Oil Skimming

Business Potential and Strategic Options Facing a Marginalised Business Segment at Sandvik Process Systems

Peter Grill

Fredrik Linde
Abstract
The purpose of this thesis is to study the oil skimming market and evaluate what drives company competitiveness and market attractiveness. Throughout the thesis, the total oil skimming market has been divided into an industrial market and an offshore market as these applications have entirely different requirements. However, the skimming market in general is underdeveloped and the long lifetime of the equipment has a negative impact on the market development speed. It is therefore characterised by a fragmented body of competitors and diverging pricing. Instead of price being an order-winning aspect, recovery rate and ability to pick up a large variety of oils has been found to be important.

In this inductive, and interpretivistic case study, a model for market analysis of an underdeveloped market is developed and applied to Sandvik Process Systems’ oil skimming business. The study is based on an extensive interview program with oil skimming equipment manufacturers, and oil spill response companies. The model comprises of an external, and an internal analysis synthesised into a SWOT-matrix from which five strategic directions are extracted. These directions are described as well as their respective business impact on Sandvik Process Systems.

Sandvik Process Systems’ skimmer is a steel belt skimmer developed in the 1960’s. With a lifting height of up to three metres and a width of up to 400 mm, the Sandvik oil skimmer is capable of lifting 354 litres per hour in optimal conditions. Compared to its competitors, the skimmer is a low cost alternative priced at 66-75% below industry average.
However, the results of the analysis indicate a poor competitiveness of Sandvik Process Systems’ product. Due to an inferior technology, Sandvik Process Systems’ skimmer lacks the capacity needed to target the offshore market. Therefore, the product can only target the industrial market. Meanwhile, many competitors offer complete solution packages including as pumps, storage tanks, and a variety of specialised skimmers in order to increase their competitiveness.

Looking at the competitors it is clear that Sandvik Process Systems’ skimmer does have advantages. However, many of the advantages are based on organisational strengths which are difficult to leverage. Also, the organisation does not have any experience from the oil skimming market and due to the small size of the market, it is doubtful if Sandvik Process Systems are able to devote the necessary resources to overcome this hurdle. Due to a revenue target set at EUR 2.33 million, Sandvik Process System’s skimmer would require a 23.9% of the market value or 119% of the number of skimmers sold.

Despite this thesis reaching the conclusion that Sandvik Process Systems should not enter the oil skimming market; it also stipulates that Sandvik Process Systems does have the potential to successfully sell skimmers. However, reaching the goal of EUR 2.33 million is deemed unlikely.
Foreword & Acknowledgement

The following thesis has been conducted as a fulfilling part of the Master of Science programme in Industrial Engineering and Management at the Royal Institute of Technology during the spring of 2013. It has been written for the Department of Energy Technology.

First and foremost we would like to thank our supervisors at Sandvik Process Systems, Staffan Karlsson and Anders Bodin, for giving us the opportunity to be part of this stimulating and enlightening experience, as well as for their continuous support throughout the project. We would also like to thank our supervisor at the Royal Institute of Technology, Per Lundqvist, for his insightful advices which have helped carry this project to its ultimate completion.

Finally, we would also like to take the opportunity to thank all the interviewees for their contributions and their time.

The Royal Institute of Technology
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Peter Grill & Fredrik Linde
# Nomenclature

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>°API</td>
<td>Measurement of how heavy or light a petroleum liquid is compared to water</td>
</tr>
<tr>
<td>cSt</td>
<td>Measurement of kinematic viscosity ((0.01 \text{ cm}^2/\text{s}))</td>
</tr>
<tr>
<td>EMSA</td>
<td>European Maritime Safety Agency</td>
</tr>
<tr>
<td>EUR</td>
<td>Euro, currency</td>
</tr>
<tr>
<td>GRN</td>
<td>Global Response Network</td>
</tr>
<tr>
<td>ITOPF</td>
<td>International Tanker Owners Pollution Federation</td>
</tr>
<tr>
<td>MBV</td>
<td>Market-Based View</td>
</tr>
<tr>
<td>MSRC</td>
<td>Marine Spill Response Corporation</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NOFO</td>
<td>Norwegian Clean Seas Association for Operating Companies</td>
</tr>
<tr>
<td>OSRL</td>
<td>Oil Spill Response Limited</td>
</tr>
<tr>
<td>RBV</td>
<td>Resource-Based View</td>
</tr>
<tr>
<td>RFQ</td>
<td>Request For Quotation</td>
</tr>
<tr>
<td>SEK</td>
<td>Swedish Krona, currency</td>
</tr>
<tr>
<td>SWOT</td>
<td>Strength, Weakness, Opportunities &amp; Threats, analysis tool</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar, currency</td>
</tr>
</tbody>
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1. Introduction

On March 14th 1910, a wellhead blowout in the Midway-Sunset oilfield in California caused the largest accidental oil spill in history. A pillar of oil and sand rose more than 50 metres from the ground and destroyed the equipment surrounding the drill site. Spilling 1.4 million cubic metres of crude oil, the Lakeview Gusher Number One spilled more than twice the amount of the offshore drilling platform Deepwater Horizon did in 2010. As a way to contain the oil, workers put sand bags around the gusher and by October the gusher was under control. Less than half of the spilled oil was recovered while the rest was left to evaporate or sink into the ground. (San Joaquin Geological Society, 2013) Since then, a tremendous change has occurred regarding environmental awareness.

When the population of Europe today lists their primary environmental concerns, water pollution is ranked at the top of the list (Eurobarometer, 2005). An important reason for this is believed to be the accident at Deepwater Horizon, where vast quantities of oil were spilled into the Gulf of Mexico. One method of addressing and handling oil spills is oil skimming, a mechanical process of separating the oil from the water. Skimming can be performed by a variety of techniques and is the only large scale method for actually retrieving the oil. (Beyer, 2013) The extensive media coverage of Deepwater Horizon caused a surge of interest for oil spill treatment and equipment, most notably within oil skimming. Nonetheless, oil skimming is also frequently used in industrial settings where skimmers are put to use in e.g., steel mills and food processing facilities to recover lubricants and tramp oils.

The competitive landscape of the 21st century is complex and characterised of a fierce competition between large, global corporations and innovative up-comers. In this environment, companies are continuously looking to expand their business and find new applications to profit from their core competencies. As social and political awareness regarding pollution and sustainability has increased lately, more companies are looking to this area hoping to find new business.

Sandvik Process Systems produced their first steel belt in Sandviken in 1901 and has since then been a major player within many different steel belt based processing technologies. As a means to diverge and grow, an oil skimmer was developed in the 1960's based on the steel belt technology. After an initial surge of interest, the skimming business slowly disappeared as other, more profitable, business areas grew. (Karlsson, 2013) However, interest for the oil-skimming segment has risen again, and this thesis will therefore analyse the attractiveness of the oil skimmer market and offer Sandvik Process Systems a basis for decision-making regarding which strategic direction to follow.

1.1. Research Questions

The primary question this thesis will attempt to answer is:

- Can Sandvik Process Systems reach future growth opportunities within the oil skimming market?
In order to be able to answer this question, three secondary questions have been formulated which together will provide the building blocks for the primary question.

- How does the market configuration affect the competitiveness of a new entrant?
- How can an analysis model be created to evaluate competitiveness in an underdeveloped market?
- How does it affect a company’s competitiveness to diverge from its core competencies when searching for growth opportunities?

1.2. Project Purpose and Objective
The purpose of the thesis is to study the oil skimming market and evaluate what drives company competitiveness and market attractiveness. Through this, Sandvik Process Systems can view their current and possible future position in the market and base their strategic direction on this.

The objective of the project is to map the strategic decisions Sandvik Process Systems is currently facing regarding the oil skimming business and their respective business implications.

1.3. Structure of the Remainder of the Report
The remainder of the report will be structured in the following way

- Chapter 2 – Methods and Methodology
  This chapter describes the methods used to perform the study. By presenting this information, the chapter aims to describe which means were taken in order to ensure a high accuracy of the analysis as well as provide a foundation on which the study can be repeated.

- Chapter 3 – Literature Review
  This chapter provides a thorough description of current literature surrounding oil and oil skimming as well as the market analysis tools used in the thesis. The literature review will further provide the reader with a snapshot of the current competitive landscape.

- Chapter 4 – Analysis
  In this chapter, the market analysis model is executed. The analysis is based upon the theoretical models described in chapter 3 and offers insight into the attractiveness of the oil skimming market and the competitiveness of Sandvik Process Systems’ oil skimmer.

- Chapter 5 – Results
  Chapter 5 provides the reader with the findings of the analysis. Furthermore a presentation of the strategic decisions facing Sandvik Process Systems is presented.

- Chapter 6 & 7 – Conclusion, Discussion & Scientific Contributions
  This chapter includes the conclusion of the thesis, where the findings are synthesised into a recommendation. A discussion regarding the limitations of the study, suggestions for future research as well as this thesis’ scientific contributions are also presented.
2. Methods and Methodology
The following section aims to describe the methods and methodology used in the study in order to allow for inspection, and promote repeatability. This chapter will follow a chronological order, beginning with the study's nature and paradigm, before moving to the literature review and analysis.

2.1. Nature and Purpose of the Research
Due to the requirements set forth by Sandvik, the study has been conducted as an inductive study based on an interpretivistic paradigm built around Sandvik Process Systems’ oil skimmer. We have strived to create a theoretical model based on empirical evidence rather than testing existing theory.

In order not to confuse the reader, all currencies in this thesis have been translated to measure in Euros rather than national currencies. The exchange rates used are the historical average of the past year. In this thesis, EUR 1 = USD 0.7774 = SEK 0.1167. (Oanda, 2013)

2.2. Literature Review
Oil skimming is an underdeveloped market cluttered with companies and technologies. As the literature review was initiated we realised that the skimming market does not have the structure of many other industries. In order to avoid simple pitfalls, and to quickly reach relevant literature, interviews were scheduled with experts. Four interviews were conducted with experts from different fields but with an interest in oil skimming or similar applications.

- **Per-Olof Persson, University Lecturer, Industrial Ecology, Royal Institute of Technology:** As a lecturer on technical environmental protection, Mr Persson has come into contact with oil skimming on a number of occasions. Mr Persson’s expertise also includes different types of oils and different oil treatment methods.

- **Örjan Nilsson, Application Technology – Purchase, Sandvik Process Systems:** Mr Nilsson is responsible for the oil skimmer within Sandvik Process Systems and has conducted tests on the skimmer. Mr Nilsson also holds the information regarding current applications of the oil skimmer.

- **Tommy Carlsson & Lars Mattson, Rescue Coordinators, Regional Control Centre, Swedish Coast Guard:** As rescue coordinators for the Swedish Coast Guard, Mr Carlsson and Mr Mattson have coordinated rescue operations to combat oil spills. They have also been active in the process of purchasing new equipment to combat oil spills and thereby hold a strong expertise in which technical solutions are available.

- **Jonas Johnson, CEO, SurfCleaner:** As the CEO of a company producing oil-skimming equipment, Mr Johnson has insight into the oil skimming market’s dynamics and development. As SurfCleaner offers an innovative product, Mr Johnson’s expertise also includes new technology on the oil skimming markets and its applications.
The interviews were conducted in a semi-structured fashion. Some questions were prepared, but the interview subjects were encouraged to develop their answers and penetrate deeper into the subject. These interviews were explorative and provided a foundation from which to proceed with the literature review.

As oil skimming as a business is an underdeveloped market, not much literature has been produced on the topic. Instead, a lot of the information was acquired from interviews with companies within the market. As a means of reaching many companies at once, we travelled to Houston, Texas, USA, in order to participate in the 2013 Offshore Technology Conference. At the conference we met with a series of oil skimming equipment manufacturers as well as companies working with oil spill response. The conference gave a great insight into the market and resulted in a number of unstructured interviews on the exhibition floor which were combined with follow-up email conversation.

2.3. Creating an Analysis Model

From our insights into the market, we applied an iterative process of developing a suitable model for analysing the oil skimming market. By developing a model and briefly testing it, we could refine its components until a suitable model had been formulated.

![Figure 1: Iterative development process](image)

The model developed focused on exterior and interior conditions and through a series of analytical tools triangulated a qualitative result. By using more than one analytical tool, the uncertainty could thus be decreased. The model is shown below in figure 2.
The analysis model is built upon an initial external analysis of three different geographical markets and then completed by an internal analysis of Sandvik Process Systems in general and its skimming business in particular in order to consequently synthesise the findings in a resulting SWOT-matrix.

### 2.4. Analysis of Model Results

By combining the results of the external and internal analysis into a SWOT-matrix, the market conditions were clearly displayed. From these conditions, five future scenarios for Sandvik Process Systems’ skimming business could be extracted. By comparing the scenario’s impact on the elements of the SWOT-matrix one could be selected as the best for Sandvik Process Systems.

### 2.5. Delimitations

- The targeted market excludes Asia and the Pacific region.
- The competitiveness analysis will be focused on Sandvik Process Systems.
- The model uses relative competitiveness as a means of analysing Sandvik Process Systems’ competitiveness compared to other companies.
- The project was carried out from January to June 2013.
3. Literature Review
Initially, the literature review covers oil and its properties and from there moves on to oil skimming in general and the Sandvik oil skimmer in particular. Later, marketing and strategy theories are covered before moving on to a concluding competitor presentation.

3.1. Oils
Oil can be defined as: “A viscous liquid derived from petroleum, especially for use as a fuel or lubricant” or “Any of various viscous liquids which are insoluble in water but soluble in organic solvents and are obtained from animals or plants” (Oxford Dictionaries, 2012). Oils are, based on these definitions, divided into two categories with different chemical composition; mineral oils (also called crude oils) and organic oils (also called fats) in which essential oils are included (Nationalencyklopedin, 2013).

3.1.1. Mineral Oils
Mineral oil is one of the two main types of petroleum, the other being natural gas. When found naturally, the liquid must contain more than 95 % liquid hydrocarbons to be classified as oil. However, depending on the types of hydrocarbons, the physical properties of the oil can differ. The colour of the oil can range from amber, to green, to black and the viscosity varies from a water-like liquid to a sticky, tar-like substance. (Nationalencyklopedin, 2013)

Every year, roughly 1.3 million tonnes of mineral oils is spilled into the sea. However, there is a lot of uncertainty surrounding this figure and estimates range from 470 000 tonnes to 8.4 million tons. 47 % is estimated to originate from natural leaks, but at least 53 % is due to human activities. Focusing on the human triggered spills, 71 % comes from operational discharges from ships and land, 23 % from accidental spills from ships and 6 % from offshore oil extraction. (United Nations, 2012)

3.1.1.1. Formation
Petroleum is the result of a long process that started millennia ago. At the time, dead organic material sank onto a seabed with little oxygen causing incomplete bacterial decomposition, which resulted in deposits of organic material within the seabed’s sediment. This organic material was slowly decomposed over time until it only consisted of carbon, oxygen and hydrogen. This mixture called kerogen was gradually pressed deeper into the ground as more sediment formed on top. At the correct temperature and pressure, the larger molecules of the kerogen began to break up into smaller molecules and eventually transformed into petroleum (mineral oil and natural gas) in a process called kerogenesis. However, during the kerogenesis both oil and natural gas is formed and the proportions of each depend on the composition of the kerogen as well as the surrounding conditions. In order for oil to form during kerogenesis, the majority of the kerogen must originate from plankton, or natural gas will form instead. Moreover, if the pressure or temperature becomes too great, all remaining kerogen as well as already formed oil becomes natural gas through a process called metagenesis. The relation between kerogen, oil and natural gas is shown below in figure 3. (Nationalencyklopedin, 2013) As can be seen in the figure, the formation of oil is dependent on multiple factors.
Drilling
The most basic and common way of extracting oil is drilling. When the drill reaches the oil, a variety of techniques are then used to recover the oil to the surface. There are three stages of oil recovery. The first stage is characterised by natural flow. Once the drilling is complete oil can begin to flow towards the surface. Sometimes the rock may not be porous enough to allow for natural flow. In such cases the most common method for increasing porosity is fracturing. When fracturing the rock a controlled detonation is performed, cracking the rock. Into the cracks, fracture fluids primarily acid salt mixtures are poured, further weakening the rock and allowing the detonation cracks to remain open, thus increasing porosity and oil flow. During this primary recovery stage 5-15% of the total oil can be recovered. (Energy From Shale, 2012)

Eventually, the pressure in the well will diminish and suction pumps are added to maintain oil flow. However, in order to maximize oil output, a second hole is drilled which is used to pump water down into the oil reservoir. This water increases the pressure in the well, causing more oil to flow to the surface at the primary drilling site. The secondary stage recovers approximately 35-45% of the total oil deposits. When this is no longer enough, a third stage of recovery begins. This stage is characterised by low recovery rates (5-15%) and the oil recovered is mainly very heavy. In order to retrieve it, steam, carbon dioxide and water is pumped into the reservoir in order to make the remaining oil more agile and force it to the surface. The tertiary stage is expensive and is not carried out if the oil price is too low. (Superior Oil & Gas Co., 2013)

Oil Sand
Oil sand consists of sand containing water and the heavy oil-based substance bitumen. Oil sand can either be found at ground level or subterranean level. In order to retrieve the bitumen from the sand, the sand is dug out and moved to an extraction plant where hot water and steam is
added to the sand in what looks like an oversized washing machine. The heat enables the melting of the bitumen and thus facilitates separation of oil and sand. Once the bitumen is recovered it can be processed into crude oil. (Suncor Energy, 2012)

3.1.1.3. **Properties Relevant to Oil Skimming**

The main properties which determine whether or not oil will be possible to skim are floatation, viscosity and the time the oil stays on the surface of the water. An oil will float to the surface of the water if its specific gravity is lower than that of the surrounding water which, depending on if it is pure water or sea water, has a specific gravity of 1-1.025 (ITOPF, 2012). To describe the specific gravity of oils, the measurement °API is often used, where a high API indicates lighter oil. Any oil with 38 or more °API are considered light, 38-22 are medium oils and oils below 22 °API are considered heavy oils (Neste Oil, 2012). °API is calculated by the equation displayed below in equation 1.

$$°API = \frac{141.5}{\text{specific gravity at 15.6 °C}} - 131.5$$

**Equation 1: Equation for calculating ° API, (ITOPF, 2012)**

Besides specific gravity, pour point is used to categorize oils. The pour point is the temperature below which an oil no longer flows. The pour point varies depending on the content of wax and asphaltene in the mineral oil (ITOPF, 2012). Based on differences in specific gravity and pour point, mineral oil is divided into four categories. These are listed below in table 1 along with the properties which separate the groups.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Arabian Super Light</td>
<td>Brent</td>
<td>Cabinda</td>
</tr>
<tr>
<td>Origin (example)</td>
<td>Saudi Arabia</td>
<td>UK</td>
<td>Angola</td>
</tr>
<tr>
<td>°API</td>
<td>50.7</td>
<td>37.9</td>
<td>32.5</td>
</tr>
<tr>
<td>Specific gravity at 15 °C</td>
<td>0.79</td>
<td>0.83</td>
<td>0.86</td>
</tr>
<tr>
<td>Wax content</td>
<td>12 %</td>
<td>No data</td>
<td>10.4 %</td>
</tr>
<tr>
<td>Asphaltene</td>
<td>7 %</td>
<td>50 %</td>
<td>16 %</td>
</tr>
<tr>
<td>Pour point</td>
<td>-39 °C</td>
<td>-3 °C</td>
<td>12 °C</td>
</tr>
</tbody>
</table>

**Table 1: Grouping of oils based on physical properties, (ITOPF, 2012)**

Oils with low specific gravity (high °API) also tend to have a low viscosity. Viscosity is a measurement of the resistance to flow of a fluid, i.e. fluid with high viscosity flows less easily than a fluid with low viscosity (ITOPF, 2012). Viscosity is a relevant measurement as different techniques are suitable for different viscosities, more on that in section 3.2.

When oil is spilled in water it begins to weather. There are many ways in which oil can weather, but the weathering can be divided into short-term and long-term weathering. The long-term
weathering factors are photo-oxidation, biodegradation, dissolution and sedimentation, but these will not be discussed further as they are factors that do not impact the oil skimming potential, as other weathering factors have made the oil unskimmable long before these have any effect. These factors are spreading, evaporation, dispersion and emulsification. (ITOPF, 2012)

The speed of oil spreading depends on the viscosity of the oil as well as external factors such as wind. Low viscosity oil spreads easily while high viscosity oils do not (ITOPF, 2012). The spreading affects the thickness of the oil layer and therefore directly limits the amount of oil in close contact with a skimming unit.

The rate of evaporation depends on the ambient temperature and wind speed, but in temperate climates all hydrocarbons with a boiling point below 200°C will evaporate within 24 hours. The ratio of hydrocarbons with such a low boiling point varies between different types of mineral oil but can be as high as 55 % in some oils. (ITOPF, 2012)

The dispersion of oils mainly occurs at sea, where there are breaking waves. When the waves break, the water breaks apart the oil spread and carry oil particles down below the surface. If the bubbles of oil are small enough (<70 µm in diameter) the turbulence of the sea is enough to keep them submerged. Dispersion generally affects low viscosity oils as high viscosity oils are more protected of dispersion as the particles are more tightly attached to each other thus requiring more force to break the oil apart. When oil is dispersed in the water, an oil skimmer cannot remove the oil until the water calms down and allows the oil particles to surface. (ITOPF, 2012)

The last short-term weathering process to act upon the oil is emulsification. This means that the oil mix with water, forming oil-water emulsions. This is an issue for two reasons. Primarily, the emulsification may cause an oil spill’s volume to increase fivefold. Also, the formed emulsion makes it difficult to separate the oil and water and causes the skimming process to be more difficult. Forming oil-water emulsions protects the oil from other weathering processes and causes oil to remain on the water surface longer which is double-edged. It provides more time to skim the emulsion but also gives the oil more time to spread onto land and affect coastal ecosystems. (ITOPF, 2012) (United Nations, 2012)

3.1.2. Organic Oils

Animal and vegetable oils are considered organic oils although they can be broken down into oils, which are liquid at room temperature, and fats, which are solid at room temperature. These organic oils come from plants or animals and are made up of triacylglycerol. Naturally occurring, these oils work as an energy deposit for plants and animals. In plants it is stored as oil while animals store it as fat. Of the organic oils more than 75 % of the oils originate from plants, 20 % from terrestrial animals and the rest from aquatic animals. (Nationalencyklopedin, 2013)

Organic oils are mainly used in the food processing industry. However, there is always waste in any manufacturing process and therefore oil skimming equipment can be found within the food processing industry where it is used to recycle oils. (Nationalencyklopedin, 2013)
3.1.2.1. Extraction

The means of extracting organic oil differ depending on the origin of the oil. From plants, the oil can either be squeezed or extracted using a solvent, or both. In animal fat the oil is extracted by heating animal cells thus melting the fat for easier collection. The oils are then put through separate refining processes to make sure the oils are not contaminated. (Nationalencyklopedin, 2013)

3.1.2.2. Properties Relevant to Oil Skimming

Organic oils are hydrophobic and have a lower specific gravity than water, i.e. the oil does not dissolve in water but rather floats to the surface. However, just like mineral oil, the organic oils form emulsions with the water, which increases the volume of the oil-water mix.

