). Whether or not this approach is suitable will also be evaluated in the next section.

4.8 Applying the SI Framework on the Arctic Offshore Oil and Gas Industry

The major oil and gas companies are the key stakeholders in driving the development of the petroleum industry in the Arctic forward. In order to develop the Arctic offshore industry, increased globalization in terms of collaboration among governments as well as oil and gas companies is necessary, since the projects require huge investments. International collaboration will reduce the business risks. However, uncertainties of not finding a commercial viable field have a big influence on attracting new entrants to the market, which in turn affect the long-term industry growth rate.

The development of sustainable technology with minimal damaging impact on the social, cultural and biological environment is crucial for a positive development of the Arctic. The Arctic governmental influence through regulations and policies, forces the development of technology to continuously improve. In addition, it lies in the best of interest for the oil and gas companies and the other operating stakeholders to act with great responsibility considering the sensitive environment. However, the direct impact from indigenous people and other stakeholders who want to prevent a continued development, such as the NGOs do not have substantial influence. Since the knowledge of environmental impact is limited, yet again, collaboration and globalization among, authorities, academia and operators is important to share knowledge and facilitate technology diffusion.

The contractors and service providers have a mutual dependency with the oil and gas companies and are more affected by the oil and gas companies than vice versa. For instance, the contractors and service providers have to deliver according to the requirements of the oil and gas companies. If the contractors and service providers, through sustainable technology and experience, can assure safe operation without interruptions, the uncertainties will be reduced

and costs and efficiency can be optimized. However, if they fail to deliver according to requirements, the result could be devastating.

Disasters such as Exxon Valdez in 1989 and the more recent Deepwater Horizon in 2010 have huge impact on the development of the Arctic petroleum industry. The incidents lever the potential risks of a catastrophe and influence more or less all stakeholders. For example, the societal concerns and the power of media have enormous influence on decision makers within the private sector as well as the public sector of slowing down or even cancel the development completely.

Each stakeholder has an impact whether it is direct or indirect, and/or is affected by the other stakeholders, which in turn may impact another stakeholder and so forth. The Arctic oil and gas industry can be characterized as complex, since many stakeholders hold different and strong opinions. It is therefore important that the operators in the region consider, respect, and respond to the interests of the different stakeholders, which refers to as serving a higher purpose than maximizing profits according to the early stakeholder theory as presented by Rehnman (1964a) and Freeman (1984). Another important aspect in close connection on how to act towards the stakeholders is the guidelines and the practice of Corporate Social Responsibility (CSR), not at least when considering operating in sensitive areas as the Arctic. CSR reminds of the views on stakeholder concerns presented by both Rehnman and Freeman, but gives more detailed guidelines on how an organization can maximize its contribution towards a sustainable development.

To conclude the reasoning above, a number of factors have been identified of having a big influence on the industry development (identified from Thompson et al., 2008):

- Technology development
- Increasing globalization
- Changes in the long-term industry growth rate
- Changes in cost and efficiency
- Regulatory influences and government policy changes
- Reduction in uncertainty and business risk
- Entry or exit of major firms
- Changing societal concerns, attitude and lifestyles
- Technological diffusion

However, according to the discussion above, there are some factors that are more evident than others of having the ability to change the development direction of the industry. Furthermore, these factors precede, and will in turn facilitate others. The theoretical discussion does not state if the concept of key drivers of change can be divided into sub-levels or identified according to the order of importance. Nevertheless, the discussion above clarifies that some factors depend on the preceding of others; yet, they are a major influence in the development of the industry and should be described as key drivers of change. A gap has accordingly been identified as well as the need to divide the factors into sub-levels in order to better understand how the industry is developing and which key drivers that are identified on what level.

The identified levels as well as which key drivers that corresponds to which level is illustrated in Figure 9.

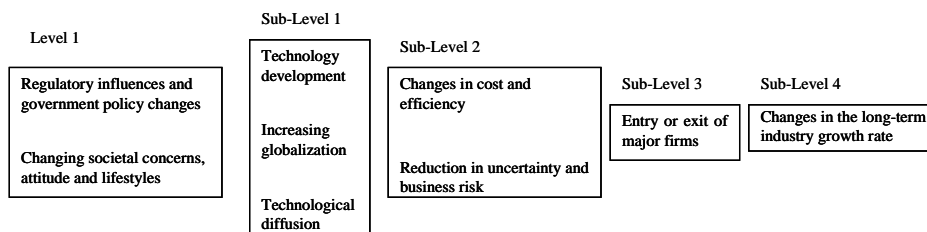


Figure 9 - Key Drivers of Change Divided into Sub-levels (developed by the authors)

The first level of key drivers refers to the impact of governments and general public and renders in the three factors of the first sub-level. These factors mainly affect the operating companies (the oil and gas companies, service providers and contractors) in terms of requirements in technology development as well as cooperation between the operating companies and authorities, which will enhance technological diffusion. These first two levels contain the key drivers that are identified as the most evident factors of driving the industry development. In turn, these factors result in changes in costs, efficiency and risk, which will affect the industry attractiveness and contribute to the long-term growth rate.

Figure 10 shows the interdependencies between the different stakeholders, which are illustrated by the arrows. The illustrated relationships is direct influence, not said that there are not any indirect influences in the arrows, but most certainly there are. However, the aim was to identify the most important relationships. The enhanced arrows emphasize the magnitude of the influence

and the accentuated arrows also indicate the two first levels of key drivers of change from Figure 9.

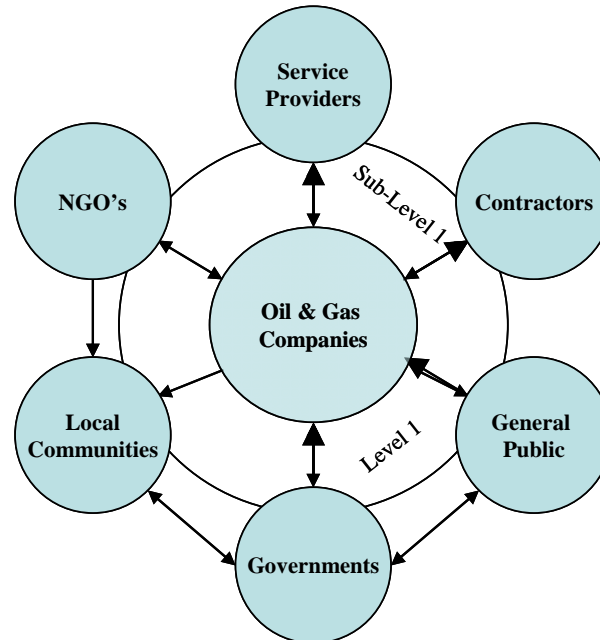


Figure 10 - The Applied SI Framework

Finally, the SI Framework is concluded to be useful in order to describe the different stakeholder groups as well as the use of the key drivers of change concept. Though the original stakeholder model was developed a mere 20 years ago, it is proven to be useful in this context. The approach of adding the key drivers of change has also been proven as a purposeful approach when identifying the stakeholder interests and impact. A further discussion of the general applicability of the SI Framework is presented in 7.2.1.

Supply Services to Arctic Offshore Operations; Macro-environment, Market
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5 MARKET DEMAND FOR SUPPLY SERVICES

This chapter will firstly give the reader an introduction to the traditional OSV industry. Secondly, the required services for Arctic operations will be identified, and the challenges and opportunities regarding these services will be discussed.

5.1 Introduction to the OSV industry

Offshore Supply Vessels have been used ever since offshore drilling and production started. The primary function was to deliver supplies associated with the operation to the offshore installation. In recent years the broader term “Offshore Support Vessels” has been applied and covers a wide range of additional functions, such as towage of offshore structures, drilling rigs and barges, anchor handling and installation of mooring systems, emergency response, subsea support including diving and ROV (Remotely Operated Vehicle) operations (Gallagher, 2010; Maersk Supply Service, 2010a). A wide range of vessels exist and are used for different purposes (see Figure 11), e.g. Field and Subsea Support Vessel for installation and maintenance of production infrastructure, Anchor Handling Tug Supply Vessels (AHTS) for towage and anchor handling, and Platform Supply Vessels (PSV) for transportation of equipment, fuel etc. (Maersk Supply Service 2010b).



Figure 11 - PSV, Craned AHTS, Field and Subsea Support (Maersk Supply Service 2010b)

As the oil and gas industry is looking for new fields to be explored, where local conditions might be harsher, such as the Arctic, the demand for more developed offshore supply vessels offering new and improved services increases (Håberg, 2010). The recent development within the OSV industry has been a paradigm shift towards more multifunctional vessels than pure specialist vessels (Brown, 2010).

5.2 Required Services from the Arctic OSV Industry

The harsh and challenging environment in the Arctic put specific requirements on the OSV industry compared to developed oil and gas regions. Furthermore, there are significant differences between the operating conditions in the different regions of the Arctic. Some areas, for instance, have first year ice while others have multi-year ice and technologies developed for first year ice conditions cannot easily be transferred to other ice conditions (Eliasson, 2010).

The supply services required in open water operations have been identified together with the additional services unique for the Arctic region. These services have been discussed from an Arctic perspective with industry people in order to identify which services the Arctic offshore industry requires, the demand for such services as well as the challenges with supplying those services.

The following services for Arctic waters have been identified through consultation with MSS, note that the list has no interrelated priority:

-
- | | |
|-----------------------|---|
| • Fire fighting | • Oil-combating/oil spill prevention |
| • Escort ice breaking | • Standby/EER (Emergency, Evacuate, Rescue) |
| • Ice Management | • Construction Assistance |
| • Towing | |
| • Anchor Handling | |
| • Cargo Supply | |

The following section aims at exploring the demand for, and challenges with, the listed services. The information has been collected through interviews with industry people.

