

The PGS-framework

- A Study of Alfdex's Environmental Strategy

Josefin Ejlertsson
Emelie Gustafsson

Copyright © Josefin Ejlertsson, Emelie Gustafsson

Department of Packaging Logistics
School of Design Sciences
Box 118
221 00 Lund
Sweden

Department of Business Administration
School of Economics and Management, Lund University
Box 7080
220 07 Lund
Sweden

Master Thesis Technology Management – No. 221/2011
ISSN 1651-0100
ISRN LUTVDG/TVTM--11/5221--/SE

Wallin & Dalholm, Lund 2011
Printed in Sweden

Abstract

- Title:** The PGS-framework
- A Study of Alfdex's Environmental Strategy
- Authors:** Josefin Ejlertsson and Emelie Gustafsson
- Tutors:** Ola Mattisson, - *Assistant professor, Department of Business Administration, Lund University*

Christina Skjöldebrand - *Professor, Department of Packaging Logistics, Lund University*

Mats Olsson - *Technical Manager, Alfdex AB*
- Issue of study:** The possibility to make environmental strategy a part of the core strategy through a framework called inside-out/outside-in was suggested by Porter in 2007. Researchers have also stated that the output of implementing a certain strategy ought to be valued during strategy planning. The two areas; environmental strategy and profitability analysis have although not frequently been combined, and thus there is a lack of frameworks on how to perform a profitability analysis on an environmental strategy. As a result, examples of generated profitability from an environmental strategy are also few.
- Purpose:** The purpose of the thesis is to develop a framework for describing and analyzing the potential profitability of a company's green strategy as a part of the core strategy. The purpose is further to apply the framework in a case study.
- Method:** In order to fulfill the purpose, a deductive study has been performed. The theoretical framework was constructed first, based on Porter's theories concerning competitive advantage and corporate social responsibility (CSR) (inside-out/outside-in) together with profitability- and life cycle assessment (LCA)-tools. Thereafter the developed PGS-framework (Profitability of Green Strategy) was tested on a relevant case company. The methodology has been a combination of quantitative and qualitative methods, and data has been collected from primary sources such as interviews and surveys (mainly empirics), and secondary sources such as literature (mainly theories).

Conclusions: The PGS-framework is a tool for performing a profitability analysis of implementing a green strategy as a part of the core strategy and it enables a framework for combining green strategy and profitability. It consists of 5 steps and is developed from the inside-out/outside-in analysis (suggested by Porter in 2007) by adding the sub-steps of LCA, five forces framework, the NEP-Scale, profitability analysis, including industrial ecology and profitability drivers. The most contributing factors to why the environmental strategy generates revenue are the discovered (unique for this company) profitability drivers; *to be proactive* and *to have proper knowledge*. The present value indicates a profit of 5,4 Million SEK, or 0,26 % of the total yearly turnover, as a result of implementing the green strategy into the core strategy. The PGS-framework has a Porter-approach, but the inside-out/outside-in analysis in step 1 shows similarities with strategic frameworks developed by other researches, why the framework is considered having a somewhat general approach.

Key-words: Environmental Strategy, Profitability Analysis, Competitive Advantage, Inside-out/outside-in analysis, PGS-framework

Acknowledgements

We are grateful for the privilege of getting to work with this thesis and for being able to dig deep into the subject environmental economy during the spring 2011. The interest for environmental issues and how we can build and maintain a sustainable society is steadily increasing, not least in the business world. The subject is under development and it has been a pleasure to take part of this latest research.

We would like to acknowledge Ola Mattisson and Christina Skjöldebrand, our University tutors, who have helped us navigate during the process of writing the thesis including finding Porter, use Porter and broaden Porter. Thank you for always answering our questions. Thank you also for our interesting meetings and discussions.

Secondly we would like to thank Mats Olsson, our tutor at Alfdex, who has continually challenged us with questions and guided us through the crankcase ventilation techniques and automotive industries, a world of its own. Also thanks to all employees at Alfdex; you have been both encouraging and helpful, answering all our questions and we have enjoyed the Friday coffee breaks. It has been educating and interesting to follow Alfdex and to study the separator and company in an expansive phase of the company life cycle. We hope that our work will be useful for you and that you will continue the solid environmental work that you have started. We believe that you have great possibilities to become a representative company of how a supplier in the automotive industry can work successfully with environmental strategy in order to gain competitive advantage.

Finally, we want to thank the employees at Volvo Trucks AB and Scania AB who have participated in our interviews, providing us with irreplaceable information for the study.

Lund, 2010-05-11

Josefin Ejlertsson & Emelie Gustafsson

Table of Contents

1	Introduction	8
1.1	<i>Background.....</i>	8
1.2	<i>Issue Discussion</i>	9
1.3	<i>Purpose.....</i>	11
1.4	<i>Delimitations</i>	11
1.5	<i>Outline</i>	12
1.6	<i>Definitions</i>	13
2	Methodology.....	16
2.1	<i>Why Green Strategy and Profitability?.....</i>	16
2.2	<i>Research Approach.....</i>	16
2.3	<i>The Case Selection</i>	17
2.4	<i>Theoretical Framework.....</i>	17
2.5	<i>Data Collection</i>	18
2.5.1	<i>Interviews for LCA</i>	18
2.5.2	<i>Interviews for Profitability Analysis.....</i>	18
2.5.3	<i>Surveys for Profitability Analysis</i>	19
2.6	<i>How the Analysis was performed</i>	19
2.7	<i>The Study’s Trustworthiness and General Reflections</i>	20
3	Theoretical Framework	22
3.1	<i>Inside-out and Outside-in Analysis</i>	22
3.2	<i>Life Cycle Assessment (LCA).....</i>	24
3.3	<i>Porter’s Perspective on Strategy.....</i>	24
3.4	<i>The New Ecological Paradigm Scale</i>	25
3.5	<i>Industrial Ecology</i>	26
3.6	<i>Profitability analysis</i>	26
3.7	<i>The PGS-framework.....</i>	27
4	Environment and the Industry	30
4.1	<i>Environmental Sustainability.....</i>	30
4.1.1	<i>The Environmental Sector</i>	30
4.1.2	<i>Environmental Institutions - Europe.....</i>	31
4.1.3	<i>Legislations, Standards and Guidelines - Europe</i>	31
4.2	<i>The Automotive Industry in Europe</i>	32
4.2.1	<i>The Environmental Awareness in the Automotive Industry.....</i>	33
4.2.2	<i>The Crankcase Industry</i>	33
5	Alfdex – an Actor in the Crankcase Industry.....	34
5.1	<i>The Company and Product</i>	34
5.2	<i>Volvo Trucks and the Environment.....</i>	38
5.3	<i>Scania AB and the Environment</i>	39

6	Analysis	42
6.1	<i>Recap of the PGS-framework</i>	42
6.2	<i>Step 1: Identifying the Points of Intersection</i>	43
6.3	<i>Step 2: Choosing which Environmental Issues to Address</i>	51
6.4	<i>Step 3: Profitability Analysis</i>	53
6.4.1	Strategic Part: To be Proactive	54
6.4.2	Strategic Part: To have Proper Knowledge.....	55
6.4.3	Responsive parts	56
6.4.4	The Profitability of Green Strategy.....	56
6.5	<i>Step 4: Creating a Corporate Environmental Agenda</i>	57
6.6	<i>Step 5: Create an Environmental Dimension to the Value Proposition</i>	58
7	Conclusions	60
7.1	<i>The Profitability of Green Strategy</i>	60
7.2	<i>Discussion</i>	61
8	Reflections and Suggestions of Future Studies	64
9	List of References	65
	Appendix 2 – Interview Questions	73
	Appendix 3 - Surveys	78
	Appendix 4 – Crankcase industry	80
	Appendix 5 – Environmental work at Alfdex	81
	Appendix 6 - Profitability analysis	84

List of Figures

Figure 1: The combination of an environmental strategy and profitability.....	10
Figure 2: The outline of the thesis, chapter 1-7.....	12
Figure 3: Corporate involvement in environment (after Porter & Kramer 2006:89).	23
Figure 4: The national diamond.....	24
Figure 5: The five forces framework.....	25
Figure 6: Resource productivity of x (after Esty and Porter, 1998:36).....	26
Figure 7: The PGS-framework.....	27
Figure 8: Strategies stated in order to reach the goal.	35
Figure 9: The PGS-framework.....	42
Figure 10: The components with highest environmental impact versus kg CO ₂ -equivavlents.....	44
Figure 11: The environmental impact of the separator in three phases.	45
Figure 12: Indirect value added.	46
Figure 13: Customer segmentation	50
Figure 14: Characterization of impacts.....	52

List of Tables

Table 1: Summary of responses on the NEP based survey.....	36
Table 2: Summary of the inside-out linkages.....	46
Table 3: Summary of the outside-in linkages.....	50
Table 4: Summary of all actions corresponding to the two profitability drivers.	57
Table 5: Interviewees.....	77
Table 6: The four statements used for measuring ecological concerns.	78
Table 7: Survey conducted with customers.....	79
Table 8: Survey conducted within Alfdex.	79
Table 9: Summary of the survey-responses.....	81
Table 10: Summary of all costs & savings associated to the environmental work.	82
Table 11: Summary of total sales and sales growth for Alfdex 2010-2016.....	84
Table 12: Summary of sold trucks in Europe for Scania, 2007-2015.	84
Table 13: Summary of all historical sales and costs.....	85
Table 14: Summary of sales and costs associated to the forecast, 2012-2018.	86

1 Introduction

The first chapter introduces the reader to a brief background of the thesis, which brings together two subjects; environmental strategy and profitability analysis. When combined, these subjects illuminate a relatively unexplored area. The chapter also states the purpose and the definitions used in the thesis.

1.1 Background

"The essence of strategy is choosing to perform activities differently than rivals do."
(Porter, 1996:64)

The ideas of strategy origins from the military, where it was used back in ancient Greece. Nowadays strategy is used in most companies to deploy resources in order to establish a competitive advantage. The idea of competitive strategy, or business strategy, concerns how a particular firm competes on a specific market through differentiation and planning. Strategy has evolved from being a part of financial performance to becoming a way to perform well in a fast moving competitive context (Grant, 2005:18ff).

"Competitive advantage grows fundamentally out of value a firm is able to create for its buyers that exceeds the firm's cost of creating it" (Porter, 1985:3)

As Porter (1985) states, a firm possesses a competitive advantage when it has a higher rate of profit than its competitors. A competitive advantage can be gained by implementing strategies that in the long-term will create a superior return compared to its competitors' strategies. A firm will gain a superior position, i.e. find the appropriate strategy, by finding its unique set of strengths. These can be cost leadership, differentiation or focus strategy (Porter, 1985:12ff). Companies have the possibility to invest assets in activities related to its core competences in order to gain competitive advantage. It is common that companies use different kinds of methods to measure the performance of a company. A method which is commonly used is profitability analysis of strategies. The method has emerged in order for managers to simplify decision making regarding strategy, which lays the foundation for actions that affects competitive advantage (Grant, 2008:41).

Milton Friedman (1970) argued that business had one responsibility; to "maximize profits of its owners and stakeholders", why social responsibility was regarded to be a concern for government and legislation. This view has gradually changed over the years, partially due to increased knowledge about environmental threats. *Silent spring* (1962), *Tragedy of the commons* (1968), *The Brundtland report* (1987) and *An inconvenient truth* (2006) all state examples of how our knowledge about our

surrounding environment has deepened throughout the years. *The tragedy of the commons* pinpoints how a common asset can be over exploited when the use of it adds no extra cost. Thereby the natural resource can be used repeatedly, which over time, can lead to a natural disaster. The problem with companies over-using the surrounding environment has led to numerous governmental regulations, legislations and policies. It is common knowledge that individuals have begun to demand better and more thorough environmental work and responsibility from companies. Scientific ideas concerning "green strategy" in companies have developed over the years in contradiction to the Friedman approach. An example of this is Michael E. Porter who published several articles on the subject during the 1990s. In the article *Industrial Ecology and Competitiveness*; Esty and Porter argue that industrial ecology can be a tool for optimizing resource productivity (Esty & Porter, 1998:41f). This early "Porter-approach" reveals that the green performance was not seen as a way to gain a competitive advantage, but still it was important for companies to take into account.

"While many companies still think of global warming as a corporate social responsibility issue, business leaders need to approach it in the same hardheaded manner as any other strategic opportunity."

(Porter & Reinhard, 2007:26)

Eight years after the *Industrial Ecology and Competitiveness* was published, Porter addressed strategic CSR-work as a way to achieve competitive advantage. The article, published in 2006, suggests that CSR should be regarded similarly as R&D, as long-term investments for the future competitiveness of a company (Porter & Kramer, 2006:91). Porter argues in 2007, in the article *A Strategic Approach to Climate*, that it is possible to have the same strategic approach to environmental issues as CSR or any other corporate issue. These thoughts were also shared among other scientists (Lash et al. 2007).

1.2 Issue Discussion

Porter's strategy approach is commonly referred to as "the positioning perspective" i.e. the company is analyzing and acting in accordance to its environmental conditions (Gibe, 2010; Porter, 1987). Another perspective of strategy, called the resource based view (RBV), was presented during the 1980s and 1990s by Jay Barney. The ideas of RBV are based on the ideas of creating competitive advantage through an "inside out logic" or more specifically; to concentrate on the company's own resources (Barney, 1991). In the 1990s a further development of the strategy concept emerged with the hypercompetition perspective. Richard A. D'aveni (1998) argued that the business world had entered a new era, characterized by a fast moving environment and hypercompetition. He further argued that "Hypercompetition has crashed against Western shores like a tsunami" and that

The PGS-framework – A study of Alfdex’s Environmental Strategy

technology, falling barriers of entry and a “heated up” economy all contributed to this (D’aveni, 1998:187).

Many companies today are working with green strategy in some way, which indicates a subtle belief that this approach might deliver return. In addition to this, scientists like Porter have recently begun to promote the CSR-work as an important part of the core business (Porter & Kramer, 2006). Several studies have shown that unclear financial effects of environmentally driven investments bring uncertainty for board members and managers in their decision making (Carrillo-Hermossilla, del Río González & Könnölä, 2009:2; OECD, 2009:32; Porter & Kramer, 2006).

The three approaches to strategy: the positioning perspective, RBV or hypercompetition can be used to analyze a company’s competitive advantage and environmental strategy. Today’s managers state that they postpone decisions associated to environmental investments because they lack evidence to state that these investments will generate increasing returns and thus they only see the short-term costs incurred. Rappaport (1998) argues that; when planning strategies the output of implementing the strategy ought to be valued. The thoughts from competitive advantage, industrial ecology and strategic CSR, generate grounds to say that environmental strategy, implemented in a company’s core strategy, may generate competitive advantage. With this in mind it would be interesting to expand this view and put a figure on the profitability of having an environmental strategy. In this thesis the Porter framework inside-out/outside-in has been selected, although it is developed uniquely to make CSR a part of the core strategy. The framework has been taken one step further by adding a potential profitability dimension, which when combined, are a relatively unexplored area of knowledge up until today. This new approach reveals if a green strategy is profitable and which actions that drive this potential profitability. Let’s go from stating that green creates competitive advantage to really putting a figure on the profitability; *what gets measured gets done*.



Figure 1: The combination of an green strategy and profitability

The center of Figure 1 presents the thesis contribution to the research area; the relation between profitability and green strategy. As stated above, both literature and companies stress that a *method* for evaluating the profitability of having a green strategy is missing and that there exist uncertainties about whether it actually is profitable or not.

1.3 Purpose

The purpose of this thesis is to develop a framework for describing and analyzing the potential profitability of a company's green strategy as a part of the core strategy. The purpose is further to apply the framework in a case study.

1.4 Delimitations

This thesis only focuses on the profitability aspect of having a green strategy. The thesis will thereby not consider or discuss moral or ethical (or similar) aspects of having a green strategy. Further the thesis only includes Europe and the European market.

1.5 Outline

The outline of the thesis is presented in figure 2.

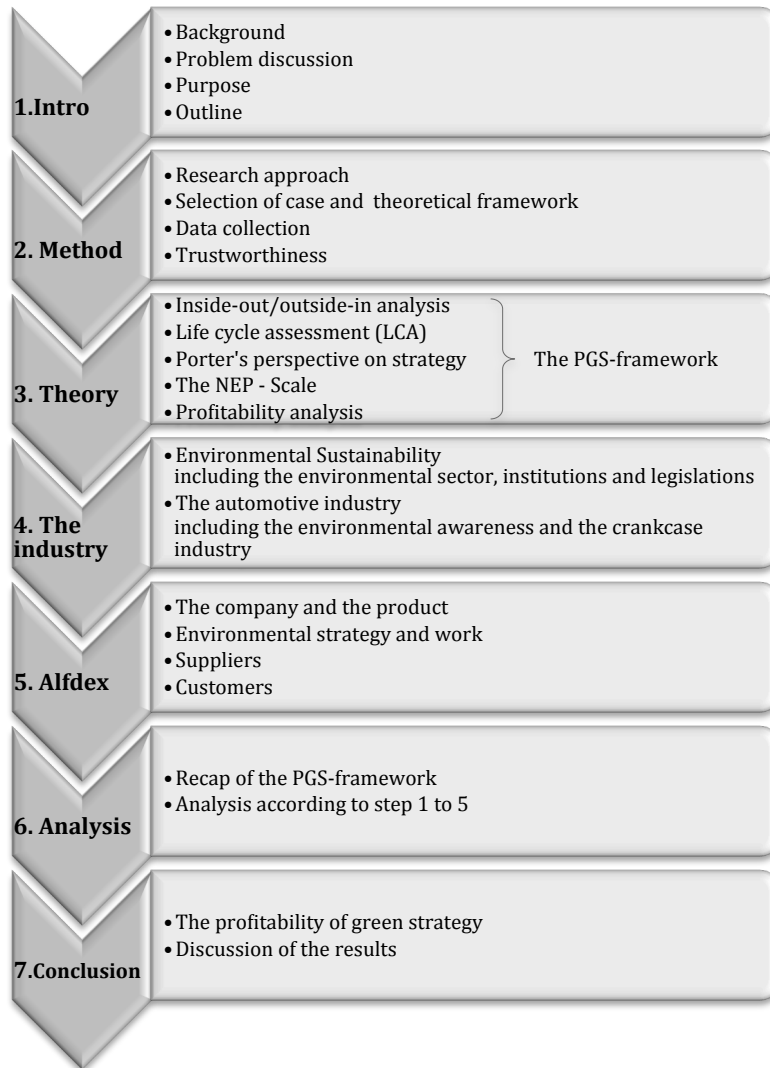


Figure 2: The outline of the thesis, chapter 1-7

1.6 Definitions

The definitions that follow are commonly used throughout the thesis, presented in alphabetic order.