(Nationalencyklopedin, 2013)
3.2. Oil Skimming

3.2.1. Overview

Oil skimming is a low-tech but reliable and efficient technique. An oil skimmer is defined as: “Any mechanical device specifically designed for the removal of oil (or oil-water mixture) from the surface of water without altering the water’s physical and/or chemical characteristics”. (NOAA, 2010)

The skimming principle, upon which the technique relies, is dependent on three physical properties of oils, namely specific gravity, surface tension and affinity. Most oils have a lower specific gravity than water, which allows it to separate from water and float to the surface unless agitated. These oils are possible to collect using an oil skimmer. Other oils do the opposite and, if not agitated, sink to the bottom of the water and must be collected by other means than skimming. (Abanaki, 2011) The light oils, which can be skimmed off the water surface, are possible to collect due to the surface tension and affinity of the oil. Most oils have little or no affinity for water, which prevents mixing of oil and water. As the skimming medium enters the water, the oil wets the surface preventing water from doing the same. Any water on the surface is pushed away as more oil attaches to the surface because of the surface tension of the oil. However, it is important that the skimming medium is not submerged too deep into the water, as it may cause the oil to be washed off the skimming medium and thereby lowering the efficiency. (Persson K., 2013)

A number of factors are to be taken into account when selecting skimmers but the most important aspects to consider are the viscosity and the adhesive properties of the oil intended to be skimmed. In open sea spills, other important factors are sea state, currents, and level of debris. In relatively predictable situations such as at fixed facilities, for instance industry processes, marine terminals and refineries, the type of oil handled may be known and hence the type of skimmer to be used can be selected accordingly. Subsequently, a versatile skimmer able to handle different kinds of oil and various situations may be preferable in some cases, but is to be kept in mind that no single skimmer can cope with all potential situations that may arise. A combination of skimmers is hence desirable, particularly as the oil weathers. (ITOPF, 2012)

The second most important factor to assess is the skimmer’s intended use and expected operational conditions. Depending on if the skimmer is to form an integral part of a vessel-mounted, offshore recovery system or if it is to be deployed manually in a port or fixed in a cooling water reservoir the selected type of skimmer will differ and aspects such as size, robustness and ease of operation, handling, and maintenance can then be evaluated. (ITOPF, 2012)

3.2.2. Skimming Technologies

The mechanisms through which oil is removed from the water surface can be divided into oleophilic techniques, which rely on the adhesion of oil to a moving surface, and non-oleophilic techniques. Non-oleophilic techniques include weir skimmers relying on gravity, suction systems, and mechanical skimmers, which physically lift the oil with scoops, or grabs. (ITOPF, 2012)
3.2.2.1. Oleophilic Skimmers

Oleophilic skimmers recover oil based on the properties of specific materials, which have greater affinity for oil than for water. There exist numerous types of oleophilic skimmers and they are therefore divided into subgroups such as disc skimmers, drum skimmers, rope mop skimmers, belt skimmers, and brush skimmers. Regardless of the type of skimmer, the principle behind the technique used is the same for all oleophilic skimmers. The skimming head, i.e. the part with the oleophilic surface, is rotated or pulled through the oil slick and the oil is then scraped or squeezed off and the oil removed into a sump to be pumped or sucked away. (NOAA, 2010) (ITOPF, 2012)

Oleophilic skimmers usually achieve the highest ratio of recovered oil in relation to entrained water, also referred to as the recovery efficiency, compared to other skimmer types. Oleophilic skimmers reach their highest efficiency when handling medium viscosity oils (between 100 – 2000 cSt). Diesel, kerosene and other low viscosity oil products generally do not adhere to the oleophilic surface in sufficiently thick layers to attain high recovery rates. Higher viscosity oils such as heavy bunker oil on the other hand, can prove to be difficult to remove due to its tendency to form large clumps in the water, which are too heavy and compact to be skimmed. Comparatively, oil-water emulsions can be almost impossible to recover with oleophilic skimmers, due to the fact that emulsions are nearly non-adhesive. (ITOPF, 2012)

Oleophilic materials are often made of some form of polymer even though metal surfaces have shown to be effective. Furthermore, studies show that discs and drums with grooved surfaces result in higher recovery rates than smooth surfaces. (ITOPF, 2012) (Broje & Keller, 2006)

Disc Skimmers

Disc skimmers work best with lighter types of oil (medium viscosity) and cannot handle emulsified oil. However, disc skimmers can be used for open sea operations and are controlled by crane operators. The volume and weight of the disc skimmers are quite large due to the size and number of rotating discs (NOAA, 2010).

Rope Mop Skimmers

Rope mop skimmers use ropes floating on the surface of the water to retrieve the oil. Rope mop skimmers are large units and require the use of a crane during the entire operation for launching from either a vessel or shore. The oil is recovered by the ropes, which are then wrung releasing the oil into a collection tank either on board the vessel or on the shore. This skimmer type is not sensitive to waves but is normally only used for single sweep operations. Vertical rope mop skimmers are most suited for lighter oil types as very little water is collected during recovery. Debris or ice will not affect the skimming operation (NOAA, 2010).

Rope mop skimmers are ideal for shallow water conditions, as the rope requires minimal water to float. Furthermore, Rope mops are ideal in trash-laden environments since the trash falls off the ropes as they come up to the wringer unit. (Cleanup Oil, 2003)

Drum Skimmers

Drum skimmers are driven by air or hydraulics and are therefore often considered for use in hazardous areas and environments. Drum skimmers are versatile skimmers and can handle
various types of oils ranging from light oils such as diesel to heavier oils such as crude oil. (Cleanup Oil, 2003)

**Brush Skimmers**

Brush skimmers can be packaged in a wide range of configurations from stand-alone units to modules mounted on a barge (self-floating unit) or on a specially constructed recovery vessel. Depending on the stiffness and density of the bristles used and the comb configuration, different types of oil can be recovered. In general, light oil is better recovered by finer, softer bristles while stiffer and wider spaced bristles are better suited for heavy oils. (Cleanup Oil, 2003)

**Belt Skimmers**

Belt skimmers are large and are therefore often mounted on a barge or on a specially constructed vessel. These skimmers have a high recovery efficiency and good recovery rate, but are specialised products and can be complicated to operate, which requires heavy equipment and specially trained personnel (NOAA, 2010). However, a fixed position mounted belt skimmer requires an initial tuning but can then operate independently. (Nilsson, 2013)

**3.2.2.2. Non-Oleophilic Skimmers**

**Suction Skimmers**

Suction skimmers such as vacuum skimmers represent the simplest skimmer design in terms of operational theory, whereby oil is recovered by air suction systems directly from the water surface (ITOPF, 2012). The simplest type of vacuum skimmer uses a hose directly connected to a vacuum truck, which can easily be employed in harbours or rivers. Due to the sensitivity to waves, vacuum skimmers are often restricted to use in harbours and calm waters. (NOAA, 2010)

Furthermore, suction skimmers are ideally suited for recovery of oil on or near the shoreline due to the widespread availability of vacuum systems. Nonetheless, the undifferentiating nature of the suction device may result in high proportions of water also being collected. (ITOPF, 2012)

**Weir Skimmers**

Weir skimmers refer to skimming devices using gravitational force to drain oil from the water surface. Weir skimmers are floating units where the edge of the weir is positioned just below the upper slick surface or at the interface between the floating oil and water, hence allowing oil to flow over the weir edge into a collecting sump. The oil is then pumped to storage tanks. Weir skimmers are normally launched from vessels using a crane and the weir can either be remote controlled by compressed air or self-adjusting. Weir skimmers are one of the most commonly used skimmer type due to its simple construction. (NOAA, 2010) (ITOPF, 2012)

Weir skimmers are however prone to be jammed or clogged due to floating debris, and although swell alone does not interfere with skimming operation, weir skimmers are very sensitive to steep waves (ITOPF, 2012).

In table 2, an overview over different skimming technologies and their properties are briefly presented.
<table>
<thead>
<tr>
<th>Skimmer Type</th>
<th>Recovery Rate</th>
<th>Oils</th>
<th>Sea State</th>
<th>Debris</th>
<th>Ancillaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc</td>
<td>Disc</td>
<td>Oil</td>
<td>In low waves and current can be highly selective with little entrained water. However, can be swamped in choppy waters.</td>
<td>Can be swamped in choppy waters.</td>
<td>Separate power pack, hydraulic and discharge hoses, pump and suitable storage required.</td>
</tr>
<tr>
<td>Rope Mop</td>
<td>Rope Mop</td>
<td>Oil</td>
<td>Can be highly selective in medium viscosity oils.</td>
<td>Can be highly selective in medium viscosity oils.</td>
<td>Separate power pack, hydraulic and discharge hoses, pump and suitable storage required.</td>
</tr>
<tr>
<td>Drum</td>
<td>Drum</td>
<td>Oil</td>
<td>Can be highly selective in medium viscosity oils.</td>
<td>Can be highly selective in medium viscosity oils.</td>
<td>Separate power pack, hydraulic and discharge hoses, pump and suitable storage required.</td>
</tr>
<tr>
<td>Brush</td>
<td>Brush</td>
<td>Oil</td>
<td>Can be highly selective in medium viscosity oils.</td>
<td>Can be highly selective in medium viscosity oils.</td>
<td>Separate power pack, hydraulic and discharge hoses, pump and suitable storage required.</td>
</tr>
<tr>
<td>Belt</td>
<td>Belt</td>
<td>Oil</td>
<td>Effective in small debris but can be swamped by large debris.</td>
<td>Can be clogged by debris.</td>
<td>Can deliver oil directly to storage at the top of the belt. Ancillaries are required to discharge from a vessel to shore.</td>
</tr>
<tr>
<td>Vacuum/Suction</td>
<td>Vacuum/Suction</td>
<td>Oil</td>
<td>Effective in small debris but can be swamped by large debris.</td>
<td>Can be clogged by debris.</td>
<td>Vacuum trucks and trailers are generally self-contained with necessary power supply, pump and storage.</td>
</tr>
<tr>
<td>Weir</td>
<td>Weir</td>
<td>Oil</td>
<td>Effective in small debris but can be swamped by large debris.</td>
<td>Can be clogged by debris.</td>
<td>Can deliver oil directly to storage at the top of the belt. Ancillaries are required to discharge from a vessel to shore.</td>
</tr>
</tbody>
</table>

Table 2: Generic characteristics of commonly encountered skimmer types, (ITOPF, 2012)
3.2.2.3. **Skimmer Performance Criteria**

There are a number of factors that can be analysed when assessing skimmer performance. However, three factors are normally used to describe skimmer performance: (NOAA, 2010) (ITOPF, 2012)

- **Recovery rate**: The rate at which pure oil is recovered

- **Recovery efficiency**: The relation between recovered oil and recovered fluids (oil-water mixture)

- **Throughput efficiency**: The relation between recovered oil and encountered oil

It is worth mentioning that the throughput efficiency often tends to decrease as the operating speed increases and the sea state worsen. Hence there is a trade-off between reduced throughput efficiency and greater encounter rate at higher operating speeds. (ITOPF, 2012)

The maximum pump capacity is often taken as the sole indicator of the skimmers performance and is adjusted for typical oil viscosities. Nonetheless, the overall performance of a skimming system should be judged from a combination of pump capacity, oil recovery rate and recovery efficiency, which together define the rate at which oil can be recovered, and the amount of associated free water. (ITOPF, 2012)
3.3. Oil Skimming Applications

Oil skimming is a wide field and there exists many application of oil skimming equipment. However, in this thesis the market for oil skimming equipment has been divided into three subgroups; (1) Offshore Skimming, (2) Industrial Skimming, (3) Innovative Skimming. These three subgroups are covered below.

3.3.1. Offshore Skimming

Offshore skimming is in this thesis defined as the skimming operations performed on open waters and in harbours. Today, two main strategies are available for combating oil on the surface of water, namely: (1) Containment and Recovery, and (2) Chemical Dispersion (White, 2000).

3.3.1.1. Containment and Recovery

Containment and recovery is often considered the ideal solution due to the fact that if performed effectively, the pollutant is removed from the marine environment. The idea behind the method is to contain and concentrate floating oil by the use of floating booms and then recover the oil through specialised skimmers. (White, 2000)

However, this approach unfortunately suffers from several fundamental problems. Primarily, the approach is in direct opposition to the natural tendency of oil to spread, fragment and disperse. Consequently, even if large-scale ship-borne containment and recovery systems are deployed and operating within a few hours of an initial release, they will tend to encounter floating oil at a low rate. (White, 2000)

Another critical success factor of containment and recovery is the type of skimming equipment used. Since many skimmers are only effective with a certain range of oil viscosities, the problems are not over simply because the oil has been contained within booms. Other factors affecting and limiting the effectiveness of recovery systems are wind, waves and currents which make recovering the oil more complicated by causing oil to splash over the booms or be swept underneath. (White, 2000) Also, if the spilled oil has a specific gravity equal to or close to that of water, the agitation of the waves alone can cause the oil to sink below the booms and surface hundreds of meters from its initial location (Joslin, 2013).

Due to these limiting factors and restricting aspects it is very rare, even in ideal conditions, for more than a relatively small proportion (10-15 %) of spilled oil to be recovered from open water situations. As an example, the recovery percentage of the Exxon Valdez oil spill was 9 %, despite the enormous resources dedicated to the task. (White, 2000)

However, although open water containment and recovery of oil frequently is of marginal benefit, a higher degree of success can be achieved in sheltered coastal areas and within port areas. Furthermore, in the case of an on-going release from a tanker, offshore platform or other static source, an improved rate of recovery may also be achieved. This is due to the fact that more time will be made available to install and implement an effective response operation in proximity to the oil source where the oil is unweathered and concentrated. (White, 2000)
3.3.1.2. Chemical Dispersion

Enhancing natural dispersion through the use of chemical dispersants today represents the main alternative to containment and recovery (White, 2000). However, as skimming is not an integral part of this oil response operation, chemical dispersion will not be covered any further in this report.

3.3.2. Industrial Skimming

The subgroup Industrial Skimming comprises many different skimming applications within various industrial settings ranging from manufacturing and processing activities to waste water management. Some of the main applications within Industrial Skimming are presented below.

- **Wastewater sumps:** Most manufacturing or processing facilities have water systems where waste oil accumulates. Skimming the floating oils from central tanks or sumps before discharging the wastewater can significantly reduce the cost of disposal. (Abanaki, 2011)

- **Coolants and cutting fluids:** Machine coolants have a tendency to become contaminated with tramp oils, which might result in reduced coolant life and reduced quality of manufactured goods. Furthermore, the coolant fluid might take on a bad odour such as a “rotten eggs”-stench. Skimming the coolants and removing the tramp oils can solve these problems. (Abanaki, 2011)

- **Heat-treating:** By removing quench oils from heat-treating parts, the oils can be re-used or disposed resulting in reduced quench oil costs, prolonged wash water life, and lower disposal costs. (Abanaki, 2011)

- **Food-processing facilities:** The removal of vegetable oils, greases, and animal fats from a plant’s wastewater stream reduces processing and disposal costs. (Abanaki, 2011)

- **Steel mills/scale pits:** Most steel mills have scale pits where grease and heavy oils are collected. However, these oils cannot be discharged into the environment, so consequently oil skimmers are used to reduce the amount of grease and oil in the wastewater, thus avoiding expensive sand filters and sucker truck disposal. Furthermore, recovered oils can be re-used as furnace fuel. (Abanaki, 2011)

- **Parking lots, garages, and service facilities:** Waste oil from leaks, spills, and other sources must be retrieved from sumps before water can be discharged to storm and sanitary sewers. (Abanaki, 2011)

- **Recovery/monitoring walls:** Oil skimmers such as a belt skimmer provide a more cost-effective way of removing oils, fuels, and other hydrocarbon from wells compared to a down well pump for instance. Oil skimmers do not have the maintenance issues and can handle very thick fluids effortlessly. (Abanaki, 2011)

3.3.3. Innovative Skimming

Skimming equipment has a lot of potential for applications within other fields than offshore and within industrial settings. Skimmers could potentially be used for any type of operation where there is an unwanted oil-water mixture or where a substance with high hydrocarbon content is to be removed from water (Johnson, 2013) (Persson P.-O., 2013). However, such applications are
still primarily in the idea phase and have not yet reached commercialisation. Two of the most prominent application areas for innovative skimming are presented below.

### 3.3.3.1. Algae Harvesting
Recent developments within areas such as biofuels indicate that algae could be a potential future source of biofuels on a large scale. The biofuels produced within the algae are hydrocarbons and therefore the algae are possible subjects to skimming. A skimmer could potentially be used to pull algae from the water as a means of harvesting. As a future introduction of algae biofuels would require algae farming on a colossal scale, the market potential for algae harvesting skimming equipment could be substantial. (Persson P.-O., 2013)

### 3.3.3.2. Water Tower Hygiene
A current problem for many water utility companies is the constant need for cleaning water towers from bacterial deposits. Microorganisms prosper in the calm, dark environment and form a coating on the water surface and on the inner walls of the reservoir. These microorganisms are rich in hydrocarbons and could present an opportunity for fixed position skimming equipment to be installed in order to reduce the costs associated to cleaning. As the number of water towers worldwide is immense, and each would require a fixed position skimming apparatus, this represents a sizeable market for skimming equipment manufacturers. (Johnson, 2013) For example, in Sweden alone there are approximately 500 water towers (Ohlsson, 2004). According to SurfCleaner CEO Jonas Johnson, this represents an untapped market of EUR c. 350,000 per year.
3.4. **Sandvik AB**

Founded in 1862 in Sandviken, Sweden, Sandvik AB is a world-leading, high-technology engineering group. The company manufactures advanced special alloys and ceramic materials, industrial tools and mining equipment. In 2012, the group had about 49,000 employees and sales of approximately EUR 11.6 billion in more than 130 countries. (Sandvik, 2013a) In figure 4, the company's different geographical markets and their respective share of the group’s sales are illustrated.

![Figure 4: Invoiced sales by geographic market area, (Sandvik, 2013a)](image)

The group’s business idea is to develop, manufacture and market highly processed products that contribute to improving the productivity and profitability of its customers and Sandvik’s operations are primarily concentrated in areas where Sandvik is – or has the potential to become – a world leader. (Sandvik, 2013b)

The group’s operations are divided into five business areas whose responsibilities include research and development, production, marketing and sales of their particular products: Sandvik Construction, Sandvik Machining Solutions, Sandvik Materials Technology, Sandvik Mining, and Sandvik Venture. Sandvik Venture develops opportunities for growth and profitability in small, attractive and fast-growing businesses and consists of four different product area; (1) Process Systems, (2) Sandvik Hard Materials, (3) Diamond Innovations, (4) Wolfram. (Sandvik, 2013a)

Sandvik Process Systems is a world-leading manufacturer of steel belts and steel belt-based processing technologies. The company has production facilities in the Americas, Asia, and Europe but has nonetheless a global presence with worldwide sales and service networks. The company employs around 500 persons. It is within this product area that Sandvik’s oil skimmer is manufactured, marketed and sold.

In figure 5, the group structure, divided into business areas and with a brief description of each business area can be seen.
Figure 5: The Sandvik Group, each division briefly explained, (Sandvik, 2013b)
3.5. The Sandvik Oil Skimmer

3.5.1. Background
The Sandvik oil skimmer was developed in the 1960’s, when a Sandvik employee reflected on how the oil levels in a combustion engine is measured by oil adhering to the oil dipstick. Following this train of thought, the same principle was tested on a large scale as a way of skimming oil. The tests led to the commercialisation of the Sandvik oil skimmer. However, after an initial surge of interest, the oil skimming business gradually deteriorated as other industries were deemed more profitable. In 2005, the interest in the oil skimmer was revived and the oil skimmer redesigned with new technology, making the skimmer require less maintenance and making the machine more compact. (Nilsson, 2013)

3.5.2. Construction and Installation
The Sandvik oil skimmer employs a very simplistic construction. The skimmer is composed of a vertical conveyor with a stainless steel belt held in place by a rubber track and a small, 120 W engine. The engine is mounted directly onto the axis of the upper turning point as can be seen in figure 6. At the top of the skimmer two rubber scrapers are placed in contact with the steel belt to scrape the oil from the surface, allowing the oil to flow into a collection tank, preferably by means of gravity but a pump can be installed. The most expensive part of the skimmer is the steel belt, which constitutes roughly 50 % of the total cost. (Nilsson, 2013)

The skimmer comes in different widths and heights depending on the clients’ needs, as can be seen in table 3. By making the steel belt wider the capacity is increased and by making the construction higher it enables the user to lift the oil to a greater height. This height, called lifting height, is important as it can enable the oil to flow into its collection tank by means of gravity rather than being pumped, which is more cost efficient. (Sandvik Process Systems, 2010) (Abanaki, 2011)
When installed correctly, the skimmer should be submerged two to five cm into the oil-water mixture and due to the compact and simple construction of the skimmer it requires very little service once in place. The skimmer requires a short, weekly inspection to make sure no part is damaged and the skimmer operates correctly. This inspection does not require the skimmer to be shut down. Once monthly, the skimmer is to be shut down and the steel belt inspected to make sure there are no cracks, the rubber track undamaged, and the belt tension sufficient. (Sandvik Process Systems, 2005)

The lifetime of the skimmer is theoretically endless; however, the belts have to be changed every 8-10 years due to cracks resulting from the stress caused by the continuous bending fluctuations. However, these figures are based on the old skimmer design where the belts were riveted and not welded as they are today. The overlap joint in the riveted belts presented a natural weak point and caused damage to the rubber scrapers. Although the welded joint in the new design is significantly stronger, it still represents the belt's weakest point. Since the redesign in 2005, the skimmer belts are expected to have a longer life span. Nevertheless, it is still not known to what extent the life span has been increased. (Nilsson, 2013)

### 3.5.3. Performance

The skimmer's capacity for extracting various oils was tested in 2009 by Sandvik Process Systems. When performing the tests, three oils of different viscosities and densities were used in order simulate the different oils a skimmer may encounter. Furthermore, skimmers with 200 mm and 400 mm wide belts were used and run at different speeds. For each speed, five to ten tests were made and an average calculated. Table 4 show the properties of the tested oils.