Fire Fighting

Fire fighting is not a critical service in the Arctic (Interview with Marthinsen). However post the Deepwater Horizon catastrophe, fire fighting will probably be a significant requirement in the future (Interview with Noble (c)). Most facilities have their own fire fighting systems, but in case of a larger fire accident, supply vessels should be able to assist, since the internal systems might be insufficient (Interview with Marthinsen). Most of the vessels operating in an Arctic environment will probably be equipped with a fire fighting feature (Interview with Niini), especially since back-up vessels from

other sites can not be called in due to the far distances (Interview with Noble (c)).

On the other hand, in case of subsea equipment, as in the project of Shtokman, the offshore gas wells are located on the sea bottom and hence there is no need for fire fighting activities (Interview with Marthinsen). A difficulty with fire fighting in the Arctic in general is the cold. When large amount of water is washed on a facility to extinguish a smaller fire, the low temperature may freeze the water, covering parts of the facility in ice, which may constitute danger for rig workers. Another challenging aspect is the pipes, which may freeze and hinder the fire fighting ability (Interview with Madsen, Interview with Rohlén).

An alternative is to use powder instead of water as quenching medium. But, in the case of a fire disaster such as the DeepWater Horizon catastrophe, the fire fighting aim to cool down the rig and create evacuation corridors in order for rescue vessels to approach in the intense heating that is generated (Interview with Elmbo).

Ice Management

Ice management is among the most important and challenging services in the Arctic, which aim is to enable other activities to operate in a homogenous environment (Interview with Larsen; Interview with Madsen; Noble, 2010). With proper ice management, the drilling season can be extended in some areas from a 2-3 months window to all year round, resulting in the cost per well being substantially decreased, therefore, the supplier that can offer a service of keeping the water surrounding a drilling facility with only moderate ice concentrations is going to be very attractive for the oil and gas companies (Interview with Jørgensen). Another aspect once the equipment is on site, is to foresee that the operating utilization is as high as possible, which is enabled by proper ice management (Interview with Rohlén).

Ice management is a wide concept in itself, which constitutes in ice monitoring, meteorology, etc. and an important aspect is how the ice conditions differ, as well as knowledge in how the ice moves. Ice monitoring is critical in order to supply leading ice management services, but the current knowledge is very limited and is hence currently the subject of extensive research attention (Interview with Jørgensen; Interview with Larsen; Interview with Marthinsen).

Monitoring the ice movements is a constant challenge, since the conditions may change from one hour to another. The activity often require a meteorology-ice alerts team to establish reports on the ice conditions by satellite imagery (predominately SAR as it works in a non visual range and can “see” in darkness and cloudy conditions). Furthermore aircraft or helicopter surveillance is used to identify critical sea ice. The sea ice is equipped with GPS transponders reporting speed and course. In addition, to be able to receive all necessary information and be able to communicate, as well as navigate in the ice, IT-systems with live updates are of high importance (Interview with Rohlén).

The demand for vessels performing ice management services varies from 1-4 vessels for a single drilling unit depending on ice severity (thickness and movement) and the drilling unit’s capacity to withstand the forces from the ice (Interview with Marthinsen; Interview with Rohlén). If the ice cover is thick, there might be a problem to transport the ice away from the drilling unit once it is broken. More vessels are then needed, either to break the ice into smaller peaces or flush it away with the vessel thrusters (Interview with Rohlén).

Standby/EER

The often far distances to shore, insufficient infrastructure and ice conditions result in safety for rig workers, crew members and the environment being critical within the Arctic region (Interview with Andersen; Interview with Marthinsen; Noble, 2010). In case of an emergency evacuation, there is a need for supply vessels to be able to accommodate personnel from the affected facilities, which in case of a rig or drill ship emergency often includes 100-200 persons. Another requirement is the need for medical facilities onboard to be able to accommodate injured persons (Interview with Rohlén).

The demand for standby vessels depends on distance to shore and size of the site etc. and range from 2-5 vessels per site (Interview with Andersen). According to Canadian law, a standby vessel is required to be within 20 minutes from the offshore installation (Interview with Simpson). The standby vessels are often equipped with oil spill response, ice breaking/management capability and fire fighting capabilities (Interview with Andersen). The biggest challenge with EER is to evacuate in high waves with severe ice conditions, in which normal rescue boats are not dimensioned to work in (Interview with Marthinsen).

Oil spill recovery/pollution prevention

One of the biggest threats to the environment is oil spill in ice infested waters (Interview with Andersen; Interview with Tolstrup). In addition, there is limited knowledge regarding the impact of an oil spill in the Arctic region (Zolothukin, 2010). There are different techniques on how to contain and recover oil spills and in some cases the low temperature may have a positive effect, since the oil thickens in low temperatures as well as the ice can act as a natural barrier to prevent the oil from spreading (Shell, 2010).

Together with standby and EER services, oil spill recovery is one of the most important services in order to guarantee social and environmental safety (Interview with Andersen; Interview with Marthinsen). Though important, oil spill recovery is a subordinate service and is applied in case of an oil spill emergency (Rolén, 2010) but will most probably be a feature which all Arctic supply vessels will have (Interview with Niini).

Cargo Supply

Long distances to ports and onshore supply bases, results in logistical challenges for every Arctic offshore operation, with the Norwegian Barents Sea as an exception due to the sea being mainly ice free all year round (Interview with Marthinsen; Noble, 2010). The cargo demand differs slightly depending on the facility, where mud is needed to control the pressure in the well when drilling and methanol is needed for production. To be able to supply both types of material would therefore be an advantage, which can be satisfied if a tank onboard a supply vessel is able to carry both materials (Interview with Simpson).

When establishing an offshore site, whether production or drilling, there will most likely be a larger supply base in the vicinity of the site that holds e.g. fuel for the activities. In case of a drill ship, the facility itself is able to hold large quantities of supplies (Interview with Rohlén). If a supply base is not established, the most likely, and probably a better solution, is to have bigger (up to five times) supply ships, which are able to carry the necessary supplies for the entire period, delivering directly from international ports (Interview with Noble (b)).

Construction Assistance

Regarding construction assistance services, it is difficult to specify the requirements since they are highly dependant on the type of facility being constructed (Interview with Marthinsen). Different requirements constitute in

the vessel being equipped with cranes, Remote Operated Vehicles (ROV's) and a helicopter deck if the drilling unit does not have one (Interview with Niini). Another aspect regarding construction assistance is that it is not needed when exploring a site, but rather when a significant discovery is found and the field is to be developed (Interview with Niini; Interview with Rohlén; Interview with Skår).

In the Beaufort Sea, the development is slow, since there is no time limit of starting to develop a field of significant findings. In Greenland and the U.S. however, it is different. Here, the licensee has 10 years from the retrieval of the license to first production, which results in a significantly faster development. In Russia the Shtokman project has been operating for some time, and even though the project has been postponed, it is to be developed within a couple of years (Interview with Rohlén).

A large vessel with icebreaking capabilities constitutes a good platform for extending it to a construction assistance vessel and vice versa (Interview with Rohlén).

Anchor Handling

Anchor handling is referred to the service of securing the stability of an offshore facility by mooring anchors to the sea bed. This service is intricate, since it constitutes a major business in the traditional offshore industry. However, modern drilling units have a dynamical positioning (DP) system, which results in anchor handling duties being less required (Interview with Rohlén). Nevertheless, the DP systems may be a restriction in the Arctic since the system may not be able to hold position in ice and consumes large amounts of fuel, which requires large storage capacities and emissions and pollution may become an issue (Interview with Seistrup).

The water depth is a threat to both moored rigs and DP systems, since the offset movements of the drill unit should only be around 2-6% of the water depth. This means that both DP and anchor handling should be able to secure a maximum of 0,8m in offset movement if the water depth is 40m with a limit of 2% movement (Interview with Noble (c); Interview with Rohlén). The water depth also increase the incentives of using ice reinforced jack-up rigs, which will decrease the demand for anchor handling duties, but increase the demand for towing. Important to note is that the current operating window is restricted to the summer months when using jack-up rigs, since the ice becomes to challenging in the winter. Development engineering is however

underway on designs for ice-resistant jack-up rigs which will be able to work in substantial ice conditions. Additionally, some companies are looking at the potential of using moored drill ships, which would require anchor handling (Interview with Noble (c)).

Towage

Towage duties are mostly referred to exploration activities, when a drilling rig is moved in and out of the drilling site. Some companies use drill ships in the Arctic because it will better withstand the pressure from the ice than a jack-up (Interview with Noble (b)). Both drill ships and semi-submersibles are capable of moving by itself, even when ice conditions are severe, but in some cases the supply vessels can be used for escort icebreaking. The difference between escort ice breaking and ice management is that when escorting an installation through ice, the route is chosen according to where the ice does not pose a serious obstacle and in ice management or ice breaking; the route goes straight through the ice the shortest way possible (Interview with Rohlén).

Due to shallow water, which aggravates anchor handling, ice reinforced jack-up rigs are more appropriate, which in this case results in an increased demand for both towage and escort ice breaking services (Interview with Noble (c)).

Important aspects when delivering the required services

It is difficult to rank the services because every service is important and required for exploration and production activities in the Arctic (Interview with Andersen). Furthermore, the requirements differ depending on the region and aspects such as ice conditions, water depth and to some extent which type of facility that is to be supplied. The vessels and equipment are being more and more purpose built to suit the prescribed conditions in the Arctic (Noble, 2010). Nevertheless, the equipment should be flexible enough to be operational in other areas if the market changes, otherwise the return on investment is going to be unsatisfying (Interview with Rohlén; Interview with Skår). In addition, the differences between supplying a drilling facility versus a production unit do not require completely specialized or particular vessels in either case other than some specific cargo supply, where tanks should be able to carry different materials after being washed (Interview with Simpson).