Active solution - Crankcase ventilation system that requires energy to operate, for example a separator.

Automotive industry - The sector for producing and selling heavy-duty trucks in Europe. This includes all components used when producing the trucks.

Cost leadership – A company that keeps costs lower than its competitors. The way to achieve cost leadership differs between different industries and can be focused on scale-production, selection of raw-material or technology. It is a strategy through which a company can gain competitive advantage (Griffin, 2008:207).

Cradle to grave - A products full process from raw material extraction to distribution, processing, use, disposal etcetera, i.e. the entire value chain for a product.

Environmental strategy/Green strategy - A set of actions, part of the overall strategy, that a company performs to gain long-term competitive advantage in tandem with environmentally sustainable benefits for society.

Environmental work - All activities and resources within a company that partially or completely can be associated as a gain for society and sustainability.

Environmental sector - The industry that produces goods and services which measures, prevents, limits, minimizes or restores environmental damage to water, air and soil as well as problems related to waste, noise, ecosystems and works for sustainability. This includes cleaner technologies, products and services that reduce environmental risk and minimize pollution and resource use (SCB.se, 2010).

Environmental impact - Environmental damage to water, air and soil as well as problems related to waste, noise and ecosystems.

Environmental impact in the LCAs - Global Warming Potential (GWP), kg CO₂-equivalents. (Since both Scania and Volvo argue that the CO₂ footprint (i.e. GWP) will be more important to report in the future, the GWP perspective was chosen)

Eco-innovation - Any form of innovation aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment or achieving a more efficient and responsible use of natural resources, including energy (Carrillo-Hermosilla et al., 2009:7ff).

Heavy duty diesel truck - Trucks with technically permissible maximum capacity load over 3500 kg, equipped with compression ignition engines or positive ignition natural gas (NG) or LPG engines (Gsgnet.net, 2011).

Inside-out/Outside-in analysis - The inside-out/outside-in analysis (core theory in the thesis) is a framework for companies to be able to align CRS work and the core strategy. In this thesis it will only include and focus on the environmental aspect of the CSR work, why headlines and frameworks are changed from *social* to *environmental*.

Life cycle - The full life cycle of a product describes all stages from resource extraction and processing/packaging, through to transportation, use and ultimately disposal (Rydh, Lindahl & Tingström, 2002).

Passive solution - Crankcase ventilation system that requires no (or a very small amount) of extra energy to operate, for example filter solutions.

Profitability of Green Strategy (PGS-framework) – Framework developed in this thesis usable for finding which environmental issues to address and calculation of the profitability of having a green strategy.

Sustainability - Development which meets the needs of the present without compromising the ability of future generations to meet their own needs (Drexhage & Murphy, 2010).

The separator - Refers to the product produced by Alfdex (the case company).

2 Methodology

The following chapter provides the reader with an explanation of the thesis's methodology approach. The chapter includes selection of thesis subject, research approach and case-company as well as the selection of theoretical framework. In addition a description of how the data collection was performed and how the analysis was conducted is presented. The chapter ends with a discussion concerning the thesis' credibility.

2.1 Why Green Strategy and Profitability?

The sustainability research and its role in creating competitive advantage has changed, see section 1.1. Porter has recently (2007) begun to pin-point the relation between competitive advantage and green strategy. Additionally, studies performed by other scientists have shown that companies generally are confused regarding which environmental problems to address, because of the uncertainty if they generate profitability (Carrillo-Hermossilla et al., 2009:2). Porter (2007) suggests a method called the inside-out/outside-in analysis for companies to rank environmental issues. What is not generally proved is whether a green strategy actually creates profitability. To be able to perform such an analysis a few additional steps to the inside-out/outside-in framework was added. Once this was done, it was of interest to use the model in a case-study to analyse the relationship between green strategy and profitability, generally an unexplored subject.

2.2 Research Approach

The study was based on a theoretical platform, where the first part of the purpose aimed to develop a framework, thus the thesis has a deductive approach (Bryman & Bell, 2003:24). Further, the framework was used on a relevant case-company. The study required a quantitative and a qualitative approach, where the LCA is mostly considered as a quantitative research method, and thus numerical data was required. The profitability analysis was partly quantitative for which the present value calculations were based on numbers. The rest of the study was of qualitative nature, where a macro- and micro-analysis of the company and its environment were evaluated (ibid:40f).

The research can be divided into two main parts, the profitability analysis and the LCA-analysis, where the former includes the latter. The LCA is to be seen as a sub-step in the profitability analysis, but also by far the most time consuming part of the study and hence the profitability analysis depended on the LCA outcome.

2.3 The Case Selection

To be able to fulfill the purpose a case study was performed, suitable for qualitative and quantitative studies. The case study was of longitudinal kind, where the authors functioned as a part of the organization during approximately four months (Bryman & Bell, 2003:74). Since the developed framework includes LCA-analyses, a particularly time consuming method (in addition two LCAs were performed in this study¹), it was decided that the study should be performed on one case only.

Alfdex was considered a suitable case-company based on a few determining factors. Alfdex is a medium sized (60 employees) and newly founded company (2004). Alfdex is a company in the automotive industry which is offering the market a product for crankcase gas ventilation that is installed in diesel engines for heavy duty trucks, see section 5.1. In 2008 an environmental strategy was formed by the company. Alfdex is located in Sweden and the market-transparency was judged to be higher in Sweden than it is in the market in general, although this might have been due to the fact that the authors were situated in Sweden, see section 4.2. From December 2013 the Euro 6 will be taken into effect, which states that all heavy trucks sold in Europe will require crankcase ventilation systems. This opens up the European market for crankcase ventilation solutions like the separator, see section 4.2.2.

2.4 Theoretical Framework

In order to fulfill the first part of the purpose, there was a need to perform the profitability analysis on a green strategy. The Porter perspective was selected since it is commonly used during strategic analysis and he is a well-known scientist with ideas well recognized. In 2006 Porter stated that there was a possibility to create competitive advantage through making CSR part of the core strategy. Porter's framework for ranking and prioritizing certain CSR activities by performing a so-called inside-out/outside-in analysis was regarded as relevant to use. Porter and Kramer also won the McKinsey Award for best Harvard Business Review article when this model was published in an article 2006 (hbr.org, 2011). Even if it would be interesting to include numerous perspectives of strategy in the study, this required resources that were not available at the time. The results from the study are believed to be replicable for other perspectives of strategy as well. The inside-out/outside-in framework did require a few additional steps and sub-steps (LCA, five forces framework, industrial ecology, profitability analysis and the NEP-Scale) in order to fulfill the thesis purpose. For motivation of why certain theories were selected and information on these, see chapter 3: Theoretical Framework.

¹ The full LCA – analysis can be found in *The Green Scale – Alfdex* (Ejlertsson & Gustafsson, 2011).

2.5 Data Collection

Data has been collected from primary sources such as interviews and surveys (mainly empirics), and secondary sources such as literature (mainly theories). The following sections describe the interview and survey approaches divided into their main parts, LCA analysis and profitability analysis. All interviews were in between 30-90 minutes long and they were conducted both in person and over the telephone. The majority of the interviews were held in Swedish but about 10 % were held in English, due to the fact that the interviewees did not speak Swedish.

2.5.1 Interviews for LCA

Structured interviews were held with employees at Alfdex and Mann+Hummel in order to map information about the two products cradle to grave processes. LCA is mostly a quantitative method, for which structured interviews are most suitable (Bryman & Bell 2003:135).² Alfdex and Mann+Hummel cooperates, why the transparency was considered to be lower relative other competitors, why Mann+Hummel was chosen as a suitable benchmarking company. The interviewee (crankcase ventilation R&D Manager) at Mann+Hummel was selected by Alfdex's contact person at Mann+Hummel.

2.5.2 Interviews for Profitability Analysis

For the rest of the profitability analysis qualitative and semi-structured interviews were held, since the authors required subjective statements from the interviewees (Bryman & Bell, 2003:361f). To get a view of how much resources that have been invested in the environmental work at Alfdex, interviews with employees at all division at Alfdex were held. A set of questions were prepared on the subject *environmental work*. These were mainly based on a list of actions developed as a part the environmental strategy Alfdex.

Interviews at Scania and Volvo were held in order to collect information about their purchasing process from an environmental perspective. The main focus was to evaluate a supplier's financial benefits of implementing a green strategy now and in the future. At both companies employees at several positions in the organizations were interviewed including top-management in environmental work as well as employees from the purchasing division. All interviewees at Volvo already had a relation with Alfdex through their purchasing function, why they also were contacted for this interview.

² For further information about the interviewees and questions regarding the LCA, see the report The Green Scale – Alfdex (Ejlertsson & Gustafsson, 2011).

The interviewees at Scania also had some indirect connection to Alfdex and they were contacted through Alfdex and/or external contacts. For more information about the interviewees and questions, see appendix 2.

Scania and Volvo were chosen due to the fact that they were both Alfdex's first ever customers and therefore judged to have good knowledge about Alfdex and its history. Scania and Volvo are also two of Alfdex's largest customers (Ekeroth, 2011a). They are both Swedish companies, which according to us might be advantageous for transparency and both claim to focus on sustainable production (Volvotrucks.com, 2011a; Scania.com, 2011a).

2.5.3 Surveys for Profitability Analysis

After having conducted the interviews, it was obvious that the study required an additional method as a complement in order to be able to quantify the price-sensitivity and number of products sold as a result of having a green strategy since this information was difficult for the interviewees to quantify. For this reason surveys were put together and distributed to some of the interviewees (within Alfdex, Scania and Volvo). The NEP-scale survey was conducted by using a five point Likert scale and it was structured with closed and quantitative questions (Bryman & Bell, 2003:74). For more information about the NEP-scale, see section 3.4. A Likert scale works well when exploring attitudes towards a subject or an issue (ibid:571) and therefore this survey method fit the purpose. The outcomes of the participants' answers were perceived responses and all the questions were mandatory. The method is similar to structured interviews and the purpose is to give all participants the exact same question frame. Also surveys are commonly used in quantitative studies (Bryman & Bell, 2003:135ff). The response rate was approximately 90 %. For survey questions, see appendix 3.

2.6 How the Analysis was performed

The analysis was performed according to step 1 - step 5 in the developed PGS-model presented in section 3.7. In the first step the LCA was performed. This became the most time consuming part in this step and therefore also the main focus of the study. In tandem the information from interviews with interviewee-objects at Volvo and Scania was analyzed together with useful information about the industry. The analysis was performed using the national diamond, five forces framework and NEP-Scale. When performing step 2 all inside-out and outside-in linkages were summarized, characterized and related to a responsive part or strategic part, based on information and knowledge from the analyses in step 1. The issues related to the strategic part were considered as possible profit drivers. In step 3 the actual profitability analysis was performed, based on a forecast-discussion concerning the profit drivers. In step 4 the most important (strategic) issues were converted into actions, based on a brainstorming session. The brainstorming was conducted by the

authors, through individual thinking and writing actions on post-its. All the actions were then put into groups related to each issue, followed by a discussion about the possibility of performing the actions suggested. Step 5 was not thoroughly performed since this is not considered as a step answering the purpose of this thesis and it is a step where the management in the company should be present, but a discussion is performed in section 0.

2.7 The Study's Trustworthiness and General Reflections

The LCAs are considered as hints of the products environmental impact from cradle to grave and give enough information about the inside-out linkages, even if a number of assumptions and estimations have been carried out. In particular assumptions regarding the filter have been made, since limited information about this product has been provided due to secrecy. This might have affected the LCA benchmarking in a negative way, but this is considered to have had a small effect on the overall results. A reason to why a benchmarking LCA (separator versus filter) was possible to perform was because values for the separator were already collected. Also good knowledge about the LCA-methodology did exist within the company, which contributed to the study. Despite this LCA-study which was performed in this thesis did take approximately 500 working hours out of totally 1000 performed working hours.

Porter's theories have been used as a base for the theoretical framework. This might, and probably will, affect the result of the study. Other reports have presented tools for identifying and ranking the most important environmental aspects for a company to address. During the process of forming a relevant theory foundation the ability of using one of these theories were discussed. A framework which was presented by the Master thesis students Fredriksson and Krasse (2009) provides a tool for companies to value their environmental work. In addition the ISO14001 perspective presents a framework for companies to evaluate their environmental impacts and linkages. The Porter view was however considered as an interesting development of the CSR-concept and by complementing the inside-out/outside-in analysis (in this case regarded as mid level theories) with general theories analyzing an industry environment (in this case regarded as high level-theories) this was assumed to be the best suitable framework (Bryman & Bell, 2003:19).

There is a number of different ways to value a strategy and the consequences of not calculating an actual value could create uncertainty and in worst case prevent companies from noting the threats of financial crises and bubbles (Koller, Goedhart & Wessels, 2010:11). The discounted cash flow (DCF) model is a regularly used method for determining a company's value and the long-term goal for a company is to maximize shareholder value. It is commonly debated if the valuation methodology is overly focused on accounting earnings rather than revenue and growth and return on invested capital (ibid). Although according to Koller et al.

(2010) there is a positive correlation between long-term shareholder returns and investments in for example R&D. The environmental strategy is regarded as an investment in this thesis, whereby the profitability of the strategy is calculated with the present value method with a five-year forecast from 2013 and onwards. This is done because the effects of the strategy are assumed to take effect in the upcoming years after 2013. There are although certain advantages with “going all the way” and performing a full valuation with DCF, but the complexity with Alfdex's shareholder situation made that kind of a study hard to perform, not to say impossible.

Interviews with two customers were performed. Perhaps the study would have been more trustworthy if more than two customers would have been included in the study. It would also have been of interest to perform interviews with employees in other parts of the organization, but the size of the project did not allow that. Neither did it provide the time and resources needed to find and set up interviews with more than the six interviewees that were used in the study. This because of the huge amount of resources needed to identify appropriate interviewees and convincing them to participate in the study.

It is also of great importance to put the right questions in structured as well as semi-structured interviews and survey questions (Bryman & Bell, 2003:175). This was taken into consideration when formulating the questions. Despite this, some question perhaps would have been better if they were formulated and put in another way. The fact that it was difficult for the interviewees to quantify some of their answers also made it difficult for the authors to compile the relevant information and use the information in the analysis. Therefore a survey was put together, where the questions were closed (Bryman & Bell, 2003:169).

3 Theoretical Framework

This chapter presents the theoretical framework used in this thesis and how it was built. It begins with presenting the core framework, concerning CSR as a competitive advantage (inside-out/outside-in, section 3.1) and continues by presenting additional theories. The outcome of the chapter is a new framework, called the PGS – framework (section 3.7). The additional frameworks are presented in the same order as they are used in the PGS-framework; LCA, National Diamond, Five Forces, NEP Scale, Industrial Ecology and Profitability analysis.

3.1 Inside-out and Outside-in Analysis

In order to help companies develop their corporate social responsibility (CSR) approach from “uncoordinated CSR and philanthropic activities disconnected from the company’s strategy” to meaningful social improvements and long-term benefits, Michael Porter and Mark Kramer (2006) developed a framework for aligning CSR and corporate strategy, called inside-out/outside in analysis (Porter & Kramer, 2006). They argue that companies and society must realize the interdependence that exists between them; "successful corporations need a healthy society" and "a healthy society needs successful companies". As Porter and Kramer argue moral obligation, sustainability, license to operate and reputation are four factors defining CSR, all of which environmental work is or can be included in (Porter & Kramer, 2006:2fff). The inside-out analysis for developing a new environmental strategy includes the 4 steps described below.

Step 1: Identifying the Points of Intersection

The company should identify the *inside-out linkages* by mapping the environmental impact of the value chain (Porter & Kramer, 2006:7). Almost all value chain activities can affect the environment, which can be expensive when legislation becomes more stringent or the environmental awareness in society grows. The inside-out impacts can come from direct (own company) or indirect (suppliers, customers or other) sources, but all of them are important to take into consideration (Porter & Reinhard, 2007:24). In addition the company should identify the *outside-in linkages* by mapping the environmental influences on competitiveness through Porters national diamond (Porter & Kramer, 2006:5). By managing these linkages strategically, competitive advantage can be achieved (Porter & Reinhard, 2007:26).

Step 2: Choosing which Environmental Issues to Address

One company cannot address all environmental linkages found in step 1, rather they must address the linkages associated with the core business and thereby create shared value for the environment and the business. This is done by characterization of the linkages into three categories; generic environmental issues, value chain environmental impacts and environmental dimensions of competitive context, see Figure 3 (Porter & Kramer, 2006:8f).

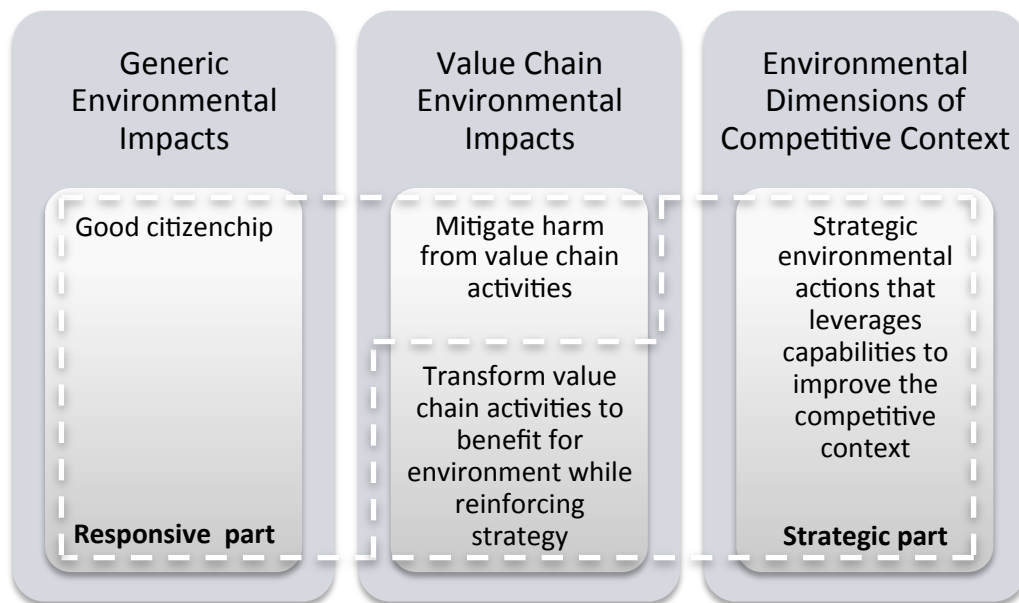


Figure 3: Corporate involvement in environment (after Porter & Kramer 2006:89).

When categorized, the environmental linkages must be prioritized into the responsive or strategic part. The responsive part includes good citizenship such as creating goodwill, good relations with society, pride among personnel etcetera. The strategic part states the linkages which can be the company's potential profit drivers (when performed differently or better than competitors) (Porter & Kramer, 2006:9ff).