<table>
<thead>
<tr>
<th>Oil</th>
<th>Dynamic viscosity Pa*s</th>
<th>Density kg/m³</th>
<th>Kinematic viscosity m²/s'10^-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jet fuel</td>
<td>1.21*10^-3</td>
<td>807</td>
<td>1.50</td>
</tr>
<tr>
<td>White spirit</td>
<td>1.6*10^-3</td>
<td>800</td>
<td>2.00</td>
</tr>
<tr>
<td>Rape oil</td>
<td>6.44*10^-2</td>
<td>920</td>
<td>70.0</td>
</tr>
</tbody>
</table>

Rape oil was used to simulate high viscosity oil while the other two oils were used to simulate different types of low viscosity oils. The results, as seen in figure 7, show that the skimmer is the most effective when extracting the high viscosity rape oil. Moreover, the jet fuel showed no response to increased speed due to its low viscosity.
Apart from showing the effectiveness when skimming different oils, the figure also shows the amount of oil the Sandvik oil skimmer can recover. At a belt speed of ten metres per minute, which is the standard setting, the 400 mm skimmer recovered an average of 354 litres of rape oil per hour, i.e. 0.354 m³ per hour. For white spirit, the same number was 52 litres per hour (0.052 m³ per hour).

3.5.4. Applications
The Sandvik oil skimmer has not been sold frequently and therefore it is difficult to name explicit applications that are more frequent than others. However, since the skimmer’s redesign in 2005 Sandvik has seen an increase in skimmer sales, but the numbers are still limited to a dozen skimmers per year. Today, nearly all of the skimmers sold are sold to industrial customers rather than marine customers. (Nilsson, 2013)

During the 1970’s Sandvik developed the Sandvik Piranha concept, which was a small marine vessel with a number of skimmers installed. The Piranha was meant to be used in harbours and adjacent coastal areas and one was sold to the Swedish Coast Guard but the project never caught momentum and was eventually shut down. (Nilsson, 2013) (Sandvik Process Systems, 1987)
3.6. Competition Overview

In this section, some of the main competitors and key players are presented and described. Many of these offer both industrial skimmers and offshore equipment. The presentation is aimed to give a brief understanding of the companies’ sizes and what type of products they offer. Also, a few products are analysed in further detail in order to be able to compare them to Sandvik Process Systems’ skimmer.

3.6.1. Lamor

3.6.1.1. About

Lamor is a Finnish company founded in the early 1980s. Since then, the company has grown and now comprises of a series of subsidiaries with dedicated sales offices in five countries and agents and distributors in another 85 countries (Lamor, 2013). However, Lamor does not have any in-house manufacturing, but instead outsources production to its suppliers (Löfgren, 2013). Due to the ownership structure of Lamor, it is difficult to assess their financial performance but the company’s turnover is at least EUR 10 million (Orbis, 2013d).

3.6.1.2. Product Offering

Lamor offers a variety of products within the oil spill response segment. Products offered include skimming units, power packs, booms, pumps etcetera. However, Lamor attempts to market their products as complete solution packages which include every item needed to contain and recover spilled oil, which are then delivered to the customer as a turn-key solution. Lamor targets a variety of customers, but the most extensive packages marketed are primarily bought by governmental agencies such as the Swedish Coast Guard. Such packages can include Lamor’s largest product, the built-in oil recovery system as can be seen in figure 8. The booms are used to collect the oil-water mixture and force it into the hull of the ship where a series of skimmers separate the oil from the water. A ship with such a system can advance at a rate of four knots per hour and have a recovery efficiency of >95%. (Lamor, 2013) For large scale solution packages, Lamor is the world leader (Beyer, 2013).

![Figure 8: Lamor's built-in oil recovery system, (Lamor, 2013)](image)

Lamor's skimming systems use brushes mounted on discs or belts to skim the oil from the surface. The brushes are made from plastic coated with an oleophilic material. According to Lamor, the oil recovery rates in their brush systems outperform competing technologies while
also enabling recovery of a greater variety of oils. (Beyer, 2013) Lamor offers a large variety of brush systems, but two systems have been analysed in closer detail as these are most similar to Sandvik’s current product offering.

**Lamor Minimax 12 (LMM12)**
The LMM12 is Lamor’s smallest available skimmer unit. It is a suction skimmer using a brush-wheel to separate the oil-water mixture. The skimmer can recover 45.4 m$^3$ per hour in ideal conditions, but has a recorded recovery rate of 19.6 m$^3$ per hour in natural conditions and can be used in shorelines, harbours and industrial applications. (Lamor, 2013) Along with a power pack, storage tank, and required hoses the skimmer costs EUR 18 000 (Beyer, 2013). The system is shown in figure 9.

![Figure 9: LLM12 collecting oil, (Lamor, 2013)](image)

**Lamor Minimax 30 (LMM30)**
The LMM30 is a belt skimmer with Lamor’s brush system mounted on the belt designed for rivers, ponds and harbours. The skimmer pulls the oil towards the belt with a suction propeller, which enables a recovery rate of 30 m$^3$ per hour in natural conditions. The skimmer is primarily efficient in high viscosity oils and is also capable of collecting oily debris. The skimmer along with pumps, power pack, storage tank and required hoses costs roughly EUR 40 000 (Beyer, 2013). The system is shown in figure 10.
Every year, Lamor spends a lot of their earnings on research and development of new skimming equipment. Currently, the increased interest in Arctic oil extraction pushes the research towards skimming equipment that can be used in Arctic conditions operating in cold temperatures and icy waters. Due to the delicate nature of the Arctic, Lamor expects the level of environmental regulations and need for on-site skimming equipment in Arctic conditions to be high. This is a potential source of future growth for a company such as Lamor. (Beyer, 2013)

Apart from hardware, Lamor also offers their customers risk assessments of their operation as well as contingency planning, oil spill response training, and maintenance. (Lamor, 2013)

3.6.2. Elastec/American Marine

3.6.2.1. About
Elastec is an American company based in Carmi, Illinois, founded in 1989 which, together with its sister company American Marine, offers oil spill response tools. With satellite offices in Virginia, Washington, Estonia, India, Turkey, and China, Elastec/American Marine employs over 200 people and can reach 140 geographies through its distribution network. (Elastec/American Marine, 2013) Elastec/American Marine has revenues of EUR ca. 50 million, but since the company has many different product categories this turnover is not solely related to skimmers (Orbis, 2013b). Elastec/American Marine is also continually listed among Inc. magazine’s 500/5000’s fastest-growing private companies in America. As a part of their growth strategy, Elastec/American Marine acquired the marketing rights to ORC Fast Water Technology’s boom systems in 2012. (Löfgren, 2013)

3.6.2.2. Product Offering
Elastec/American Marine was founded at the time of the Exxon Valdez oil spill in 1989 and early launched a skimmer unit as well as a fire resistant boom. Since then, the product offering has grown and Elastec/American Marine now offers all equipment needed to control a water pollution situation such as various skimming units, booms, incinerator products and more. In early 2013, Elastec/American Marine formed an alliance with Kvichak Marine Industries, a developer and manufacturer of aluminium workboats. (Elastec/American Marine, 2013)
In 2011, following the wake of the Deepwater Horizon accident in the Gulf of Mexico, Elastec/American Marine entered into an entrepreneurial challenge to develop a rapid deployable and highly efficient way of collecting oil from the water. Elastec/American Marine’s innovative grooved disc skimmer won first prize and it has since then won other technological prizes worldwide. (Elastec/American Marine, 2013)

Below, two of Elastec/American Marine’s products most similar in size and application with Sandvik’s oil skimmer are described in more detail.

**MiniMax**
The MiniMax is a small drum skimmer developed for industrial applications. The skimmer is made of polyethylene in order to make it resistant to many of the chemicals which may be found in industrial applications. However, depending on the customer’s need, the drums can also be delivered in aluminium or stainless steel to cope with hot and corrosive applications. The pickup rate is c. 0.6 m$^3$ per hour. (Elastec/American Marine, 2013) The MiniMax is shown in figure 11.

![Figure 11: MiniMax skimmer, (Elastec/American Marine, 2013)](image)

**TDS118**
The TDS118 is a drum skimmer designed for both industrial applications as well as oil spill response in lakes and rivers. The TDS118 can retrieve a variety of oils with a water content of 2-3%. (Elastec/American Marine, 2013) The skimmer can also be delivered with Elastec/American Marine’s grooved drum for enhanced recovery rate, which increases the recovery rate of the TDS118 from 0.72 m$^3$ per hour to 1.8 m$^3$ per hour (Broje & Keller, 2006). The TDS118 is shown in figure 12.

![Figure 12: TDS118, (Elastec/American Marine, 2013)](image)
3.6.3. SurfCleaner

3.6.3.1. About
SurfCleaner is a Swedish company founded in 1997 by Stig Lundbäck MD PhD, and Jonas Johnson, MSc, and built upon a pump technology inspired by the principles of the human heart. Until now the main activities of the company have revolved around and focused on developing, patenting, and proving its new technology. SurfCleaner does not currently have any employees and is operating as a subsidiary of Midrocc International and Inovacor AB. However, the company is seeking a new strong partner/owner with an existing production and distribution network, ready to commercialize the patented technology on a wider scale. Talks with Lamor were initiated in 2005 but never resulted in any deal. Approximately, around 20-25 SurfCleaners have been sold to date. (SurfCleaner, 2012)

3.6.3.2. Product Offering
The product is specialised in the removal of oil and sludge of medium and low viscosities. The skimmer contains only two moving parts, the weir ring and the propeller, resulting in minimal mechanical wear and low service costs. By means of sensors, the SurfCleaner can be completely self-regulating for continuous and unattended operation. This is made possible since the skimmer is not affected by variations of water levels or changes in oil layer thickness. The SurfCleaner is made out of stainless steel and polyester. There are currently two models of the SurfCleaner, the SCC400, which is the larger one and the SCC150 which is a smaller model. The oil recovery rate ranges between 1.5-10 m^3 per hour of pure oil depending on the model and the type of oil. Table 5 offers some technical data for the two models of the SurfCleaner. (SurfCleaner, 2012)

<table>
<thead>
<tr>
<th>Model</th>
<th>SCC150</th>
<th>SCC400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input capacity:</td>
<td>0-20 l/min</td>
<td>0-200 l/min</td>
</tr>
<tr>
<td>Max emptying per cycle</td>
<td>15 l</td>
<td>150 l</td>
</tr>
<tr>
<td>Max head</td>
<td>1 m</td>
<td>1 m</td>
</tr>
<tr>
<td>Weight</td>
<td>35 kg</td>
<td>210 kg</td>
</tr>
<tr>
<td>Power during collecting</td>
<td>6 W</td>
<td>150 W</td>
</tr>
<tr>
<td>Power during discharging</td>
<td>30 W</td>
<td>500 W</td>
</tr>
</tbody>
</table>

Table 5: Technical data of the two SurfCleaner models, (SurfCleaner, 2012)

Each SurfCleaner is quite expensive to manufacture since they are assembled by hand in small batches, oftentimes single batches. The manufacturing cost lies in the range of a couple of thousand EUR. The SurfCleaner is then sold at around EUR 58,000 for the SCC400 model, and at around EUR 23,000 for the smaller SCC150 model. (Johnson, 2013)
3.6.3.3. Technology

The technology builds upon the weir skimmer principle of collecting both the carrier fluid and the top layer substance, which are separated internally, allowing an extraction of layers as thin as 100 nm. The SurfCleaner can be operated manually or by an automatic sensor control system. A software package also enables full remote control, e.g., over the Internet. Furthermore, the skimming systems have low energy consumption (flow rates of \(10 \text{ m}^3\) per hour have a power demand of less than 500W) and are thus suitable for photovoltaic applications. (SurfCleaner, 2012)

Working Principle

In figure 15, the working principle behind the SurfCleaner is illustrated and is further explained in the following paragraphs.

![Concentration Separation Emptying](Figure 15: Working principle of the SurfCleaner technology based on three operational steps, (SurfCleaner, 2012))

Concentration

For the SurfCleaner to work, it first requires the oil layer to become concentrated, which is done by letting a bottom-mounted propeller generate a negative pressure thus creating a circular inflow zone at the surface. The carrier fluid with the polluted surface layer then flows into the SurfCleaner and the surface layer is thus concentrated in the centre of the inflow zone as can be seen in figure 16. The red layer represents the pollutant. (SurfCleaner, 2012)
Separation
When a sufficient thickness of the surface layer has been concentrated in the centre of the inflow zone, the flow of the carrier fluid will pull down the concentrated pollutant down towards the bottom of the SurfCleaner. With the help of deflection disks, the carrier fluid along with the pollutant is forced out in the periphery. This entrains a considerable lowering of the flow velocity resulting in a diverging of the pollutants upwards towards the upper part of the underwater body. The carrier fluid on the other hand continues its downward trajectory towards the propeller and further on, is ejected from the underwater body through the outlet. This separation step is shown in figure 17. (SurfCleaner, 2012)
Emptying

When the separation step is complete, the bottom-mounted propeller is reversed creating a positive pressure in the underwater body. This pressure affects the membrane at the top of the body thus creating an opening at the centre of the SurfCleaner. Furthermore, the pressure affects the bellow and the circular floating ring, closing it with a sealing on the outflow pipe. By inversing the pressure in this fashion, the pollutants can use the carrier fluid as a piston and be discharged of the underwater body to an external storage tank. A sensor connected to a control system, automatically controls the emptying procedure. In figure 18, this procedure can be viewed. (SurfCleaner, 2012)
Figure 18: Emptying step of the working principle of the SurfCleaner, (SurfCleaner, 2012)

3.6.4. Abanaki

3.6.4.1. About
Abanaki Corporation is an American company situated in Chagrin Falls, Ohio, and was founded in 1949. The company’s original goal was pollution control which later evolved into oil skimming. However, in 2008 Abanaki also acquired Aerodyne, active within air pollution control and thus expanded the business to rely on two separate income streams. Although accurate information is unavailable, Abanaki’s turnover is roughly EUR 1.5 million (Orbis, 2013a).

3.6.4.2. Product Offering
Abanaki offers a wide variety of oil skimming equipment. Most of the skimmers offered are belt skimmers and Abanaki offers five different belt materials depending on the skimmer’s application (Abanaki, 2011). Below, the different materials are described and compared. See also table 6.

Corrosive resistant steel
Stainless steel is the standard material in Abanaki’s skimmers. The material combines high durability with application versatility. The stainless steel alloy used in Abanaki’s belt has a higher than average chrome content and a low carbon content. (Abanaki, 2011)

Elastomeric
The elastomer belt is recommended for applications in which physical abuse to the belt is likely. However, the oleophilic property of the belt is diminished by ultraviolet light and the belt must therefore be protected from direct sunlight. (Abanaki, 2011)

Poly
The poly belts are made from a polyester mono-filament with polyurethane liner which makes the material very stretch resistant. This makes the belt suitable for applications with a high lifting
height requirement. Abanaki offers poly belt skimmers with lifting heights of up to 30 meters. The belts also have a slightly better capacity for retrieving emulsified oils compared to other belt materials. (Abanaki, 2011)

**XP-Poly**
The XP-Poly belt is similar to the poly belts but is enforced with a nylon core, which offers superior resistance to flexing fatigue in more extreme temperatures (-30°C - 100°C). (Abanaki, 2011)

**Fuzzy**
Fuzzy belts are designed for high volume recovery of low viscosity oils. Pickup fibres, each 0.45 cm long, are mounted on a poly belt at a 45° angle against the direction of belt travel. These fibres can increase the recovery rate of low viscosity oils by a factor of 95. (Abanaki, 2011)

<table>
<thead>
<tr>
<th>Belt materials</th>
<th>CR Steel</th>
<th>Elastomer</th>
<th>Poly</th>
<th>XP-Poly</th>
<th>Fuzzy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature range</td>
<td>&lt;104°C</td>
<td>&lt;49°C</td>
<td>&lt;71°C</td>
<td>&lt;100°C</td>
<td>&lt;71°C</td>
</tr>
<tr>
<td>pH range 2-13</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Operates in presence of grit fines and other suspended particles</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Removes certain emulsified oils</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Effective for very light oils</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 6: Belt material properties of Abanaki’s skimmers, (Abanaki, 2011)

Abanaki also offers additional products to complement the skimmers such as solar panels and batteries to operate the skimmer in areas which have no or limited power supply. However, the main products are the skimmers Oil Grabber 8 and Oil Grabber 4. (Abanaki, 2011)

**Oil Grabber 8**
The Oil Grabber 8 is a heavy duty oil skimmer with a 20 cm (eight inches, thereof the name) wide belt. The skimmer’s construction is similar to that of the Sandvik oil skimmer; compact, sturdy, with the motor mounted directly on the drive axis of the skimmer. Furthermore, the Oil Grabber 8 is also available as a multi-belt skimmer in which a number of belts are serial mounted on the same drive axis. The recovery rate is an estimated 0.150 m³ per hour for each 20 cm steel belt. For belts of other materials the recovery rate can differ. (Abanaki, 2011) Figure 19 shows the Oil Grabber 8.
Oil Grabber 4
The Oil Grabber 4 is a heavy duty oil skimmer with a ten cm (four inches, thereof the name) wide belt. The construction of the Oil Grabber 4 is very similar to that of the Oil Grabber 8 except it is smaller. Figure 20 shows the construction. The Oil Grabber 4 is also available as a multi-band skimmer. The skimmer can recover 0.075 m³ per hour. (Abanaki, 2011)

3.6.5. Oil Skimmers Inc

3.6.5.1. About
Oil Skimmers Inc is an American company which has been active within oil skimming for over 40 years. Headquartered in Cleveland, Ohio, Oil Skimmers Inc has 38 sales offices across North America and partnerships with 48 dealers in the rest of the world which provide a global coverage (Oil Skimmers Inc, 2013). Oil Skimmers Inc is a privately owned company with 22 employees but due to the ownership structure it is difficult to assess the financial performance. However, the company’s turnover is at least EUR 2.3 million (Orbis, 2013e).
3.6.5.2. **Product Offering**

In many ways Oil Skimmers Inc’s product offering is similar to Sandvik’s. The construction is simple yet robust with a significantly lower recovery rate compared to Lamor’s systems. However, instead of using belts as the foundation of the design, Oil Skimmers Inc use plastic tubes. This has some advantages compared to Sandvik’s design as the skimming medium is cheap as well as durable which allows the skimmer to have a high lifting height without affecting the price. This in turn allows the skimmers to operate without pump systems but rather rely on gravity for recuperating oil, which reduces the operating cost. The tube is also partially heat resistant which allows it to be heated to operate in winter conditions. However, due to the smooth surface of the tube the capacity to recover low viscosity oils is diminished compared to high viscosity oils. Oil Skimmers Inc primarily target industrial customers and their two main products are Model 6V and Model 5H. (Oil Skimmers Inc, 2012) These are described in closer detail below.

**Model 6V**

The Model 6V is Oil Skimmers Inc’s primary product. It is a tube skimmer capable of collecting 0.042 m³ per hour. The skimmer is designed to have a low maintenance demand and low operating costs and due to the compact and durable construction it is estimated to have an operational lifetime of over 20 years. (Oil Skimmers Inc, 2012) The skimmer is shown in figure 21.

![Figure 21: Model 6V, (Oil Skimmers Inc, 2012)](image)

**Model 5H**

The Model 5H is a more compact version of the Model 6V. This model is designed to fit in areas otherwise difficult to reach. Despite the compact design, the Model 5H is capable of collecting as much as the Model 6V, 0.042 m³ per hour using a similar tube system as the one used in the Model 6V. (Oil Skimmers Inc, 2012) The Model 5H is shown in figure 22.
3.6.6. Kepner Plastics Fabricators

3.6.6.1. About
Kepner Plastics Fabricators (KPF) is an American company based in Torrance, California, founded in 1961. Initially the company focused on custom plastic fabrication such as pond liners. KPF took the step into the oil skimming business after an Ocean Eagle tanker grounded in San Juan Harbour, Puerto Rico, in 1968. After initial failure to contain the c. 83,000 barrels leaked, KPF was contacted to produce something to contain the oil. The result was SeaCurtain, a containment boom which eventually managed to contain the San Juan Harbour spill. The success of SeaCurtain was repeated in 1969 when an oil platform in the Santa Barbara Channel had a blow-out, releasing 750 m³ of crude oil into the water. Following success in the Santa Barbara Channel, KPF went on to develop additional products to handle oil spills. To this day, oil response equipment is barely one of the plastic products offered by KPF. (Kepner Plastic Fabricators, 2012) KPF’s do not publish any figures regarding financial performance, but estimates indicate a turnover of EUR c .2.1 million (Orbis, 2013c).