In the Arctic, simplicity is the key, together with the best of safety and emission design. Evolutionary designs that have experienced limited testing as well as trying to include as many capabilities as possible in a vessel is not the right solution and results in high costs and low operational on-hire percentage

on each service. An ice management vessel for example will spend all its time breaking ice and there will be little time to perform anchor handling duties. Furthermore, outfitting a platform supply vessel with oil spill response capability will affect the cargo capacity negatively as well as it will limit the effectiveness as a single oil spill response vessel (Noble, 2010; Interview with Simpson). However, the high costs will not result in an offshore site having a number of specialized standby vessels on hold, but those services will probably be integrated in an ice management or anchor handling vessel. It is however important to note that with the far distances to shore bases, a certain redundancy is important, since, it will take a long time for the nearest assistance to reach the site in case of a failure (Interview with Rohlén; Interview with Skår).

The services can be characterized into two groups, main services and subordinate services. Ice management, cargo supply, anchor handling and construction assistance are typical main services since the drilling or production activities are dependent on these services, whereas standby/EER, oil-spill recovery, and fire fighting are necessary services and of great importance in case of something unforeseen would happen (Interview with Andersen; Interview with Marthinsen; Interview with Rohlén).

5.3 Market Demand

The result of the required services in the Arctic region is divided into main services and subordinate services. This indicates by no means that the subordinate services are considered less important nor can they be neglected. The main services are more critical in terms of assuring continuous operations, and the subordinate services are a necessity in order to assure both social and environmental safety in case of an emergency or failure. The below lists have no interrelated priority.

Main Services

- Ice Management
- Anchor Handling
- Construction Assistance
- Cargo Supply
- Towage/Escort Icebreaking

Subordinate Services

- Standby/EER
- Oil-spill Response
- Fire Fighting

The market demand for services in the Arctic region is accordingly mainly the same as for open water operations, with the ice breaking capabilities as an addition. However, the services cannot be extrapolated from a conventional

market to the Arctic market, due to the specific challenges in the Arctic region. The biggest challenges observed are related to the Arctic cold and the ice conditions, which affect more or less all of the above services. However, high sea and sea ice is aggravating the subordinated services the most. Since ice management vessels' purpose is to operate with and in ice, all vessels must have appropriate ice classification depending on the ice severity in the area of operation. Since the ice conditions are different from one region to another, it is important to foresee that the vessel can operate in different ice concentrations or acknowledge the limitations the ice puts on a vessel, restricting the vessel to operate only in certain areas.

With regards to combine a wide range of duties in order to supply different needs is not the solution, simplicity rather is, since a vessel cannot perform ice management and act as a standby vessel at the same time. However, a supplier of OSV services has to find purposes for the vessels outside a special region or site if the market, for which the equipment originally was built, fails.

It is an interesting observation that the majority of the representatives (Noble, Simpson and Andersen) from the oil and gas companies in this chapter argue for purpose built equipment, whereas the persons from the OSV companies (Rohlén and Skår), together with vessel constructor (Niini) Aker Arctic argue for a development towards more differentiated vessels in order to secure the vessels' purpose if the market fail.

In this thesis, the market aspect of the total number of vessels needed in the Arctic region in the near future have not been pointed out since the authors have not had the possibilities within the time frame. This assignment would have demanded an extensive access to market information, which the authors have not gained during the period. Additional suggestions on further research is established in 7.2.3.

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6 BUSINESS POTENTIALS IN THE ARCTIC OSV INDUSTRY

This chapter will present the business potentials for an OSV company in the Arctic. First the competition will be identified and the market attractiveness will be discussed. Secondly the risks that are associated with Arctic operations will be elucidated and lastly the business potentials for the case company Maersk Supply Service will be presented.

Chapter 5 clarified that there certainly is a market demand for OSV services in the Arctic. It is however important to investigate the competition within the Arctic OSV industry in order to determine the market attractiveness from a competitive perspective.

6.1 Competition

Using the five forces of competition framework, described in 3.3, the competition within the Arctic OSV market will be analyzed.

Rivalry

Rivalry within the OSV market in general is volatile with a large number of firms. In the ultimate years the industry has been very profitable and hence many new players have entered the market (Interview with Skår). However, until today, there are only a few competitors with icebreaking supply vessels within the Arctic OSV industry (Interview with Rohlén). The biggest players that have been identified are Trans Viking¹⁰, Arctia Shipping¹¹, Fesco, and Swire Pacific Offshore (Interview with Rohlén; Interview with Skår).

Due to the seasonal operating conditions in the Arctic it is important to find an alternative market for the vessel to assure a high utilization even during the off season in order to achieve a satisfactory return on investment. A company that has been successful in terms of combining summer and winter activities is Trans Viking. During the winter months they are breaking ice in the Gulf of Bothnia on behalf of the Swedish Shipping Administration (Sjöfartsverket), while they during the summer months collaborate with oil and gas companies in the Arctic (Interview with Rohlén).

¹⁰ Trans Viking is a 50/50 joint venture between Transatlantic and Viking Supply Ships A/S (Interview with Rohlén)

¹¹ Former FinstaShip (Interview with Rohlén)

Some companies have at the moment no interest in commencing Arctic operations, for instance Deep Sea Supply (Interview with Wennesland) and Farstad (Interview with Ulstad). Both are of the opinion that the potentials in the market at this early state are too small and insecure. Solstad on the other hand sees a potential, but due to the current low market volume, they are taking a more moderate position. However, they have the ability to enter the Arctic market and are following the development closely. But, a market entry will not be interesting until they can secure profitability (Interview with Skår).

The product differentiation in the traditional OSV market is low and hence the competition is mainly based on price. Quality is however always important, especially in the Arctic since it is associated with many risks (Interview with Skår). The distances to shore base are far, which together with the risks increase the demand of special services and combined solutions. The products are therefore more differentiated with purpose built solutions for the Arctic. In addition, the current early market state has not yet developed any standards, which together with the few existing actors, increase the switching costs for the customers (Interview with Rohlén). OSV operations in the Arctic are related to high fixed costs since the purpose built vessels for the Arctic are approximately twice compared to traditional vessels (Interview with Elmbo).

New entrants

The few already established operators in the Arctic makes it especially interesting to investigate the entry barriers for new entrants. The small number of operators also increases the interest for traditional OSV owners to establish their presence in the Arctic if they find it profitable.

The barriers to enter the Arctic market are characterized by high costs and knowledge. All the major OSV companies may have the possibility to enter the Arctic and would have an advantage over completely new actors, since they already possess some of the resources, competencies and competitive capabilities needed to overcome the barriers of entering the market (Interview with Skår).

Technology may be obtained by new entrants but in order to acquire the right technology, an understanding for what is needed is an absolute requirement. The technological barriers are thus low, but the special competence in how to use it, is much more difficult to obtain (Interview with Rohlén). If oil and gas are found and the business is proved to be profitable the competition will

probably increase along with an increased market demand for Arctic OSV services (Interview with Skår).

It is crucial for new entrants to consider the fact that the operations depend on seasonal climate changes. Hence, vessels should be developed with the purpose to work both in ice and ice free water in order to maximize both profit and utilization, even though they might not work perfect in ice free waters, due to design factors (Interview with Skår). Furthermore, all operations in the Arctic are related to insecurities in terms of operating challenges and the risk that oil and gas companies might not find the sought resources. Thus, sustainable profits are not guaranteed, which put extra an emphasis on the necessity to develop equipment that can easily be used also in other waters than in the Arctic. Additionally it is, like in other service industries, difficult to reach economies of scale since one unit is a single vessel (Interview with Skår).

Regulatory policies and impact from governments may be an obstacle for both new entrants and existing operators, especially regarding operations in the U.S. due to the Jones Act, which precludes non U.S. companies from participating unless they become Jones Act qualified (Interview with Noble (b); Interview with Simpson).

Buyers

Buyers of traditional OSV services have a substantial bargaining power since the market can be seen as a commodity market (Interview with Skår). The fact that there are only a few OSV service providers operating in the Arctic with the competence needed, lowers the bargaining power among customers. It is difficult to change supplier and switching costs are therefore high. The offered products are not standardized within the Arctic, since different conditions require different services and since the market is fairly new. However it is the buyers' requirements that control the development of the equipment (Interview with Rohlén).

The oil companies are striving to become more cost efficient, however the safety is always crucial. Consequently, price together with competence regarding technology and safety, are the most important factors when choosing supplier in the Arctic market. The main reason for Trans Viking to successfully gain the contracts with Cairn Energy, off the west coast of Greenland, and Shell in Alaska depends on two reasons; Trans Viking already had the vessels and they had a good track record after previous collaboration

with Shell in 2007. This enhances the fact that competence is important (Interview with Rohlén).

As of today there are not many buyers, but in steps with an increased exploration and production in the region the competition among oil and gas companies will increase in the region. (Interview with Larsen; Interview with Madsen)

Substitutes

One of the biggest threats for the OSV industry is dynamically positioned drilling units, which makes mooring systems unnecessary. The power of this substitute may even eliminate the anchor handling in the traditional OSV industry (Interview with Sørensen). The fuel consumption for a dynamically positioned rig is however very high, which in the Arctic might signify a disadvantage since the distances to land are far and it is difficult to refill with fuel (Interview with Elmbo). The restricted air emission permission in the Arctic may also implicate an obstacle (Interview with Noble (b)). Additionally, the use of DP systems may be limited since it may not be able to hold position in ice (Interview with Danielsen).

Suppliers

The Arctic OSV industry has many different suppliers in terms of ship yards, helicopter companies, weather stations, satellite imagery suppliers, bunker companies, and insurance companies. The ship yards are however the biggest and most important supplier (Interview with Rohlén) and there are only a few suppliers that possess the right competence within the Arctic OSV industry (Interview with Rohlén). The suppliers have many different customers and are hence not only delivering to the Arctic OSV industry (Interview with Niini).