Step 3: Creating a Corporate Environmental Agenda

In order to create a corporate environmental agenda the strategic linkages must be converted into actions.

Step 4: Creating an Environmental Dimension

By including the environmental dimension (strategic actions from step 3) into the value proposition it becomes integrated in the overall strategy (Porter & Kramer, 2006:12).

3.2 Life Cycle Assessment (LCA)

No specific tool is suggested by Porter in order to be able to perform the value-chain analysis (inside-out analysis, step 1), but LCA is defined as; “a process used to summarize resource and environmental consequences (from cradle to grave) of all activities needed for a product or service to fulfill its function”, why the LCA-method was chosen (ISO14040, 1997). The LCA is traditionally used as an R&D-tool or when calculating the life cycle costs (the costs of the environmental impact from a product), but not commonly used as a strategic approach. A LCA is normally divided into four steps; the goal and scope definition, inventory analysis, impact assessment and interpretation, where the most time-consuming part is the inventory analysis where all the data is collected (Rydh et al., 2002).

3.3 Porter’s Perspective on Strategy

The National Diamond

The diamond framework provides a method for a better understanding of the surrounding environment in which a company exists and it is suggested by Porter (2006) to be used when performing the outside-in analysis. The framework consists of four dimensions, where all of them connect and influence the other, summarized in Figure 4 (Porter, 1990).

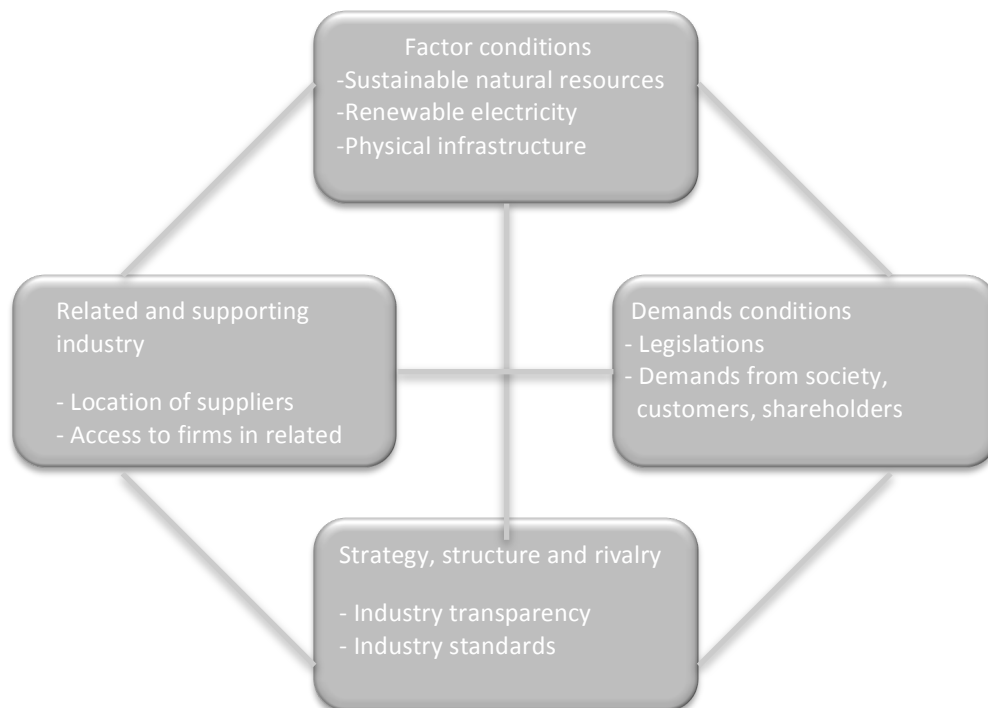


Figure 4: The national diamond.

Porter's Five Forces of Competition Framework

In order to strengthen the strategy, structure and rivalry dimension in the national diamond, the five forces framework was considered suitable to use. This is done since the national diamond framework is a high level framework. The five forces framework is frequently used when determining the intensity of competition and level of profitability. The five forces of competitive pressure are Industry competitors, suppliers, potential entrants, substitutes and customers, which together determine the profitability in the industry, summarized in Figure 5 (Porter, 1979).

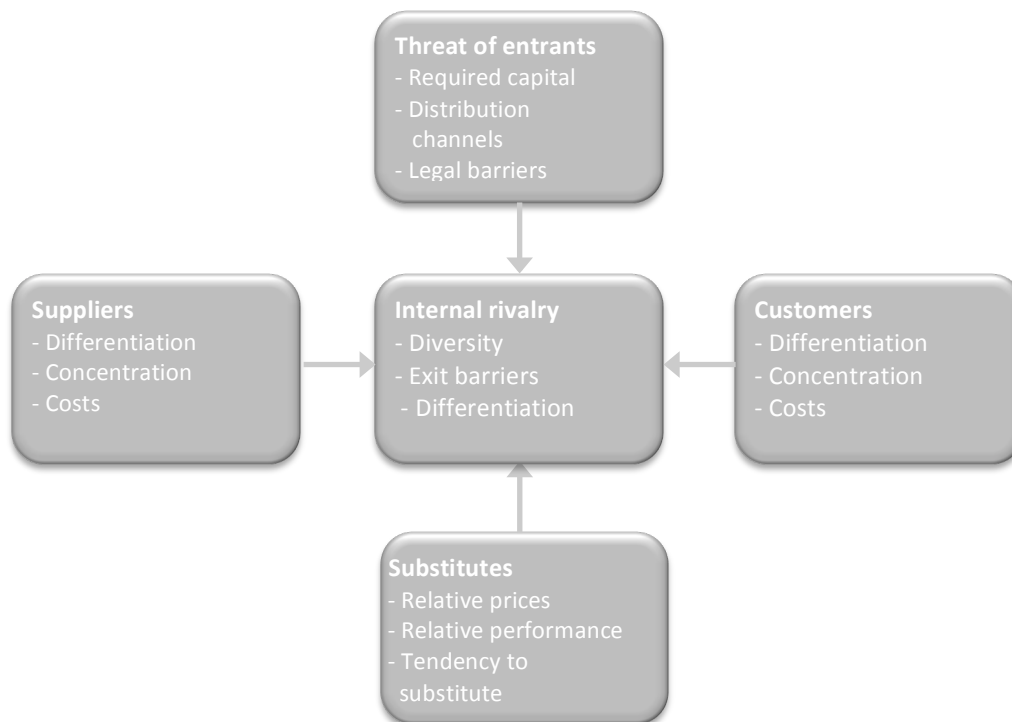


Figure 5: The five forces framework

3.4 The New Ecological Paradigm Scale

Many costs and revenues are of a complex nature, since they can be associated to technical, quality and/or environmental aspects, and thus create synergies. In order to evaluate the proportion of the costs and revenues that can be related to the environmental strategy, parts of the New Ecological Paradigm Scale (the NEP-Scale) were included in the framework. It has been developed in order to be able to measure the environmental concerns in the society and it has been frequently used in many studies with high reliability (Nilsson & Forsberg, 2003:4). The NEP Scale includes 15 statements, where 8 indicate a pro-ecological view and 7

indicate the opposite. The statements were designed to approach five interest areas (3 statements per area); the reality of limits to growth, anti-anthropocentrism (the world exists for humanity), the fragility of nature's balance, rejection of exemptionalism and the possibility of an ecocrisis (Dunlap, van Liere & Jones, 2000). In this thesis one statement from each of the four interest areas were selected, see appendix 3.

3.5 Industrial Ecology

Porter and van der Linde (1995) argue that competitive advantage is derived from cutting costs or adding value to a product, i.e. increased resource productivity defined as in Figure 6.



Figure 6: Resource productivity of x (after Esty and Porter, 1998:36)

Direct value added and direct costs of a production process are core focuses in companies, where the environmental contributions can be recognized by mapping all processes and emissions throughout the value chain. The indirect value added and indirect costs are often not included in the core activities and may therefore be hidden. Esty and Porter (1998) present three places where indirect value added and indirect costs can be discovered; within the firm, within the chain of production (involving suppliers and customers) and beyond the chain of production (such as using neighboring industry's by-products).

3.6 Profitability analysis

In order to perform the profitability analysis the thoughts from industrial ecology in tandem with the net present value (NPV) and profitability driver method were added to the framework. The NPV method is regularly used when calculating the profitability of an investment. The calculation is made by the following equation (initial investments excluded)(Persson & Nilsson, 1999:61fff): $NPV = \frac{a}{(1+i)^n}$. The data is; revenues minus costs (a), the economic life (n), discount rate (i) associated to the investment. All future payments are discounted to "year zero" (Persson &

Nilsson 1999:22). Profitability drivers are metrics used to monitor company performance and often considered the underlying factors for driving profit in a company, hence useful when valuing companies and performing forecasts (Koller et al., 2010:430ff). Many drivers might be identified, but the most important drivers must be focused on. In addition the drivers can simplify when prioritizing between investments (ibid).

3.7 The PGS-framework

The profitability of green strategy framework, henceforth called the PGS-framework, shown in Figure 7, includes 5 steps. The framework is developed from the inside-out/outside-in analysis by adding the sub-steps of LCA, five forces framework, the NEP-Scale, profitability analysis, including industrial ecology and profitability drivers.

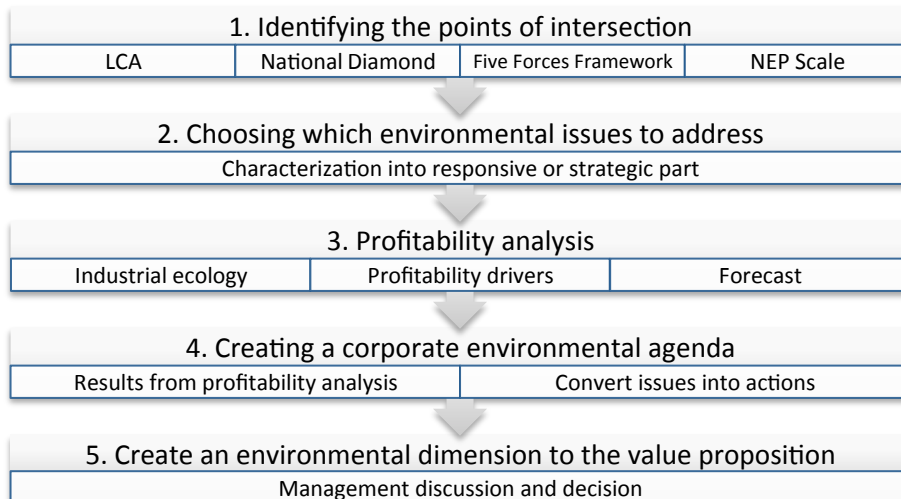


Figure 7: The PGS-framework

The main steps, called 1, 2, 4 and 5, derive from the inside-out/outside-in analysis (section 3.1), whilst step 3 is added and derived from the profitability analysis and industrial ecology perspective (section 3.5 and 3.6).

In step 1 a thorough analysis of the company’s value-chain (inside-out linkages) and outside environment (outside-in linkages) is performed. The inside-out linkages are recognized through the LCA-analysis in tandem with the industrial ecology thoughts of finding hidden linkages outside the value chain. In addition the outside-in linkages are recognized through the national diamond (as suggested by Porter, 2006), where the dimension *strategy, structure and rivalry*, is performed by using the five forces framework. Furthermore the NEP-Scale is used to evaluate the proportion of costs and revenues that can be related to the environmental strategy. In step 2, the

environmental linkages, recognized in step 1, are categorized in *generic environmental impacts*, *value chain environmental impacts* and *environmental dimensions of competitive context* and thereafter in responsive- versus strategic parts. The strategic linkages are to be considered as profitability drivers. In step 3 (the added main step) the profitability analysis is performed based on the profitability drivers and a forecast of how the profitability drivers will develop. The forecast is derived from the analyses performed in step 1 and 2. When this is completed, actions will be created for the linkages representing the *strategic part* since these are considered as the most important in order to create a profitable environmental strategy (step 4). In step 5 the integration of an environmental dimension to the core strategy is done. In this step it is important that the management is present in the discussion and decision.

4 Environment and the Industry

In chapter 4 and 5 the collected empirical data is presented, divided into two parts; Environment and the industry (4) and Alfdex (5). This chapter is divided into two parts; environmental sustainability (4.1) and the automotive industry in Europe (4.2). The environmental sustainability part includes history, the environmental sector and growth, institutions and legislations and policies. The next part, the automotive industry in Europe, includes a brief history, growth and market, the environmental awareness in the industry and the sub-industry referred to as the crankcase industry.

4.1 Environmental Sustainability

Today some people argue that the world will collapse if we continue our existing consumption habits whilst others disagree with this mindset. Björn Lomborg, wrote the book *Cool it - The Skeptical Environmentalist's Guide To Global Warming*, where he argues that the environmental actions performed today are mostly based on emotion rather than scientific proof and that there is a risk that these (expensive) actions will not stop global warming (lomborg.com, 2011). On the other hand, during recent decades publications and reports have been eye-openers for society's way of looking at the environment, growth and sustainability. The debate about the harm of the environment started in the 1960's with Rachel Carson's book *Silent spring* that discussed the problems with the chemical DDT and was followed by the publication *Limits to growth* written by D.H. Meadow in the 1970's. The Brundtland report from 1987 first defined sustainable development. In a recently released book, the authors Anders Wijkman (EU Parliament) and Johan Rockström (Stockholm Environment Institute), argue that we need to reform our economical models and theories in order to fit sustainability boundaries (Miljoaktuellt.idg.se, 2011).

4.1.1 The Environmental Sector

With a growing environmental concern in society, the market for companies in the environmental sector such as environmental consultants, air emission control, renewable materials is steadily growing. During the period 2003-2008 the environmental sector in Sweden increased its export with 65 % and in the same period the total export (all sectors included) increased with 55 %. The difference in growth is about 2 % per year (svd.se, 2010; SCB.se, 2008). In addition Björn Edsfeldt (2011), Director Transaction Services at Deloitte, argues that companies in the energy-sector can earn a higher profit through price-segmentation, providing proactive and caring customers clean and renewable energy at a higher price. Veridantix (2011) further argues that the market for LCA tools will increase by 2012 as a result of the last five years of increasing pressure from regulators, supply chain partners and end users to address the environmental impacts of manufactured products.

4.1.2 Environmental Institutions - Europe

Environmental policies concerning all sectors in the European Union (EU) are developed and addressed by the EU institutions (European Parliament, Council and Commission) and the member states' governments (Europeiska Kommissionen, 2006). These policies do affect the European market in different ways. The following sections aim to describe some of the central environmental institutions in the EU.

EU has worked with environmental issues since the 1980s, and is today following *the sixth environmental action program* aiming at four priorities; Climate change, nature and biodiversity, Environment, health and quality of life, Natural resources and Waste. A specific objective is to reduce emissions of carbon dioxide produced when fossil fuels like coal and oil are burned. The European Commission systematically checks that the member states fully implement the EU policies in the national regulations and that the rules are complied with. Companies that do not follow the rules face sanctions and may also have to repair the damage they caused to the environment (Europeiska Kommissionen, 2006). In addition there are around 200 universities in Europe, of which about 50 universities and colleges are situated in Sweden, that offer almost 900 courses concerning environmental aspects in some matter (studera.nu 2011a; studera.nu 2011b). In addition, there are a range of science parks and similar adjacent to major universities, for instance Ideon Science Park in Lund and Cambridge Science Park (Ideon, 2011; Cambridge Science Park, 2011).

4.1.3 Legislations, Standards and Guidelines - Europe

The policies and legislations set in the EU institutions (section 4.1.2) concern all sectors and companies in Europe. Some of these regulations are presented in the following sections.

EMS-systems

The ISO14001-standard is a set of requirements for environmental management systems (EMS) in order to help companies control their environmental impacts, and improve their environmental performance (iso.org, 2011). The ISO14001 Certification is widely used in the automotive industry and can be considered as an industry standard (Lans, 2011). The so-called ISO14000 family also includes guidelines for specific environmental aspects, such as labeling, LCA and auditing (iso.org, 2011).

The EU ETS & the Green Public Procurement

The EU Emissions trading scheme (EU ETS) was launched in 2005 and it is the first so-called cap-and-trade system of allowance for emission of greenhouse gases (among these CO₂). Each ton of emitted carbon has a price, which enforces new low carbon projects to start up. The project includes 27 EU member states, Norway, Lichtenstein

and Iceland. Today the project includes heavy industries but will from 2012 also include air flights (European Commission, 2006). The Green Public Procurement (GPP) is a voluntary policy defined as "a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured." A recommendation is to use the environmental LCC (life cycle cost) methodology in the purchasing process, including costs of investment, operation, maintenance, end-of-life disposal expenses and external environmental expenses. The latter is based on LCA where the outcome is converted into monetary costs (European Commission, 2010).

The Euro Standards & Chemical Regulations

The heavy-duty truck emissions is regulated by the Euro standards, ranging from Euro 0 to Euro 6, regulating carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx) and particulate matter (PM) emissions (European Parliament, 2009). Euro 0, introduced in 1988, only included CO, HC and NOx, but ever since Euro 1, introduced in 1993, PM has also been included, ranging from emissions at 0.15 g/kWh to 0.01 g/kWh in the new upcoming standard, Euro 6, 31st December 2013. Vehicle manufacturers are now searching for the technologies needed to meet the Euro 6 standard, due to the fact that the technologies used today are not good enough (Truck & Bus Builder, 2010). This does affect the market for crankcase ventilation and the possibility for Alfdex to distribute their solution to all producers of heavy duty trucks. IMDS (International Material Data System) is a common system where all suppliers in the automotive supply chain can report which substances that are present in their products. GADSL (Global Automotive Declarable Substance List) and REACH (Registration, Evaluation, Authorization and Restriction of Chemical substances) are two substance lists used in IMDS. The purpose is to improve safety, quality and protect humans and the environment through earlier identification of substantial properties of chemicals but also to give the industry incentives to innovate in order to eliminate chemicals (IMDS.com, 2010; European Parliament, 2006).

4.2 The Automotive Industry in Europe

The automotive industry went through a tough period during the financial crisis in late 2008. During 2010 the market indicated a rise, particularly in two regions; Asia and Europe. In Europe about 77 % of all inland freights are transported by trucks (PWC, 2011:1; Eurostat, 2011). In the automotive industry the truck sector is highly cost-focused and the evaluation process when choosing a new supplier is important. The question is often about who can deliver the best possible solution to lowest cost (Johansson, 2011; Porretta, 2011). Even if the automotive industry is cost-focused, the manufacturers are under pressure from both society and legislators to become more environmentally aware and to find (new) solutions aimed at improving the environment (Sylvander, 2011).