3.6.6.2. Product Offering
KPF’s primary business within the oil skimming industry is containment booms. Many of the booms offered are mobile, and self-inflatable to facilitate a quick and simple deployment. However, KPF also offers a weir skimmer to retrieve the oil contained by the booms. The skimmer, called SeaVac Delta Skimmer, is a heavy duty skimmer intended for open water usage rather than industrial applications. In order to avoid the system clogging, the orifice is protected by a lattice. The skimmer has a high recovery rate but lacks an internal separation process which causes it to retrieve large quantities of water as well. However, in order to decrease the retrieved amount of water the orifice is also surrounded by three doors which can be closed individually in order to retrieve fluid in a targeted direction. (Lee, 2013) The SeaVac Delta Skimmer is shown in figure 23.
3.6.7. Vikoma

3.6.7.1. About
Vikoma was founded by British Petroleum in 1967 following the Torrey Canyon oil spill. Since then, Vikoma have operated as a separate company and is now based on Isle of Wight and owned by Energy Environmental Group (EEG). EEG is a holding company with focus on the environmental sector, aiming to discover and exploit innovative technologies (Vikoma, 2013). Vikoma is one of the larger companies within the industry with revenues of EUR c. 12 million and 76 people employed (Orbis, 2013f). Some of Vikoma’s products are manufactured in-house (Vikoma, 2013).

3.6.7.2. Product Offering
Vikoma offers a variety of oil response equipment for offshore applications, but also skimming units designed for industrial applications.

Within the offshore application, Vikoma offers a complete solution package with booms, skimmer units, vessels, tanks and dispersant systems. Vikoma offers skimmers of many different types; mechanical skimmers to retrieve very heavy oils, oleophilic disc skimmers for medium oils, and weir skimmers for light oils. For industrial applications, Vikoma’s product offering is more limited as Vikoma offers a weir skimmer as well as three different sizes of disc skimmers. The disc skimmers offered by Vikoma are all of a series called the T-series and are described in closer detail below. (Vikoma, 2013)

T-series disc skimmers
The disc skimmers are delivered either as a floating device for applications with varying water levels, or as a fixed position skimmer. The whole construction, including the discs, is made from stainless steel, which ensures low water content (<2%) in the retrieved liquid. The recovery rate varies from 6-14 m³ per hour depending on the size of the skimmer. In figure 24, a picture of the T9-skimmer can be seen. The T9 has a recovery rate of 9 m³ per hour (Vikoma, 2013).
Figure 24: T9-skimmer (Vikoma, 2013)
3.7. Market Overview

3.7.1. Europe

The European market segment is geographically focused on Western Europe. The area is politically stable and the main political powers are the European Union as well as the countries’ governments. In the area there are also three manufacturers of oil skimming equipment that are used for the analysis apart from Sandvik, Finnish Lamor, Swedish SurfCleaner, and British Vikoma.

In the European area there are several large customers of oil skimming equipment; The national coast guards, the European Union as well as members of the Global Response Network (GRN). GRN is a coalition of major oil spill companies and in Europe there is a Norwegian branch, Norwegian Clean Seas Association for Operating Companies (NOFO), as well as an international branch, Oil Spill Response Limited (OSRL), based in the United Kingdom. NOFO is an organisation with over 30 members, primarily operating companies stationed in Norway. Amongst the members in NOFO are some of the largest oil companies in the world such as British Petroleum, Shell, ExxonMobil, Chevron and Total. NOFO’s mission is to respond to oil spills caused by any of its members, which for the members is more cost efficient than having its own personnel on stand-by. NOFO responds to oil spills any time of the day and in total its skimming units can collect 100,000-200,000 barrels of oil per day. (Global Response Network, 2008) (Norwegian Clean Seas Association for Operating Companies, 2012) OSRL is very similar to NOFO, but with a larger geographical scope. OSRL have units stationed in all over the world and since 2010 they have responded to 33 oil spill alerts. (Oil Spill Response Limited, 2013)

Western Europe also has a lot of processing industry enabling skimming equipment sales to industrial customers. Especially countries such as Sweden, Germany, Finland, Estonia, and Poland are nations with a large need for industrial skimming. (Beyer, 2013)

3.7.2. North America

The North American market is focused on USA and Canada. Politically and economically both countries are stable. Some of the main industries in the area are oil and gas, commodities, processing industry, and manufacturing industry. In other words, there are plenty of opportunities for skimming equipment manufacturers to sell their goods.

There are a lot of skimming manufacturers in North America. Examples include Elastec/American Marine, Abanaki, and Oil Skimmers Inc. There is also one dominating customer to whom all companies seek to sell their equipment, Marine Spill Response Corporation (MSRC). MSRC is an organisation in many ways similar to NOFO, and OSRL. It was founded in 1990 as a non-profit, U.S. Coast Guard Classified Oil Spill Removal Organisation and has since then been active in the foundation of GRN. MSRC offers its customers a full range of oil spill services and if needed, MSRC can call upon one of the largest arsenals of oil spill response equipment in the world. MSRC have over 30 large scale, dedicated oil recovery vessels, over 300 skimmer systems, 6 dedicated dispersant spray/spotter aircrafts as well as 200 km of containment booms. MSRC’s customer base include almost all of the large oil companies active in North America and therefore it is easy to understand how much MSRC means to oil skimming
equipped manufacturers worldwide with regards to offshore applications. (Marine Spill Response Corporation, 2013)

3.7.3. Emerging Markets

The emerging markets are in this thesis defined as South America, Africa and the Arctic. It is not the geographies most commonly mentioned when using the expression emerging markets, but they are nonetheless very interesting to the oil skimming market. South America and Africa are similar to each other, while the Arctic is looked upon as an area with huge potential.

In South America and Africa, the political systems are not as stable as in Europe and North America. Lately however, political regulations regarding environmental issues such as water pollution have begun moving closer to those regulations set in other geographic markets. Despite this, no global companies manufacturing oil skimming equipment have come from these areas. Instead, these continents are viewed as important due to their business potential for foreign companies. Manufacturing and processing industry is growing faster in these economies than in the European or North American markets which in turn cause the potential skimming market to grow likewise. South America and Africa also hold great deposits of natural resources and the increased exploiting of these also creates a greater need for oil skimming. (Lee, 2013)

The Arctic is largely unexploited by oil companies and therefore the need for oil skimming in the area is low. However, if oil drilling on a large scale would be allowed in the Arctic, the need for oil skimming would grow a lot. However, in order for this to get started the governing body of the Arctic, the Arctic Council, must give its unanimous blessing (Arctic Council, 2011). The business potential in the Arctic is primarily for offshore applications but the skimming systems currently used must be improved to deal with the large amounts of ice in the Arctic. Lamor’s sales director in America summarised the business potential of the Arctic region by saying:

“If the Arctic were to open up for the oil companies… Wow! This would truly be an unprecedented opportunity” (Beyer, 2013)
3.8. **Strategy and Operations – A Theoretical Framework**

In order for a more structured approach, the market as a whole has been divided into two dimensions – an external and an internal. The external dimension comprises of strategic theory based around market dynamics and market positioning while the internal dimension consists of a strategic segment covering company competitiveness, operational excellence and core competences.

Below, each of these dimensions is described using a number of models and frameworks which will later be used to analyse the oil skimming market and the competitiveness of the Sandvik oil skimmer.

3.8.1. **Competitive Advantage**

Strategic choices are resource allocation decisions that enable the firm to create distinctive assets and capabilities. This allows the firm to create imperfections in markets that are specific to itself and therefore, the firm can reap the benefits of this positioning in terms of higher prices and/or lower costs. These firm specific market imperfections are often referred to as competitive advantages and are considered a means for achieving higher profitability. (McGee, Thomas, & Wilson, 2005) Competitive advantage can be defined as follows:

1. “*When two or more firms compete within the same market, one firm possesses a competitive advantage over its rivals when it earns (or has the potential to earn) a persistently higher rate of profit.*” (Grant, 2010)

2. “*Delivering superior value to customers and in doing so earning an above average return for the company and its stakeholders.*” (McGee, Thomas, & Wilson, 2005)

Focusing on profitability, a firm’s ability to earn a superior rate of profit generally depends upon two distinctive factors: the attractiveness of the industry in which it operates, and its competitive advantages over rivals, as illustrated in figure 25. (Grant, 1991)
Industry attractiveness has historically often been emphasised as the primary basis for superior profitability. Consequently, management are primarily concerned with seeking favourable industry environments, locating attractive segments and strategic groups within industries, and moderating competitive pressure by influencing industry structure and competitors’ behaviour. However, international competition, technological change, and diversification by firms across industry borders have meant that industries which we once considered safe havens for making easy profits are now subject to increasingly vigorous competition. The fact that competitive advantages rather than external environments are the primary source of inter-firm profit differentials focuses attention upon the sources of competitive advantages. (Grant, 1991)

**Sources of Competitive Advantage**

Identifying opportunities for establishing and sustaining competitive advantage requires the understanding of the competitive process in the specific market. For competitive advantage to exist, there must consequently be some imperfection of competition. In a production market, such as the oil skimming industry, the sources of imperfection of competition may be barriers to imitation and barriers to innovation. The identification of imitation barriers (e.g. deterrence, pre-emption, causal ambiguity, resource immobility and barriers to resource imitation) thus represents an opportunity for competitive advantage. (Grant, 2010) It is important to remember that competitive advantage cannot simply be bought by cutting prices or by adding quality without reflecting the cost premium in higher prices. Competitive advantage requires the firm to be sustainably different from its competitors in such a way that customers are prepared to purchase at a suitably high price. ( McGee, Thomas, & Wilson, 2005)
Competitive advantages are by nature temporary and decay quickly, as competition tries to make up for lack thereof. Hence, no advantage is safe from competitive threat from a long-term perspective and the main concerns for many firms are: (1) how large is my advantage, and (2) for how long can I retain it. (McGee, Thomas, & Wilson, 2005) In the long run, competition works to eliminate differences in profitability between competing firms, hence competitive advantage is a disequilibrium phenomenon that is a consequence of changes. The source of these changes can either be internal or external to the company, as shown in figure 26.

![Figure 26: The emergence of competitive advantage, (Grant, 2010)](image)

Internal sources of change originate from the firms’ different resources and capabilities. The identification of the types of resources and capabilities necessary to compete paired with the circumstances of their availability is crucial for understanding these market imperfections and will be more thoroughly covered in section 3.8.3.1, The Resource-Based View. External sources of change are more complex and harder to pinpoint. It can be factors such as changing customer demand and technological innovations. Moreover, a changing macroeconomic environment is also an external source of change that needs to be addressed in order to develop or sustain a competitive advantage. However, for an external change to create competitive advantage, the change must have differential effects on companies because of their different resources and capabilities or strategic positioning. (Grant, 2010)

### 3.8.2. External Strategy

#### 3.8.2.1. Porter's Five Forces

Porter’s model of the five forces was first introduced in 1979 and attempts to explain the various forces governing industry competition and explain why fierce competition in certain markets is not coincidental. However, Porter’s market forces go beyond the existing combatants of a market to look at the underlying competitive landscape and economics. By analysing the relationship
between the different forces one can evaluate the attractiveness and potential profitability of a market. By understanding the interaction between these forces, one can evaluate how to gain and sustain a competitive advantage by taking offensive or defensive actions in relation to the industry competitors.

**The Model**

The five market forces are (1) Threat of new entrants, (2) Bargaining power of suppliers, (3) Bargaining power of customers, (4) Threat of substitute products or services and (5) Jockeying for position among current competitors. (Porter, 1979) Below, each market force is described in detail.

1. **Threat of new entrants:** New entrants bring with them capacity, the desire to expand and often substantial resources to the market. The threat of new entrants is reduced if there are entry barriers to the market. Porter has coined six major barriers to entry. These are: (a) Economies of scale, (b) Product differentiation, (c) Capital requirements, (d) Cost disadvantages independent of size, (e) Access to distribution channels and (f) Government policy. Each barrier represent one obstacle a new entrant must overcome in order to be successful (Kotler & Keller, 2009). Each will be covered briefly below:
   a. **Economies of scale:** Economies of scale force a new entrant to either enter the market on a large scale or accept initial cost disadvantages. Economies of scale can also be applied to R&D, marketing, human resource etcetera. (Porter, 1979)
   b. **Product differentiation:** Brand identification forces new entrants to spend heavily in order to overcome customer loyalty through product differentiation. Brand identification is suggested by Porter as the most important protective barrier of entry for established companies. (Porter, 1979)
   c. **Capital requirements:** Capital is always necessary, but markets which require large, unrecoverable up-front investments pose a larger risk for a new entrant and thus it becomes less desirable. (Porter, 1979)
   d. **Cost disadvantage independent of size:** Some advantages can be unavailable to new entrants despite their sheer size. Examples of such advantages are experience, access to premium raw material, governmental subsidies or a favourable location. (Porter, 1979)
   e. **Access to distribution channels:** A new entrant must either purchase an existing distribution network, develop its own or claw their way into shared distribution channels. For example, a new food product must take the place of an existing one on the supermarket’s shelf through price cuts, promotion, and intense selling efforts. (Porter, 1979)
   f. **Government policy:** Governmental policies create greater barriers within some industries than in other. For example, the electricity grid in Sweden is a controlled monopoly which effectively shuts the door for companies looking to enter the market. Other examples are liquor retailing, mining, skiing areas etcetera. However, governmental policies can also form an entry barrier by applying high environmental standards which are difficult to comply with. (Porter, 1979)
2. **Bargaining power of suppliers:** Strong suppliers can increase costs or lower quality, thereby extracting more profit which the industry in turn may not be able to claim from their customers. Suppliers are considered strong if their products are unique or differentiated and the market for suppliers is consolidated into a few large companies. The suppliers’ power is also increased if the industry adapts to specialised equipment, which in turn causes a switching cost, or if the industry is not a main customer of the supplier. (Porter, 1979)

3. **Bargaining power of customers:** Customers have the possibility to play out companies against each other and demand lower prices, and/or higher quality at the expense of industry profits. Customers are empowered by the volumes they purchase as well as low switching barriers. (Porter, 1979)

4. **Threat of substitute products or services:** Substitute products may severely cripple an industry’s ability to extract profits by placing an upper price limit. If a substitute product or service offers a better price-performance trade-off, this forces an industry to slash prices, increase the quality, and/or increase the level of perceived differentiation e.g. through marketing. (Porter, 1979)

5. **Jockeying for market position among current competitors:** Rivalry amongst competitors lead to price competition, product introductions, and advertising slugfests. Intense rivalry is related to a series of factors such as the number of competitors and the nature of the product or service offered. If the competitors are numerous and roughly of the same size, the stage is set for more intense rivalry than in an industry with one large, global company with regional competitors. The competition between companies can also increase if there are high exit costs in the industry. In such industries, the rivals may sell products or services with very low or even negative margins in order to starve its competitors to bankruptcy. In such cases, a poorly managed company with a lot of resources can eventually break healthy competitors by continuous price cuts. (Porter, 1979)

Porter’s model of the five forces is visualised as shown in figure 27.
Critique towards Porter’s model

Despite Porter’s accomplishment to distil the complex world of business strategy into five market forces, his model is increasingly questioned for being too shallow and outdated in the 21st century market. Grundy (2006) delivers harsh critique towards the model, but also ways of improving it. According to Grundy, Porter’s model would benefit from being a tool in a more thorough market analysis also containing a PESTLE-analysis as this provides a better macro-understanding. (Grundy, 2006)

3.8.2.2. **PESTLE-Analysis**

PEST-analysis is a model for performing macro-analysis of a market environment. The name PEST is an acronym of the various aspects of the analysis: (1) Political, (2) Economic, (3) Social and (4) Technological. (Carruthers, 2009) The standard PEST-analysis is often expanded by adding two more aspects, (5) Legal and (6) Environmental, creating the PESTLE-analysis. (Grant, 2010)

1. **Political**: The political aspect considers the extent to which the government can affect the market environment through regulations. Governmental regulations can be taxes or trade tariffs which severely impact the established market environment and the ability to create a profitable business. (Carruthers, 2009)

2. **Economic**: The economic aspect mainly focuses on macroeconomic factors such as interest rates and inflation. Changes in such factors affect pricing strategies as well as the purchasing power of the buyers thereby possibly upsetting the supply-demand relationship. (Carruthers, 2009) In this thesis, the economic aspect will not focus around macroeconomic data but rather on Sandvik Process Systems’ economic objectives.
Although this is not the conventional way of performing a PESTLE-analysis, its contribution to the final result is expected to exceed the conventional application of the analysis.

3. **Social**: Social factors include demographic and cultural trends. Such aspects are important to consider when studying shifts in demand. (Carruthers, 2009)

4. **Technological**: Technological advances occur in practically every market and must be analysed in order to understand its implications on specific segments. Technological advances can severely impact the market dynamics and potentially render existing technologies moot. (Carruthers, 2009)

5. **Legal**: When considering the legal aspects, one must both consider laws regulating the business landscape in countries or regions, but also consider internal policies. (Grant, 2010) In this thesis, the legal aspect will not be covered due to authors’ inability to assess the legal system’s impact on the business landscape.

6. **Environmental**: The environmental aspect is made up of two subgroups. Firstly, there are the environmental concerns for business within environment-dependant industries such as agriculture, tourism etcetera and secondly there are environmental concerns such as geographic location, climate, and weather etcetera. (Grant, 2010)

When combined, these six factors provide a holistic view of the market environment in which the companies’ rivalry can be analysed in detail.

### 3.8.3 Internal Strategy

#### 3.8.3.1 The Resource-Based View

The resource-based view (RBV) is used to understand how, in a competitive environment, firms maintain unique and sustainable positions. The RBV argues that the heterogeneous market positions of close competitors derive from each firm’s unique bundle of resources and capabilities. (Hoopes, Madsen, & Walker, 2003) Hence, the RBV theory maintains that competitive advantage is grounded within the firm. (Lucas & Kirillova, 2001)

The distinction between resources and capabilities lies in the difference that resources are considered inputs into the production process, such as patents, brand names, finance, skills of individual employees etcetera, whereas a capability is the capacity for a team of resources to perform a certain task or activity, as productive activity requires the coordination of teams of resources. (Grant, 1991) However, in order to be a source of sustained competitive advantage, resources and capabilities must fulfil four conditions: (1) Valuable, (2) Rare, (3) Inimitable, and (4) Non-substitutable (Hoopes, Madsen, & Walker, 2003).

1. **Valuable**: A valuable resource permits a firm to improve its market position relative to competitors, by enabling the firm to employ a value-creating strategy. (Barney, 1991) (Hoopes, Madsen, & Walker, 2003)
2. **Rare:** To be of value in sustaining competitive advantage, resources must be available in short supply relative to demand. (Barney, 1991) (Hoopes, Madsen, & Walker, 2003)

3. **Inimitable:** To be rare, resources need to be difficult for competitors to duplicate. (Barney, 1991) (Hoopes, Madsen, & Walker, 2003)

4. **Non-substitutable:** To be a source of sustained competitive advantage there must be no strategically equivalent valuable resources that are themselves either not rare or imitable. (Barney, 1991) (Hoopes, Madsen, & Walker, 2003)

It is not difficult to understand how valuable and rare organizational resources may be a source of competitive advantage since they allow firms to engage in strategies other firms could neither conceive of, nor implement. However, valuable and rare organizational resources can only be sources of sustained competitive advantage if firms that do not possess such resources cannot neither obtain nor substitute them. (Barney, 1991) (Hoopes, Madsen, & Walker, 2003) Factors such as learning curve effects, buyer switching costs, and economies of scale all help to prevent both substitution and imitation of strategic resources. (Lewis, Brandon-Jones, Slack, & Howard, 2010)

It is important to remember that a sustained competitive advantage does not imply that it will last forever. It merely suggests that it will not be competed away through the duplication efforts of other firms. (Barney, 1991) Consequently, three general isolating mechanisms prevent the imitation of resources and capabilities: (1) Property rights, (2) Learning and development costs, and (3) Causal ambiguity (Hoopes, Madsen, & Walker, 2003).

1. **Property rights:** Property rights protect the firm against infringement by competitors.

2. **Learning and development costs:** As the required investment for imitating a rival’s resource increases, the probability others will attempt imitation decreases.

3. **Causal ambiguity:** Ambiguity about how a rival’s resource and capabilities create superior performance impedes imitation.

Nonetheless, over the long-term, competitive advantage and the returns associated with it will be eroded both through the depreciation of the advantaged firm’s resources and capabilities, and through imitation by rivals. Hence the postponement of such an occurrence is of outmost importance. (Grant, 1991)

This report will focus on assessing and analysing Sandvik’s resources and capabilities in order to determine and identify possible sustainable competitive advantages. Five different resources and five different capabilities, important within the oil skimming business, have been chosen as a basis for analysis. These can be seen in table 7 below.
Table 7: Chosen resources and capabilities

<table>
<thead>
<tr>
<th>Resources</th>
<th>Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1. Technology</td>
<td>C1. Product Development</td>
</tr>
<tr>
<td>R2. Plant &amp; Equipment</td>
<td>C2. Purchasing</td>
</tr>
<tr>
<td>R3. Location</td>
<td>C3. Marketing &amp; Sales</td>
</tr>
<tr>
<td>R5. Finance</td>
<td>C5. Product Portfolio Management</td>
</tr>
</tbody>
</table>

Resources

- **R1. Technology**: The resource Technology relates to the technology level of current products, its quality, its use, as well as its applications.

- **R2. Plant & Equipment**: Focuses on the quality of dedicated production facilities and capacity to scale up production to satisfy mass-market demand.

- **R3. Location**: Physical locations covering a large part of the geographical market with sales staff/offices.

- **R4. Brands**: Assesses the possibilities of leveraging brand equity and determining level of brand awareness.