Even though the suppliers are few, it is possible to find cheaper solutions as the competence in Asian countries increases. Quality assurance is of utmost importance, especially in the Arctic, and therefore it may not be worth the risk to hire a supplier that offers lower prices but might gamble with quality and safety (Interview with Sørensen).

Economies of scale in procurement are rare since it requires very large purchase volumes, but one possible area is the procurement of bunker products. However, it is very few OSV owners that have the ability to practice economies of scale that outperforms its competitors (Interview with Elmbo).

Market attractiveness

There are only a few competitors within the Arctic OSV industry today that possess the necessary equipment, knowledge, and technology, hence rivalry is low.

Products are differentiated, which increases the customers' switching costs, which in turn aggravates market entry among new actors. Furthermore customers switching costs are high due to the low amount of existing suppliers. Switching costs related to few suppliers will however be lower if rivalry increases.

Moreover the few substitutes to the OSV services in the Arctic confirm the higher switching cost for the customer. However it also makes the market more attractive for both existing operators and new entrants.

Even though customers switching costs are high they possess a substantial bargaining power since their requirements control the development of the vessels. Since investments in new equipment specialized for operations in the Arctic region are expensive, operators need to be certain that the offered products will satisfy the customers' need.

A market entrance is correlated with high costs and knowledge, which would intensify the barriers for new entrants. However, existing operators within the traditional OSV industry have an advantage, since they already possess some knowledge. Technology is possible to obtain, which decreases the entrance barriers. But, more importantly is the knowledge and experience in how to use the technology, which is more difficult to acquire. As long as new entrants are building vessels that work in both ice covered and ice free waters the exit barriers decrease as well as the risks when entering the market. Furthermore, the non existing scale economy in providing OSV services makes it more beneficial for new entrants.

The high fixed costs in terms of capital expenditures may indicate that OSV operators, if demand is lower than expected, are more willing to lower their day rates in order to cover the high fixed costs, which would increase the customers' power.

Since there are only a few suppliers in terms of ship yards that possess the expertise and competence needed, they have a considerable bargaining power. However there are only a few rivals within the industry, which indicates that

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their bargaining power decreases. The Arctic OSV industry is not the key customer, since the suppliers also supply other industries with products. Hence their bargaining power increases.

It is possible to find cheaper solutions in steps with increased knowledge in Asian countries, which would decrease the suppliers' bargaining power. However, since quality plays an important role, it is more likely that an operator chooses to build vessels in collaboration with a well-known ship yard that does not compete with price.

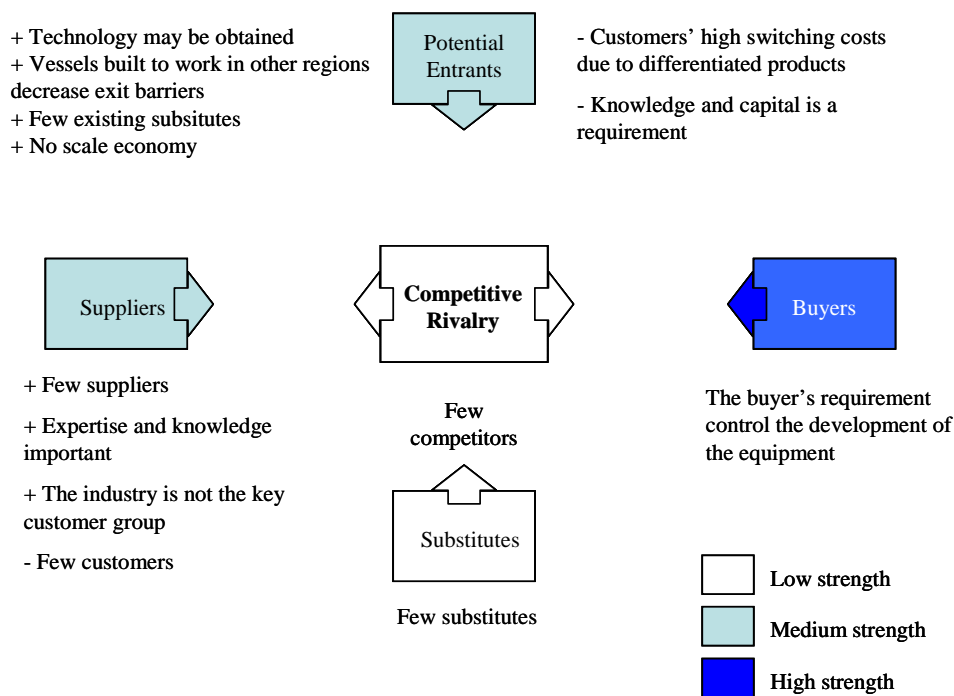


Figure 12 - The competition within the Arctic OSV industry applied on Porter's (1980) five forces of competition framework

As illustrated in Figure 12 the buyers possess the highest strength, whereas suppliers and new entrants constitute a fairly strong threat. The existing rivalry is low and so is the threat from substitutes. Existing OSV companies with the capital needed have however the ability to enter the Arctic market if oil and gas are found and hence competition would increase.

6.2 Key Success Factors

The Arctic OSV industry's key success factors that will have the greatest impact on the future competitive success have been identified. As stated in previous chapters operations in the Arctic are related to additional risks and

challenges compared to traditional offshore operations. Hence, buyers choose the supplier that can offer high quality services, with a special emphasis on the services that can guarantee operational contingency. Quality is critical both regarding equipment and skilled employees. The first one can be assured by using competent suppliers and work closely together with them in order to develop good solutions. The latter one indicates that the workforce must be talented, both onshore and offshore. The OSV industry is characterized by high fixed costs for assets, such as the vessel fleet, thus it is important to have a high level of utilization for the vessels to stay profitable. This is especially difficult in the Arctic since operations may take place only during a couple of months. The competitor that succeeds to utilize the equipment competitively all year around will definitely get a competitive advantage. Furthermore the high investments needed in fixed assets require a strong balance sheet and access to financial capital. The OSV industry's identified key success factors are listed below;

- High utilization of the vessels
- A strong balance sheet and access to financial capital
- Equipment that can guarantee contingency operations and safety for the work force in the area where operations are taking place.
- A talented workforce, both onshore and offshore, that can guarantee high quality services

6.3 Risks

From previous chapters, a market demand for OSV services in the Arctic has been identified. Furthermore, it has been established that the market is attractive in terms of the competitive landscape. However, there are still many challenges that have to be taken into consideration for both a potential entrant as well as for an existing OSV service provider in the Arctic. This section is the authors own analysis of the thesis' previous empirical data.

According to the COSO framework for Enterprise-wide Risk Management, presented in 3.8.1, the risks can be categorized into four; *hazardous*, *financial*, *operational* and *strategic*. This section aims to identify, discuss, and categorize the most important risks associated when operating in the Arctic. The risks discussed are not company specific, but are applicable on the Arctic OSV industry in general.

Hazardous Risks

The harsh environmental conditions generate a number of hazardous risks for both crew and equipment. The low temperatures, strong winds and high waves raise the risks for crew members' health and safety. In addition, in case of an evacuation and rescue emergency, the risk for the distressed safety is also intensified due to the harsh conditions.

Not only human risks, but also the vessels and other equipment are associated and exposed to risks due to the harsh climate and ice conditions. Such as simple as improperly isolated piping systems etc. can cause machine failures and other vessel damages, which in turn can have huge consequences to operations.

Force majeure in the Arctic would have immense consequences on the activities in the Arctic, especially since already challenging conditions. Furthermore, the knowledge regarding ice movements etc. is limited, which is augmented by the constantly changing conditions.

The Hazardous Risks are identified as:

- Health and Safety
- Machine failure
- Property damage
- Force majeure

Financial Risks

The Arctic OSV industry is exposed to a number of financial risks. If the market fails, the income for the existing icebreaking vessel operator will decrease, since customers in an alternative operating area, the traditional market, are not willing to pay prices as high as in the Arctic. Hence there is a risk that not enough revenue will be generated in order to meet the high costs. Furthermore the value of assets in terms of the value of the vessel will also decrease. Since the industry is capital-intensive it is important to either be very liquid or have the possibility to get beneficial funding from elsewhere.

A number of countries have owner interest in the Arctic region. In addition, the operating firms are both global and local and therefore trading occurs in different currencies. This may pose exchange rate risks for the trading companies.

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The Financial Risks are identified as:

- Value of assets
- Liquidity
- Exchange rates

Operational Risks

The operational risks are caused by a company's internal processes and business operations. In terms of OSV service providers in the Arctic region, competent and quality employees are a pre-requisite in order to be successful. Vessel crew may pose a great risk if they are not well educated and have experience from operations in Arctic waters, since lack of knowledge of navigating and operating in the Arctic region may result in harm for crew, equipment, and environment. Also skilled personnel onshore, with excellent nautical, commercial, and managerial abilities are of importance to provide high quality and sustainable services.

The far distances to operational sites in the Arctic requires careful planning and supply chain management. The costs of transporting equipment and supplies to remote Arctic regions are huge and if something in the supply chain would cause a disruption, there would be consequences. It is therefore of importance to plan for redundancy in case of an incident.

IT-systems are an important part to be able to communicate and navigate in ice infested waters. With regards to ice management, a crucial part is ice monitoring, which for instance requires satellite up-link, meteorology data. If those systems are lacking or would fail, it would severely hinder the vessel to provide a quality service.

Since the petroleum industry is very capital intensive in general, this also reflects the OSV industry. The Arctic offshore market is no exception, rather, it is even more costly to practice operations within the sensitive environment of the Arctic waters. Business processes such as planning, budgeting, investment evaluation etc. is evidently very important in order to be cost effective in a very capital intensive industry.

The Operational Risks are identified as:

- High quality vessel crew
- High quality onshore crew
- Supply Chain Management

- IT-infrastructure
- Business processes

Strategic Risks

The stakeholder analysis concluded many challenges and threats that are facing the Arctic offshore oil and gas industry. In addition, the environmental conditions as well as the market demand for OSV services and competition generate a number of strategic risks.