4.2.1 The Environmental Awareness in the Automotive Industry

A scan of the headlines in the industry journal "Truck and Bus Builder" from January 2008 until December 2011 indicates that the number of articles that concerned environmental issues were almost as frequent during 2008 as 2010 (approximately 3-4 articles per monthly issue). In 2009, during the financial crisis, this number was approximately 1,5 articles per issue. The total amount of articles in an issue of the journal is approximately 50, which indicates an average of 6 % of environmental articles during 2008 and 2010. What was also observed was the fact that approximately 90 % of the articles concerning environment published in 2008 was about legalization and/or different kinds of hybrid techniques. During 2010 the subjects had diversified and the articles subject's concerned different types of techniques such as bio fuel, fuel cells, solar cells, CO₂-reduction in general, Euro 6 etcetera (Truck & Bus Builder, 2008-2010).

4.2.2 The Crankcase Industry

The automotive industry can be segmented into sub-industries, where the crankcase industry can be defined as one sub-industry. The number of crankcase ventilation suppliers is approximately 15-20 for heavy-duty trucks, including all types of solutions (separators, filters and cyclones etcetera). Crankcase ventilation systems have been installed in engines during the last 20 years, mostly where legislations has demanded it, i.e. the USA, South Korea and Japan. Today there are several methods for performing crankcase ventilation all with various separation efficiency. The solutions can be divided into active (needs energy), passive and new solutions (not yet entered the market). For more information about crankcase gas, the market and products, see appendix 4.

5 Alfdex – an Actor in the Crankcase Industry

This chapter presents the case company Alfdex, including its environmental strategy, suppliers and customers. Alfdex's Swedish customers, Volvo Trucks and Scania are presented with a thorough focus on their environmental work and purchasing processes.

5.1 The Company and Product

An initiative to create a solution for crankcase gas ventilation initiated by Volvo Penta 1997 led to a cooperation with the company Alfa Laval AB. Alfa Laval had solid knowledge about separation technique, a technique used in the Alfdex separator, see appendix 4 for more information (Olsson, 2011:a). Alfa Laval was in need of a partner with distribution channels in the automotive industry, whereby Haldex AB was identified. Haldex and Alfa Laval started a joint venture in 2001 - Alfdex. Today Alfa Laval and Haldex own Alfdex with a 50 % share each. An approximation of Alfdex's turnover for 2011 is around 300 Million SEK, based on 300 000 sold separators, see appendix 6 (Internal Documents, 2011). Alfdex R&D department is situated at Alfa Laval in Tumba, whilst the Production-, Logistics-, Purchasing- and Technical departments are situated at Haldex production site in Landskrona (ibid). Alfdex has about 50 patents related to the separator, the first of which expires around 2020. Lars Göran Nylén (2011) argues that there is a need for good marketing and distribution channels, economies of scale and great knowledge in the crankcase ventilation industry today. Some of Alfdex employees have cooperated with filter experts in order to gain more knowledge about the competing filter technique. In Sweden there are a number of companies which manufacture and distribute industry-filters. These have good knowledge about filter separation and new techniques for reducing emissions to air of different kinds (Olsson, 2011b).

Alfdex' Environmental Strategy

The separator is a product for crankcase gas ventilation, a so called eco-innovation, and so the environmental thinking has always been a natural part of the work at Alfdex. Together with the Haldex Green Production Systems program (GPS) a strategy has been developed (extra.ivf.se, 2009; Ekeroth, 2011:b) in which the Alfdex goal "High resource efficiency and low environmental impact" is mentioned. A goal reached through the strategies (ongoing 2009-2013) showed in Figure 8.



Figure 8: Strategies stated in order to reach the goal.

Ekeroth (2011b) argues that the environmental thinking is becoming more important for manufacturing industries. This statement, together with the environmental work already conducted at Alfa Laval and Haldex, is an important reason why Alfdex since 2008 have been working to increase their "environmental friendliness". For Alfdex it has been important to perform even better than its mothers concerning environmental care. The philosophy is that every small step in the right direction is good for the environment and this is the mindset in the company, but uncertainties about the financial gain has also been discussed (ibid).

An environmental policy/vision has been formulated by Alfdex;

"Alfdex as a product and its activities shall be the most environmental friendly alternative, meaning the lowest possible emission from the engines' crankcases combined with the least environmental impact when supplied to the market" (Olsson, 2011:b).

The perceived importance of the environmental work and strategy in Alfdex is about 6 % compared to other work (see appendix 5). The results from the environmental awareness survey (NEP-scale) is shown in Table 1. (All answers are converted so that a high value indicates a pro-ecological view, in order to become more comparable. For more information about the statements see appendix 3)

Table 1: Summary of responses on the NEP based survey.

Statement	Answer (Average)
If we continue do things the way we have always done, the eco-system will soon collapse.	3.6
The balance in the nature is strong enough to stand the impact of the industrialism.	3.9
Human beings have the right to change the surrounding environment in order to fit their own needs.	2.7
The earth has plenty of recourses if we only know how to develop them.	2.6

Alfdex’ Environmental Work

Earlier Haldex handled the administrative tasks connected to environmental issues, such as ISO14001 revisions, but from the end of 2010 Alfdex has to perform all of these tasks due to an organizational change.

In order to realize the environmental strategy knowledge about sustainability and LCAs available at the Swedish Universities, collaboration was initiated by Alfdex. This resulted in a report published by two students in 2008 (Eklund & Nantapotidech, 2008) focusing on the environmental work at Alfdex, a half-day course with workshops and an action list (green and red list) with certain actions that the company should perform in order to become more environmentally friendly. The action list contained about 40 environmental actions, from CO₂-compensating travels and printing on both sides of the paper to elimination of waste and introducing new materials. These actions have all been addressed during the years of 2008 until 2010 (Internal documents, 2011). For example, use of renewable energy has been investigated, but since Alfdex shares the production plant with other companies this was not possible to implement, also the stated policy has been formulated. Apart from this, the course mentioned above included an element whereby all employees watched the movie “*An inconvenient truth*”, to make the employees more aware of the environmental problems in society (Saxne, 2011a). Most actions taken by Alfdex have generated costs associated with working hours spent, changes to more expensive materials, added activities and/or investments in equipment. At the same time some have generated cost savings associated to changes to cheaper or less material or having telephone conferences instead of travel (Saxne, 2011a; Mellblom, 2011a; Olsson, 2011c; Pogén, 2011b; Ekeroth,

2011b; Nilsson, 2011; Petersson, 2011). In addition to the action list Alfdex became certified for ISO 14001 in 2009. An environmental group has also been appointed. (Pogén, 2011b, Saxne, 2011a). For a summary of the environmental work, including all costs and cost savings associated with the work, see appendix 5. Ekeroth (2011b) argues that Alfdex will continue with the environmental work in the same spirit as today, but also states that he believes that demands on environmental standards in society might become stricter (Ekeroth, 2011b).

Suppliers

The separator mostly consists of plastic and die casted components and there are many suppliers producing these materials operating on the market today. Alfdex has many specific ingoing parts and so they have to invest in tools for their suppliers and this narrows the number of suppliers available. The tools may be moved to another supplier, but the new relationship and the learning curve for the new supplier is about one year. Since Alfdex' customers require ISO14001 certification, IMDS etcetera, Alfdex also places the same demands on their suppliers (Mellblom, 2011b).

Customers

Today there are approximately 15 heavy truck manufacturers all over the world. Most of these heavy truck manufacturers are customers of Alfdex i.e. Daf, Renault, Mac, Daimler, Scania, Volvo etcetera (Internal documents, 2011). The European truck market was approximately 160 000 trucks sold in 2010 and is predicted to increase by 50 % until 2015 due to steady growth and a large down-size of the sector during the financial crisis in 2008/2009 (JD Powers, 2011). In Europe all vehicles produced from December 2013 will need a crankcase ventilation system due to the Euro 6 legislation (European Parliament, 2009). The environmental work and purchasing processes performed at Alfdex' Swedish customers, Volvo Trucks and Scania, are presented in the coming sections.

5.2 Volvo Trucks and the Environment

Volvo Group was founded in 1927 and has a strategy which is to focus on profitable growth, product renewal and internal efficiency (volvo.com, 2011b). According to Kroon et al. (2008) the company focuses on a cost-leading strategy. In addition the company works actively with environmental issues and environmental care is one of the group's core values. The company states on their homepage that their goal is to meet the demand of vehicles and "decrease the emission of greenhouse gases and harmful substances" (Mårtensson, 2011, Volvotrucks.com, 2011b). Mårtensson (2011) also claims that the environmental work performed by Volvo Trucks was raised to a new level when Leif Johansson became CEO of the Volvo Group back in 1996. He also argues that the company is a leader in the environmental work in the truck industry, which has been an advantage when customers gradually have introduced tougher requirements (ibid). The result from the environmental awareness survey at Volvo gave a value of 2,7. For a complete company description, see appendix 1.

Volvo PT Purchase

One of the largest business units in the Volvo Group, Volvo Powertrain (Volvo PT) AB, is responsible for engine manufacturing. The purchasing division at Volvo PT is in charge of all purchases regarding engine components such as the separator. At the purchasing division 3 employees have been interviewed: Sandberg and Ronstad (Operational Purchasers) and Porretta (Strategic Purchaser). For information about the separator, see appendix 1.

The operational purchasing process is performed on long-term basis where meetings are held regularly with the suppliers. A certain number of criteria are evaluated during the meetings and according to the operational buyers there is not room for subjective evaluations in this process (Sandberg 2011, Ronstad 2011). This outlook is shared by the strategic function at Volvo PT through Porretta (2011) who states that the decision of which supplier to choose is mostly based on non-subjective evaluation and that decisions are made on basis of strict criteria. The environmental minimum requirements are important and these requirements must be fulfilled in order to become a new supplier within Volvo Trucks. What can be valued is whether a direct product/concept improvement can be identified and communicated by the supplier, for example if the product has a new feature or more environmentally friendly components (Porretta, 2011).

Sandberg (2011) argues that the importance of "green thinking" in order to be proactive and make good decisions for a better environment is great. Sandberg (2011) also says that he most often does not get informed about any extra environmental work (environmental strategy) that the suppliers perform, except from the requirements such as ISO 14001 and REACH. According to Porretta (2011) an environmental strategy is not that important in order to win bigger orders or to be

able to set a higher price as a supplier to Volvo PT. The determining factors of which solution/supplier that is chosen by Volvo PT is based on the technical standard, for example separation efficiency and the quality of the product in relation to existing legalization in certain market areas and the end-customers preferences (Porretta, 2011).

5.3 Scania AB and the Environment

Scania, founded in 1891, is using a modular system to be able to customize the products and keeping down costs through product development, production- and parts management. Nilsson and Dernroth (1995) argue that it is difficult to categorize Scania's competitive advantage as cost-leadership, differentiation or focus strategy, instead they state a "luck in the middle" scenario where Scania is said to be using both a focus and differentiation strategy. The sustainability work in the company is mentioned as "an important factor behind Scania's position as a leading company in its industry" (scania.com, 2011a). One example of the company's environmental work is the user-program called "Ecolution by Scania" which is funded to help their customers to reduce their emissions of CO₂ (scania.com, 2011b). Since a year ago the responsibility for "the green products" lies with Stefan Sylvander and his team and the goal is to be able to offer the customer a product with as good an energy efficiency as possible and to work proactively. The willingness to work this way has existed for a long time and the active work started four years ago (Sylvander, 2011). Scania has also developed a green portfolio program during the previous years, where the focus is to reduce energy-consumption and emissions of CO₂ "here and now" (ibid). Sylvander (2011) argues that there are no clear legal requirements today stating that a company needs to reduce the emissions of CO₂. However what has been noticed is the customers' customers are becoming increasingly aware of this. As a part of this, the policy called Green Public Procurement was put in action in 2008 (Sylvander 2011). The result from the environmental awareness survey at Scania gave a value of 3,0. For a complete company description please, see appendix 1.

Scania Purchase

Scania's main focus when choosing a supplier is the product function and during the decision making process some decisions are made based not only on hard-fact criteria but also on subjective views, this goes hand in hand with Scania's corporate culture. Scania's main focus when choosing a supplier is quality to the right price (Johansson, 2011). According to Sofia Johansson, Manager Business Development at Scania Global Purchasing (2011), it is of importance for Scania to build and maintain a good relationship to their suppliers. This is, along with other factors, one reason why Scania work with suppliers for a longer period of time. One of the strategic purchasers has mentioned to Johansson (2011) that every meeting held with a specific supplier contains discussions that concerns environmental aspects in some way. The environmental aspects get more attention when the product is an eco-innovation, where the product is developed to contribute positively to the environment (ibid).

According to Stefan Sylvander (2011), the importance of a supplier's environmental strategic work is great, and to fulfill the minimum standards is a qualification to win an order. In contrary to this he states that the industry has not reached the stage where extra environmental work is valued, i.e. a supplier cannot charge customers an extra tariff based on performed environmental work, and thus the price sensitivity is high. He further argues that unless it is possible to offer the market a product with environmental properties that make a difference for Scania's customers, a higher price cannot be motivated. What is noticed however is a trend among suppliers, that some of them have become more aware of the potential in having a "green-profile" and when they mention this, Scania is encouraging their work and helps them to identify how this work can contribute to the suppliers' sales (ibid).

6 Analysis

In the following chapter the PGS-framework will be applied in the Alfdex case, beginning with a recap of the framework. In the first step points of intersection are identified through LCA, Five Forces, National Diamond and the NEP-scale. Thereafter the characterization into the three dimensions is performed. As a third step the profitability drivers are discussed and the profitability analysis is performed and the fourth step includes converting the strategic issues into actions. Lastly a discussion concerning step 5 is performed.

6.1 Recap of the PGS-framework

The PGS-framework was introduced in section 3.7, the summary is presented in Figure 9 below. In the coming sections the analysis will be performed according to the framework (step 1 to 5). Firstly step 1 is performed, this step is the most time consuming. Thereafter step 2 is done, and the findings from step 1 are categorized. This done, the profitability analysis is performed using the information from step 1 and 2. In step 4 and 5 the findings from the profitability analysis are used in order to define which actions that should be prioritized and implemented in the core strategy.

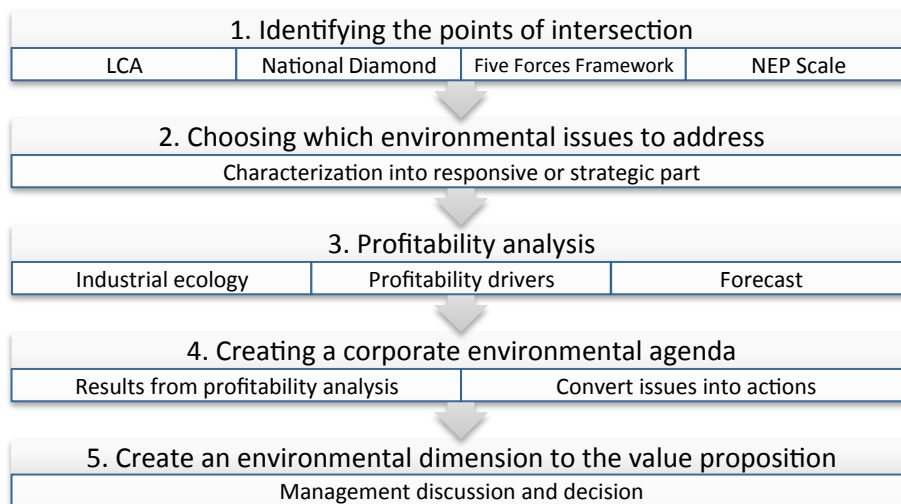


Figure 9: The PGS-framework

6.2 Step 1: Identifying the Points of Intersection

In this step an inside-out analysis, consisting of LCA and indirect value added is performed firstly. Secondly an outside-in analysis is done, using the national diamond and five forces framework. The NEP scale is used in order to be able to put a value on the environmental awareness in the industry, and it is described last in this section.

Inside-out: LCA and Indirect Value Added

The inside-out analysis is divided into two parts, *the LCA* and the analysis of factors that were not identified through the LCA, called *indirect value added*. The findings from the inside-out analysis (LCA and indirect value added) are presented in the next section.

Inside-out: The LCA

Porter argues that all value chain activities can affect the environment in some way. CO₂-emissions, use of excess or toxic material and lack of waste separation systems are all potential environmental threats, which can derive from industrial processes. These value chain activities are possible to detect with a LCA-approach and they represent the direct value and direct costs when optimizing resource productivity. The summary of the main results is presented in this section (two LCAs were performed in the study, but only the results from the Alfdex' product are regarded as relevant along with the pure benchmarking-results, why only these are presented).³

³ In the report *The green scale – Alfdex* (Ejlertsson & Gustafsson, 2011) the full LCAs and findings are described.

Figure 10 shows which components of the separator that have the highest negative environmental impact. These parts are the Turbine house (approximately 11 kg CO₂-equivavlents/kg aluminum), the House and the Bowl disc (both approximately 8 kg CO₂-equivavlents/kg plastic). What is noticeable is that most of the components with highest impact are plastic parts (represented by the House and Part 1-5 in the figure). The conclusion of this is that it is of importance for Alfdex to try to decrease the environmental impact from the Turbine house, the House and plastic parts in general.

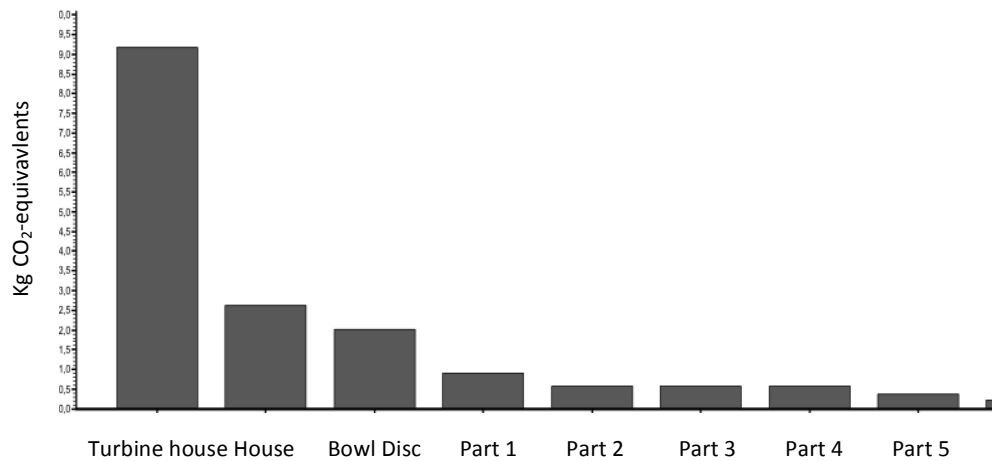


Figure 10: The components with highest environmental impact versus kg CO₂-equivavlents.