- **R5. Finance**: Evaluation of the firm’s financial resources and willingness as well as capacity to invest.

Capabilities

- **C1. Product Development**: Focuses on determining the firm’s ability to develop current product offering and gauge the level of innovation of the products.

- **C2. Purchasing**: Level of sourcing and bargaining power that can be exercised on suppliers

- **C3. Marketing & Sales**: Degree of educated sales staff and marketing actions. Assessing the level of priority within the firm.

- **C4. Market Understanding**: Market knowledge relating to industry trends, competition, profitable geographical markets and potential applications.

- **C5. Product Portfolio Management**: Determining whether the product constitutes a part of a larger product offering enabling upselling opportunities or if it is considered a stand-alone product within the firm.

These parameters, ranked in no particular order, are then attributed two values, each ranging from 1-10; 1 being low, depending on Sandvik’s ability to compete with contemporary firms, based on its superiority/inferiority of resources and capabilities. The first attributed value
assesses the importance of the resource/capability within the skimming business whereas the second value, the relative strength, corresponds to Sandvik’s relative advantage compared to competitors.

### 3.8.3.2. Market-Based View

**Generic Competitive Strategies**

Section 3.8.2.1. Porter's Five Forces, described competitive strategy as taking offensive or defensive actions to create a defendable position in an industry aiming to successfully cope with the five competitive forces and thereby yield a superior return on investment for the firm. (Porter, 1980)

Whether a company chooses to adopt a defensive or aggressive posture within its industry, Porter identifies three generic strategies that may be used to reposition the firm with respect to its competitors: (1) Overall Cost Leadership, (2) Differentiation, and (3) Focus. (Porter, 1997)

These strategies allow for the company to outperform its competitors within the industry, but do not however in themselves guarantee profitability in an inherently unprofitable environment (Porter, 1997). In figure 28, the difference between the three generic strategies is illustrated.

![Figure 28: Porter's three generic strategies, (Porter, 1980)](image)

**Overall Cost Leadership**

Overall Cost leadership is the most commonly adopted strategy and involves the pursuit of economy and efficiency in all business operations aiming to provide a product or service to the buyer at the lowest possible price. Although this strategy does not exclude an attention to quality and detail, these are not the main considerations. (Porter, 1997) (Porter, 1980)
A typical cost leadership strategy involves amassing market share in pursuit of efficiencies of scale, keeping tight control of overheads and maximising the cost benefits of industry experience and new technology. A company focusing on overall cost leadership will avoid unprofitable or marginal customer accounts and minimise running costs or investments in processes seen as ancillary such as research and development, sales force, advertising and customer service. Once in place, a cost leadership strategy should aim to be self-sustaining as increased market share leads to further economies of scale. (Porter, 1997) (Porter, 1980)

**Differentiation**
The differentiation strategy implicates developing one significant aspect of a product in order to set it apart from its competitors. One or more product functions, such as brand image, technology and features, or customer service and dealer network, is developed to a high quality level. The resultant added value perceived by the customer consequently offsets the negative impact of a higher price. (Porter, 1997) (Porter, 1980)

**Focus**
The focus strategy may be viewed as a variation of the differentiation approach, in involving targeting the product specifically towards the needs of a highly defined market segment. A company using this strategy aims to provide an exhaustive service to a niche market, i.e. a precisely identified buyer group, product line or geographic market. Ideally, the product will achieve both a differentiated and low cost position with respect to its chosen market segment. (Porter, 1997) (Porter, 1980)

In table 8, the main advantages and drawbacks of each respective generic strategy is clarified.
<table>
<thead>
<tr>
<th>OVERALL COST LEADERSHIP</th>
<th>DIFFERENTIATION</th>
<th>FOCUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The company is defended against cost cutting by less efficient competitors</td>
<td>Strategy defends against buyer price-sensitivity through brand loyalty and perceived added value</td>
<td>Targeting of a specific segment should avoid threats of competition, substitution and new entrants</td>
</tr>
<tr>
<td>Company is best placed within industry to defend against substitution or new entrants</td>
<td>Increased profit margins should deflect the impact of cost leadership by the opposition</td>
<td>Strategy feeds brand loyalty and raises switching costs</td>
</tr>
<tr>
<td>Strategy allows for sufficient price flexibility to minimise impact of supplier demands</td>
<td>Higher margins will absorb pressure from suppliers</td>
<td>The company is able to focus exclusively on profitable market segments</td>
</tr>
<tr>
<td>Price sensitivity from buyer works in favour of the firm in terms of market share</td>
<td></td>
<td>Market share should largely increase as company is able to monopolise selected distribution channels</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawbacks</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy may require initial competitive advantage</td>
<td>Strategy may result in perceived exclusivity and limit market share</td>
<td>Similar cost and investment considerations to differentiation strategy</td>
</tr>
<tr>
<td>Existing product line may require redesign</td>
<td>Strategy involves high start-up and running costs</td>
<td>Target market may not follow same growth pattern as overall industry market</td>
</tr>
<tr>
<td>Price differential must be maintained through continual streamlining and reinvestment in processes</td>
<td>Strategy likely to involve cost trade-off that may lead to defection of existing customers</td>
<td>Cost disadvantages where non-focused products begin to meet the demands of focused market segments</td>
</tr>
<tr>
<td>Other players within industry may reduce their own costs through imitation</td>
<td>Risk of imitation and a fall in demand if need for differentiated products decline</td>
<td>Market fragmentation may lead to competitors outflanking the firm by identifying even more tightly defined market segments</td>
</tr>
</tbody>
</table>

Table 8: Advantages and drawbacks with Porter's three generic strategies, (Porter, 1997)

Lack of Strategy
A firm that fails to develop a strategy in at least one of the three directions is considered to be “stuck in the middle” and is almost guaranteed low profitability. The low profitability either stems from losing the high-volume customers who demand low prices, or by bidding away profits in order to keep the customers away from low-cost competitors. By failing to differentiate, the company may lose high-margin business thus also resulting in poor profitability. (Porter, 1980)

A firm stuck in the middle must make fundamental strategic decisions to overcome this situation. The company can choose to take the steps necessary to achieve cost leadership, or achieve certain level of uniqueness (differentiation), or it must orient itself towards a particular target (focus). However, if opting for the cost leadership strategy, a compromise can be to at least
achieve cost parity, which usually involves aggressive investments to modernize and/or the possibility to buy market share. (Porter, 1980)

3.8.3.3. Parenting-Fit Matrix

The parenting-fit matrix is used to assess the inclusion of different businesses in a multi-business portfolio. Under a parent organisation, multi-business companies bring together businesses that could potentially be independent. Such parent companies can justify themselves economically only if their influence creates value by influencing, or parenting, the various businesses they own. The successful parent companies create more value than any of their rivals would if they owned the same businesses. Hence, those companies have what is termed a parenting advantage. Simply put, a parenting advantage occurs when the skills and resources of the parent company fit well with the needs and opportunities of its businesses. (Campbell, Goold, & Alexander, 1995)

The parenting-fit matrix attempts to determine what business a multi-business company should own and why. This framework hence focuses on the competencies of the parent organisation and on the value created from the relationship between the parent and its businesses. Nevertheless, the fit between a parent company and its businesses is a two-edged sword; a good fit can create value whereas a bad one can destroy value. Assessing and determining the fit between the business and the parent company can however often prove to be a difficult task. Nonetheless, the use of a structured analytical approach can help overcome the hurdles and consists of the following four steps: (1) Critical Success Factors: Understanding the Business, (2) Parenting Opportunities: Gauging the Upside, (3) Characteristics of the Parent: Assessing Fit, and (4) Impact of Results: Validating the Judgments. (Ibid.) (Campbell, Goold, & Alexander, 1995) These are explained below:

1. Critical Success Factors: Understanding the Businesses

   Critical-success-factor analysis is important for assessing fit and judging whether friction is likely to develop between the business and the parent organisation. A parent that does not understand the critical success factors in a business is likely to destroy value. (Campbell, Goold, & Alexander, 1995)

2. Parenting Opportunities: Gauging the Upside

   In order to add value, a parent company must improve its businesses. Parenting opportunities are hence business areas with unexploited improvement potential. The purpose of this analysis is thus to identify those opportunities and estimate their significance. (Campbell, Goold, & Alexander, 1995)

3. Characteristics of the Parent: Assessing Fit

   Determine how closely the parent organisation fits with businesses in the portfolio. This involves documenting the characteristics of the parent organisation and then comparing them with the critical success factors and parent opportunities in each business. (Campbell, Goold, & Alexander, 1995)
4. Impact of Results: Validating the Judgments

Conducting performance analyses can validate managers’ judgment about fit by reviewing the performance of each business compared with its competitors. Another way is to categorise and classify important past decisions as success/failure/neutral and then analyse eventual patterns. (Campbell, Goold, & Alexander, 1995)

These different analyses then form the basis for assessing and determining the fit between the business and its parent company which is plotted in a parenting-fit matrix, see figure 29. The horizontal axis of the matrix records how well the parent’s characteristics fit the business’s parenting opportunities and the vertical axis represents the extent of any misfit between the parent’s characteristics and the business’s critical success factors. It is important to note that each position on the matrix has implications for the company’s corporate strategy. (Campbell, Goold, & Alexander, 1995)

![Parenting-Fit Matrix](image)

**Figure 29: Parenting-Fit Matrix, (Campbell, Goold, & Alexander, 1995), (modified by authors)**

1. **Heartland Businesses:** Heartland businesses have critical success factors that the parent understands well and furthermore have improvement opportunities that the parent knows how to address. These businesses should have priority in the company’s portfolio development and be at the heart of the corporation’s future. (Campbell, Goold, & Alexander, 1995)
2. **Edge-of-Heartland Businesses**: Businesses that fall into this category have some characteristics that fit with the parent, some that do not. The net contributions are not clear-cut and the parent can both create and destroy value. The aim is to transform these businesses into heartland businesses and thus consume much of the parent’s attention. (Campbell, Goold, & Alexander, 1995)

3. **Ballast Businesses**: Most portfolios contain a number of ballast businesses, in which the potential for value creation is low, but the business fits comfortably with the parenting approach. Ballast businesses can be important sources of stability, providing steady cash flow and reliable earnings. However, ballast businesses can also represent a nuisance to the company, slowing growth in value creation and distracting managers from more profitable undertakings. (Campbell, Goold, & Alexander, 1995)

4. **Alien-Territory Businesses**: Alien-territory businesses have little opportunities to be improved by the corporate parent and a misfit exists between the parenting characteristics and the critical success factors. These businesses are often remnants of past experiments with diversifications, pet projects of senior managers, or attempts to find new growth opportunities. Companies must seek to divest these businesses as soon as possible. (Campbell, Goold, & Alexander, 1995)

5. **Value-Trap Businesses**: Value-trap businesses have a fit in parenting opportunities but a misfit in critical success factors and hence the potential for upside gain often blinds managers of the downside risks. These types of businesses often represent the biggest parent managers’ mistakes. (Campbell, Goold, & Alexander, 1995)

3.8.3.4. **Product/Market Positioning**

Within a market, companies can position themselves and their products within different categories. Igor Ansoff (1962) formulated the product/market matrix in which companies can position themselves and their products in order to target one of four positions; (1) Product development, (2) Diversification, (3) Market penetration and (4) Market development. It is important to note that companies aiming at one of these positions may have certain products within other positions as well. (Uggla, 2006) A brief presentation to each position will be given below.

1. **Product development**: Within the product development position, one offers new products to an already existing market. (Uggla, 2006) An example of such a positioning is Apple’s iPhone, which revolutionised the mobile phone industry.

2. **Diversification**: Diversification is a new type of product targeting a new market segment. (Uggla, 2006) Such companies could be innovative pharmaceutical companies targeting orphan diseases or products such as Google Glass.

3. **Market penetration**: Market penetration may be the least dramatic position to target. Here, companies try to penetrate deeper into an already existing market segment with
similar products to those already existing. For companies focusing on market penetration a low-cost strategy is often adopted. (Ugglia, 2006) An example of a market penetration strategy is McDonald’s. By continuously opening new restaurants, they seek to penetrate deeper into the fast food market and reach even more customers.

4. **Market development**: Market development means using an existing product to find a new market segment to target. An example of a market development was when Gilette, commonly connected to the market penetration position, began selling their razors to women. Without altering the technology an entire new market segment opened up. (Ugglia, 2006)

Figure 30 shows the product/market matrix.

![Figure 30: Ansoff's product/market matrix, (Ugglia, 2006)](image)

It is possible for a company to be at one position in this strategy matrix but strive towards another. A position within the diversification segment may allow for better gross margins, but may also put a lot demand on the company to continuously innovate. (Ugglia, 2006) Although some positions are more favourable in certain markets, it is impossible to say that there is one “best” position for every business. Instead, it is highly dependent on market characteristics.

### 3.8.4. Internal Operations

#### 3.8.4.1. Six Operation Performance Objectives

Although high-level strategic management is important for a global company to show sustainable competitive advantage it is not the optimal way of corporate governance at a local level. For local managers, a new set of objectives must be set in order for day-to-day operations to flow seamlessly and create the most possible customer value. Slack, Chambers, & Johnston (2010) examine five performance measures applicable to any type of operation: (1) Quality, (2) Speed, (3) Dependability, (4) Flexibility and (5) Cost. It is important to understand that an operation cannot master all of these objectives, but instead one must decide what creates the most
customer value e.g. if the market price-elasticity is high and clients demand high quality - then quality must be emphasised over the other objectives (Slack, Chambers, & Johnston, 2010). Wheelwright & Bowen (1996) also use performance measures in their discussion about operations management and competitiveness. Here, one additional performance objective is discussed; innovation (Wheelwright & Bowen, 1996). Below, these six performance measures are discussed in further detail:

1. **Quality**: The quality objective can easily be described as “doing things right”. Quality is the most visible of the performance objectives as it is easy for the customer to judge. Therefore, quality is very important to achieve high customer satisfaction. However, quality also provides for internal benefits such as reduced costs and increased dependability as no time must be wasted correcting previous errors in the operations. (Slack, Chambers, & Johnston, 2010)

2. **Speed**: Speed indicates the time it takes for an order to be delivered once the order has been received. Speed is important as it raises the likelihood of a customer purchasing a product or service as well as increasing their price tolerance. Inside the operation, speed can reduce the cost of inventories by lowering the throughput time as well as reduce uncertainty. (Slack, Chambers, & Johnston, 2010)

3. **Dependability**: Dependability indicates a company’s capacity to deliver a product or service on time. This is important as a high dependability can secure repeat business and poor dependability can override other criteria such as quality and cost. Dependability is a factor judged by customers over time and it is therefore necessary to focus on dependability improvement for a longer time before any effect can be seen. The company must gain the trust of the customer before the dependability can provide repeat business. Internally, dependability can reduce costs and save time as weak links in a production chain causing entire operations to come to a halt can be identified and removed. (Slack, Chambers, & Johnston, 2010)

4. **Flexibility**: The flexibility objective is very broad as flexibility is defined as allowance for some type of change in the operation. It could either be what is done, how it is done, or when it is being done as all require flexibility within the organisation. A high internal flexibility allows for a broader service offering to customers, such as mass customization. Such services put a lot of stress on the organisation, but if mastered it offers an opportunity to raise prices and extract a premium. Flexibility can also improve dependability and decrease throughput time as resources can be focused more easily. (Slack, Chambers, & Johnston, 2010)

5. **Cost**: The cost objective is obviously prioritized by companies aiming at a low-cost strategy. By lowering production costs, the company can offer lower prices to their customers and thus receive a competitive advantage. Even companies not using a low-cost strategy are interested in keeping costs low. One of the best and most widely used performance indexes to measure cost control is productivity. Productivity is defined as
the ratio of what is produced to what is required to produce it. (Slack, Chambers, & Johnston, 2010)

6. **Innovation:** Innovation is an externally supportive objective which becomes increasingly important as a company aligns itself to its long-term strategy within the other performance objectives. Innovation can be the slight differentiation which provides competitiveness, but it cannot carry the company on its own and can therefore not be categorised as a core competence. Therefore, a company must adhere to its priorities and focus on its core performance objective, which cannot be innovation. (Wheelwright & Bowen, 1996)

When a company has aligned these performance objectives, a map can be drawn which shows the strategic direction of a company. Figure 31 illustrates the strategic direction of a company focused on great speed and high productivity.

![Figure 31: Example of the strategic direction of a company](image)

### 3.8.4.2. **Operation Characteristics – Four V’s**

All operations have one similar characteristic; they transform inputs. However, depending on the industry and a company’s role within an industry, the operations can differ on four key levels, commonly called the four V’s – (1) Volume, (2) Variety, (3) Variation and (4) Visibility. Each of these levels can profoundly impact the cost effectiveness of a process as well as customer satisfaction. (Slack, Chambers, & Johnston, 2010) They are described in closer detail below and a potential configuration is shown in figure 32.

1. **Volume:** The volume of processed goods directly affects the repeatability and systematisation of the work process. A company with a high volume can achieve a lower unit cost than an operation with low volume through standardisation and specialisation. This can easily be exemplified by comparing the processes at a McDonald’s restaurant.
with the operation at a small cafeteria. At McDonald’s each employee has a specialised task while the employees (possibly employee) at a small cafeteria must be able to perform a variety of tasks thus lowering repeatability. (Slack, Chambers, & Johnston, 2010).

2. Variety: The variety of an operation indicates its ability to process products and customising them to the customer’s demands. In order to be able to accept a high variety of orders, a company needs to have a high flexibility which could be costly. However, tailoring the orders for the customer’s demand can enable a company to charge a higher price. (Slack, Chambers, & Johnston, 2010) An example of a company with a high variety is a taxi company. The customers may want to travel to any address and the driver must be able to comply. The opposite, a low variety transport service, is a bus route where the driver only drives a pre-set route.

3. Variation: Variation is a measurement of demand fluctuations. For operations with low variation in demand, standards and routines can be established and thereby a cost advantage can be obtained. (Slack, Chambers, & Johnston, 2010) An example of an operation with high variation is holiday resorts which experiences an increased amount of visitors during peak season.

4. Visibility: Visibility indicates how much of an operation can be physically seen by customers. This impacts the necessity for good customer contacts as poor contacts may have a strong negative impact on the customer. Online-shops do not suffer from any visibility as the customer can only see the webpage while a retail shop on the other hand have a great deal of customer contact. Depending on the level of the service, a company can either build customer relationships and possibly increase the chance of repeat business, or suffer in brand equity and risk losing repeat business. To ensure a positive customer contact a company must make the necessary investments to retain an adequately trained, positive, and numerous staff. (Slack, Chambers, & Johnston, 2010)
Generally speaking, low volume, high variety, high variation and high visibility all carry cost penalty for an operation. However, depending on the market in which a company operates, some cost penalties might be necessary in order to please the customers. (Slack, Chambers, & Johnston, 2010)
4. Analysis
The analysis part of the thesis will be based on the usage of the models described in the theoretical framework in the literature review.

The analysis is divided up into two parts: (1) an External Analysis, and (2) an Internal Analysis. In the external analysis, focus will revolve around the market, its driving factors, opportunities, characteristics and size. Three different geographical markets, broken down into regional markets by market-specific characteristics, will be analysed: (1) Europe, (2) North America, and (3) Emerging Markets. Each regional market will subsequently be subject to a Porter’s Five Forces-analysis and a PESTLE-analysis to assess and determine the business potential in each respective market for oil skimming equipment and to gauge the competition within each regional market. Complementing the external analysis, an internal analysis will be carried out to evaluate the corporate-specific potential more in-depth. This internal analysis will consist of Ansoff’s product/market matrix, an RBV and MBV analysis, a parenting-fit analysis as well as an operations assessment analysing the six performance objectives and the four V’s. An illustrative model of the analysis can be seen in figure 33 in order to reach a better understanding of the analysis procedure and how the analysis will form the basis for the results.

The results of the analysis will then constitute a SWOT-matrix in which the external and internal analyses will merge into one coherent snapshot of the company’s oil skimming business. Based on the SWOT-matrix, five different business cases will be built in order to assess the different potential alternatives and strategic directions the company is facing.
Figure 33: Illustrative analysis model

**ANALYSIS**

- **EXTERNAL**
  - PESTLE
  - PORTER'S FIVE FORCES
    - EUROPE
    - NORTH AMERICA
    - EMERGING MARKETS

- **INTERNAL**
  - STRATEGY
    - PRODUCT/MARKET MATRIX
    - RBV & MBV
    - PARENTING-FIT MATRIX
  - OPERATIONS
    - SIX PERFORMANCE OBJECTIVES
    - FOUR VS

**RESULT**

- **SWOT**
  - STRENGTHS
  - WEAKNESSES
  - OPPORTUNITIES
  - THREATS

Legend:
- Analytical Tools
- External Analysis
- Internal Analysis
4.1. External Analysis

4.1.1. Europe

4.1.1.1. **PESTLE-Analysis**

**Political:** The political regulatory power is strong and has the capacity to profoundly affect the oil skimming market. However, for suppliers of oil skimming equipment there is primarily an upside in the political regulations, as they tend to opt for stricter environmental regulations. In turn, such regulations could increase the demand for skimming products. The regulatory power is exercised both in the national congresses as well as in the European Parliament, which increases the pressure exercised on the market by the politicians.

Within the industrial skimming sector governmental regulations have had some impact in the past few years. According to Westlund (2013), companies such as Ragn-Sells (separates oil-water mixtures collected from damage control companies, petrol stations etcetera) have observed increased demands on water purity from water treatment plants in order to avoid fees. In other industries it is primarily the cost savings associated with recycling which acts as incentive.

Within the offshore application the political involvement has been significant in the later years. In 2002 the European Maritime Safety Agency (EMSA) was formed in order to develop and implement European legislation regarding maritime safety, pollution by ships and maritime security. However, EMSA was also given operational tasks such as oil pollution response. In 2013, the agency’s budget was EUR 58.8 million. EMSA is just one example of the political activity affecting the oil skimming market.

**Economic:** As Sandvik’s economic goals are set on a global basis this aspect will be covered at the end of the external analysis.