Since the oil and gas development in the Arctic is highly debated and monitored, a company is responsible for an oil spill, high emissions, lack of business ethics etc. which would either affect the social or biological environment, may face severe reputational damage. This could affect both public relations, as well as business contacts such as customers, suppliers and competitors. Operational impact on the environment is a risk that is intensified in the Arctic compared to the traditional oil and gas industry and affects all operators in the Arctic region. In case of a disaster, the consequences are immense because of the sensitive environment.

The current competitive situation for the Arctic OSV industry makes the market attractive. However, as a result of further development and an increased demand for OSV services, the competition will probably increase, especially since the entry barriers are relatively low, if the operator can manage the high costs. In addition, new technology such as Dynamical Positioning systems on drilling units may pose a risk for substitutes out competing current service such as anchor handling. Furthermore, technology may pose a risk in sense of quality. Due to a capital intensive industry, capital availability becomes a risk if the capital needed for business and technology development is too difficult to obtain.

Governmental regulations such as bans or legislative restrictions in terms of emission, trade, etc. pose a high risk for the Arctic development, and therefore also the OSV industry. The U.S emission restrictions and the Jones Act are examples of such regulations. Governmental decisions and political trends are highly dependable on the current development and even single incidents. Governmental regulations also affect customer demands in terms of technological requirements and a ban would result in a non existing customer demand. In addition, the different local conditions may result in a shifting customer demand, depending on area of operation and the special requirements on provided OSV services.

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The Strategic Risks are identified as:

- Reputational damage
- Environmental impacts
- Competition
- Technology innovation/development (unique concepts)
- Capital availability
- Regulations and politics
- Customer demands

Summary

As discussed, the risks associated with the Arctic OSV industry are many. The risks are recognizable in the traditional OSV market as well; however, many of them are augmented in the Arctic. The identified risks have been categorized into four, and are listed in Table 1 below. The majority of them are derived from the specific, sensitive and harsh environment that characterizes the Arctic region in terms of environmental impact on operations, as well as operational impact on the environment.

All four categories pose risks, but most of the risks are strategic and operational. However, the importance of the risks is not being evaluated in this section, but an assessment will be conducted by applying the risks on the case company in 6.4.3.

Table 1 - The most likely risks associated with the Arctic OSV industry

Hazardous	Financial	Operational	Strategic
Health and Safety	Value of assets	High quality vessel crew	Reputational damage
Machine failure	Liquidity	High quality onshore crew	Environmental impacts
Property damage	Exchange rates	Supply Chain Management	Competition
Force majeure		IT-infrastructure	Technology development
		Business processes	Capital availability
			Regulations and politics
			Customer demands

6.4 The case of MSS

The remaining part of this chapter will elucidate the business potentials for the case company Maersk Supply Service.

6.4.1 Company Description

Maersk Supply Service (MSS) is a part of the A.P. Moller - Maersk Group,

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which is a global organization with around 120,000 employees in 130 different countries. The company was founded in 1904 and the global headquarters is located in Copenhagen, Denmark. The group is listed on the Copenhagen Stock Exchange and in 2009 the revenue was almost 193 billion DKK (Maersk 2010 a).

The corporate group owns one of the world's biggest container shipping companies, but is also involved in other business areas such as energy, shipbuilding, retail and manufacturing industries, see Figure 13. Maersk Supply Service (MSS) is together with Maersk Drilling, Maersk Tankers and Maersk FPSO (Floating Production Storage and Offloading) a part of the business area Tankers, offshore and other shipping activities (Maersk 2010b).

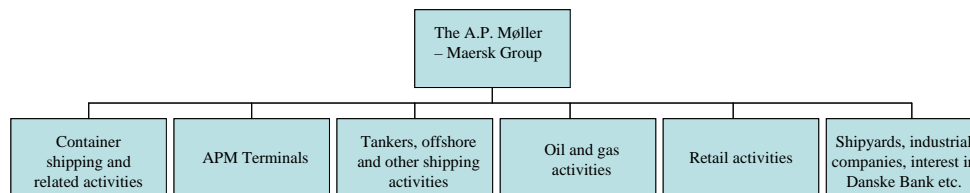


Figure 13 - The A.P Moller - Maersk Group and subsidiaries (Maersk 2010a).

In 1967, MSS entered the offshore market as the first Scandinavian shipping company and seven years later MSS was established as an independent business unit within the group. In 1979, MSS became the leading company of offshore support vessel operations and has been established among the leading companies within the industry ever since. In 2008 MSS became a separate limited company registered as Maersk Supply Service A/S (Maersk Supply Service, 2010).

MSS operates in all major deep-water regions world-wide, with Brazil, the North Sea and West Africa as the major operating areas, and provides the offshore industry with over 60 vessels. MSS vision is:

“to be the customers’ first choice as a supplier of *Safe, High Quality,* and *Reliable* offshore vessel services.” (Interview with Sørensen)

The company offers services from three types of vessels: field and sub sea support vessels, anchor handling tug supply vessels and platform supply vessels. MSS has around 225 employees onshore and about 1,800 offshore crew members employed primarily from Denmark, United Kingdom, Canada and Brazil (Maersk Supply Service, 2010).

6.4.2 MSS Competitive Advantage

Company strategy and overall objectives

According to Sørensen (2010), Chief Commercial Officer at MSS, the strategy is to remain a big player where they are operating today, while growing on new markets. The focus will hence be on taking a stronger market position on markets where they already possess a strong position, but also to focus on niche products that are superior and specified.

Lately there has been a shift in the demand of anchor handling vessels. Many oil rigs have their own dynamic positioning system, which makes anchor handling equipment unnecessary. Since MSS core competence is based on anchor handling they are currently remaking the strategy in order to retain a strong position within the OSV industry and they will hence focus on other niche areas (Interview with Seistrup).

The “mission is to be the most *profitable* provider of offshore vessel services generating enough income to depreciate the invested capital and secure profitable growth”. The company is “committed to *quality, safety and the protection of human life, health, property and the environment*”. Furthermore they aim to “work worldwide in partnership with their customers to meet their requirements by creating innovative, reliable and cost-efficient solutions” (Interview with Sørensen).

SWOT

By doing a SWOT analysis MSS strengths, weaknesses, opportunities and threats regarding operations in the Arctic will be discussed and presented in **Table 2**.

Strengths

Being a part of the A.P. Møller Maersk group gives MSS strength in terms of a strong brand. Furthermore, the corporate group supports the business units and when funding is needed the group provides the business unit with funding if the investment can bring enough profit. Furthermore MSS is a global company that, in comparison with competitors, is willing to work everywhere, in all terms of climate conditions and geographical locations (Interview with Sørensen).

MSS has loyal customers on the traditional OSV market and customer satisfaction surveys shows that the satisfaction is high. Furthermore, MSS has a good track record related to earlier performances and they are delivering

high quality services. High quality is secured by having competent personnel both onshore and onboard the vessels (Interview with Sørensen). MSS employees hold technical competence, they possess vast experience from operations in open water, and also some experience from navigating in ice covered waters.

Furthermore they are innovative and have a good sense for the market (Interview with Elmbo), for instance only two vessels are built when already having a contract signed; the others are all built on speculations. All vessels have a high level of utilization; hence they have been successful in their speculations. Moreover the company possesses especially strong knowledge within anchor handling and fire fighting duties (Interview with Sørensen).

Weaknesses

MSS have limited experience from operations in ice, which states a weakness. Hence they have no Arctic track record. As of today, they have no equipment that with the capability to operate in the Arctic, thus new, purpose built equipment has to be developed and produced. Previously there has been very little focus on cost efficiency, which is an imperative aspect to stay competitive (Interview with Seistrup)

Opportunities

Since the Arctic is a new market for the OSV industry, the competition is still low, and so are the barriers to enter the market, if the firm has the required capital. One of the biggest opportunities for MSS is that they are able to enter the market, and obtain the funding and technology needed if the industry is proved to be profitable (Interview with Elmbo). In addition, the fact that the conventional oil and gas industry is mature and existing fields will eventually run out constitutes a basic opportunity. This leads to an increased presence of oil and gas companies in the Arctic and furthermore an increased demand for OSV services. In steps with an increased activity, new technologies will be developed and used.

The global warming and melting Arctic ice signify an opportunity that will facilitate operations in the Arctic in the future (Sandven, 2007).

Governments that support the development of the Arctic oil and gas industry may pose an opportunity. In MSS case, this opportunity exists especially in Greenland since MSS, as a Danish company, will get a competitive advantage (Interview with Elmbo).

Threats

Politics is a main threat to a further development of the Arctic petroleum industry (Interview with Sørensen). The Jones Act, for instance, affects operations in the U.S. and MSS will not try to go around the regulations (Interview with Elmbo). Another threat is the harsh environment and it is a balance between focusing on the environment and being as profitable as possible (Interview with Sørensen; Interview with Seistrup). Additionally it is considerably harder to navigate in the Arctic compared to open water and there are still many aspects that are unknown regarding operations in ice covered water (Interview with Seistrup).

Operations in the Arctic are dependent on competent and experienced crew members. There is however a shortage in the availability of high quality experienced crew, since it takes several years to get the education and experience needed (Interview with Sørensen). Furthermore crew members that are working for Maersk are very attractive for other service providers, higher salaries offered by competitors may thereby pose a threat (Interview with Elmbo).

Moreover, being a part of the A.P. Møller Maersk group signifies that they are dependent on the group to consider the market entrance to be favorable and in line with group objectives. Hence, they also compete with other business units in order to get additional funding for investments related to e.g. a new market entry (Interview with Sørensen). To get funding for developing purpose built vessels for the Arctic, it might be required to present a contract, and also to clarify statistics, forecasts for the supply and demand of OSV's in the Arctic, budget planning, cost allocation and investment evaluations (Interview with Elmbo). This means that it might be difficult for them to get funding compared to competitors, whose only business purpose is OSV operations. Another issue is the challenge to build a vessel cost efficiently that is adjusted to the Arctic (Interview with Seistrup). When entering a brand new market there is always a threat that the customer demand will change or decrease.