The LCA also showed in which phase of the life cycle the separator had highest environmental impact, see Figure 11. According to the result the separator has the highest impact during the usage phase, in total 85-90 % of the impact occurs here. This is a common relation for all kinds of active solutions. Still it is of importance for Alfdex to work actively to reduce the impact during the usage phase in order to decrease the overall environmental impact during the life cycle.

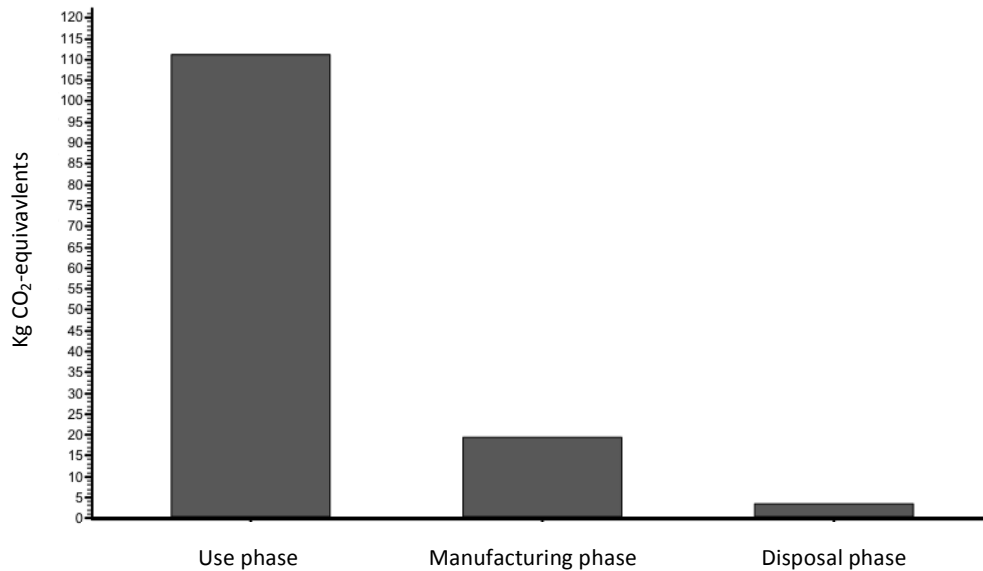


Figure 11: The environmental impact of the separator in three phases.

The main finding from the benchmarking LCA of the separator and the filter confirms that the active solution (separator) has the highest negative environmental impact when the life cycles are put into relation. On the contrary, the separator has a higher efficiency, whereby the positive environmental impact is higher for the separator than for the filter, why the difference in environmental impact is equal. The benchmarking study confirms that Alfdex should improve its energy efficiency during the usage phase. In the coming section the indirect value added will be analyzed.

Indside out: Indirect Value Added

In order to identify the indirect value- and costs added that might be hidden (and not recognized by the LCA), an analysis that goes beyond the chain of production is conducted according to the industrial ecology theory. The identified factors are environmental impacts listed in the action list, which have emerged as part of the environmental strategy work that Alfdex started in 2008. Since Alfdex has been working with these impacts for a long time, they were already converted into actions and thus they are also presented as actions, see Figure 12.



Figure 12: Indirect value added.

Summary of the inside-out linkages

The inside-out part has now been performed and a number of different impacts/actions have been identified. A summary of the results is shown in Table 2.

Table 2: Summary of the inside-out linkages.

Inside out linkages	
LCA	Indirect value added
<i>Manufacturing phase (components)</i>	Environmental policy
Turbine house	Renewable energy sources
House	Recycling of waste
Plastic components in general	Printings on both sides of paper
<i>Usage phase</i>	Education
Use of fuel	CO ₂ -compensation for travels
<i>Disposal phase</i>	Telephone conferences
Incineration of plastics	

Outside-in: National Diamond and Five Forces

The outside-in linkages are identified through a macro and micro-analysis of Alfdex competitive context. The competitive context is first analyzed via the national diamond and secondly an industry analysis is performed with the five forces framework as a base. Lastly an analysis of the environmental awareness within Alfdex and its customers is performed to be used when addressing the share of costs and price, linked to environmental issues.

Outside in: National Diamond

Factor conditions

In Europe most Universities are providing courses in environmental sustainability, energy-systems, LCAs etcetera. The institutions' research and education are important activities in order to shape, develop and spread the knowledge further to society and industries. The universities' activities affect the ability for companies to grasp scientific knowledge, and thereby be able to develop their own concepts and products offered to the market. An example of a company that has been able to successfully use these institutions is Alfdex. Environmental Director at Haldex, Monica Bellgran, who is also professor at Mälardalen Högskola, has initiated several projects concerning environmental work at Haldex. One of these has led to the start-up off the environmental strategy at Alfdex, an activity from which the action list was derived. The Universities educate students, providing the companies with new employees with knowledge within the subject. An extended project performed by students also resulted in a first LCA in order to decrease the company's environmental impact in the entire value-chain.

Related Industries

Alfdex is owned by Alfa Laval and Haldex in corporation and since Alfdex production site is situated at Haldex in Landskrona their environmental work has been influenced by Haldex's environmental work i.e. the Haldex-project, "Green Production Systems" (GPS). In addition, several companies manufactures industrial filters in Sweden. Their competencies have been used by Alfdex before (gaining knowledge) and during this project, mostly in the LCA study.

Demand Conditions

Through interviews with customers it has emerged that the interest for environmentally friendly products and environmentally caring companies has increased and with this also the information of the supplied products' environmental impact during its entire life cycle. This development might derive from the continual development of the EU legalizations, requirements and policies. These have all contributed to setting so-called minimum standards in the automotive industry (such as REACH and ISO14001) and will most likely continuing setting new environmental standards in the future, since there are constantly new policies created which are changing the conditions in the market. One of them is the GPP (Green Production Procurement), which sets a new standard for the public sector in Europe. This affects actors in the automotive industry, who thereby need to evaluate each part of the value chain to increase the ability to report the origins of their products environmental impact. The EU ETS is also an example of an instrument that was implemented in order to reduce the emissions of CO₂ in the EU. This regulation reflects the awareness of climate change in society and the

willingness to reduce the emissions of CO₂. The regulation does affect Alfdex's customers and their reporting of carbon-emissions and will also most likely in the near future make them claim reports of carbon-emissions from their suppliers, including Alfdex.

Strategy, Structure and Rivalry

For analyzing this factor the five forces framework is used, see next sections.

Outside in: Five Forces Analysis

Industry Competition

Alfdex is an active solution for crankcase ventilation on the market where Euro 6 (or similar) is implemented already, i.e. USA, South Korea and Japan. In these markets the potential entrants or competitors are non-existing or are existing in a very small scale. It is therefore assumed that there will be no existing competitors present on the European market when the Euro 6 is taken into action. According to the JD Power Automotive Forecasting, the truck sales in Europe were about 160 000 heavy trucks during 2010, a potential market for Alfdex to penetrate when the Euro 6 is executed in 2013. In addition the number of sold trucks forecast is about 320 000 trucks in 2015, a potential growth of some 50 % in five years from today. The industry competition is regarded as low based on the previous discussion.

Power of Suppliers

It is possible for Alfdex to find new suppliers for each component in its product, but all of Alfdex's suppliers are required to be certified according to ISO14001 as a consequence of Alfdex's customers' requirements. In addition to this the start up costs are relatively high (specific tools are needed at the supplier, since the component differentiation is high) and the start-up time required to start collaboration with a new supplier is approximately one year. This makes the switching costs high and this does affect the ability for Alfdex to change suppliers. The discussion indicates that the power of suppliers is medium.

Substitutes

There are three (known) existing substitutes for crankcase gas ventilation on the market today: filters (passive solution), electro-static filters (active solution) and cyclones (passive solution). Because of the Euro 6, heavy truck manufacturers need an efficient crankcase ventilation system and the requirement of the crankcase separation efficiency is dependent on the engine and how clean it is. The substitutes have different draw-backs (need of exchange, separation efficiency etcetera), which has made them non-comparable after the Euro 6 is taken into action. Two new active separation solutions have been identified, but they have not reached the market in a larger scale yet and so they are not regarded as existing substitutes. They are seen as similar technical solutions as the Alfdex and it is unclear if they are

able to enter the market due to patent-intrusion. This force is therefore considered to be medium.

Barriers of Entry

The technology for producing active solutions is more advanced than for passive solutions, which makes the product development for active solutions more complex and thus more costly. Besides this, economies of scale are needed. Today's separation technology needs "know-how" in order to be able to create a satisfying product and the learning curve is long. In addition the distribution channels need to be well developed. There have been some indications of companies trying to develop separation elements, but none are distributed to the market in a larger scale yet. Alfdex has today some 50 patents that will last until 2020. The overall judgment is that the barriers of entry in the crankcase ventilation industry are high, why the force is high.

Bargaining Power of Customers

Customers in the automotive industry have a high influence on their suppliers. There are about 15 truck manufacturers existing in the market, supplied by 15-20 crankcase ventilation manufacturers. It is therefore important, as a supplier, to build and maintain good relations to these relatively few potential customers. The number of trucks sold during 2015 in Europe is predicted to increase with approximately 50 % to 320 000 sold trucks from today's amount. The bargaining power of customers is regarded as high, based on the fact that there are relatively few existing customers on the market relative the suppliers of crankcase ventilation systems. The interviews performed with Volvo and Scania indicates that the two companies have slightly different strategies. Both Volvo and Scania had a NEP value of environmental awareness in the range of 2,7 – 3,0, why neither of the customers are thought to be extra aware of environmental issues. What differs is that whilst Volvo is truly cost-focused, entirely following their internal standardizations based on strategic decisions when selecting suppliers, Scania expressed that they also are following subjective reviews when selecting suppliers. The customers have therefore been segmented into two categories; entirely cost focused and cost focused + subjective opinions. Both companies have a cost-focused strategy, and none of them says that an environmental strategy could directly motivate a higher price of a purchased product today. What Scania expressed however was that if an environmental strategy somehow could be derived to the product or product concept this sometimes could motivate a cost, and thereby a higher price. The price sensitivity in the automotive industry is estimated to be high; even though the price, for some customers (such as Scania) is allowed to vary some if it can be derived directly to the product. For customer segmentation, see Figure 13.



Figure 13: Customer segmentation

Summary of outside-in linkages

The national diamond and industry analysis has now been performed. The bargaining power of customers is seen as the major power in the industry. In addition competence and cooperations with universities and related industries has been important for Alfdex in the past in order to gain knowledge about the environmental impact and changes in the company environment. Another finding is that the increasing demands from society affects the legislations and thereby the customers and their demands on suppliers. The outside-in analysis has now been performed and a number of different influences have been identified. A summary of the results are shown in Table 3.

Table 3: Summary of the outside-in linkages.

Influence
New knowledge and from science institutes
New knowledge from industry-filter manufacturers and other companies
New knowledge from Alfa Laval/Haldex
Demand of environmental impact data (carbon footprint)
Demand of environmentally friendly components in products
Demands on reducing CO ₂ -emissions
Demand of more energy efficient products
Increasing knowledge in society
Standardizations (EMS, REACH etcetera)
Policies and instruments (GPP, EU ETS, etcetera)
Legalizations in the EU (Euro6 etcetera)
Waste elimination demands

Measuring Environmental Awareness – NEP scale

Lastly an analysis of the environmental awareness within Alfdex and its customers is performed in this section and this ought to be used when addressing the share of costs and price linked to environmental issues.

The average time spent on environmental work and the average perceived importance of environmental work at Alfdex was 6 % according to the calculations performed in appendix 5. The environmental concern measurement (NEP-scale) at Alfdex gave an average value of 3,2. Since 3,2 is approximately in the middle of the environmental attitudes scale (1-5), it is assumed that the value 6 % does not need to be weighted (reviewed). In addition this value seems to correlate with the automotive industry in general, since the environmental concern measurement (NEP-scale) was in the same range for Volvo and Scania, approximately 2,7-3,0 %. With this as a background 6 % is considered to be an appropriate share when calculating the share of costs invested as well as share of price that can be assigned the environmental strategy.

Summary of step 1: Identifying the Points of Intersection

In step 1 the inside-out and outside-in linkages have been identified and summarized through the inside-out and outside-in analyses and the NEP-value for Alfdex and its customers have been described. The points of intersection from step 1 are categorized in the coming section.

6.3 Step 2: Choosing which Environmental Issues to Address

In this step the characterization into the three dimensions; *generic environmental impacts*, *value chain environmental impacts* and *environmental dimension of competitive context*, of the identified linkages from the inside-out and outside-in analyses are done based on a thoroughly discussion. Through interviews with Volvo and Scania it was identified that the most value-creating environmental actions are those that can be directly linked to the product, why these are prioritized. The characterization is summarized in figure 15 followed by an explanation.

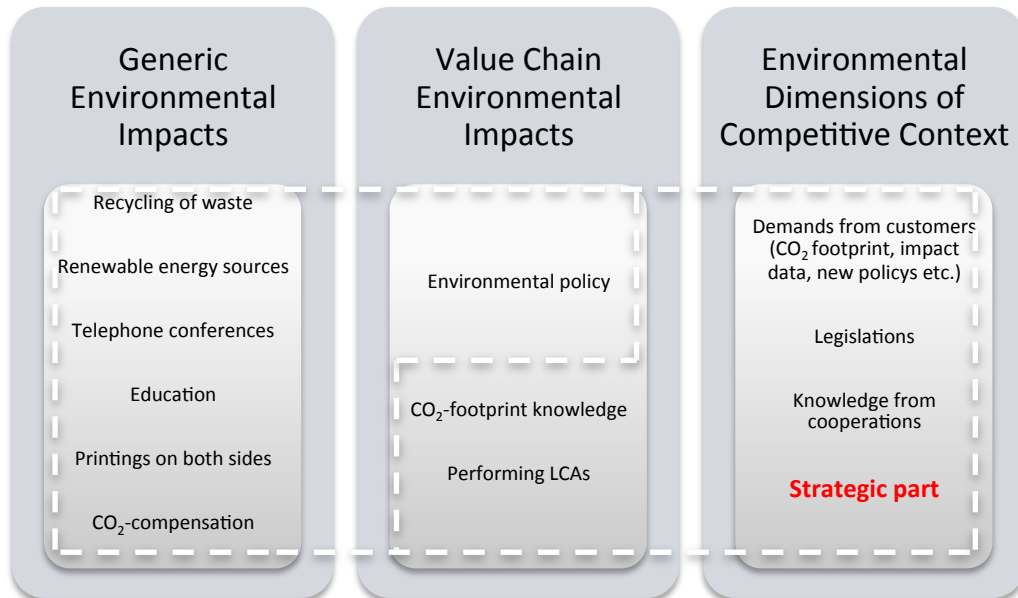


Figure 14: Characterization of impacts

Generic Environmental Impacts

Recycling of waste is a minimum standard and an everyday task at Alfdex, why this action is considered a must do and thereby a *generic impact*. Alfdex has taken an initiative towards using renewable energy at their production plant, but unfortunately it is not possible for them because they share production plant with other companies, why this action can not generate any profit today and is therefore considered as a *generic impact*. Telephone conferences and printing on both sides of the paper are considered as actions, which are good for society, but without capability of being linked to the product. The education is considered as a good action in order to improve the production process. What is doubtful is whether this work can be linked directly to the product and the performance of the components in the product. The CO₂-compensation is said to be becoming more important, but it is today hard to directly link this to the product and it is therefore regarded as a generic environmental impact. All generic impacts are considered belonging to the responsive part.

Value Chain Environmental Impacts

The environmental policy states that Alfdex should work actively to reduce the environmental impact from the separator. This activity cannot be regarded as something that can be derived directly to the product (but as marketing of the environmental profile), even if an active work to fulfill this can lead to a decreased environmental impact in the long-term. It is therefore regarded as a *value chain impact*, but without being a part of the strategic actions. Lars Mårtensson argues that the CO₂ footprint will become increasingly important to report in the future. An

example on how this is manifested is Scania that has mentioned the importance of the GPP-policy, where environmental impact analyses are demanded in public purchasing. Both the customers and the legislations seem to demand some kind of reporting of the value chain impacts, a context where the CO₂ footprint is often mentioned. This indicates that *performing* a LCA and the CO₂ footprint is important *value chain environmental impacts*, thus responding to the strategic part. This because the LCA provides information about which activities in the value chain it is most important to mitigate harm and more knowledge about the CO₂ footprint, which is important to be able to report in the future.

Environmental Dimensions of Competitive Context

The five forces analysis revealed that the customers' power is high relative to Alfdex. This fact in tandem with the fact that society seems to become more aware of companies environmental impact and that legislations are becoming more stringent indicates that demands from customers and legislators ought to be prioritized and thus regarded as influences affecting the *dimensions of competitive context*. To provide transparency for the customers, end-customers and society, legislations (such as Euro 6) and policies (such as ISO14001), have been developed. This results in a raise of the minimum demands of ingoing components and how they are manufactured, thus the suppliers. All influences in the dimensions of competitive context are considered belonging to the strategic part.

Summary of step 2: Choosing which Environmental Issues to Address

The most important environmental issues are those categorized as strategic in Figure 15 (the right side of the figure) above, i.e. demands from customers, legislations and knowledge from corporations. In addition knowledge about the CO₂-footprint and continually performing LCAs are value-chain activities that are important to have/do in order to be able to fulfill demands from customers and since policies and legalizations are becoming more stringent they are important to be aware of. This can be done through getting proper knowledge in advance. The other environmental issues are regarded to be less important than the strategic and are categorized to the left in the figure (responsive part).

6.4 Step 3: Profitability Analysis

The profitability analysis is based on the issues presented in step 2 and the analysis is based on the ideas of industrial ecology, profitability drivers and a forecast. The issues characterized as the strategic part can be summarized in two main profit drivers; *To be proactive* (demands from customers and legislations) and *To have proper knowledge* (knowledge from different cooperations). The profit drivers are considered as the most important issues to address in order to be able to charge revenues from the customers and thus, get a higher profit. What is important to mention is the fact that the environmental debate is constantly changing. During the 1960's the DDT-threat was referred to as one of society's worst threats. Today

emissions of CO₂ and global warming are seen as a major threat. In short term it has been noticed that articles concerning environment in the automotive magazine Truck & Bus Builder have changed, why it is of importance for companies to follow the debate, to be proactive and have proper knowledge. The profitability drivers are described below, including a forecast followed by the responsive part.

6.4.1 Strategic Part: To be Proactive

The industry analysis reveals that the greatest force is the *bargaining power of customers* as a consequence of the increasing requirements from the society where the general awareness about which products to consume is increasing. At the same time the demands from the customers and legislators are responding to the strategic part in the characterization and so it is important for Alfdex to be able to meet the customer demands correctly and before upcoming competitors. Another important fact is that according to Björn Edsfeldt (Deloitte) companies in the energy-sector received a higher profit through price-segmentation. This happened when they provided proactive and caring customers, clean and renewable energy to a higher price. This approach can make Alfdex flexible; they are able to satisfy customers that require just minimum standard products (Volvo) but can at the same time meet proactive customers' demands in advance (Scania), charging them a higher margin, whereby the recognized customer segmentation in the five forces is important. In addition to this Alfdex will not have to spend unexpected expenses finding new possible materials if/when requirements from new legalization make the current materials non acceptable.