**Social:** There is a clear trend in increasing environmental awareness amongst citizens and companies in Europe. Also, water pollution is listed as the primary concern amongst citizens in Europe’s largest countries, followed by man-made disasters such as oil spills, according to a survey conducted by Eurobarometer on behalf of the European Commission (Eurobarometer, 2005). The results of the survey, in which people listed the top five environmental issues, are shown in figure 34.
Based on this survey, it is clear that there is a demographic trend towards environmental conservation, which can create business opportunities for manufacturers of oil skimming equipment.

**Technological:** In general, oil-skimming equipment is technically simple. Most manufacturers focus on high durability, reliability, and developing skimmers with broader applications rather than improving the technical foundation. However, this does not mean that there is no innovation within the oil skimming market. Companies from the European region such as Lamour, and SurfCleaner have included 21st century technology, such as electronic control systems, and sensors, in all or some of their products. These products show improved collection rates with higher efficiency indicating that product development can play a part in sustaining a long-term competitiveness.

**Legal:** Not covered in this thesis.

**Environmental:** Environmental concerns such as geographic location do not impact the competitiveness of the manufacturers of oil skimming equipment, nor does the climate or weather in general. However, manufacturers of oil skimming equipment target a global market and therefore a local presence in targeted geographies is important to reached local customers. Lamor for example have sales representatives in Finland, United Kingdom, China, Oman and USA.

### 4.1.1.2. Porter's Five Forces

**Threat of new entrants:** The European oil skimming industry does not contain a large number of dominant players. Of the existing companies, only Lamor can be said to hold any kind of dominating position. Lamor, as one of the world leaders in skimmer systems, can achieve economies of scale unparalleled to any other European competitor. However, this does not
hinder other companies from entering the market. The pricing of oil skimming equipment is diverged and there is no evident trend towards equilibrium between prices and demand. Instead, entrants with innovative products could achieve the same margins as an existing player such as Lamor. An example of such an entrant is SurfCleaner who successfully priced the weir skimmer at almost three times the price of a medium sized skimming system from Lamor such as LMM30.

Companies entering the skimming industry may find a need for initial funding. As oil skimming is a fragmented industry with a large number of small companies, it could take time to build brand awareness and recognition, especially on a global level. While also building the brand equity, a new entrant must also develop a distribution and sales network to reach customers outside its geographical vicinity. This could be costly, but companies such as Oil Skimmers Inc. have developed a large network of partnering companies through which their products can be marketed.

**Bargaining power of suppliers:** The suppliers’ bargaining power is dependent on the technology employed by certain companies. Many companies market skimming solutions based on very simple mechanical devices that do not contain any advanced or scarce parts. Therefore, a large number of different suppliers could provide the necessary parts and the suppliers’ bargaining power is decreased. However, in some of the new and innovative skimmer systems, such as SurfCleaner, there could be specialised resources that are difficult to obtain. In such cases the bargaining power of the suppliers is obviously greater.

**Bargaining power of buyers:** The bargaining power of the buyers in the European market environment is high. The buyers of skimming equipment are often large organisations or companies such as national coast guards or large industries such as steel mills. Although these companies need skimming equipment, the switching cost between two different skimming technologies is low and the buyers are usually interested in purchasing large volumes. For the fragmented industry of skimming equipment providers, these customers’ contracts are important and therefore the buyers could potentially play the competitors against each other. However, due to the low degree of industry development and small average size of skimmer providers, the buyers are not able to take full advantage of this bargaining power. This is shown by the inconsistent pricing of skimming equipment.

**Threat of substitute product or service:** In industrial application the threat of substitute products is low. Industrial customers require the skimming equipment in order to process their wastewater and save money on oil and lubricant recycling. However, the switching cost between different skimming technologies is low and therefore it is important to keep a high responsiveness towards customer demands in order to ensure that the customer remains loyal. Furthermore, as political regulations increase the demands on wastewater cleanliness, skimming as a technology may eventually become completely obsolete, as skimmers are unable to reach the same low concentration of waste as a filter.

For offshore applications however, the threat of substitutes is greater as there are other methods for handling the oil. Chemical dispersants and in-situ burning are the primary alternatives to skimming. Skimming has some advantages compared to the other technologies, as it is possible
to recover the oil and possibly capitalise on this oil. However, skimming equipment is not able to treat as large quantities of oil as the other technologies. Technological advances in chemical treatment could possibly affect the skimming market if the chemically treated oil could be easily recovered and the oil extracted at a lower cost, or in greater volume than through skimming.

**Jockeying for market position among current competitors:** The rivalry amongst manufacturers of skimming equipment is low. There is no evidence of pricing slugfests resulting in lowered prices and reduced margins for equipment manufacturers. For many of the smaller competitors, attempting to pursue a pricing war is not in their best interest as they do not possess the economy of scale nor the funding to last long enough to reap the benefit.

### 4.1.2. North America

**4.1.2.1. PESTLE-Analysis**

**Political:** The Deepwater Horizon accident on April 20th 2010 caused a surge in political involvement in the oil and gas extraction industry. Following the accident, U.S. Secretary of Interior Ken Salazar called for a six months moratorium on deep-water drilling (U.S. Department of the Interior, 2010). In the U.S., the pollution of water is regulated by the Federal Water Pollution Control Act, or Clean Water Act, of 1972. In the law, dischargers of pollutant are under pressure to lower the pollution levels continuously over time. Thus political influence over the market can be considered high. However, just as in Europe, the political influence on the market is primarily acting in favour of the oil skimming equipment manufacturers.

**Economic:** As Sandvik’s economic goals are set on a global basis this aspect will be covered at the end of the external analysis.

**Social:** Accidents such as Deepwater Horizon did not only cause political involvement, but also an increased awareness amongst people and companies. In the aftermath of the accident a large number of companies involved in oil skimming entered the market, but after the initial surge of interest the number of new market entrants has declined rapidly. (Beyer, 2013).

“There was a rush into the market after Deepwater Horizon, but most companies only made it for six months to a year. They thought the skimming market would be an easy buck, but when it turned out that it was not they disappeared. Today, most of the companies from that time are gone.” (Beyer, 2013)

**Technological:** In the North American marketplace some companies sets themselves apart from the competition by combining the basic skimming technologies with modern parts such as sensors and digital control systems. Most competitors are, just as in Europe, mainly focused on improving durability and reliability but there is some activity within product development. Companies focus on adapting skimming units to different applications and environments in order to maximise the skimmer’s potential.

**Legal:** Not covered in this thesis.

**Environmental:** Environmental concerns such as geographic location do not impact the competitiveness of the manufacturers of oil skimming equipment in North America, nor does the
climate or weather in general. However, manufacturers of oil skimming equipment target a global market and therefore a local presence in targeted geographies is important to reached local customers. Companies such as Oil Skimmers Inc. have local sales representatives in very many markets through partnerships with other companies (Petrucci, 2013). However, although this creates a strong geographical coverage, the knowledge transfer barriers may impact the efficiency of the partners’ sales staff negatively.

4.1.2.2. Porter’s Five Forces

Threat of new entrants: The threat of new entrants is higher in the North American market than in any other market. The geographic location places new entrants close to large customers such as MSRC, which could lure new entrants into the business. Conversely, as in Europe there is one primary actor within the market, Elastec/American Marine, whose dominating position over the market may deter new entrants. However, the pricing divergence within oil skimming equipment is a global phenomenon and therefore Elastec/American Marine may be unable to force competitors out of the industry. Nonetheless, Elastec/American Marine’s dominating position indicates a connection between Elastec/American Marine and MSRC, which may hinder new entrants’ ability to sell products to MSRC.

The effect of new entrants in the industry has been shown recently when new entrants flooded the market in the wake of the Deepwater Horizon accident. However, shortly later many companies had disappeared indicating that although it is easy to enter the market, it is also difficult to sustain a market position. This surge of interest in oil skimming and collapse thereof may indicate that there is a larger need for capital funding than it initially appears, which would explain why many companies dropped out of the business quickly.

Bargaining power of suppliers: As a large portion of the market’s skimming equipment is sold by a few companies, these companies are able to put quite a lot of pressure on their suppliers. As many parts in an oil skimmer are technically simple it is difficult to imagine suppliers being able to increase prices or lower quality without jeopardising their own business.

Bargaining power of buyers: The bargaining power of the buyers is high as the buyers of skimming equipment are usually large corporations such as MSRC. MSRC in some ways are dependent on the equipment providers as they need the proper skimming equipment, but due to the large number of companies offering material, the bargaining power falls to MSRC. However, large producers of skimming equipment such as Elastec/American Marine may not suffer from this bargaining power as they, as opposed to many other companies, can offer a complete solution package which is seamlessly integrated, thus providing greater value to a customer such as MSRC.

Threat of substitute product or service: In industrial applications, the skimmer still holds a strong position as a required part of a wastewater management. However, new regulations may increase the demands on wastewater purity, which in turn may affect the skimmer’s business potential, as companies turn to filters instead in order to reach the desired level of purity. Skimmers may still play a part in these systems, but it could be significantly reduced.
In offshore applications the main threat of substitutes comes from chemical dispersants, other chemical components, and incinerator products. In offshore applications skimmers are often unable to recover enough oil to compete with other products, especially if the oil has weathered and spread into a thin slick.

**Jockeying for market position among current competitors:** The jockeying amongst rivals seems to be quite low, as no evident price cuts can be observed. However, as MSRC is such a large customer there is bound to be some rivalry when it comes to securing the contracts with MSRC. MSRC on the other hand most likely encourages the rivalry as it increases their bargaining power and may also lead to lower prices and/or higher quality.

4.1.3. Emerging Markets

4.1.3.1. **PESTLE-Analysis**

**Political:** As the emerging markets are scattered it is difficult to give a holistic view of the regulatory power of all emerging markets. However, the most interesting governing body is the Arctic Council as the Arctic Council has regulatory over the Arctic region in accordance with the Ottawa Declaration (Arctic Council, 2011). The Arctic area is expected to contain 25% of the world's uncharted oil reserves and is therefore of major importance to large oil companies. However, in order for the Council to make a decision all eight member countries must agree unanimously. The Council is currently working to establish oil spill response guidelines for the Arctic area (Lindahl, 2013). Due to the difficulty of retrieving oil from icy waters, the sensitivity of the Arctic environment, and the unknown effects of oil spills in such an environment the guidelines set by the Council will decide the future potential for oil skimming equipment manufacturers, as the Arctic region is expected to fuel the growth within the market (Beyer, 2013).

Other governing bodies with potential to affect the oil skimming market are governments in emerging economies. These economies are often driven by process industry or natural resources and could potentially require a large amount of skimming equipment if strong regulations were in place. However, the regulations are moving in a positive direction for oil skimming equipment manufacturers. Recently, strengthened regulations in Africa have led to an increase in sales for harbour-adapted skimmers (Lee, 2013). As in other geographies, newly adopted regulations favour skimming equipment manufacturers as allowed levels of pollution is continuously lowered.

**Economic:** As Sandvik’s economic goals are set on a global basis this aspect will be covered at the end of the external analysis.

**Social:** A lot of companies and NGOs are interested in the Arctic region due to its natural resources. However, while large oil companies are looking to harvest these resources, NGOs such as Greenpeace are working to preserve the Arctic environment and ban oil extraction in the area (Lindahl, 2013) (Greenpeace International, 2013). Greenpeace is working to increase global awareness regarding the potential dangers of oil spills in the Arctic environment and was present for the Arctic Council’s summit in Kiruna in May 2013 to attempt to influence the summit’s outcome (Greenpeace International, 2013).
**Technological:** The demand for high-tech skimming equipment is different throughout the emerging markets. In developing economies the demands are generally lower than in more developed economies due to weaker political regulations. However, in the Arctic region the demands are a lot higher than in any other geography. A skimmer operating in the Arctic region must be able to cope with large amounts of ice without diminished performance. Currently, the Association of Oil and Gas Producers are conducting a four-year research project in order to develop new methods for collecting oil in Arctic conditions (Lindahl, 2013).

**Legal:** Not covered in this thesis.

**Environmental:** The emerging economies do not have any global company working solely with oil skimming. Instead, the market is fragmented with local companies competing in their own market with the global actors. For these companies, their geographic location is very important as the business in many cases might be founded on personal relationships. Also, no evidence has been found of environmental issues affecting competitiveness.

**4.1.3.2. Porter’s Five Forces**

**Threat of new entrants:** The threat of new entrants is high within the emerging markets as entrepreneurial companies may be lured by possible business opportunities. However, these opportunities are very different in the potential Arctic market and the other emerging economies.

The Arctic market solely consists of complicated offshore applications, and therefore the need for basic skimmers is non-existent. In order to satisfy the Arctic environment, entrants must satisfy the need for technically advanced skimming equipment able to retrieve large amounts of oil in icy waters. Nevertheless, seeing as many of the established companies themselves lack the optimal equipment for this application, a technical innovation could provide a new entrant with a first mover advantage which could be developed into a strong market position. However, the development of such technology can prove to be costly both in monetary value and time. For a new actor with the right technology, aspects such as distribution network or location play a much smaller role than for the common skimming applications. The reason for this is that the large oil companies are continuously looking for the right technology and are prepared to buy it from anywhere. (Beyer, 2013)

Apart from the Arctic, the other emerging markets are also a source of interest for entrepreneurial skimming companies. These markets often contain a lot of processing industry, and commodities and therefore need skimming units. Furthermore, as environmental regulations are moving in the direction of the Western economies a need for skimming equipment arises in currently unavailable locations. Already companies are seeing an increased demand from African markets and this is not expected to decline (Lee, 2013). For new entrants, these new markets offer possibilities, as the customers may not demand technically advanced equipment but rather a cheap and reliable solution (Lee, 2013). However, for such equipment, the large actors in the market are more likely to achieve scale economy advantages.
Bargaining power of suppliers: The bargaining power of most suppliers is low. However, it depends on what is supplied. Companies supplying the basic parts to the skimmer must struggle for orders while a supplier of important parts of an ice-adapted skimmer may be able to exercise a great pressure on their customers.

Bargaining power of buyers: The bargaining power of the buyers is in many ways inverted to that of the suppliers. If a company offers equipment suitable for Arctic applications the buyers’ bargaining power is extremely low. Instead, if looking for a basic skimmer to process a steel mill’s wastewater the buyer has a lot of bargaining power as there are many suppliers to choose from.

Threat of substitute product or service: The threats in emerging economies are similar to those in other geographies but weaker. The skimmer is less likely to be replaced by filters in a near future as environmental regulations are not as progressed in emerging economies. Skimmers can maintain an acceptable level of water purity while also being cost efficient. For offshore applications the same risk of chemical dispersants apply to emerging markets and for Arctic applications there is currently a large risk of substitutes as product development moves forward.

Jockeying for market position among current competitors: The jockeying for market position is greater in the emerging markets compared to the others. This can be explained by the number of companies offering their products within the emerging markets as well as their wish to secure a strong position within the market. The emerging markets have future potential, both in industrial applications, offshore applications, and Arctic applications and therefore skimming companies seek to establish their brand.

4.1.4. Global Economic Objectives

In order to consider increased sales efforts within the skimming market, Sandvik has set a revenue target of EUR 2.33 million (SEK 20 million) (Karlsson, 2013). In order to achieve this, Sandvik must sell 466 skimming units globally at an average price of EUR 5,000. Although 466 units do not sound like a high figure, it must be put into perspective. According to figures from (SurfCleaner, 2012), the market potential for skimming units in Sweden over the next three years is EUR 500,000 per year. However, as this figure is used in the business plan presented to potential investors it is possible to question the objectivity of this figure.

An alternative way of calculating the required market share needed to reach the revenue goal is by looking at the combined revenues of the companies described in section 3.6. These companies have been selected due to their large market position and therefore represent a majority of the total market size. However, there are a few more figures that are important to the calculation, such as the skimmer’s percentage of total sales and the percentage of skimmer sales intended for industrial application. The industrial application variable is added as Sandvik’s current product offering offers little hope of entering the offshore market. The required market share could then be calculated as shown in equation 2.
Equation 2: Calculation of required market share

\[
\text{Required market share (\%)} = \frac{\sum \text{Other comp. revenues} \times \text{Skimmer's share of sales(\%)} \times \text{Industrial skimmers (\%)}}{\text{Sandvik's revenue goal}}
\]

Together, these companies have revenues of roughly EUR 78 million. However, these companies also offer a variety of other skimming equipment such as booms and vessels. According to Lee (2013), a majority of the revenues stem from boom sales. From this, the total skimmer's share of sales is estimated to 25% and of these half are estimated to be for industrial applications. This results in the following equation:

\[
\frac{2.33}{78 \times 25\% \times 50\%} = \frac{2.33}{9.75} = 23.9\% = \text{Required market share (\%)}
\]

Equation 3: Required market share

Although this calculation is based on estimates, it indicates that Sandvik requires almost a quarter of the industrial skimming market in order to reach their revenue goal.

Furthermore, it is interesting to analyse how this market value translates to skimming units. Using an average price on skimming units of EUR 25,000, the market value of EUR 9.75 million equals 390 skimmers sold. As Sandvik, in order to reach their goal, are looking to sell 466 skimmers, the outlook to reach this goal is bleak at best, not to say impossible. Even if the offshore market is included the total number of skimmers sold reaches 780 units. In this case, Sandvik has to sell 60% of the total number of skimmers in order to reach their target.
4.2. Internal Strategy

4.2.1. Resource-Based View

4.2.1.1. Resources

R1. Technology

| Importance: 10 | Relative Strength: 3 |

This resource is a very important one as it determines much of the firm’s success. Although skimmers can be perceived as a low-tech product, many companies both small and large are now focusing on increasing the technology level of skimming systems. Integrated electronics, computer boards, and photovoltaic power systems are getting increasingly more popular on new skimming systems. Recent tendencies within the market indicate that innovative products with a higher level of technology are highly considered by customers. Automated skimmer activity is a popular feature where a skimming system automatically senses that there is an imminent need for skimming and starts up by itself. Self-adjustable weir skimmers are also an important feature. Research and development in skimming medium material has also lead to increased recovery rates.

Sandvik’s current skimmer is, as previously covered, a very simple system and in this sense far behind competing technologies. The skimmer is easy to use but has no higher technology built in. The most high-tech part of the Sandvik skimmer is the steel belt itself. The Sandvik skimmer is a low-cost alternative compared to competitors but on the other hand very durable with proven track record, hence the value 3 in relative strength.

R2. Plant & Equipment

| Importance: 7 | Relative Strength: 5 |

As plant and equipment focuses on the availability of dedicated production facilities and the possibility to scale up production to satisfy mass-market demand, this resource is important as it forms the basis for a profitable business. Several companies active within the oil skimming business are small, entrepreneurially led firms based upon an incremental innovation of skimming systems and are produced on a very small scale, sometimes even without proper facilities. The SurfCleaners are actually assembled in a garage and hence lack the advantages of standardized manufacturing processes and the benefits associated with it. Although the product is highly regarded, the access to production facilities would considerably lower the manufacturing costs and could thus enable a lower pricing of the products, possibly leading to increased sales.

Sandvik as a large manufacturing group has in theory all the resources needed associated with plant and equipment, including the know-how. However, as the skimming business today is a marginal business within Sandvik Process Systems, skimmer production is not prioritised and is assembled by hand in a small workshop/exhibition studio. Furthermore, there are questions surrounding the availability of production facility. In the case where other production would need to be shut down, an analysis of the alternative costs must be performed. However, this has not been the focus of this study.

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* Importance and relative strength for all resources and capabilities are evaluated by authors based on interviews and acquired market knowledge. In a more developed market, the value assessment could be improved by using focus groups of market experts.
R3. Location

Importance: 5  Relative Strength: 10

Location is not deemed to be a decisive part of the oil skimming business. Although local presence and sales offices around the world is an advantage in many cases, it is not a critical part for this type of business. However, as the oil skimming market is very fragmented, a local regional player may get a large portion of that specific geographic market. Some companies, such as world leading Lamor, have dedicated operational hubs in five countries and are furthermore represented by sales agents in 85 other countries, whereas even small companies without sales staff have seen some international success due to the superior product offering, e.g., SurfCleaner.

Sandvik as a corporate group has perhaps one of the best locational presences worldwide with its many sales offices and distribution networks. This could prove to be a huge advantage if the skimming business were to be scaled up, but is however not a guarantee for success, as the technology must be to par with competing technologies.

R4. Brands

Importance: 4  Relative Strength: 9

According to interviews with customers [Joslin, 2013], [Westlund, 2013], [Carlsson & Mattson, 2013], the brand does not represent a decisive factor when buying skimming equipment, as other aspects are considered more important such as recovery rate, usage, and skimming independency. Well renowned brand can possibly open up for business through RFQ’s, but first-time customers does not choose product based on brand. Small companies looking to replace their skimming system however, have a high propensity for recurring business.

The brand Sandvik is very strong and amongst the top in the world, however not within the oil skimming business. Although Sandvik has been manufacturing oil skimmers since the 1960’s very few people, even within the skimming business seem to know that Sandvik sells and markets oil skimmers. Nonetheless, Sandvik’s strong brand and high brand recognition could be leveraged to increase sales within the skimming market.

R5. Finance

Importance: 7  Relative Strength: 10

As previously covered, the skimming market is fragmented and characterised by several smaller players marketing various technologies. These smaller players often have limited access to financial resources potentially limiting their growth. The reason behind this is the relatively low profitability rate compared to sold skimming units, i.e., you have to sell a lot of skimmers to be able to make decent money. However this fact does not impede these companies to hold a strong position within the market. As with all manufacturing industries, finance or rather access to financial resources is paramount when scaling up production. Hence, it is important to note that the high level of importance appropriated to this resource is not an expression of the ability to be active within this business but rather a reflection of the importance of financial resources in order to become a large, dominant, international player.