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Table 2 - SWOT analysis of MSS

Strengths	Weaknesses
Brand Corporate group Global reach Loyal customers Track record within traditional OSV Quality employees Specialized on AHTS Fire Fighting Leading innovation	No track record in the Arctic No Arctic specialized equipment Limited Arctic experience Cost efficiency
Opportunities	Threats
New market Moderate competition Governmental approval (Greenland) Increasing market demand Melting Arctic ice Technology development	Governmental regulations Harsh and sensitive environment Shortage of qualified crew Changes in or decreasing demand Insufficient technology development Competing to get funding

Resourced-Based View (RBV) and VRIO Analysis

Historically, MSS has been before its competitors in terms of having knowledge about what the customers demand (Interview with Seistrup). For instance they have only built two vessels when already having a contract, while the others are all built on speculations. All vessels are also highly utilized which confirms their ability to develop vessels that suit their customers' requirements. By satisfying their customers' need and deliver high quality services they have got a good track record in terms of earlier good performances (Interview with Elmbo).

Being a part of the A.P. Møller Maersk Group gives them a strong financial position, support, and a strong brand. Furthermore since the group purchases bulk products to several business units they can negotiate favorable prices and reach scale economy. The brand is associated with high quality and competence, which in turn create customer loyalty. Moreover being present and operating in many different parts of the world gives them a big network, which also the entire group contributes to (Interview with Sørensen).

Both onshore and offshore employees are competent in terms of experience and technology. Crew members are offered education and, for instance, Maersk has its own training centre. Employees that are working onshore are innovative and unique solutions are constantly worked out, of which some are patented in order to be the best service provider (Interview with Elmbo). However, MSS is not focusing on patents, as they believe that patents may

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slow down continuous technology development since focus then is put on protecting the existing patents from intrusion. MSS is rather focusing on continuous development and improvements of solutions that as well are available for competitors in order to contribute to a sustainable development within the industry (Interview with Seistrup). Additionally MSS strong track record, brand and high quality give them a good negotiation position with both customers and suppliers (Interview with Elmbo).

MSS resources and capabilities are listed in Table 3 below, where every resource/capability is evaluated in line with the VRIO-framework.

Table 3 - The identified sustainable competitive advantages are all valuable, rare, inimitable, and organized to benefit from their resources and capabilities

	Valuable	Rare	Inimitable	Organized
Competent and experienced personnel	x	x		
Brand	x	x	x	x
Corporate group	x	x	x	x
Track record	x			
Quality services	x			
Network	x	x	x	x
Technology innovation	x	x	x	x
Education	x	x		
Scale economies	x	x	x	x

The VRIO-framework shows that the resources and capabilities that meet all criteria and hence are a sustainable competitive advantage are the brand, the corporate group, a global network, technology innovation, and scale economy. It is an interesting observation that more or less all the competitive advantages are related to the corporate group. Since many of their resources and capabilities fulfill all criteria they have good qualifications to be successful on the market.

6.4.3 Risk assessment for MSS

In this section, the risks identified in 6.3 are assessed from a MSS perspective. Considerations have been taken to MSS mission of being the most profitable OSV service provider, and with the objectives of providing quality services with focus on health and safety to people, environment, and property. For the risk assessment form, see Appendix 2.

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The risks have been assessed with regards to both probability and impact to receive a total risk value. The assessment is qualitative and based on the information that previously is presented in this thesis. The following definitions have been used (defined by the authors):

Probability:

- 1 = Unlikely
- 2 = Possible
- 3 = Probable
- 4 = Almost certain
- 5 = Expected

Impact

- 1 = Insignificant
- 2 = Minor
- 3 = Moderate
- 4 = Damaging
- 5 = Catastrophic

The risks have been divided into four severity categories (1-4); where 4 state the most severe risks. The categorization includes the risk value (Probability*Impact) and the limits are shown in Table 4:

Table 4 - Risk Severity Category Limits

Category	Risk Value
1	<11
2	11-12
3	13-15
4	>15

The result of the risk assessment is shown in Table 5.

Table 5 - MSS Risk Assessment by Severity Category

Severity Grade	
1	2
Reputational Damage (S) Value of asset (F) Business processes (O) Capital Availability (S)	High quality onshore personnel (O) Property Damage (H) Liquidity (F) IT-infrastructure (O) Substitutes (S) Technology Development (S)
Severity Grade	
3	4
Force Major (H) Machine Failure (H) Exchange rate (F) Supply Chain Management (O) Customer demand (S) Environmental impacts (S)	Regulations & Politics (S) Health & Safety (H) High quality crew (O) Competition (S)

H=Hazard, F=Financial, O=Operational, S=Strategic

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Many of the risks in the higher category are associated with hazards and strategic aspects. The harsh environment causes risks with potential harm to both crew and operations. Governmental regulations state a great risk, since it affects many other aspects as well, e.g. customer demands and operations. If a government decides to raise a ban on offshore development in the Arctic, it could have major consequences for both existing operators who have acquired the necessary equipment and totally hinder potential entrants.

High quality crew in sense of experience and knowledge within Arctic operations are crucial for a successful business. Since quality crew is a scarce resource, it poses a major risk if MSS is not able to either attract new or retain existing personnel. Since the market is new, the possible strategic moves by competitors may have an influence on MSS in terms of first mover advantage etc., which will aggravate a market entry of MSS.

Most risks, if they occur, also affect operations in one way or another. If a risk cause a vessel to a stand still, it in turn, could have major consequences for MSS's customers. A stand still for a vessel performing e.g. ice management, could in worst case result in a drilling unit to either abort operations or face a major catastrophe if there is no time to perform a proper cancellation. The most important aspect in terms of Arctic offshore operations is to assure contingency for the drilling unit and the costs of forcing a drilling unit to cancel operation is very high, much due to the short season.

In case of a severe incident, the importance of having a Business Continuity Plan (BCP) is emphasized in theory. A company that has established a BCP has much better chances of mitigating the consequences of such risks.

Since this risk assessment aim to identify and explain potential risk severity on a new market, the assessment intends to give an indication on the possible risk severity and should not be viewed from an absolute perspective. The Risk Assessment Plan in Appendix 2 also presents a mitigation plan to each risk. It is however important to note that this plan just exemplifies possible actions and a residual risk value has not been calculated, since both likelihood and impact is much dependant on MSS risk management strategy of whether to avoid, accept, reduce, share etc. In addition, to be able to perform a complete risk assessment and risk management plan, a thorough analysis of historical incidents and their impact should be performed.

6.4.4 MSS potentials in the Arctic

A part of MSS strategy is to grow on new markets and to focus on niche products that are superior and specified. Hence they have the willingness and ambition to enter new markets, the question is only if they have what is required to enter the Arctic market, and if not, is it possible to obtain it?

Studying the Arctic competition indicates that the market is attractive in terms of low rivalry and few substitutes. The entrance barriers are quite low, which for a new entrant, like MSS, is attractive. However the customers' requirements control the development of the market and hence it is important to develop concepts that satisfy the customer.

The most critical factor for oil and gas exploration and production activities is to assure an operational contingency. In ice covered water this means keeping the operation site free from interruptions caused by ice conditions. Hence ice management is crucial. Beyond ice breaking capabilities the market demand for services in the Arctic region is mainly the same as for open water operations. However since the services cannot be extrapolated from the conventional to the Arctic market, MSS need to develop or acquire both competence and new equipment.

MSS has limited experience from operations in ice covered waters. One of their strengths and competitive advantages is however to develop innovative concepts and furthermore they have competent and experienced employees, which indicates that they may have the right tools to develop required services even without experience in the field. Furthermore, since only two of around 60 vessels have been built on contract they demonstrate that they possess knowledge about the market demand, at least on existing market. Their competent personnel, which is a key success factor, are also a competitive advantage. However it is not inimitable and employees may also transfer to another employer.

MSS core competence is anchor handling and they are also very competent regarding fire fighting. Fire fighting is, as stated in the market demand, a subordinated service. By using existing competence and acquire the additional competence needed they have the potential to develop concepts that integrates main services, such as ice management, and subordinated, but still very important, services that are beneficial for the customer. Their ability regarding anchor handling may even be of bigger use in the Arctic, since it is a required

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service within many of the Arctic areas, whereas the demand for anchor handling decreases within the traditional market.

Many risks and challenges are associated with operations in the Arctic region, among other things changes in customer demand. Hence there are several reasons to collaborate with the customers. Firstly, to assure customer loyalty by offering the services that the customer requires, and secondly since a contract may be a requirement in order to get the funding needed. MSS good track record, global network, loyal customer and the brand that is associated with high quality are all positive factors that may help them. However the VRIO analysis indicates that among the resources and capabilities mentioned here only brand and global network are sustainable competitive advantages. These resources may nevertheless contribute to a good track record and customer loyalty.

MSS has great potential to enter the market since they possess experience, competent personnel that are able to develop unique concepts, and additionally they may easily get funding if profitability in the new market is proved. Hence they are able to fulfill all the key success factors, listed above, that could bring future success. It is however crucial to focus on what is most important for the customer, since they control the development of the market. Customers' primary demand is services that help them operate without interruption; ice management is hence the most crucial service. If MSS succeeds develop a concept that facilitates operational contingency for the customer, while they also offer subordinated services that create a safe work environment for the crew members and an undisturbed life for the indigenous people and the environment they will be successful. If they additionally thrive to deliver the services with a high quality and to a reasonable price they may have the possibility to be a preferred supplier in the Arctic.