Alfdex environmental work has ever since 2008 helped the company to act fast and proactive as new environmentally associated demands from customers have emerged, which has generated profit in terms of some cost savings, see appendix 6 – table 13. What is important to mention is that these factors often are linked directly to the product concept. In late 2013, when Euro 6 is implemented and the European market for crankcase ventilation opens, the capability of being proactive will most likely generate revenues from proactive customers. The proactive customers will most likely put demands on Alfdex even before official legislations are put into action. Through the customer segmentation, Alfdex can then charge these customers for the extra effort performed in association to the special demand, which makes it possible for Alfdex to, for example, choose new materials in advance and the cost of these early demands can be minimized, hence a good margin can be achieved.

With the above discussion as a background, the revenues for being proactive until 2013 is set to zero, since the Euro 6 has not been taken into effect, thus the number of separators sold in Europe are assumed to be zero. After 2013 the revenues from the proactive customers are assumed to be equal to the total costs of goods sold (COGS) with the average operating margin of Volvo and Scania, 11.5 %, as a margin.

The COGS (see appendix 6, table 14, COGS) are assumed to be proportional to the growth of the company and 11.5 % is regarded as a representative figure to use in the calculations since the real Alfdex margin is unknown. The sales are referred to as *PD – to be proactive* in Appendix 6, table 14.

6.4.2 Strategic Part: To have Proper Knowledge

Alfdex knowledge about their product's life cycle and the action list has all derived from the Universities and thus student master theses. Alfdex does not have this competence and knowledge within the company, why they have partially hired people with expertise to perform this work or give advice for improvement. This knowledge has then been translated into actions. New students have then continued the study, contributed to new knowledge, thus a positive knowledge-circle has been created. Also the shareholders, Haldex and Alfa Laval, have contributed with knowledge and research in particular for the separator technique and the automotive industry. Alfdex has a profound cooperation with the shareholders, which makes them able to collect valuable knowledge from them. The cooperation also provides Alfdex with economies of scale in research resources. In addition Alfdex cooperates with competitors and other valuable companies in the industry. These relations simplify for Alfdex when collecting knowledge for the LCA and when benchmarking competitors. All these cooperations make it possible for Alfdex to effectively gain the right knowledge with fewer resources i.e. hiring consultants, new employees etcetera. Simultaneously Alfdex achieves synergies from the knowledge fetched from Universities, shareholders and partners in the industry. This fetched knowledge makes it possible for Alfdex to be at the forefront regarding environmental work and thus can achieve competitive advantage. Further, the proactive customers have stated that they are making decisions based on subjective opinions, for example regarding their personal feelings about suppliers' company culture, when auditing potential and actual suppliers. Since Alfdex is creating a positive "knowledge circle" by translating and implementing the knowledge into the everyday work and thus the corporate culture, this approach could possibly be displayed in some matter. This could mean that Alfdex could gain competitive advantage through the proactive customers' decision making processes.

It is assumed that the demands of environmental work performed at a supplier might be 6 % of total work, a demand Alfdex can generate revenue from. Since only the proactive customers include subjective opinions in their audits, the potential revenues could then be equal to 6 % of totals sales to proactive customers, after 2013. In addition the environmental sector is increasing by an average of 2% more than the overall, why the revenue is assumed to increase by 2% each following year, see *PD – proper knowledge* in Appendix 6, table 14. This reasoning is based on the scan of the number of articles associated to environmental issues published in Truck & Bus Builder that gave a value of 6 % and the resources associated to environmental work at Alfdex that gave the same value (6 %) together with an

environmental awareness at 3,2. In addition both studied customers had an environmental awareness in the range of 2,7 - 3. With this as a background it can be assumed that the customers in the automotive industry in general allocate 6 % of their resources on some kind of environmental work, why 6 % of total sales to proactive customers are assumed to be the potential profit.

6.4.3 Responsive parts

The issues characterized as responsive are considered as factors that do not drive profit in the environmental strategy, whereby the revenue they contribute to is negligible. These factors are materials A-F (summarized as COGS), meetings A-C, working hours B (including waste handling), CO₂ - compensation A-B and cost savings (see appendix 6, Table 14). The forecast for costs and cost savings related to these factors are considered as proportional to the growth of the company, since Mats Ekeröth stated that Alfdex will continue with the environmental work with the same resources as today. The growth varies from 27 % in 2012 to 12 % in 2018 (see appendix 6, Table 11).

From the end of 2010 Alfdex has had to perform the administrative tasks (such as ISO revision etcetera) conducted by Haldex before, within Alfdex, why more resources will be required. The resources are referred to as *working hours A* in Appendix 6, Table 14, and are assumed to increase by 2% each year, based on the increase in working hours between 2010 and 2011, where the shift occurred. (The ISO revision costs are set as constant since the increased resources are included in *working hours A*). Not to forget however is that this might also benefit the company, which will get a broader over-view of its environmental work and impacts.

By using students and thereby knowledge from universities, Alfdex can fetch the newest information concerning their environmental work for a low cost. At the same time some employees in the company have shown interest for the subject, developed the analyses and administered the knowledge. In order to maintain this positive circle, it is assumed that Alfdex will continue having one group of students each year focusing on the environmental performance and strategy (see appendix 6, Table 14, *Master Thesis*). Alfdex is not planning to have any education associated to sustainability, why this cost is set to zero.

6.4.4 The Profitability of Green Strategy

Given the scenario where the profitability drivers, *to be proactive and to have proper knowledge*, generates revenues according to above reasoning, the profitability analysis gives a net present value (NPV) of about 5,4 million SEK in total over 2012-2018, see Appendix 6, *result*. This indicates that the environmental work and thus, resources and costs associated to this work, will in the future generate revenue exceeding the costs. Some clarifications to have in mind; Euro 6 will be taken into effect in late 2013, why the sales are assumed to be zero until then. The direct costs

for materials etcetera are assumed to be zero during 2012 (during 2013 it is assumed that the separators delivered in late 2013 are built, why direct costs are *not* zero). Overhead costs are assumed to exist even when there are no sales. This is because the company still exists and works actively with the environmental strategy during this period. The historical data is based on the world market; the forecast originates from the historical data, but is scaled down to only the European market (44 %). The discount rate is set to 15 %. For more information, see Appendix 6.

6.5 Step 4: Creating a Corporate Environmental Agenda

In order to be able to generate the potential profit of 5,4 million SEK, the strategic issues have to be converted into actions. When implemented and performed within Alfdex, these are the actions that will generate profit, since they are actions converted from the issues that are considered as the most strategic ones to address (the issues in the profitability drivers). The transformation into actions was done with the help of a brainstorming session (some issues are already converted into actions by Alfdex). The actions for the two profitability drivers are summarized in Table 4.

Table 4: Summary of all actions corresponding to the two profitability drivers.

Influence	Actions
To be proactive	<ul style="list-style-type: none"> - Use LCA continuously - R&D in order to find new materials - Evaluate new materials - Evaluate transports - R&D in order to decrease use of energy - Electricity driven separator - Higher efficiency of existing drive unit - Scan for new upcoming standards - Ability to implement and follow up standardizations - Ability to follow the debate and modify the business proactively
To have proper knowledge	<ul style="list-style-type: none"> - Perform LCA - Assimilation of new knowledge through new employees and students - Assimilation of knowledge through cooperations - Maintain good/old cooperations - Incinerate new cooperation

6.6 Step 5: Create an Environmental Dimension to the Value Proposition

Step 5 is a general discussion since the results from this step are not of value for the purpose of the thesis and the management team at Alfdex should be present in the decision making of how to implement the environmental dimension to the value proposition. A short general discussion about which environmental actions that can be prioritized is although presented below.

The actions in the responsive part, which do not generate profit, are actions Alfdex could discontinue doing from a profitability perspective (as long as they are not legislated). Such actions are CO₂-compensating travels, printing on both sides of the paper and education for employees. But from a moral point of view they might be considered important for the employees. The strategic actions will affect the profit and are thereby the actions Alfdex should invest more money in and try to gain knowledge within, i.e. the actions *to be proactive* and *to have proper knowledge*, summarized in Table 4 above. These actions are actions linked to the product-offering such as finding a new, less energy-consuming driving unit, new and lesser materials and/or cooperations with universities and other companies. This since they are actions that drive profit in the long-term and can make a difference for the competitive advantage. The profitability analysis shows there is a high profitability possibility in performing customer segmentation and offering the more proactive customers a somewhat better product concept according to environmental standards. Therefore it is suggested for Alfdex to work actively on this kind of segmentation and develop an effective way to market the proposition. Knowledge is known as a powerful tool to use in order to create a suitable playground that can generate profit. It is of course of importance for Alfdex not to ignore the actions that generates no direct profit, when creating their environmental strategy. These actions might not contribute to the financial performance in a direct way but some of them can, and most likely will, contribute to the well being of the employees and the company brand. It is also possible that some of these actions, in the long-run, will improve the profitability. This might be education and environmental policy which are likely to affect the product's environmental performance and thus, profitability over time. The possibility that this will happen over a period of seven years are seen as unlikely, why they are not categorized as strategic.

7 Conclusions

This chapter gives the answers to how the purpose of the thesis has been fulfilled. Further it is discussed how the results can be applied into other contexts and the scientific contribution of the thesis.

7.1 The Profitability of Green Strategy

The PGS-framework, first presented in section 0 is a suitable tool for valuating a company's green strategy. The framework consists of 5 steps through which a company can identify and allocate the most profitable environmental actions to address. The framework is developed from the inside-out/outside-in analysis (suggested by Porter in 2007) by adding the sub-steps of LCA, five forces framework, the NEP-Scale, profitability analysis, including industrial ecology and profitability drivers. The PGS-framework is thereby a tool that combines two areas that are relatively unexplored when combined, known as green strategy and profitability analysis. The framework can be used hands-on by a company that wishes to perform an analysis of a green strategy and it does indicate which environmental actions a company should address in order to gain competitive advantage.

According to the case-study performed at Alfdex, in which the PGS-framework has been used, the outcome of having a green strategy will generate a potential profit of about 5,4 million SEK between 2012 and 2018, equal to 0,26 % of the total yearly turnover. In relation to the operating margin in the industry of 11,5 %, 0,26 % can be regarded as a significant share. The biggest contributing factor to why the environmental strategy generates revenue is the identified profitability driver *to have proper knowledge*. *Proper knowledge* includes assimilating knowledge from universities and cooperations with other companies in order to gain the right knowledge about how to act and gives a value of 2 million SEK/year from 2014. The other factor contributing to revenue is the profitability driver *to be proactive*. *To be proactive* includes being aware of demands in society and new legislations in order to be able to meet customer demands fast and easy, and thus at a lower cost and gives a value of some 70 000 SEK/year from 2014. In addition it is important for Alfdex to be able to segment its customers correctly, in order to know which customers are proactive and which ones that only require minimum demands, to be able to market its strategy in a satisfying way. The potential revenue derived from the profitability drivers (and thereby also potential profit) is however dependent on a range of factors; such as if society's demands and the proactive customers do develop at the pace that the analysis predicts. For instance, if the Alfdex fails to market the green strategy to their customers in the proactive segment it is logical that the revenues from the proactive customers will disappear, even if the company has both the proper knowledge and is proactive.

7.2 Discussion

The study shows that having a green strategy can be profitable if it is implemented in a satisfying way and if the company's industrial context develops as predicted and thus, a company might then be able to gain competitive advantage through implementing a green dimension in the overall strategy. Through the PGS-framework managers can clarify which environmental activities that are the most profitable to focus on and this reduces uncertainty in the decision-making processes. According to us the PGS-framework can be used in all industries and all types of companies. It might be advantageous if the company that uses the framework have been working with environmental activities before in order to be able to evaluate this work successfully. Even if there are several activities that a company wishes to continue with (even if they are not value creating) the effect of these are known by the manager whereby the managers' ability make adequate decisions based on facts rather than guesstimates increase. The PGS-framework has been developed in the process of writing this thesis and it has not been used before. Therefore it is not possible to tell if the results from the analysis are adequate. If the model is applied in future cases and if Alfdex manages to categorize different customers into different segments and thereby generate value will determine the quality of the framework.

The PGS-framework suggests a range of methods to be used when performing the inside-out analysis of the company. The most time-consuming part of the study is the LCA, which generates a profound analysis of the activities and materials in the company's value chain. In addition, several other perspectives inside the company have been analyzed in the inside-out analysis. This way of analyzing a company's most important factors in order to find strengths and weaknesses is a common approach in the RBV perspective, even if the RBV-perspective mostly focuses on resources. In the study a deep analysis of the company's competitive context (outside-in analysis) has been performed with the national diamond and the five forces framework. The analysis indicates that the policies, legalizations in the EU and conditions in the automotive industry are constantly changing, why this perspective has similarities with the ideas of hypercompetition. The inside-out/outside-in theory suggested by Porter in 2007 can be defined as a high-level theory and it is not specifically said how the analysis can be performed. What have been done in this thesis is that some of Porter's former theories have been included in the theory, together with LCA, NEP-scale and Industrial ecology. This have made the inside-out/outside-in theory more usable and concrete and hopefully easier to adapt, understand and use for other students, scientists and/or organizations. The value of including LCA (a relatively specific method) in the strategy study (a relatively unspecific method) is also great, though this have not been done before according to our knowledge.

The selected theoretical approach for the study was nonetheless the Porter-view. Even if the study is based on the perspective with Porter's theories as a focus, the possibility that implementing an environmental strategy into the overall strategy creates profitability also in other strategic contexts must not be excluded. The PGS-framework provides the user with a broad framework in which many different perspectives are used. Therefore the results from this study can provide information about profitability, competitive advantage and environmental strategy in general. This study also states an example of how to put a figure on environmental strategy and might therefore be valuable for coming studies which aim to do the same.

It is obvious that the results from the study do differ with a range of factors; the uncertainty of what is happening in the industry context is high and based on which perspective that is used as a focus-area the results may differ from study to study. In this analysis the focus is the LCA analysis and the outside-in analysis and if the framework was put differently the results might have been different. On the contrary, as argued above, there are similarities with the ideas of hypercompetition, why the results might not differ greatly. This indicates that the framework has a somewhat general approach. The study gives an example of what profitability a green strategy might generate and a possible way to perform such an analysis and we truly hope that this will inspire future studies to do the same.

8 Reflections and Suggestions of Future Studies

During the process of writing this thesis new areas that might be of interest to explore, in order to deepen and increase the knowledge about green strategy and profitability, have been found and they will be discussed in this final chapter.

When talking to external experts about financial performance and green strategy another method for valuation was advocated. This method is built on benchmarking between a company that has implemented a green strategy and a company that has not, in order to expose the difference. That study could be performed with the DCF-method (Discounted cash flow), where the companies value per share is compared. To perform this study on Alfdex and some additional cases could contribute to show the long-term value of going green and indicate which activities that do not add direct (short-term) value, but indirect (long-term) value. This kind of valuation is often done in the business world in order to value companies' strategies for mergers and acquisitions. Such a study would also be interesting for the academia, since it would increase and deepen the knowledge about the combination of green strategy and profitability further.

Another interesting study would be to investigate the relation between having a green strategy and CSR strategy in general. Sustainability as a concept is steadily increasing in interest and that is a part of CSR, but the question is how profitable a CSR-strategy really is. If environmental issues will continue affecting us through natural catastrophes and similar, will the profitability of implementing an environmental strategy then exceed a CSR-strategy in general? Exploring this would contribute to our knowledge about how we should create strategies from today and in the future.

Many companies are working with CSR today and they use it frequently in their marketing and PR-activities. What would be of interest is to investigate the relation between what is said and what actually gets done, through a quantitative method; i.e. to measure how well the CSR-strategy has been implemented in a company in all levels of the organization from management level to operational level, also known as top-down. During our study companies' uncertainty about how environmental strategy is implemented has arisen, and to explore this subject further, and perhaps be able to develop a suitable tool to use in order to measure how well the CSR-strategy is implemented could be valuable for the business world as well as for the academia.

9 List of References

Barney, J. (1991). Firm Resource and Sustained Competitive Advantage. *Journal of Management*. Issue 17:1, pp.99-117.

Bryman, A. Bell, E. (2003) *Företagsekonomiska forskningsmetoder*. Slovenia: Korotan Ljubljana.

Cambridge Science Park. (2011)

Available at Internet:

<<http://www.cambridgesciencepark.co.uk>> (Accessed: 2011-04-07)

Carrillo-Hermossilla, Javier. del Río González, Pablo. Könnölä, Totti. (2009). *Eco-Innovation – When Sustainability and Competitiveness Shake Hands*. United Kingdom: Hampshire: Palgrave Macmillan.

Climatecrisis.net (2011). *The Film*.

Available at Internet:

<http://www.climatecrisis.net/an_inconvenient_truth/about_the_film.php>

(Accessed: 2011-04-26)

D'aveni, R.A (1998). Waking Up to the New Era of Hypercompetition. *The Washington Quarterly*. Issue 21:1, pp. 183–195.

Drexhage, J. and Murphy, D. (2010). *Sustainable Development: From Brundtland to Rio 2012*. USA: New York: International Institute for Sustainable Development (IISD).

Dunlap, R. van Liere, K. and Jones, E. (2000) Measuring Endorsement of the New Ecological

Paradigm: A Revised NEP Scale. *The Society for the Psychological Study of Social Issues*. Volume 56, Issue 3, pp. 425–442.

Also available at Internet:

<<http://onlinelibrary.wiley.com.ludwig.lub.lu.se/doi/10.1111/0022-4537.00176/pdf>>

(Accessed: 2011-04-18)

Eklund, A. and Nantapotidech, V. (2008) *Climate smart production systems at Alfdex*. Mälardalen: Mälardalen University Sweden, Center of product realization.

Esty, D. and Porter, M E. (1998) *Industrial Ecology and Competitiveness. Faculty Scholarship Series*. Paper 444.

Available at Internet:

<http://digitalcommons.law.yale.edu/fss_papers/444> (Accessed: 2011-03-31)

European Commission (2006). *The EU Emissions Trading Scheme*.

Available at Internet:

<http://ec.europa.eu/clima/publications/docs/ets_en.pdf> (Accessed: 2011-05-02)

European Commission (2010). *Environment - Green Product Procurement*.

Available at Internet:

<<http://ec.europa.eu/environment/gpp/lcc.htm>> (Accessed: 2011-04-06)

European Parliament. (2006) Regulation (EC) No 1907/2006 of the European parliament and of the council. *Official Journal of the European Union*. No: 30 December 2006.