Sandvik, being a large corporation certainly has the financial resources needed to invest and enter this market on a broader scale and become a dominant player. It is rather a question if the company desires to reach such a position. The market being small and rather unprofitable does
not encourage such an investment. An analysis of alternative investments and alternative costs would be necessary to perform before initiating such engagements.

4.2.1.2. Capabilities

C1. Product Development  Importance: 6  Relative Strength: 2
Although skimming is a relatively low-tech industry, product development still plays a part within this market. Various different techniques compete in finding the best, most efficient way of recovering oil from water. Many companies are based upon incremental innovations and their limited financial resources does not enable them to develop their product any further. Larger companies such as Lamor however, invest large sums in R&D, especially in arctic applications in order to become leading players in that particular market and reap the benefits of first-mover advantages. The latest product developments within oil skimming equipment, such as optic sensors and digital control systems have in fact increased the competitiveness of those products. However, as oil skimming in general is a basic, unprioritised operation, the market has not demanded a high level of product development. This leads to a situation where product development is important for certain types of skimming, e.g., skimming in arctic conditions, and skimming of very low viscosity oils. Wastewater skimming however, does not require this type of product development capabilities thus explaining the large amount of small companies offering low-tech skimming equipment.

Sandvik’s skimmer has not been subject to any product development for more than 40 years and although Sandvik possesses product development capabilities within the organisation, they have not been put to use in this particular field.

C2. Purchasing  Importance: 4  Relative Strength: 10
Purchasing capabilities always play a certain role within manufacturing business as the firm can lower costs and perhaps also prices, but does not seem to play a crucial, integral part of the skimming business. Other factors are considered more important and although margins could be accentuated by developing purchasing capabilities, no such tendencies have been identified.

Nonetheless, Sandvik’s business and type of organisation implies very capable purchasing capabilities and abilities to exercise bargaining power on suppliers hence the high mark in relative strength.

C3. Marketing & Sales  Importance: 6  Relative Strength: 5
Marketing and sales is often considered as the nuts and bolts of any business as it represents the capability to earn revenues. However, within the skimming business it is not considered a deal breaker if the organisation possess average or sometimes even below average marketing and sales capabilities. That being said, it is not without importance but rather not prioritised as in businesses selling generic products such as lemonade. The marketed technology plays a much more important role paired with strong market understanding capabilities.

Sandvik’s large organisation should offer all potential marketing and sales capabilities needed in order to successfully sell and market oil skimmers. Nevertheless, a majority of the sales staff does
not even know that Sandvik is actually manufacturing oil-skimming equipment, which poses challenges in selling oil skimmers. With their vast global sales network there is a potential for strong marketing and sales capabilities, but that requires training of staff and more coordinated sales efforts between subsidiaries and divisions under the Sandvik umbrella.

C4. Market Understanding
Importance: 10
Relative Strength: 1

If technology is the single most important resource, market understanding represents by far the single most important capability. In a fragmented market such as the oil skimming business, understanding the market the firm is operating in, is paramount in order to be a successful player. Market understanding is a broad term encompassing many things, but understanding the various existing types of technologies and their practical applications is mainly intended in this case. Furthermore, knowing your competition and your relative strengths and weaknesses compared to competitors is also a crucial factor. Market understanding also includes knowledge of customer needs and intended uses of the product in order to deliver a suitable product and ensure repeat business. Fragmented markets offer the customers myriads of possible solutions to their particular problems and can overwhelm the customer with choices. Hence, companies knowing their customers and understanding their needs, and even more important how to address those needs, have a competitive edge compared to other firms.

Although market understanding represents the most important capability enabling success, currently Sandvik does not possess this capability whatsoever and has really no idea of the market dynamics. However, this is a capability that can be quickly acquired through analysis and market evaluation. If acquired properly, this capability can quickly turn things around for Sandvik and enable them to strive in this market. The results and conclusions of this report could help Sandvik in the right direction.

C5. Product Portfolio Management
Importance: 5
Relative Strength: 4

The importance of high product portfolio management capabilities has proven to be very dependent on the type of intended application of the oil skimmer. For industrial applications the need of a strong product portfolio is not of great importance, as the customer only requires a skimming system or rather a skimming unit. For offshore applications on the other hand, a product portfolio comprising other related equipment has been revealed to be of great importance. Customers often start buying booms in order to contain the (potential) spill and do not focus on recovering the oil at an initial stage. Hence, the skimming unit is often sold as a complement to booms rather than the other way around. (Lee, 2013) Having a complete product offering thus tend to be of great benefit for both customers and suppliers.

As Sandvik only markets and sells skimming units, and does not offer a complete range of equipment this represents a weakness if the firm aims to be active in the offshore market. Nonetheless, Sandvik already provides other kind of equipment within the oil and gas industry and could potentially use these channels to increase skimmer sales.

These resources and capabilities can be plotted in a matrix as in figure 3.5 in order to better illustrate the strengths and weaknesses of the firm.
Analysing the matrix in figure 35, it can be concluded that Sandvik does not possess either resources or capabilities that can be considered irrelevant to the manufacturing and marketing of skimming equipment. The company even has some superfluous strengths in R4. Brands, and in C2. Purchasing that could be used to fuel the business. However, according to the analysis, the company currently possesses a lot of key weaknesses, especially in capabilities. C1. Product Development, C4. Market Understanding, and R1. Technology stands out as the weakest factors. Despite these factors having a great strategic importance, it is probably better to have precisely these resources and capabilities as weaknesses, as they can easily be acquired. Technology and market understanding can more easily be bought, licensed or copied compared to brand and purchasing, which usually takes a long time to build up and develop.
Overall, the large organisation offers some strengths, especially in terms of hard-to-acquire resources and capabilities such as brand, location and finance, but alarmingly, a majority of the analysed resources and capabilities are not developed to a satisfying level for the company to be successful within the oil skimming business at this point.

4.2.2. Market-Based View
Although Sandvik Process Systems in general would want to characterise their business as differentiated or perhaps focused, in the aspect that a particular, specific market is targeted, this is not the position currently held by their skimming system. No particular industry is targeted and there does not seem to be a clearly segmented, targeted market where the company has chosen to position its product offering. This implies that the company, in this particular case, can be considered as “stuck in the middle”. The lack of strategy has resulted in low-priced products compared to competition without being able to increase market-share and turning down high-margin business opportunities.

Taking all factors into account, the Sandvik skimmer business is currently pursuing an overall cost leadership strategy without benefitting from the advantages associated with the strategy. The market share is vanishingly small and does not seem to increase, if something rather the contrary. What is particularly intriguing is the fact that they market a premium belt in a low-cost application.

“Roughly 5 % of the cost of a belt consists of raw material, the rest comprises of value-adding activities in terms of refinement and processing of the belt” (Karlsson, 2013)

The pricing of the Sandvik skimmer is at least approximately 3-4 times lower than competition, which begs the question why not more Sandvik skimmers are sold? The answers that come to mind are either, the product is badly promoted, and/or the technology is far below par. According to interviews however [ (Joslin, 2013), (Carlsson & Mattson, 2013)], it can soon be concluded that the offshore applications of the Sandvik skimmer are practically non-existing. The desired position for Sandvik would therefore be to strategically target a particular segment such as the industrial market. Steel mills, utilities companies, and food-processing industries would hence be adequate markets to target. The existing technology does not offer any particular uniqueness, apart perhaps from the steel belt quality, but the company should nonetheless strive towards a more differentiated position in order to achieve a focus strategy, preferably geared towards the upper end of the scale. This would entail high-margin business, which would be of benefit to Sandvik. The skimming market being relatively small in terms of sold skimmers in absolute numbers, calls for the need of high-margin, high-priced products in order to remain profitable and make decent revenues. Furthermore, the advantages associated with a focus strategy also involve high level of repeat business, as brand loyalty tends to increase and lead to the possible monopolisation of selected distribution channels.

Notwithstanding, there is a risk that the low degree of interest for this type of products and the unprioritised nature of oil skimmers in most industries leads to the demand for these products not being strong enough to put serious requirements on the product. This puts differentiation strategies at risk, as the demand merely revolves around a kind of oil removal rather than on an
efficient way of doing so. Furthermore, the extremely fragmented nature of the market always carries the risk for competitors outperforming Sandvik through the identification of more tightly defined market segments. Especially since even incremental innovations, may quickly gain a leading position. An example of this is SurfCleaner, the company does not even possess production facilities and has only sold about 20-25 skimmers worldwide but are nonetheless to be considered as an important player on the skimming market.

4.2.3. Parenting-Fit Matrix

The skimmer business is for analysis purposes evaluated as an independent business operating under the Belts division at Sandvik Process Systems, which is as previously covered a product area within Sandvik Venture.

Sandvik is a very large corporation encompassing various types of high-technology businesses, so the question whether Sandvik should pursue an oil skimming business or not, does not offer a clear-cut decision. From a value perspective, the question that must be brought up to discussion is whether the financial resources used in the manufacturing of the products could not be put to better use in another setting, i.e., the alternative costs. Such an analysis has not been performed in this report as it lies outside the scope of the analysis but should definitely be considered in a future decision. Sandvik could definitely be successful within the oil skimming business should the company want it. By developing in-house or acquiring a new technology the firm really has all the prerequisites for success. The question is merely if the company wants to be in the skimming business or if it simply wants to make money. If the company chooses the latter path, then there are probably other more profitable businesses to pursue.

As the Sandvik skimmer is built upon a seamless steel belt constituting a conveyor, the organisation understands this type of technology very well and possesses the know-how to successfully sell steel belt-based applications. Nonetheless, as covered in the RBV-analysis, the company currently does not understand the critical success factors of the skimming business as they have key weaknesses in market understanding. This is potentially destroying value since the company is offering a high-technology steel belt as a product application to a market where this technology is neither demanded nor to par with other available technology. In doing so, the company fails to extract a correct value for their knowledge and expertise.

The know-how within the organisation offers great parenting opportunities that could add value to the business if used properly. Once again however, the analysis can be viewed from two perspectives; it can either be seen from (1) a skimming business standpoint, or (2) a Sandvik Process Systems standpoint. Looking at the first alternative, the skimming business standpoint, the business would be better off if owned by another company. On the contrary, considering the specific technology at hand, the business makes most sense under Sandvik Process Systems.

Sandvik Process Systems manufactures high quality steel belts to the food processing industry and to chipboard pressers successfully and is world-leading at that. The technology has also successfully been put to use in the pastellisation of sulphur within the petrochemical industry. The current technology marketed by Sandvik hence does have a good fit with other products sold by Sandvik Process Systems, and fits well within the product portfolio.
When taken these factors into consideration, the skimming business can be placed in the Parenting-Fit Matrix, as can be seen in figure 36.

Reflecting upon its characteristics, the skimming business really is hard to place in the parenting-fit matrix as it has some properties that cover several positions. However, it has to mainly be considered a ballast business. The potential for value creation is low but the technology does fit comfortably with the parenting approach. As such, the business really can be pondered as a nuisance to the company, distracting managers from undertaking more profitable business projects. The history of the product within Sandvik, being a diversification experiment in the 1960’s and 1970’s in order to find new growth opportunities, and the degree of misfit between the parenting characteristics and the critical success factors within the skimming business itself, also suggests that the business may have alien territory aspects. To a certain extent however, the skimming business touches even upon some edge-of-heartland characteristics. The net contributions of the business are not clear-cut and the business has some characteristics that fit and some that do not, resulting in a situation where Sandvik can both create and destroy value by pursuing this business.
4.2.4. Product/Market Positioning

Sandvik’s skimmer is currently positioned in the market penetration segment as the nine different versions of the skimmer do not represent product development nor are targeting different market segments. The product has not been developed further since its creation in the 1960’s and although there are thoughts of applying the skimmer within the innovative skimming segment, these plans are still in the idea phase. As it is currently positioned, Sandvik should focus on reaching into available geographies. However, as there are currently no active sales ambitions, any activity would greatly improve the current position.

In order to improve the value proposition, Sandvik may look to competitors to see how their products are positioned. By comparing the competitors positioning with Sandvik’s market penetration positioning, one can determine how Sandvik should change their value proposition to imitate successful competitors. Looking at the product portfolio, it is clear that competitors often have a broader product offering. Many companies have some specialised product within the product development position, such as Lamor’s rock cleaner system (Lamor, 2013). Other companies, such as Elastec/American Marine, are targeting the Arctic skimming market with both their current products, which is a market development, but also developing new specialised equipment for skimming in Arctic conditions, which represents diversification (Löfgren, 2013). While positioning these products in segments in which there is potential to possibly extract better margins on the products, the companies still keep simpler skimmers positioned in the market penetration segment. This broad positioning of the product portfolio allows these successful competitors to target both the high margin applications while providing an economic foundation of high volumes of low margin sales.

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>MARKET</th>
<th>NEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXISTING</td>
<td>Market Penetration</td>
<td>Market Development</td>
</tr>
<tr>
<td>NEW</td>
<td>Product Development</td>
<td>Diversification</td>
</tr>
</tbody>
</table>

Figure 37: The oil-skimming business position in the product/market matrix
4.3. Internal Operations

4.3.1. Six Performance Objectives
Any industrial operation can be analysed and evaluated depending on its performance and its ability to reach certain objectives. The following analysis, based on the six operation performance objectives, will serve as the basis for understanding the strategic direction of Sandvik’s oil skimming business from an operational standpoint.

Quality
The level of quality of the skimming product offered by Sandvik is among the best in the industry. The skimmers are sturdy, reliable, and durable. The Sandvik skimmer has proved to last for almost 25-30 years in certain documented cases. The redesign in 2005, when a seamless, welded belt replaced the riveted belt, increased the durability of the belt even further. The rivets represented the weakest point of the construction and were thus replaced in order to increase quality.

Speed
The skimmers manufactured by Sandvik are made to order and take around five hours to assemble. However, as the skimmers are made to order, the need for inventory is eliminated. Although the delivery time could be speed up by holding a stock, this is not believed to be a crucial factor for the customers. In the case of a price increase however, the speed might become a more important factor.

Dependability
The nature of the oil skimming business, where products have long lifetime does not seem to have an impact on the dependability. Dependability is often seen as a mean of securing repeat business by providing a good service. Nonetheless, since the skimmers offered by Sandvik often last for over 15 years, dependability cannot be seen as factor securing recurring business. Other factors such as the customer already having a Sandvik skimmer installed, has shown to be of much more importance for repeat business.

Flexibility
The flexibility of the manufacturing operation at Sandvik is high. The skimmer offering consists of one model but can be customised in nine different versions in order to comply with customer demand. It is mainly the belt size that varies between the versions and it is thus the component that is subject to flexible manufacturing. This puts a lot of pressure on the operation to be as flexible as possible. However, as steel belt production is the core business of Sandvik Process System, the organisation possesses good know-how and expertise within this area, including flexible production.

Cost
Sandvik clearly has cost advantages in manufacturing the belt, since it is a core business within Sandvik Process Systems. However, the operation per se does not benefit from cost advantages. The batches are too small to benefit from scale benefits. Production costs, however low compared to competition, can still be lowered. The low production costs are partly related to the
low-tech design of the product and partly related to the access to in-house production facilities and know-how.

**Innovation**

The Sandvik oil skimmer in its current version cannot be seen as an innovative product within this market. The design of the product has not seen any innovation and practically no product development since its launch in the late 1960’s. Even though the skimming market is a relatively low-tech industry, competition has tried to develop the products towards a more high-tech level by including sensors, cameras, and photovoltaic systems, in order to offer more intelligent skimming. This has, however, not been the case for Sandvik.

In figure 38, the strategic decision for Sandvik’s oil skimming business based on operational performance can be seen.

![Figure 38: The strategic operational direction of Sandvik Process Systems' oil skimming business](image)

Taking a look at figure 38, it can clearly be seen that despite having a product with a low degree of innovation, the quality of the product is still very high. The fact that the product maintains a high quality could be considered symptomatic for the Sandvik organisation as a whole. Moreover, the flexibility of the operations is high due to the customisable options available for the customers. The cost objective is average since there is belief that there still exist room for cost-cutting opportunities despite the low-cost impression of the product. Consequently, it can be concluded that the quality objective is the most prominent one among these six performance objectives and therefore the one performance measure that Sandvik should try to differentiate themselves with.

**4.3.2. Operations Characteristics – Four V's**

When analysing the operational performance and characteristics, only the factors affecting or affected by the skimming business have been taken into consideration. This analysis is hence only attributable to those operations.
Volume
To start with, the volume of manufactured and processed skimmers per year is extremely low, as around 10-15 skimmers are sold yearly. This does not offer great repeatability and although the production may be standardised, it is not systemised. The low volumes of sold skimmers do neither offer great economies of scale benefits since every skimmer must practically be made to order. If the number of manufactured skimmers would increase this would naturally lead to a lower unit cost thus improving the margins. This holds especially true for the steel belt since the business of Sandvik Process Systems almost exclusively revolves around steel belts and steel belt-based applications.

An idea of the low degree of systemisation can be given by noting that an engineer, either on the shop floor, or in a showcase room to which the parts have to be transported, assembles the skimmers by hand.

Variety
The current product offering presented by Sandvik consists in one model, which on the other hand can be made available in nine different versions depending on width and oil-lifting height. This versatile product offering is made to satisfy customer demand and offer customisation options for specific demands. Compared to competition, nine versions of the same model as a standard offering might seem a bit excessive and raises the question about the increased costs in favour of the flexibility. Nonetheless, it has to be borne in mind that it is merely the belt that is customised, thus not resulting in a noticeable cost increase.

Other factors to consider are the targeted customers’ needs. Sandvik offers nine different versions to the same customer segment where even the largest skimmer has a low recovery rate compared to competitors. Moreover, the difference in recovery rate between the various skimmer versions does not vary as much in comparison to competitors.

Variation
The variation in oil skimmer demand at Sandvik is extremely high. There is no constant demand, no seasonal demand, nothing that can be said about the demand with regards to something similar of a trend whatsoever. One skimmer can be sold in January, then three in August, four in October and two in December. The demand cannot be anticipated, hindering the establishment of standards and routines. In practice, the variation does not really affect the organisation in a noticeably negative way, as would be the case in other settings. The company already manufactures steel belts and it is merely a question of just cutting out a piece of belt from the ordinary steel belt production.

Visibility
The nature of the oil skimming business and the status it has among customers (often purely seen as a cost item with no value-creating capabilities), does not imply the need for good visibility. Customers give little notice about this type of product and as explored in the RBV-analysis, the brand and the values associated with it really are of low strategic importance. The visibility is low
and the customer does not come into contact with the manufacturing process or the product until delivered and/or installed.

In figure 39, the configuration of the operations characteristics is illustrated.

Figure 39: Sandvik Process Systems’ skimming business configuration of the four V’s
5. Results
Grounded on the analysis, this part will summarize the main considerations and results into positive and negative aspects regarding the Sandvik oil skimming business based on both the external and internal perspectives.

5.1. SWOT-Matrix

5.1.1. Strengths
The main strengths lie in the parenting opportunities of the organisation. The Sandvik Group (as opposed to just Sandvik Process Systems) really has all the prerequisites to become a successful player within the skimming industry. The company has an advantageous presence worldwide with a great distribution network covering all markets. Although this is not a criterion for being successful, the fragmented nature of the skimming business is often prone to benefit smaller regional players. Hence, the company has a competitive edge in that regard. Notwithstanding, the experience of selling on a global scale is also an advantage that could benefit Sandvik’s skimming business. Furthermore, the company’s strong financial resources enable an investment in the skimming business if need be. Such an investment could be a rapid international expansion of the business paired with an intensive marketing campaign. Training sales staff could also complement this in order to increase awareness on market of the Sandvik oil skimmer. Simply put, the company could finance a strong expansion if such a venture is deemed necessary and/or desirable.

Another strength to consider is the fact that Sandvik already has many existing customers that could be in need of a skimmer. Sandvik being a large corporation active within various business areas is already selling other kind of equipment and products to companies that certainly could use oil skimmers. This presents good upselling opportunities for the company.

In terms of the actual product, the main strength consists of the quality of the product. Sandvik’s skimmer is sturdy and reliable with low service need and long lifetime. Its quality is really at the top compared to competing products. Additionally the skimmer is very cheap, which is a strength considering the fact that skimmers in general are considered to be an uninteresting product that does not add value to the business. To elaborate on the product’s characteristics, a strength associated to the current technology is the company’s profound knowledge and expertise in steel belts.

Conclusively, a major strength lies in the Sandvik brand. The ability to leverage the strength of the brand to build a strong position on the market is an advantage that is a rare luxury. Sandvik’s brand is well spread, well known, and carries positive associations enabling the pursuit of business opportunities in both offshore and industrial markets.

5.1.2. Weaknesses
Sandvik’s major weakness is the lack of knowledge and expertise within the skimming market. Despite being in the market for around 50 years, the organisation lack in knowledge of the market dynamics, how the market is structured, what factors that characterise the market and most importantly the idea of the market size and the competition. The reason behind this lack of knowledge lies in the fact that oil skimmers have been an unprioritised product segment for
Sandvik for many years. Some initial enthusiasm for the product was shown when it was first conceived. However, after fruitless experiments in the 1970’s the product was never commercialised to a greater extent and has remained in the product catalogue ever since as a marginal side-business.

The unprioritised status of the oil skimmer has also lead to an unclear strategy for the product. The skimmer exists and is sold, although in small quantities, but there is no underlying plan for the product. The skimmer lives its own life within the organisation and its existence has really not been questioned until now. The lack of strategy revolving around the product has resulted in a diffuse positioning on the market. The product is intended for all types of applications in practically any industry. However, according to the analysis, the use of the product in its current version is very limited. For example, the application of the current product in offshore environments is completely out of the question, as far better products are available on the market. Moreover, the limited product portfolio within skimming equipment is also a weakness with regard to offshore applications. Most companies targeting the offshore market also offer various booms and other equipment. The focus of those companies hence does not revolve around skimming but rather on oil spill response.