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7 CONTRIBUTIONS AND FINAL REMARKS

The contribution that the thesis results in will be presented in this chapter. Final conclusions from chapter 4, 5, and 6 will be elucidated and furthermore final remarks in terms of whether the result meets the purpose will be discussed. Finally, suggestions to further studies will be identified.

7.1 Contributions

The purpose of this thesis was to contribute to the knowledge regarding the Arctic offshore Oil and Gas industry in general and the business potentials for the Offshore Supply Vessel (OSV) industry within the waters of the Arctic region in particular.

In order to achieve the purpose three objectives were set, which are presented below;

- To describe the general conditions and challenges associated with Arctic oil and gas operations and to identify the industry stakeholder characteristics.
- To investigate the market demand for OSV services to Arctic exploration and production activities.
- To analyze the business opportunities and risks for OSV services in the Arctic and to evaluate the business potentials for one of the leading suppliers; Maersk Supply Service.

Below our contribution to the knowledge regarding the Arctic offshore industry will be presented.

7.1.1 General Conditions and Stakeholders

The general conditions for the Arctic oil and gas industry differ from operations in open water. The environmental issues are always important due to the risk of e.g. oil spill that can have devastating consequences, not to mention BP's explosion on the Deepwater Horizon drilling rig in the Gulf of Mexico in mid April 2010. The Arctic environment is however considerably more sensitive, which means that operations may have a hazardous impact if operations are not performed with caution.

Furthermore, the Arctic climate and, of course, ice conditions are harsher, which implicate severe work conditions, which have a big impact on operations and vice versa. The sensitive environment involves many

stakeholders, whose interests, opinions and influences have to be taken into consideration when operating in the region. The most important stakeholders as well as their direct relations are illustrated in the Figure 14. The illustration also emphasizes the magnitude of influence as well as the main key drivers of change.

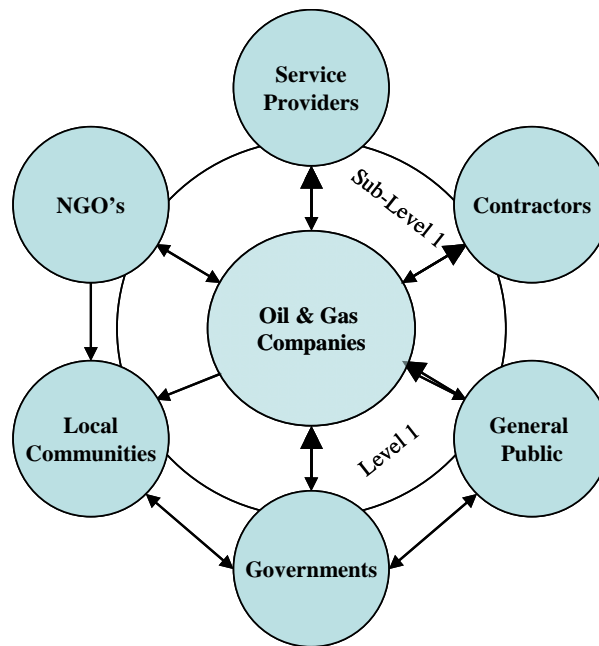


Figure 14 - The Applied SI Framework

Level 1 of key drivers:

- Regulatory influences and government policy changes
- Changing societal concerns, attitude and lifestyles

Sub-level 1 of key drivers:

- Technology development
- Increasing globalization
- Technological diffusion

The major oil and gas companies are the key stakeholder that drives the development of the activity in the Arctic region. Their activity has to some extent an impact on all the other stakeholders. Existing technology still has an unknown impact on the environment and stakeholders put high demand on technology that is environmentally sustainable. Activities may however bring tremendous benefits to both governments and indigenous people in terms of job opportunities and income potential.

7.1.2 Market demand

In steps with increased exploration and production activities in the Arctic, there is an apparent market demand for OSV services. The required services are mainly of the same type compared to the traditional OSV market, but can not be extrapolated to an Arctic market. The biggest difference and challenge is the harsh climate and ice conditions, whereas specific services such as ice management becomes crucial, and hence vessels need ice breaking capabilities and protection from and against very low temperatures.

The required services have been divided into two categories; main services and subordinate services. The first are more critical in terms of assuring operational contingency, and the latter are a requirement in order to assure social and environmental safety in case of an emergency or failure. However, the unique conditions of the Arctic affect the performance of every service, especially the subordinate, which the ice and low temperatures makes extremely challenging.

Main Services

- Ice Management
- Anchor Handling
- Construction Assistance
- Cargo Supply
- Towage/Escort Icebreaking

Subordinate Services

- Standby/EER
- Oil-spill Response
- Fire Fighting

In the Arctic, simplicity is the key. However, the vessels must have an ability to deliver a wide range of services and redundancy is very important. The demand for and the nature of the services varies depending on the specific area and its conditions. In addition, the type of drilling unit is of importance. For instance, shallow water depth increases the incentives for a reinforced jack-up rig, which rather requires towing duties instead of anchor handling. The opposite is argued for when using a drill ship.

7.1.3 Business Potentials

As of today, competition within the Arctic OSV industry illustrated, in Figure 15, is low. It is attractive to enter the market, especially if the new entrant possess or may acquire the required competence and technology. The oil and gas companies, the buyers, control the development of the competence and equipment. If or rather when oil and gas are found in the region the competition will most likely increase in steps with an enhanced presence of buyers.

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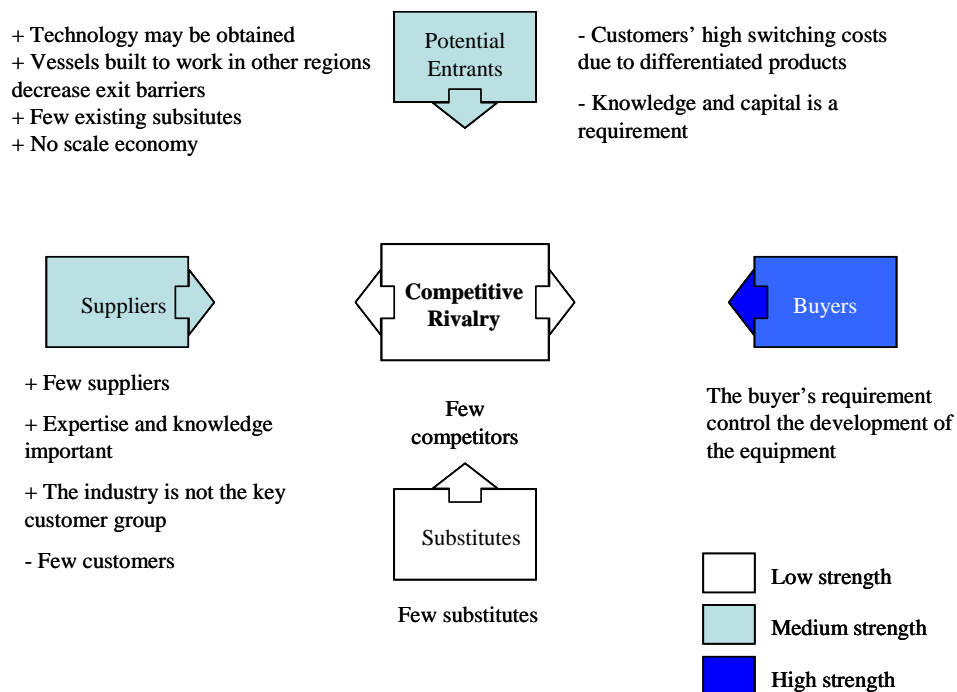


Figure 15 - The competition within the Arctic OSV industry is low

Four key success factors that will be the key to future success in the Arctic OSV industry have been identified;

- High utilization of the vessels, since it is a capital-intensive industry and furthermore due to the short season.
- A strong balance sheet and access to financial capital, to be able to invest in quality equipment.
- Equipment that can guarantee contingency operations and safety for the work force and environment where operations are taking place.
- A talented workforce, both onshore and offshore, that can guarantee high quality services.

If a company manage to be better than their competitors in one or more of these factors they will obtain a competitive advantage and be a successful player on the market.

7.1.4 General OSV Business Risks

The many challenges in the Arctic accordingly result in a number of different risks. The risks identified in this thesis are business risks, which affect the business as an entirety. Hence, they are not allocated to departmental or functional levels. Many of the risks are generated by the environmental conditions in the Arctic, either as a direct impact on operations or indirect in

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terms of regulations etc. established to assure environmentally sustainable operations. Further risk aspects are associated with quality human resources and threats from competitive forces.

The majority of the risks are categorized as Strategic and Operational, and the identified risks are listed in Table 6.

Table 6 - Identified Risks Associated with the Arctic OSV Industry

Hazardous	Financial	Operational	Strategic
Health and Safety	Value of assets	High quality vessel crew	Reputational damage
Machine failure	Liquidity	High quality onshore crew	Environmental impacts
Property damage	Credit	Supply Chain Management	Competition
Force major	Exchange rates	IT-infrastructure	Technology development
		Business processes	Capital availability
			Regulations and politics
			Customer demands

7.1.5 MSS Risk Assessment

As no exception, MSS is exposed to all risks identified in 6.3. However, all risks are not as severe as others and depend on MSS resources and capabilities. The result of the MSS risk assessment is shown in Table 7. The likelihood and potential impact has been evaluated and the most severe risks, those with the highest gross risk value have been categorized in Severity Category 4, and the risks with the least gross value is categorized in Severity Category 1.