European Parliament. (2009) Regulation (EC) No 595/2009 of the European Parliament and of the Council. *Official Journal of the European Union*. No: 18 June 2009.

Europeiska Kommissionen (2006). *Eu:s bidrag till en bra miljö*. Series: Europa på väg. Luxemburg: Byrån för Europeiska gemenskapens officiella publikationer.

Eurostat (2011). *Road share of inland freight transport - % of tonne-km*.

Available at Internet:

<<http://epp.eurostat.ec.europa.eu/tgm/graph.do?tab=graph&plugin=1&language=en&pcode=tsien080&toolbox=type>> (Accessed: 2011-04-07)

Fredriksson, H. and Krasse, C. (2009) *Environmental Performance & Reporting at Scania - A Study of How Scania Sales & Services Can Meet Increased Environmental Demands*. Södertälje: Scania Repro.

Friedman, M. (1970). *The social responsibility of business is to increase its profits*. New York: New York Times Magazine. Issue: 13 September 1970.

Gibe, J. (2010). *Resursbaserad strategiteori*. Tutorial: Technology Management 2010-05-16.

Grant, R M. (2005) *Contemporary strategy analysis*. (5th Edition) United Kingdom: Cornwall: Blackwell Publishing.

Grant, R M. (2008) *Contemporary strategy analysis*. (6th Edition) United Kingdom: Oxford: Blackwell Publishing.

Griffin, R W. (2008) *Management*. USA: Boston: Houghton Mifflay Company.

Gsgnet.net (2011). *Emissions Standards: European Union Heavy-Duty Diesel Truck And Bus Engines*.

Available at Internet:

<http://www.gsgnet.net/gsgpdfs/09_EmisStandrds.pdf>

HalDEX.com (2010). *Basic function*.

Available at Internet:

<<http://www.haldex.com/en-GB/Products/European-markets/Emission-Reduction-Systems/Alfdex-oil-mist-separator-2/Basic-function/>> (Accessed: 2011-03-31)

hbr.org (2011) *McKinsey Award Winners*.

Available at Internet:

<<http://hbr.org/web/2009/mckinsey/mckinsey-award-winners#2000s>> (Accessed: 2011-03-30)

Hedström, R. (2010) *Alfdex Manufacturing Footprint, Future Expansion Strategy for Production 2014 - a Global Review*. Sweden: Eskilstuna: Mälardalen University. School of Innovation.

Ideon (2011)

Available at Internet:

<<http://www.ideon.se>> (Accessed: 2011-04-07)

IMDS.com (2010) *New to IMDS?*

Available at Internet:

<<https://www.mdsystem.com/magnoliaPublic/en/public/New2IMDS.html>>
(Accessed: 2011-05-09)

Internal documents (2011). For more information about the internal documents at Alfdex please contact the environmental group at Alfdex.

ISO14040 (1997) *Environmental performance evaluation - Life Cycle Assessment - Principles and framework*. (EN ISO 14040:1997) Belgium: Brussels: International Organization for Standardization

iso.org (2011) *ISO 14000 essentials*.

Available at Internet:

<http://www.iso.org/iso/iso_14000_essentials> (Accessed: 2011-04-06)

JD Powers (2011) Alfdex internal documents: Special access to JD Powers. Contact Mats Olsson, Technical Manager, Alfdex AB.

Koller, T. Goedhart, M. and Wessels, D. (2010). *Valuation - Measuring and Managing the Value of Companies*. (5th Edition) USA: New Jersey: John Wiley & Sons Inc, McKinsey & Company.

Kroon, M. and Månsson, D. (2008) *Strategival och suboptimering – Kopplingen mellan lågkostnadsstrategi och suboptimeringsproblematiken*. Göteborg.

Lash, J., & Wellington, F. (2007). Competitive advantage on a warming planet. *Harvard Business Review*, 85(3), 94-102, 143. Harvard Business School Publishing.

lomborg.com (2011) *Cool it - The Skeptical Environmentalist's Guide To Global Warming*.

Available at Internet:

<http://www.lomborg.com/cool_it/> (Accessed: 2011-04-26)

Miljoaktuellt.idg.se (2011). *Den stora förnekelsen*.

Available at Internet:

<<http://miljoaktuellt.idg.se/2.1845/1.375130/bok-den-stora-fornekelsen>>

(Accessed: 2011-04-12)

Nilsson, C H and Dernroth, J. (1995). The Strategic Grounding of Competitive Advantage - The Case of Scania. *International Journal of Production Economics*. Volume 41, pp. 281-296.

Nilsson, E. and Forsberg, S. (2003). *Allmänna värderingar, Miljöspecifika attityder och Beteende: Olika mätinstrument och könsskillnader*. Umeå: Umeå Universitet: C-uppsats.

OECD (2009). *Eco -Innovation in Industry - Enabling Green Growth*. OECD Publications 2009.

Persson, I. and Nilsson, S-Å. (1999). *Investeringsbedömning*. (6th Edition) Sweden: Malmö: Liber Ekonomi.

PWC (2011). *Driving Value - Automotive M&A Insights 2010*. Available at Internet:

<<http://www.pwc.com/gx/en/automotive/publications/mergers-acquisitions-insights-2010.jhtml>> (Accessed: 2011-05-02)

Porter, M E. and Kramer, M. (2006) Strategy and Society - The Link Between Competitive Advantage and Corporate Social Responsibility. *Harvard Business Review*. Issue 12. pp. 80-92.

Porter, M E. and Reinhardt, F. (2007) A Strategic Approach to Climate. *Harvard Business Review*. Issue 10. pp. 22-26.

Porter, M E. and van der Linde, C. (1995) Toward a New Conception of the Environment-Competitiveness Relationship. *Journal of Economic Perspectives*. Volume 9, pp. 106.

Porter, M E. (1979) How Competitive Forces Shape Strategy. *Harvard Business Review*. Issue March-April.

Porter, M E. (1985) From Competitive Advantage to Corporate Strategy. *Harvard Business Review*. Issue May-June.

Porter, M E. (1990) *The Competitive Advantage of Nations*. New York: Free Press

Porter, M E. (1996) What is strategy? *Harvard Business Review*. Issue 11.

Rappaport, A. (1998) *Creating Shareholder Value*. USA: New York: The Free Press.

Ryd, C J. Lindahl, M. and Tingström, J. (2002) *Livscykelanalys - en metod för miljöbedömning av produkter och tjänster*. Sweden: Lund: Studentlitteratur.

Scania.com. (2011)a. *Sustainability*.

Available at Internet:

<<http://www.scania.com/scania-group/sustainability/>> (Accessed: 2011-02-18)

Scania.com. (2011)b. *Ecolution by Scania - Customer benefits*.

Available at Internet:

<<http://www.scania.com/products-services/trucks/environment/ecolution-by-scania/benefits/index.aspx>> (Accessed: 2011-04-04)

SCB.se (2008). *Gröna företag växer snabbt*.

Available at Internet:

<http://www.scb.se/Pages/PressRelease____257601.aspx> (Accessed: 2011-03-09)

SCB.se (2010) *Environmental sector in Sweden, 2003- 2009*.

Available at Internet:

<http://www.scb.se/Pages/TableAndChart____206293.aspx> (Accessed: 2011-04-13)

Studera.nu (2011a) *Universitet och Högskolor*.

Available at Internet:

<<https://www.studera.nu/studera/864.html>> (Accessed: 2011-04-07)

Studera.nu (2011b) *Sök utbildning - miljö*.

Available at Internet:

<<https://www.studera.nu/aw/courseSearchResult.do?freeText=milj%F6&period=HT+2011&type=1&type=2&type=3&type=4&type=5&type=6&intensity=2&intensity=3&searchType=freeText&showAdvanced=false&page=1&sortColumn=0&subject=&publisher=&location=&lang=sv>> (Accessed: 2011-04-07)

Svd.se. (2010) *Miljösektorn ökar i betydelse*.

Available at Internet:

<http://www.svd.se/naringsliv/miljosektorn-okar-i-betydelse_4733621.svd> (Accessed: 2011-04-20)

Truck & Bus Builder (2008-2010) England: Truck and Bus Builder Publishing LTD. Volume 30, Issue 1-Volume 32, Issue 12.

Truck & Bus Builder (2010) England: Truck and Bus Builder Publishing LTD. Volume 32. Issue 2.

Veridantix (2011) *Smart Innovators Product LCA Software*. United Kingdom: London: Veridantix

volvo.com (2011)a. *Kraftig resultatförbättring*.

Available at Internet:

<http://www3.volvo.com/investors/finrep/ar10/sv/lastvagnar/pops/printable/19_la_stbilar_sv.pdf> (Accessed: 2011-04-07)

volvo.com (2011)b. *Övergripande strategier*.

Available at Internet:

<<http://www3.volvo.com/investors/finrep/ar10/sv/overgripandestrateg/inledning.html>> (Accessed: 2011-04-07)

Volvotrucks.com (2011)a. *Our promise and dedication*.

Available at Internet:

<<http://www.volvotrucks.com/trucks/global/en-gb/values/Pages/values.aspx>> (Accessed: 2011-02-18)

Volvotrucks.com (2011)b. *Taking sustainability seriously.*

Available at Internet:

<<http://www.volvotrucks.com/trucks/global/en-gb/values/environment/Pages/Sustainability.aspx>> (Accessed: 2011-04-04)

Volvotrucks.com (2011)c. *Total solution provider.*

Available at Internet:

<<http://www.volvotrucks.com/trucks/global/en-gb/company/Pages/company.aspx>> (Accessed: 2011-04-07)

Volvotrucks.com (2011)d. *Volvo Powertain.*

Available at Internet:

<http://www.volvogroup.com/group/sweden/sv-se/Volvo%20Group/our%20companies/volvopowertrain/pages/volvo_powertrain.aspx> (Accessed: 2011-04-07)

Appendix 1 – Customer Descriptions

Volvo Trucks – company description

Volvo Group (founded in 1927) uses the same engine platforms in their vehicles, all provided by the company Volvo Powertrain (volvotrucks.com, 2011d). The truck manufacturers in Volvo Group i.e. Volvo Trucks, Renault Trucks, Mack and UD trucks has approximately 38 000 employees, a turnover of 167 000 MSEK (69 000 MSEK in Europe) and an operating margin of 6,7 %. The truck function operates in about 140 countries and the amount of trucks sold in Europe is 65 000 during 2010 (volvo.com, 2011a; volvotrucks.com, 2011c). Volvo Group's strategy is to focus on profitable growth, product renewal and internal efficiency (volvo.com, 2011b). According to Kroon and Månsson (2008) the company has a cost-leading strategy.

Scania – company description

Scania AB is a Swedish truck manufacturing company founded in 1891 with about 34 000 employees operating in some 100 countries. Scania's turnover was 78 168 MSEK 2010 and operating margin 16.3 %. The number of vehicles sold worldwide in total during 2010 was approximately 70 000 including trucks (58 000), buses and engines (12 000). Scania's modular system is a way to be able to customize the products and keeping down costs through product development, production- and parts management. The sustainability work in the company is mentioned as "an important factor behind Scania's position as a leading company in its industry" (Scania.com, 2011a). Nilsson et al. (1995) means that it is difficult to categorize Scania's competitive advantage as cost-leadership, differentiation or focus strategy.

Appendix 2 – Interview Questions

Internal interview questions

Strategic department, Alfdex

What is Alfdex environmental strategy today?

How do you think it will change in the future?

When did the environmental work begin at Alfdex?

- Why?

- Who initiated it?

Tell us about your environmental work?

What actions have you performed since 2008?

- Why did you perform these actions?

Do you think your customers have chosen Alfdex due to these actions?

What actions are performed at the other departments at Alfdex?

Are your department doing more or less than the other departments?

- Why?

Do you think Alfdex can have a higher price due to a good environmental strategy?

Do you think Alfdex can have sell larger orders (more separators/customer) due to a good environmental strategy?

For what reason does Alfdex have an environmental strategy?

What is Alfdex long-term environmental strategy?

Will it change in the (near) future?

- How?

- Why?

How much do you plan to invest in your environmental strategy in the coming years?

- Will you increase or decrease your efforts?

- Will this affect how the environmental resources are allocated?

Do you think the environmental strategy may have contributed to a higher price and/or number of orders?

Do you think the environmental strategy may have contributed to cost savings for Alfdex?

Why is the Alfdex logotype green?

The education (movie and course):

- Why education about the environment?

- How much did it cost?

- Did all employees participate?

Company cars:

-Who can chose to have a company car?

- How much does the company cars cost?

- When will the incentives for buying a "green" car be realized?

- How will this affect the costs?

Marketing department, Alfdex

Sporadic and open interviews were held at several occasions with the marketing division. The overall theme for these interviews have been *the crankcase and automotive market*:

- Size of different segments
- Number of customers
- Number of competitors
- Price sensitivity
- Forecasts
- Marketing strategies
- Differentiation strategies
- Customer demands / Industry demands

External interview questions

Environmental director, Volvo and Scania

Tell us about yourself and your background.

Tell us about your role in the company.

Which products do you call green products?

To what extent do you think that your company is proactive?

Do you work together with the purchasing division?

How does the Euro 6 affect your work?

What is your overall picture of Alfdex?

What do you think about the Alfdex brand?

What does it mean to you that a company has an environmental strategy?

How important do you think it is that your suppliers are working actively with a green strategy?

How do you verify that they do their work?

As far as we are concerned, Alfdex is a somewhat more expensive product. Why do you still choose Alfdex?

Rank the factors below (1=most important, 6=least important):

Separation efficiency

Quality

Relation to supplier

Location

Legalization

How do you think this will change over time?

The truck industry is a cost-focused industry. How does the cost-focusing vary with different types of products, i.e. how price-sensitive are you when you for example buy engines? How price-sensitive are you when you are buying components like the Alfdex?

How do you think that the fact that products generally have their highest environmental impact during the usage-phase?
Why have you chosen Alfdex to the extent you have?
How subjective are you when making decisions about which products to buy?
Do you see any winning for suppliers to be proactive in their environmental work?
How much would you say that the price of crankcase gas ventilation is allowed to vary when choosing between two similar products?
When did you first start to use crankcase gas ventilation?
How much would you say that you use your environmental work in your marketing?
How do you think your environmental/your suppliers environmental strategy will change over the coming 5 years?
What do you think about the society's willing to know more about your environmental work?
What importance do you think that a supply chain management perspective has in these questions?

Strategic level, Purchasing division, Volvo and Scania

Tell us about yourself and your background.
Tell us about your role in the company.
Who participate in the purchasing process and how does it operate?
What do you know about Alfdex?
What do you think about when you think about Alfdex?
What does it mean to you that a company has an environmental strategy/profile?
What do you know about the environmental activities that your suppliers perform?
As far as we are concerned, Alfdex is a somewhat more expensive product. Why do you still choose Alfdex?
Rank the factors below (1=most important, 6=least important):
Separation efficiency
Quality
Relation to supplier
Location
Legalization
How do you think this will change over time?
What importance does it have that a supplier has an environmental strategy/profile when you choose the supplier/product?
How do you think a supplier's environmental profile affects you?
What do the suppliers tell you about their environmental work?
What does Alfdex tell you about their environmental work?
How many of your suppliers would you say have an expressed environmental profile?
The truck industry is a cost-focused industry. How does the cost-focusing vary with different types of products, i.e. how price-sensitive are you when you for example buy engines?

How price-sensitive are you when you purchase components like the Alfdex?
How does the Euro 6 affect your work?
How much would you say that the price of crankcase gas ventilation is allowed to vary when choosing between two similar products?
How do you think the importance of environmental work/strategy/profile will change over time for you, for your suppliers and in the society in general?

Operational level, purchasing division, Volvo and Scania

Tell us about yourself and your background.
Tell us about your role in the company.
Who participate in the purchasing process and how does it operate?
What do you know about Alfdex?
What do you think about when you think about Alfdex?
What does it mean to you that a company has an environmental strategy/profile?
What do you know about the environmental activities that your suppliers perform?
What is your time-horizon when working with the suppliers?
We know that you have certain environmental requirements for your suppliers. How many are those and have you got a specific list with the requirements?
Apart from these requirements have you got any extra preferences regarding your suppliers environmental work/strategy/profile?
What do you know about Alfdex's environmental work?
Rank the factors below (1=most important, 6=least important):
Separation efficiency
Quality
Relation to supplier
Location
Legalization
How do you think this will change over time?
What importance does it have that a supplier (Alfdex) has an environmental strategy/profile when you choose the supplier/product?
Would you choose a supplier that does not have an ISO14001 certification?
What do your suppliers tell you about their environmental work?
Is there any other supplier that work actively with an environmental profile that you know about?
Do you ever discuss your supplier's environmental work?
How does the Euro 6 affect your work?
Do you think the environmental profile will rise in importance?
Why do you not use the filter solutions?
How much would you say that the price of crankcase gas ventilation is allowed to vary when choosing between two similar products? How do you think the importance of environmental work/strategy/profile will change over time for you, for your suppliers and in the society in general.

The PGS-framework – A study of Alfdex's Environmental Strategy

Table 5: Interviewees.

Name	Company	Position	Date
Internal Interviews			
Ekeroth, Mats	Alfdex	CEO	2011-03-02(a)
Ekeroth, Mats	Alfdex	CEO	2011-03-30(b)
Lans, Fredrik	Alfdex	Customer Project Coordinator	2011-04-08
Mellblom, Jonny	Alfdex	Logistics Manager	2011-03-10(a)
Mellblom, Jonny	Alfdex	Logistics Manager	2011-04-08(b)
Nilsson, Jesper	Alfdex	Manufacturing Manager	2011-03-21
Olsson, Mats	Alfdex	Technical Manager	2011-01-21(a)
Olsson, Mats	Alfdex	Technical Manager	2011-02-07(b)
Olsson, Mats	Alfdex	Technical Manager	2011-03-09(c)
Petersson, Tony	Alfdex	Production Assistant	2011-03-23
Pogén, Mats-Örjan	Alfdex	Product Development Engineer	2011-02-08(a)
Pogén, Mats-Örjan	Alfdex	Product Development Engineer	2011-03-10(b)
Rönn, Roger	Alfdex	CFO	2011-03-22
Saxne, Johnny	Alfdex	Product Development Engineer	2011-03-08(a)
Saxne, Johnny	Alfdex	Product Development Engineer	2011-03-18(b)
External Interviews			
Edsfeldt, Björn	Deloitte	Director Transaction Services	2011-04-11
Gäre, Hanna	DHL	Project Manager	2011-03-04
Haag, Inger	Nolato	Material Developer	2011-04-11
Hilmersson, Erik	Nolato	Technical Manager	2011-04-12
Johansson, Sofia	Scania	Manager, Business Development	2011-03-30
Kronström, Börje	Shell	Product Engineer	2011-03-01
Mårtensson, Lars	Volvo Trucks	Environmental Director	2011-02-21
Nilsson, Marie	Nederman	Industrial Designer	2011-02-07
Persson, Allan	DSV	Fleet Manager	2011-03-01
Peterson, Kent	Filton	CEO	2011-03-21
Porretta, Arnaud	Volvo PT	Purchasing Commodity Director	2011-03-17
Ronstad, Åsa	Volvo PT	European Buyer	2011-03-11
Sandberg, Henrik	Volvo PT	SQA-Engineer	2011-03-15
Sylvander, Stefan	Scania	Head of Distribution/Green Sol.	2011-03-17
van der Broeck, Hervé	Camfilfarr	Business Manager	2011-04-11

Appendix 3 - Surveys

The statements showed in table 6 were used in order to measure the ecological concern within Alfdex and the customers including interest area and what an agreement will indicate for each question. All statements derive from the NEP Scale.