The ambiguous strategy also manifests itself in the construction and pricing of the product. The oil skimmer is priced as a low-cost skimmer but uses a premium steel belt of high quality. Another intriguing factor is the lack of skimmer sales despite being priced 66-75 % below industry average. This weakness is most certainly attributable to the technology used. The performance of the skimmer is inferior to skimmers marketed by competitors and the product has not seen any development during the past 50 years. Many other technologies today often do it better and more efficiently.

An interesting weakness to consider is the seemingly lack of sales coordination within the corporate group. As previously covered, Sandvik already has many customers that could use oil skimmers and thus, potentially huge values are lost due to the inability to combine the product offerings of all subsidiaries at one sales opportunity. This inability to cooperate across subsidiaries might also weaken and dilute the strengths associated with the corporate group, and could thus not be utilised by Sandvik Process Systems to its full potential.

5.1.3. Opportunities

There are several opportunities in the oil skimming market, which Sandvik could benefit from. Primarily, political and social trends favour environmental awareness, and regulations continuously increase the demands on water purity levels creating business opportunities. This trend can be seen in all analysed geographies. However, the emerging markets are currently lagging the developed economies in regulatory rigidity, which creates an untapped potential in these markets. Also, Africa and South America both represent markets with a high amount of oil skimming requiring industries, enlarging the market potential. Large-scale oil drilling in the Arctic is also a possible future scenario, which would be of great importance to oil skimming equipment manufacturers. The sensitive Arctic environment would require a higher density of skimming equipment compared to other geographies. Combined with the large potential for drilling this
would lead to a very large number of skimmers sold for Arctic applications. However, these skimmers must be adapted to work in such extreme conditions.

As social awareness of water pollution and the hazard of oil spills increases, so does the obtainable goodwill and social appraisal associated with combating these hazards. However, this appraisal is primarily directed towards companies working with offshore skimming rather than industrial applications. Despite more continuous use of industrial skimmers, the extensive media coverage of offshore spills causes social awareness to target these spills.

The market structure is appealing to a company such as Sandvik. The market is fragmented and the entry barriers are low, which would allow Sandvik to easily access the market and claim a position without opposition from large companies singlehandedly capable of blocking Sandvik’s market entry. Sandvik also possesses most attributes needed to break into a market with an already developed distribution network etcetera. Furthermore, the market is dominated by large customers to whom a company such as Sandvik may be better equipped to sell goods compared to a small, insignificant company. This enables Sandvik to compete for the large contracts immediately upon entering the market.

5.1.4. Threats
The most obvious threat surrounding the oil skimming market is its small size and thereby the difficulty to contribute in any significant way to Sandvik’s result. Skimming equipment is constructed to work in demanding environments and is therefore sturdy and reliable. Most skimmers have a technical lifetime of over ten years, which reduces the frequency of purchases.

Skimming equipment for offshore applications is particularly unprioritised as these customers buy the equipment with the hope of never having to use it. As it is an unprioritised task it is not always devoted the appropriate amount of time to fully investigate the available options. Therefore geographical presence and brand recognition are important in order to be considered. For industrial applications the skimmer is used often, but does not handle large volumes. Therefore it is rarely changed on the basis of lack of capacity but rather because of being worn out. Due to the long service life, customers often return to the same manufacturer to purchase a new skimmer instead of investigating the market’s alternatives. Moreover, as the alternatives are not investigated the prices of skimming units are not questioned. This has led to a market with high price elasticity and diverging prices on similar equipment. This reduces the competitive advantage of being a low cost alternative, which reduces the Sandvik skimmer’s competitiveness.

Although skimmer units have developed a lot since the 1960’s in general, the development has slowed down as of late. Instead, development is currently focused on chemical dispersants, which have improved considerably lately. Although skimmers and dispersants in many ways are compliments, a continued development of dispersants could severely affect the skimmers’ market potential.

Another factor, which risk decreasing skimmers’ market potential, are political regulations. Currently they favour skimmers over polluted water, but as stricter regulations are enforced, skimmers may not be able to cope, and different types of filters may be used instead. Although
this is currently a speculation, a continued development along the current trajectory would result in such a scenario.

In figure 40, the positive and negative considerations from the external and internal analyses have been integrated into a SWOT-matrix.
Figure 40: Resulting SWOT-matrix

**INTERNAL**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience of selling on a global scale</td>
<td>United product portfolio within skimming</td>
</tr>
<tr>
<td>Strong financials</td>
<td>Limited product portfolio within skimming</td>
</tr>
<tr>
<td>Strong brand</td>
<td>Limited product application and performance</td>
</tr>
<tr>
<td>Many existing customers</td>
<td>Under product strategy</td>
</tr>
<tr>
<td>Questionable potential to leverage organisational resources</td>
<td>Underperforming product area</td>
</tr>
<tr>
<td>Lack of skimmer market knowledge</td>
<td></td>
</tr>
</tbody>
</table>

**EXTERNAL**

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic regulations favouring oil spill response</td>
<td>Political regulations making skimming redundant</td>
</tr>
<tr>
<td>Untapped market potential</td>
<td>Too tough political regulations making skimming unprofitable</td>
</tr>
<tr>
<td>Faster product development within chemical dispersants than oil skimming</td>
<td>Higher price elasticity due to lack of interest</td>
</tr>
<tr>
<td>Small market size</td>
<td>Limited product application and performance</td>
</tr>
<tr>
<td>Unprofitable market</td>
<td>Limited product portfolio within skimming</td>
</tr>
</tbody>
</table>

**POSITIVE CONSIDERATIONS**

- Quality product – cheap, durable
- Strong brand
- Many existing customers
- Undiscovered customers
- Low entry barriers to market
- Fragmented market
- Increased social awareness of environmental concerns
- Potential to earn goodwill and positive social concern
- Global presence
- Distribution network experience of selling on a global scale
- Existing product area
- Underperforming product area
- Limited product portfolio within skimming
- Underperforming product area
- Lack of skimmer market knowledge
- Experience of selling on a global scale

**NEGATIVE CONSIDERATIONS**

- Questionable potential to leverage organisational resources
- Limited product portfolio within skimming
- Limited product application and performance
- Underperforming product area
- Lack of skimmer market knowledge
5.2. **Strategic Directions**

With the resulting SWOT-matrix as a starting point, five different strategic directions have been identified. These five strategic directions form representative cases of the alternatives Sandvik is facing regarding its oil skimming business. The five cases are built to cope with different aspects of the SWOT-matrix and are intended to lie as a foundation for strategic decisions at Sandvik regarding the company’s oil skimming business and the current product. The five cases are:

I. Business as Usual  
II. Develop Skimming Business  
III. Shut Down Skimming Business  
IV. Acquire Competing Technology  
V. Form Joint Venture

5.2.1. **Case I: Business as Usual**

Keeping the skimming business segment unchanged would leave it in as an unprioritised, marginal side business. As the global sales force remains passive, the strategy would not result in any increased costs, but most probably no increased revenues either. However, as a few skimmers are sold each year the business segment would still generate revenues, yet negligible.

The business implications of such a strategy are marginal. The corporate strengths are not leveraged but instead the skimming market segment is left undeveloped. In such a case, the business is very exposed to changes in external conditions. As the market develops, the value offered by Sandvik’s skimmer risks decreasing. Current customers may eventually explore the market options and would then most probably choose a different skimmer supplier.

If choosing to keep business as usual, the strategic ambiguity remains. Managers and employees risk being indecisive about the product and ponder whether there is no further market potential for the product. This is the same train of thought that resulted in the need for this study to begin with. An unclear strategic direction therefore risks repeating history forcing a new investigation of the market potential in a few years.

5.2.2. **Case II: Develop Skimming Business**

Developing the skimming business has many implications on the organisation. Primarily, it focuses on active and outreaching sales efforts of skimming products. The product is to be developed in order to create new skimmer models based on the same technological foundation. The new skimmers could be developed to fit certain industrial applications, increasing the sales opportunities. New markets can be developed and targeted as well as niche markets within innovative skimming such as algae harvesting. A large difference from Case I, is that a strategic decision is chosen. The strategy is no longer ambiguous, but instead focused on steel belt oil skimmers. The objective of the strategy is not only to sell oil skimmers, but to sell the existing oil skimming technology. This strategy also fits well into the company’s overall mission statement; to offer steel belt solutions to the world.

The implications of an increased focus on the skimming segment are significant. The global distribution network as well as sales force would have to be involved and educated within this
new business segment. There is much internal strength to give credibility to Sandvik’s skimmer such as the intimate knowledge of steel belts as well as strong brand equity. Sandvik also already have customers within industries using oil skimmers, which could provide a natural entry into the market. The industry’s generally low entry barriers will enable Sandvik to enter the market in force, something that is also made possible by Sandvik’s financial strength.

Despite some weaknesses in Sandvik’s product offering as well as lack of experience, Sandvik can without a doubt sell skimming equipment. The strengths in many ways outweigh the weaknesses. However, due to bleak market outlook it is still questionable if this is the most desirable strategic direction. Due to the small market size it can be seen as unlikely that Sandvik will reach their goal of EUR 2.33 million in revenues from the skimming segment. However, as social awareness increases the potential of obtaining goodwill and social appraisal is continuously increasing. Although this is interesting, there are also apparent risks in the oil skimming market which must be considered. As the market matures, current customers risk abandoning Sandvik for a technologically superior product from a competitor. Also, as the skimming segment, whether having revenues of EUR 2,33 million or not, will remain a side business compared to the industrial steel belts it is questionable how much product development the future holds for the oil skimmer. It is therefore risky to make an initial effort to sell skimmers only to abandon the project in a few years’ time in order to focus on the industrial steel belts, which is what happened in the 1970’s. However, a maturing market is not only negative. As Sandvik skimmer today represents a clear low-cost alternative a maturing market can lower the high price elasticity and thus increase Sandvik’s competitiveness.

All factors taken into account, it is of outmost importance to consider if the effort of improving the value proposition and actively market the product is worth the small amount of economic compensation. However, if the decision is to choose such a direction it is important to not make initial efforts only to abandon the business once the core business segments require more attention.

5.2.3. Case III: Shut Down Skimming Business

Shutting down the skimming business truly is a straightforward alternative for Sandvik. The business being small for Sandvik, around EUR 50,000-75,000 a year in sales contributions, represent a vanishingly small portion of the whole business. Moreover, there are no employees that are solely focusing on this business and neither production capacity dedicated to these products, which makes it easier to shut down. The costs associated with shutting down the business can thus be kept to a minimum.

The rationale behind shutting down the business is mainly linked to the small, unprofitable market that oil skimming represents. For the market to be interesting for Sandvik, the company needs to sell approximately 466 skimmers per year in its current version without product development. Besides being highly unlikely with regards to the inferior technical performance, 466 skimmers worldwide would represent around 119 % of the expected number of industrial skimmers sold per year.
A factor to consider is also the fact that the strengths in organisational resources and capabilities may not be used to its full extent. The Sandvik corporate group possesses these strengths but there are serious doubts that Sandvik Process Systems could use them in a potential wide commercialisation of the skimmer. This leads to suggest that the strengths are conditional, and considering the small market potential of the skimming business, would be put to better use in other ventures. This fact is probably the most compelling. The entire current skimming business at Sandvik can be replaced by selling one regular steel belt, which begs the question why the company should wager on this business. By shutting down the skimming business, Sandvik Process Systems frees up resources to pursue other, more profitable alternatives.

Notwithstanding, the increased level of political regulations regarding water quality puts a pressure on the industry, as skimmers risk no longer being able to comply with set regulations. Other methods such as filtration using ultra-filters can be used instead, limiting the skimming business opportunities. The increased usage of chemical dispersants further outcompetes skimming systems for offshore applications, which also speak in favour of shutting down the business.

5.2.4. Case IV: Acquire Competing Technology

A possible strategic direction for Sandvik would be to acquire a competing technology. Sandvik’s current product offering although limited in its application is an excellent low cost alternative for industrial customers. However the low volumes and the low prices does not provide the company with good business prospects. A way to overcome this issue and still be active in the skimming business would therefore be to acquire a competing technology to either complement the Sandvik skimmer or replace it.

By complementing the Sandvik skimmer business, i.e., acquiring a competing technology and keeping the current skimmer, the company builds a portfolio of different skimming products targeting different markets. This is a way of diversifying the product offering and reach new customers, for example offshore customers. By doing so, Sandvik could quickly gain a stronger position on the market and thus become a more prominent player. Moreover, the current weaknesses of inferior skimming technology, limited product application, and limited product portfolio could all be reduced.

A possible acquisition candidate is the company SurfCleaner. The SurfCleaner skimmer is very versatile by being applicable in both offshore and industrial applications. Furthermore, the products are more high-tech, thus opening up the possibility to enter high-price and high-margin business opportunities. Sandvik’s manufacturing capabilities and facilities could be used to scale up production to further lower the manufacturing costs. The technology is patented in several markets including Europe, North America, China, India, and Australia and has initially experienced a strong demand.

What makes this case all the more interesting is the fact that the current owners of SurfCleaner are currently looking for an exit opportunity and/or a company to partner with in order to reach a more global customer base. Hence, if Sandvik were interested in entering the skimming market on a wider scale this would be a great opportunity. The company consequently buys a technology
and provides the global sales and distribution network. The fact that SurfCleaner is still in its infancy would suggest that the financial consideration could be maintained at a relatively low level.

Considering this alternative and the sales objective of EUR 2.33 million, around 60 SurfCleaner skimmers at an average price of EUR 40,000 would need to be sold per year to reach the set target. This makes it a much more likely scenario compared to selling 466 Sandvik skimmers bearing in mind that the potential market is doubled since the product can be marketed towards both industrial and offshore customers. Nonetheless, this strategic direction also implies more active sales efforts from the organisation and a more prioritised status of the business within the organisation for it to be successful and reach its potential. Furthermore, the acquiring of a technology does neither imply that market understanding nor market knowledge is transferred and assimilated which is something to consider.

In theory, Sandvik could also acquire a larger, well-established company such as Lamor, Elastec, or Vikoma. However, this would command a much more substantial price since the company, besides acquiring technology and know-how, must pay for the market-share. Furthermore, this would be a significantly more complex issue and greatly divert from the company’s core business.

Conclusively, the company must really consider and decide whether it is the market that is the objective or if it is the product. Potential exists to become a large player on the market if that is the goal. However, by doing so the company diverts from the core business of selling steel belts and steel belt applications.

5.2.5. **Case V: Form Joint Venture**

The final case looks to see how a joint venture between Sandvik and a partner may look. Considering Sandvik’s weak product offering, it is likely that Sandvik would contribute organisational strengths to the joint venture. Such strengths would likely include sales and distribution network, and possibly brand equity. The partner company would preferably be a strong player within oil skimming, such as Lamor or Elastec/American Marine, with a broad and attractive product offering. A joint venture between Sandvik and a strong player within skimming would certainly address many of the weaknesses in Sandvik’s value proposition. Through a joint venture Sandvik could access superior technology, experience, and develop a strong product portfolio. However, although such a joint venture most likely could attract a significant amount of business, it is questionable if this is in line with Sandvik’s overall strategy and the optimal utilisation of the sales resources.
6. Conclusion

The characteristics of the oil skimming business paired with Sandvik’s current position on the market leads to the conclusion that there is an unappealing revenue potential-to-risk ratio surrounding this business.

Taking the company’s expectations on the business as a starting point, the bar is set unrealistically high considering the inherent market potential. The target of EUR 2.33 million in sales contributions from this business translates into a need of selling 466 skimmers per year for the company. Putting this figure into perspective, the estimated sales of skimmers worldwide are approximately 780 units, regardless of application – offshore or industrial. However, the technology is not up to par with other available technology on the market and can thus not be used for offshore applications, resulting in a much smaller market segment of c. 390 units when splitting the market fifty-fifty. Taking these factors into consideration it becomes quite clear that this is not a promising market for Sandvik to target. Nonetheless, regardless of the plausibility, if the target is reached, it would still represent a negligible business in relation to Sandvik’s other product segments and thus continue to be an unprioritised, marginal side-business.

Goodwill can in some ways be considered a “revenue” in terms of positive social appraisal and corporate social responsibility and could thus potentially lower the revenue expectations. However, the goodwill associated with oil skimming is concentrated to the offshore segment and thus currently not attainable for Sandvik.

The technology of the product is in many ways inferior compared to competition. Nevertheless, the technology is suitable for oil skimming and works very well in some applications. However, the accumulated business stemming from these applications is not large enough to be of great interest. In more profitable segments such as offshore and large scale skimming, the skimmers used have a performance that is far superior to Sandvik’s.

Surely, Sandvik could develop their product internally or acquire a technology that would make them more competitive and able to target more interesting market segments, but this represents a risk when taking market trends into consideration. Within the offshore market, chemical dispersants have increasingly developed the last couple of years and is outcompeting oil skimming as an oil spill response product. For industrial applications, tougher political and environmental regulations have lead to skimmers becoming increasingly obsolete in some situations, as skimmers’ performance cannot comply with the tighter regulations.

From another strategic standpoint, acquiring a competitor or a competing technology might make sense in theory, but contemplating the operational perspective, it would lead to the company diverging from its core business. The know-how and expertise must be built up within the organisation and thus represents another risk factor to account for.

A general conclusion is that if the skimming business is to generate value for Sandvik, the company must either commit fully with intention of becoming market leader or simply abandon this market and pursue other, more lucrative business ventures. This conclusion leads however to
question the business sense in wagering on this business when Sandvik Process Systems makes more money in selling one steel belt compared to the entire annual Swedish skimming market.

Another concern is the fact that an expansion of the oil skimmer business has already been tried more than 40 years ago without success. Although market conditions may have changed to a more positive business outlook for the skimmer business factoring in the surge of environmental concern, the Sandvik skimmer has not technically developed at the same pace as the rest of the market and no changes have been made that suggests that the Sandvik oil skimmer would be more successful in today’s business environment.

Concluding, we do not question the company’s ability to sell oil skimmers and be an active player within this market, but given the market constraints and risks, we would not recommend Sandvik to further invest in the oil skimming market. Our recommendation is to opt for Case III: Shut Down Skimming Business, and pursue more profitable opportunities.

Referring back to the research questions stipulated in section 1.1, the following can be concluded.

- **Can Sandvik Process Systems reach future growth opportunities within the oil skimming market?**
  The answer to this question is yes, Sandvik Process Systems can increase their revenues from the skimming business. However, the expected returns from this business segment are not sufficient to accommodate the necessary investments and therefore the skimming segment can be classified as an unappealing growth segment.

- **How does the market configuration affect the competitiveness of a new entrant?**
  As shown in this thesis, a fragmented market with few large companies provides a possibility to successfully enter the market with high competitiveness. As the market is also dependant on the technological level of the skimming equipment a small player can enter the market and quickly become a prominent player by having a superior technological foundation.

- **How can an analysis model be created to evaluate competitiveness in an underdeveloped market?**
  This thesis has created an analysis model made up of several qualitative analysis tools. Together, they form a collectively exhaustive tool for analysing an underdeveloped market such as the oil skimming market, the Linde-Grill framework.

- **How does it affect a company’s competitiveness to diverge from its core competencies when searching for growth opportunities?**
  Although some business opportunities may seem lucrative, a divergence from one’s core competencies may affect the overall business fundamentally. A shift in focus and strategy may negatively impact core business segments which, as in the case of Sandvik Process Systems, may be far larger than the desired growth segment. This thesis has, through its research, found that the expansion must be driven by application knowledge already possessed rather than by hopes of a lucrative market not related to core business.
7. Discussion & Scientific Contributions

7.1. Discussion
The Sandvik oil skimmer is a product developed more than 40 years ago. Although the process of recovering oil is technically simple, development since the 1960’s is inevitable and this has decreased the competitiveness of the skimmer dramatically.

Although oil skimming is an old technology, the low degree of social and political awareness did not make it an acknowledged market until the Exxon Valdez accident of 1989. The market is therefore fairly young and the long lifetime of the equipment has a negative impact on the market development speed. Furthermore, the poor market development has had a negative impact on the thesis’ results. Information gathering has been difficult as no scientific attention has been directed towards oil skimming as a business, but rather on the environmental impact of oil spills. In turn, this makes current actors within the market the primary source of information which in turn increases the risk connected to the thesis’ results. As the market is fragmented, the companies able to offer insights into the global market are few and therefore good relations with these companies have been essential. However, this thesis has suffered a setback due to refusals to assist with information from a few of the largest companies in the business. Instead, market sizing and assumptions are based on information from a smaller number of sources which increases the uncertainty. However, although sources are scarce, much information has been obtained from some of the largest companies in the market.

Among the strategic directions, a divestment of the oil skimming business has intentionally been left out. Selling the oil skimming business is primarily a divestment of the knowledge required to produce the steel belts, information which is vital to Sandvik’s core business. Such a direction could potentially therefore threaten Sandvik’s core business and is an utterly unappealing direction.

7.2. Future Research
The thesis has provided a foundation for future research studies to build from. Interesting topics not covered in this thesis are:

- How do you estimate the alternative cost associated with committing or leaving the oil skimming business? Such a research topic is not only applicable to this subject, but Sandvik’s current position is an interesting position to analyse.

- The conclusion, to shut down the oil skimming business, risks losing a competence earned over a long period of time. How can this competence be evaluated? Is it possible to put a monetary value on such experience?

- Due to the close connection between oil skimming and oil spill response, an expanded study could investigate the business potential of this market. Due to the underdeveloped nature of the market, the study could prove very interesting. Focus in such research could either target strategic market potential as well as accurate market sizing.
• The competitive landscape is dynamic, but in an industry such as oil skimming it would be interesting to analyse how the landscape changes as the market matures. Is the primary cause of the current market environment the small market size, the unprioritised business segment or the fact that the market is still young?

7.3. Contributions to Science

• This thesis has developed a method for evaluating competitiveness based on qualitative data

• We have developed a method for guiding strategic decision-making within an underdeveloped market environment

• Confirmed the relevance of experienced strategic models such as Porter’s Five Forces, PESTLE, RBV etcetera.

• Proven that the method of using an interview-driven literature review works better than academic literature in underdeveloped markets
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