Table 7 - MSS Risk Severity

Severity Grade	
1	2
Reputational Damage (S)	High quality onshore personnel (O)
Value of asset (F)	Property Damage (H)
Business processes (O)	Liquidity (F)
Capital Availability (S)	IT-infrastructure (O)
	Substitutes (S)
	Technology Development (S)
Severity Grade	
3	4
Force Major (H)	Regulations & Politics (S)
Machine Failure (H)	Health & Safety (H)
Exchange rate (F)	High quality crew (O)
Supply Chain Management (O)	Competition (S)
Customer demand (S)	
Environmental impacts (S)	

H=Hazard, F=Financial, O=Operational, S=Strategic

The result indicates the risks that consider constant attention as well as the risks that are less critical. Since the individual risks cover relatively wide areas, a sub-risk assessment is preferable to be able to identify specific risks within one are, such as Supply Chain Management.

7.1.6 Maersk Supply Service Potential

A part of MSS strategy is to grow on new markets and to focus on niche products that are superior and specified. Hence they have the willingness and ambition to enter the Arctic market. With regards to the current market situation and the industry's key success factors MSS has great potentials to enter the Arctic OSV industry. The VRIO-analysis identified MSS resources and capabilities, of which, among others, the corporate group constitutes a sustainable competitive advantage, which also meet the key success factor of having access to financial capital (if, in this case, profitability can be proved). Being a part of the A.P. Møller Maersk group gives them additionally competitive advantages in terms of a strong brand and scale economies regarding procurement of bulk products, an advantage that smaller companies within this industry are unable to possess.

Even though MSS only holds limited experience within the Arctic industry, their competent personnel and their ability to develop technology innovations will help them meet the customers' demand. It is crucial to focus on what is most important for the customer since they control the development of the market. Customers' primary demand consists of services that help them operate without interruption.

If MSS succeeds to develop a concept that facilitates operational contingency for the customer, while they also offer subordinated services that create a safe work environment for the crew members and an uninterrupted life for the indigenous people and the environment they will be successful. Furthermore if the purpose built equipment also can be used in other regions they will secure a high level of utilization, which guarantees higher profits. And if they additionally thrive to deliver the services with a high quality and to a reasonable price they succeed to meet all the key success factors and may hence have the potential to become a preferred supplier in the Arctic.

7.2 Final remarks

With regards to the presented findings, the objectives of this thesis are well accomplished, so is the purpose.

7.2.1 Theoretical Contribution

General Applicability of the Stakeholder Influence (SI) Framework

The stakeholder model developed in this thesis first and foremost build on the model presented by Freeman (1984). Instead of placing a single company in the center, a stakeholder group is (in this thesis the oil and gas companies). This approach widens the model's scope. In addition, the concept of *key drivers of change* is used in order to identify the most influential aspects on the development of the industry as well as which stakeholders that asserts this influence. The stakeholder model and the key drivers of change together constitute the SI Framework. The framework is considered to be purposefully useful and applicable on the oil and gas industry in the Arctic.

The SI Framework can be generalized, since it depict and address the entirety of an industry. Parallels can be drawn to other energy industries such as nuclear power, coal, wind, water etc. since the development of these energy sources more or less involve the same stakeholders. However, the stakeholders may have both different opinions and different influence, depending on which energy source that is to be analyzed. In wider spectra, the SI Framework can be used as a guide on how to analyze stakeholders of any industry as well as how to identify the influential key drivers of change for that particular industry.

7.2.2 Potential improvements

The area in which most improvements can be made is verifying and validating the results further than what has been the case in this thesis.

The study relies on the opinions of experts within the industry. However, the experts appointed do not represent every stakeholder that is identified. For instance governmental personnel, representatives from indigenous communities and NGO's have not been interviewed in this study and their interests have rather been cited from secondary sources. Hence the thesis is missing direct opinions from these stakeholders. Therefore, it would have been of value to the study to have interviewed a more diverse selection of experts. Also, the number of interviewees is limited due to a number of aspects, e.g. limited time frame of the authors as well as the sought persons and persons being either unreachable or unidentifiable etc. In addition, to use a more quantitative method in data collection by the use of e.g. a

questionnaire could have generated valuable indications on e.g. trends, opinions, and differences among stakeholders. If additional interviewees were addressed, the verification process of the findings should be improved.

7.2.3 Suggestions for Further Research

The subject of Arctic petroleum industry development is both wide and complex and some areas have gained more research attention than others. In a general perspective, the Arctic environment is highly on the subject and heavily debated. However, knowledge regarding the actual impacts from all activities related to the oil and gas is relatively unknown and will need much attention in order to fully understand both the social and the biological impacts. Another area is to study the influence of different stakeholders more thoroughly than conducted in this thesis, to be able to identify the absolute magnitude of the different influences.

Regarding the OSV industry, this initial study leaves many areas for further studies, since it only discusses market aspects and business potentials from a general perspective. A natural next step would be to perform a quantitative study, where market aspects such as profitability, future cash flow, market demand in “volume” (number of vessels and services) etc. is presented. In addition, the market demand for OSV services in different regions etc. is of interest in order to give recommendations on which the customers are, where they operate and what volume they require. Since the market is new, the strategic moves of competitors may have a big influence on the competitive situation and a thorough analysis of the competition, covering competitors’ strengths and weaknesses, strategies and most likely moves could be very important in order to quickly respond to those strategic moves.

An area with more focus on technology, would be to establish a specification on a vessel with ice breaking capabilities and/or develop new technologies and concepts of e.g. oil spill recovery, ice management etc.

The risks in this thesis are addressed as business risks, in order to understand the most potential harms to the company. A thorough risk analysis and management plan is therefore to recommend, much due to the unknown aspects when entering a new market. The importance of establishing a Business Continuity Plan (BCP) has been addressed however one is not developed. Due to the severe consequences of a machine or even a market failure, the need for having an organization who know how to proceed and quickly respond if such an incident becomes reality, could be the answer to company survival.

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9 APPENDIX - MSS Risk Assessment

MSS Risk Assessment		Likelihood	Impact	Rating	SG*	Total Risk
		Unlikely	Insignificant		1	1
	High Risk - SG 4	Possible	Minor		2	2
	Medium Risk - SG 4	Probable	Moderate		3	3
	Moderate Risk - SG2	Almost Certain	Damaging		4	4
	Low Risk - SG 1	Expected	Catastrophic		5	5
						<11
						11-12
						13-15
						>15
Category	Risk Name	Risk Description	Likelihood	Impact	Total Risk	Mitigation plan
Strategic	Regulations & Politics	Ban on operation area, regional and international trade regulations, local crew requirements, technology and emission regulations	4	5	20	1. Establish a BCP in case of a ban. 2. Monitor political debates. 3. Follow regulations and be proactive in low emission designs etc. 4. Be a global actor on both the Arctic and the traditional market.
Hazard	Health & Safety	Personal injury or deceases due to the harsh climate conditions	5	4	20	1. Develop safe designs. 2. Create standards and routines on how to practice safety. 3. Educate crew members on safety procedures
Operational	High quality crew	Difficulties in attract and retain experienced and competent crew members	4	4	16	Competitive salaries and privileges, offer training and development plans, pay special attention to new entrants and competitors' conditions for employees.
Strategic	Competition	Competitors strategic moves affect MSS	4	4	16	1. Monitor competitors and their respective strategies as well as strength and weaknesses. 2. Be a leading supplier of OSV services in the Arctic, with focus on quality and safety.
Hazard	Force Major	When extraordinary incidents occur that have no influence from the involved parties	3	5	15	Formulate a detailed business continuity plan to be able to quickly respond to the incident
Hazard	Machine Failure	Machine failure due to harsh climate conditions	3	5	15	Develop special equipment that withstand the harsh climate
Financial	Exchange rate	Changes in revenue currency and underlying cost currency	5	3	15	Hedge net exposure in non-USD currencies
Operational	Supply Chain Management	Disruption in the supply chain has big impact due to far distances	3	5	15	Have redundancy in activities to secure operational contingency
Strategic	Customer demand	Shifts in customer demands or lack of customer demand	3	5	15	1. Have close contact with current and new customers 2. Monitor trends and developments on the Arctic market. 3. Close contact with suppliers in order to respond to new customer demands.
Strategic	Environmental impacts	Social and biological impacts from emission, pollution and other environmental imprints	3	5	15	1. Follow current restrictions and best practices on emissions etc. 2. Develop sustainable technology and design to reduce environmental footprints.
Operational	High quality onshore personnel	Difficulties in attract and retain experienced and competent personnel	3	4	12	Competitive salaries, performance planning, education and training, recruitment, trainee programs
Hazard	Property Damage	Damage on the vessel itself and/or its equipment due to ice conditions	3	4	12	Develop special equipment that withstand the harsh climate, especially ice breaking capabilities
Financial	Liquidity	By being an independent limited corporation, MSS needs to have a positive cash flow or find alternative funding sources	3	4	12	1. Budget and cash flow forecasts. 2. Working capital management
Operational	IT-infrastructure	Failing IT-systems (communication, navigation, ice monitoring etc.)	3	4	12	1. Regular system maintenance. 2. Alternative routines and guidelines if breakdown occurs
Strategic	Substitutes	New technology and concepts replace MSS services	3	4	12	1. Continue to be leading within technology innovation and concept design. 2. Close interaction with customers. 3. Enter new markets.
Strategic	Technology Development	Unsuccessful development of new and unique concepts required in the Arctic	3	4	12	1. Focus on new concepts rather than protect existing concepts. 2. Encourage personnel to be innovative.
Strategic	Reputational Damage	Negative associations and impact related to the brand	2	5	10	1. Pursue sustainable technology and practice CSR. 2. Close interaction with stakeholders and media.
Financial	Value of asset	The value decrease due to low customer demand and utilization on the specific market	2	4	8	1. Develop versatile vessels able to work in different environments and regions. 2. Practice good cost efficiency on investments. 3. Monitor market trends
Operational	Business processes	Faulty and misguiding budgets, plans, investment evaluations etc.	2	4	8	1. Close cross functional communication and transparency.
Strategic	Capital Availability	Difficulties in getting funding for investments needed to enter the Arctic market	2	4	8	Establish sustainable business cases of provable profits e.g. provable contracts

* SG = Severity Grade