Table 6: The four statements used for measuring ecological concerns.

Statements	Interest area	Agreement indicates:
If things continue on their present course, we will soon experience a major ecological catastrophe	The possibility of an ecocrisis	proecological view
Humans have the right to modify the natural environment to suit their needs	Antianthropocentrism	Antiecolological view
The balance of nature is strong enough to cope with the impacts of modern industrial nations	The fragility of nature's balance	Antiecolological view
The earth has plenty of natural resources if we just learn how to develop them	The reality of limits to growth	Antiecolological view

The PGS-framework – A study of Alfdex's Environmental Strategy

The questions showed in table 7 were used in order to measure how much attention the environmental work gets at the customers.

Table 7: Survey conducted with customers.

Questions	Answer option
Name	Written
To what extent do you work with environmental issues/questions in your job per week?	0 min, 5 min, 10 min, 30 min, 60 min, 2 hours, 5 hours, 10 hours, 20 hours, more than 20 hours
What share of the price of the purchased product can be addressed to the supplier's environmental strategy?	0,1 %, 0,1-0,5 %, 0,5-1,0 %, 1 %, 2 %, 3 %, 4 %, 5 %, 6 %, 7 %, 7-10 %, 10-20 %, more than 20 %
What share of the total amount purchased products from a supplier can be addressed to the supplier's environmental strategy?	0,1 %, 0,1-0,5 %, 0,5-1,0 %, 1 %, 2 %, 3 %, 4 %, 5 %, 6 %, 7 %, 7-10 %, 10-20 %, more than 20 %
On a scale (1-5), range the factors do you consider most important in your job? (1 = most important, 5 = least important)	Costs, Quality, Supplier relations, Environmental strategy, Other

The questions showed in table 8 were used in order to measure how much attention the environmental work gets within Alfdex.

Table 8: Survey conducted within Alfdex.

Questions	Answer option
What is your position within Alfdex?	Written
How much time of your working hours do you work with the environmental strategy per week (average over a year)?	0 min, 5 min, 10 min, 30 min, 60 min, 2 hours, 5 hours, 10 hours, 20 hours, more than 20 hours
How important do you think that environmental work is in your work (in relation to other important aspects such as costs, customer relations, quality etc.)?	1 %, 2 %, 3 %, 4 %, 5 %, 6 %, 7 %, 8 %, 9 %, 10 %
How important do you think that environmental work is for Alfdex as a company (in relation to other aspects such costs, customer relations, quality etc.)?	1 %, 2 %, 3 %, 4 %, 5 %, 6 %, 7 %, 8 %, 9 %, 10 %, 10-20 %, more than 20 %
How many flights do you have in a year?	0, 1-5, 6-10, 11-20, 21-30, more than 30
Alfdex has a policy to reduce the number of flights and instead perform telephone conferences. How many fewer flights do you have per year due to this policy?	0, 1-5, 6-10, 11-20, 21-30, more than 30
What share of the total amount purchased separators do you think can be addressed to the environmental strategy?	0,1 %, 0,1-0,5 %, 0,5-1,0 %, 1 %, 2 %, 3 %, 4 %, 5 %, 6 %, 7 %, 7-10 %, 10-20 %, more than 20 %
What share of the price of the separator, do you think can be addressed to the environmental strategy?	0,1 %, 0,1-0,5 %, 0,5-1,0 %, 1 %, 2 %, 3 %, 4 %, 5 %, 6 %, 7 %, 7-10 %, 10-20 %, more than 20 %

Appendix 4 – Crankcase industry

What is crankcase gas?

Crankcase gas originates from exhaust gases that escape to the crankcase via the piston rings and cylinder wall. In order to withhold a stable pressure in the crankcase the gas must be ventilated out of the crankcase. This has traditionally been solved through a end-of-pipe solution where the gas has been ventilated through a hole in the crankcase to the surrounding environment. Today the gases are ventilated through a range of different systems (Ekeroth, 2011). The number of crankcase ventilation suppliers is approximately 15-20 for heavy trucks, including all types of solutions: separators, filters and cyclones. Crankcase ventilation systems have been installed in engines the last 20 years, mostly where legislations demand it, i.e. the USA, South Korea and Japan. The solutions can be divided into five product groups such as the Alfdex separator (up to 99 % separation efficiency), filter solutions (below 80 % separation efficiency), cyclone (below 70 % separation efficiency). In addition, there are other solutions that either have not been introduced on the market yet (other types of separator solutions) or solutions that does not work properly (electrostatic filters). Both the ordinary filter solutions as well as the cyclone are so called "passive solutions", whilst the Alfdex separator, other separators and the electrostatic filters are so called "active solutions" (Hedström, 2010:32). Studies have shown that filters, because of the new legalizations, need to be exchanged at least 5 times during its life-time in order to work satisfying (Münkel, 2011). Cyclones are not as efficient as they need to be in order to fulfill the requirements of Euro 6 and electro-static filters have technical problems (Olsson, 2011b).

The separator and how it works

Alfdex's product, "the separator", is based on is the traditional centrifuging technique, originally invented by Alfa Laval. The separator's main purpose is to clean crankcase emissions. The oil-turbine that the separator is driven by uses oil from the pressure lube oil surplus in the truck engine. The rotor stack (that actually performs the separation) is driven by the turbine. The gas that is pressed into the crankcase (containing oil droplets) is centrifuged in the rotor-stack where the oil-droplets separate from the gas and the oil flows down the house wall as the gas is guided to the outlet (open crankcase ventilation) or guided back to the engine (closed crankcase ventilation) (Olsson, 2011:a, Haldex.com, 2010). According to Stefan Sylvander, Director Distribution and Green Products, (2011) the traditional problem with crankcase gas has been fleet truck owners' problems with oil-spill from the trucks, particularly those transporting goods to sterile production sites such as the food industry, pharmaceutical industry etcetera. Today the oil-spill is not the single reason to why there is a need for crankcase gas ventilation in engines due to that the environmental legalizations, such as the Euro6, has hardened.

Appendix 5 – Environmental work at Alfdex

Perceived importance of environmental work

A summary of the survey regarding the perceived importance of the environmental strategy and environmental work at Alfdex is shown in Table 9 below. The average of the three first questions is about 6 %. The survey was distributed to 13 employees at Alfdex and the response rate was some 70 %. The questions are short versions of the original questions stated in the survey.

Table 9: Summary of the survey-responses.

Question	Answer (Average)
Share of hours spent per week working with environmental questions in relation to total working hours	3.10 %
Perceived importance of environmental work in your employment	5.14 %
Perceived importance of environmental work for Alfdex as a company	10.29 %
How much the price per sold product may vary due to having an environmental strategy	3.62 %
How many more products might be sold due to having an environmental strategy	0.25 %

Cost and cost-savings of environmental work (historical)

The environmental work performed at Alfdex between 2008 and 2011 are summarized in Table 10 below. The table includes resources needed such as materials and time, cost and cost savings associated to the resource. The resources and figures are based on the action-list and interviews conducted within Alfdex.

Table 10: Summary of all costs & savings associated to the environmental work.

Resource	Cost (SEK)				Cost savings (SEK)			
	2008	2009	2010	2011	2008	2009	2010	2011
Material A	0	36000	0	0	0	0	0	0
Material B	0	8400	8400	8400	0	0	0	0
Material C	0	0	6000	3000	0	0	0	0
Material D	0	0	0	802	0	0	0	0
Material E	395	329	494	987	3702	4936	7404	14808
Material F	0	0	0	66636	0	0	0	29775
Meeting A	28800	28800	28800	15696	0	0	0	0
Meeting B	3000	3000	3000	1635	0	0	0	0
Meeting C	96000	96000	96000	52320	0	0	0	0
Working hours A	0	0	133800	74556	0	0	0	0
Working hours B	0	7200	7200	7200	0	0	0	0
Master Thesis	45000	0	0	135000	0	0	0	0
ISO Revision	0	19200	19200	31392	0	0	0	0
CO ₂ -compensation A	0	0	500	1500	0	0	0	0
CO ₂ -compensation B	0	0	4250	12750	0	0	0	0
Education	57320	0	0	0	0	0	0	0
Telephone conferences	0	0	0	0	0	0	0	1543
Investment	0	0	0	23878	0	0	0	0

Assumptions and clarifications of cost and cost-savings for Table 10

- All costs and cost-savings are based on the environmental actions listed at Alfdex (green and red list) since 2008 (Internal document, 2011: Miljöaktiviteter Alfdex 2008) and interviews held with employees at Alfdex. (see *Material A-F*)
- Social security benefits are set to 50 %. (Meeting A-Working hours B)
- Average wages is set to 600 SEK/hour (including social security benefits) up until 2010, since Alfdex hired personnel from Haldex up until then (Olsson, 2011c). From 2011 and forth the average wages are set to 218 SEK/hour i.e. 327 SEK/hour (including social security benefits) (lönestatistik, 2011). (see *Meeting A – Working hours B, ISO Revision and Education*)
- Alfdex was ISO14000 certified in 2009. The ISO revision occurs twice a year. 2009-2010 it is assumed that the revision required two employees during one day. 2011 it requires three employees during two days. 2012 and forth

it requires three employees during one day (Saxne, 2011b). (see *ISOR*revision)

- CO₂-compensation for flights was introduced in September in 2010 and the cost is 15 SEK at company A and 85 SEK at company B, one way. It is assumed that Alfdex conducts 100 one way flights/year with company A and 150 one way flights/year with company B (Internal documents, 2011: Alfdex resor 2010) (see *CO₂-compensation A*, *CO₂-compensation B*)
- The education is the total cost for the environmental education mentioned in Figure 12.
- Master thesis wages 2008 is set to 15000 SEK/student and 2011 to 30000 SEK/student. 2011 extra costs are added for travels, print of thesis etcetera. (see *Master thesis*)
- One flight is assumed to have an average cost of 1000 SEK/person. Approximately 25 flights are eliminated. Some 6 % of this is directly linked to the company's environmental care based on the discussion in section 6.4.4. (see *Telephone conferences*)
- Investment is a onetime investment in improved production technique, beneficial for the environment. Some 6 % of the total investment is linked to the environment.

Appendix 6 - Profitability analysis

The profitability analysis is conducted with the Net Present Value (NPV) method; described in the theoretical framework section 3.6. The NPV-method is used in the calculations in appendix 6. The equation used is:

$$PV = \frac{a}{(1 + i)^n}$$

a = total sales year x - total costs year x

i = 15 % (Rönn, 2011)

n = 5 year after the Euro 6 legislation was put into action (2018).

Sales and growth – Alfdex

Total sales and the calculated sales-growth are shown in Table 11. The sales figures are based on Alfdex’s customer analysis and are stated as thousands of separators (Internal documents, 2011: Alfdex standard presentation 2010: Long term volumes).

Table 11: Summary of total sales and sales growth for Alfdex 2010-2016.

Year	2010	2011	2012	2013	2014	2015	2016
Total Sales	170	300	380	410	470	520	580
Sales Growth (%)	-	76	27	8	15	11	12

Sales and growth - Scania

The total sales and sales growth for Scania are shown in Table 12 (JD Powers, 2011).

Table 12: Summary of sold trucks in Europe for Scania, 2007-2015.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Scania									
Total Sales	34 935	33 826	19 527	20 237	26 104	31 598	36 566	35 181	37 194
Sales Growth (%)	4,40	-3,20	-42,3	3,60	29,0	21,0	15,7	-3,80	5,70

The NPV was calculated based on the historical data shown in Table 13 and the forecast is shown in Table 14, and is based on the discussion in section 6.4.4. The historical data is based on the world market; the forecast originates from the historical data, but is scaled down to the European market (44 % of the total sales).

Table 13: Summary of all historical sales and costs.

	Historical data			
	2008	2009	2010	2011
Profit driver - to be proactive	0	0	0	0
Profit driver - proper knowledge	0	0	0	0
Cost savings - Material E	3702	4936	7404	14808
Cost savings - Material F	0	0	0	29775
Cost savings - Tele conferences	0	0	0	1543
Total sales	3702	4936	7404	46125
Material A	0	36000	0	0
Material B	0	8400	8400	8400
Material C	0	0	6000	3000
Material D	0	0	0	802
Material E	395	329	494	987
Material F	0	0	0	66636
Total COGS	395	44729	14894	79825
Meeting A	28800	28800	28800	15696
Meeting B	3000	3000	3000	1635
Meeting C	96000	96000	96000	52320
Working hours A	0	0	133800	74556
Working hours B	0	7200	7200	7200
Master Thesis	45000	0	0	135000
ISO Revision	0	19200	19200	31392
Total overhead costs	172800	154200	288000	317799
CO ₂ compensation A	0	0	500	1500
CO ₂ compensation B	0	0	4250	12750
Education	57320	0	0	0
Total other costs	57320	0	4750	14250
Investments	0	0	0	23878
Total investments	0	0	0	23878
Depreciation	0	0	0	4776
Total costs	230515	198929	307644	440528
Sales - Costs	-226813	-193993	-300240	-394402

The PGS-framework – A study of Alfdex's Environmental Strategy

Table 14: Summary of sales and costs associated to the forecast, 2012-2018.

	Forecast →		Euro 6 →				
	2012	2013	2014	2015	2016	2017	2018
PD- proactive	0	0	61071	67568	75364	84060	93759
PD- proper knowledge	0	0	2 110 860	2276273	2352401	2431076	2512382
Cost sav. – Mat. E	0	8905	10208	11294	12597	14050	15672
Cost sav. – Mat. F	0	17904	20525	22708	25328	28251	31510
Cost sav.- Telephone	0	928	1063	1176	1312	1463	1632
Total sales	0	27737	2203727	2379019	2467003	2558901	2654956
Material A	(All costs of materials are summarized below in the row COGS)						
Material B							
Material C							
Material D							
Material E							
Material F							
Total COGS	0	47780	54772	60599	67591	75390	84089
Meeting A	8748	9439	10820	11971	13352	14893	16611
Meeting B	911	983	1127	1247	1391	1551	1730
Meeting C	29160	31462	36066	39903	44507	49642	55370
Working hours A	33461	34130	34813	35509	36219	36943	37682
Working hours B	4012,8	4329,6	4963,2	5491,2	6124,8	6832	7620
Master Thesis	19800	19800	19800	19800	19800	19800	19800
ISO Revision	6906,24	6906,24	6906,24	6906,24	6906,24	6906,24	6906,24
Total overhead costs	102999	107049	114495	120827	128300	136567	145720
CO2 comp. A	836	902	1034	1144	1276	1423	1587
CO2 comp. B	7106	7667	8789	9724	10846	12097	13493
Education	0	0	0	0	0	0	0
Total other costs	7942	8569	9823	10868	12122	13521	15081
Investments	0	0	0	0	0	0	0
Total investments	0	0	0	0	0	0	0
Depreciation	2101	2101	2101	2101	0	0	0
Total costs	113042	165500	181191	194395	208013	225478	244890
Sales - Costs	-113042	-137763	2022536	2184624	2258990	2333423	2410066

Result

The present value was calculated and the result is 5,4 million SEK over 7 years (2012-2018) or 77 000 SEK/year. In relation to the company turnover 2011, which is approximated to be 300 000 000, this is some 0,26 %.

Calculations

PD - Proactive: Cost of Goods Sold (COGS materials A-F) * Sales growth, see Table 11 * operating margin (11,5 %). (Materials A-F are different materials that have been invested in partially or fully with aim to decrease environmental impact. They are all materials which have been by demanded/sold to proactive customers).

PD-Proper Knowledge: Sales to customers segmented as proactive, see section 6.3, see Table 12 * price/separator * environmental awareness in the industry, see section 6.4.2.

Cost savings Material E & F and Telephone Conferences: Based on the historical data, see Table 10 * share of the European market (44 %) * sales growth Alfdex, see Table 11.

Over Head Costs & Other Costs: Based on the historical data, see Table 10 * share of the European market (44 %) * sales growth Alfdex, see Table 11.

Assumptions and clarifications

- The historical data (2008-2011) is based on costs and cost savings summarized in appendix 5, and since the Euro 6 has not been put into action the number of trucks are assumed to be zero and thus the sales.
- The forecast is based on the historical data and the profit drivers. The profit drivers are presented in section 6.4.4.
- The resources (actions) not characterized as profit drivers are considered as factors that does not drive profit in the environmental strategy. Thereby the forecast for expenses/investments/costs and revenues related to these factors are considered as proportional to the sales growth of Alfdex.
- The sales growth for Alfdex of 2017 and 2018 is assumed to be equal as for the year 2016.
- The sales growth for Scania 2016-2018 are assumed to be equal as the average sales growth for 2007 – 2015.
- The forecast of COGS (2012-2018) are based on the average COGS 2008-2011 and are assumed to be proportional to the sales growth Alfdex.
- 6 % of the total costs/investments and price are addressed to the environmental work.
- Social security benefits are set to 50%.
- Average wages are set to 600 SEK/hour (including social security benefits) up until 2010, since Alfdex hired personnel from Haldex up until then (Olsson, 2011c). From 2011 and forth the average wages are set to 218 SEK/hour i.e. 327 SEK/hour (including social security benefits) (lönestatistik, 2011).
- Alfdex was first ISO14000 certified in 2009. The ISO revision occurs twice a year. 2009-2010 it is assumed that the revision required two employees during one day. 2011 it requires three employees during two days. 2012 and forth it requires three employees during one day (Saxne, 2011b).
- CO₂-compensation was introduced in September in 2010 and the cost is 15 SEK at company A and 85 SEK at company B, one way. It is assumed that Alfdex makes 100 one way flights/year with company A and 150 one way flights/year with company B (Internal documents, 2011: Alfdex resor 2010)
- One flight is assumed to have an average cost of 1000 SEK/person.
- Master thesis wages 2008 is set to 15000 SEK/student and 2011 to 30000 SEK/student.
- The depreciation of is assumed to be constant during five years (Rönn, 2011).