

A Business Perspective on Reducing the Climate Impact from Tetra Pak's Transportations of Goods

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Summary

- Title:** A Business Perspective on Reducing the Climate Impact from Tetra Paks Transportations of Goods.
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- Problem Analysis:** Increased awareness concerning climate change will put pressure on companies to reduce their climate impact. Problems arise when trying to reduce the impact from transportations due to companies' limited control on forwarding agents and difficulties measuring the emissions.
- Purpose:** From a business perspective, this report will enable a reduction of the climate impact that arises from Tetra Paks transportation of goods. A tool called Climate Business Scoring will be created to evaluate prospective measures, which will be the foundation for a climate strategy.
- Method:** The report is based mainly on data from different suppliers of transportation services. Furthermore, to get an insight into Tetra Pak and the climate field, interviews with several relevant employees at TLGT&T were conducted. In addition, theoretical studies have been carried out to obtain a broad, but at the same time deep understanding of the relevant areas. An analysis of the problem is conducted, using the theoretical and empirical findings. Finally, based on the analysis, conclusions and recommendations are formulated.
- Conclusions:** Reduced emissions with reduced cost are possible. The list of alternatives, the CBS tool and the developed strategies are helpful for Tetra Pak to move forward. The next step for Tetra Pak is to measure CO₂ emissions from transportations and set goals for reduction.
- Key words:** Climate change, Environment, Transportation, Strategy, Decision making.

Preface

We would like to thank Tetra Laval Group Transport & Travel, especially our company supervisor Björn Lindahl, for their support and insight. Both our supervisors at the University, Lars J Nilsson and Nils Månsson, have encouraged and supported us along the way. We are also very appreciative to Trivector Traffic and all others that have contributed with information or likewise to make this report possible.

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Chapter 1. Introduction

The introduction explains the problem at hand and briefly presents the background of the study. It gives an outline of the study with its purpose, contributions and limitations.

Chapter 2. Methodology

The research methodology is described. Furthermore, it describes the way data is collected and analyzes the credibility of sources.

Chapter 3. Theoretical Framework

A theoretical framework is presented, which consist of theories about key factors for creating a successful strategy and making decisions. Product development theories are used as a complement to Multi Criteria Decision Making.

Chapter 4. Information Gathering

This chapter summarizes information regarding Tetra Laval Group Transport & Travel, their environment approach and characteristics for the different transportation modes.

Chapter 5. Develop Alternatives

A list of measures is presented, consisting of 43 alternatives to reduce the climate impact. Furthermore, an exemplification of a measure is given. Finally, a reflection on the developed alternative is analyzed.

Chapter 6. Rate Each Alternative

The Climate Business Scoring tool is described and how the process of evaluating all the alternatives is performed. Thereafter, a compiled list of the alternatives ranked according to their aggregated score is presented. The chapter ends with an reflection of the Climate Business Scoring tool.

Chapter 7. Strategy

This chapter starts with creating prerequisites for a long term initiative to be implemented. A presentation of how the strategies are created is followed by the actual climate strategies. Finally, a reflection on the strategies is performed.

Chapter 8. Discussion

Strength and weaknesses of the list of measures, the Climate Business Scoring tool and the strategies is discussed. Further aspects are pointed out.

Chapter 9. Conclusions

The findings from the study are described and the purpose is answered.

Chapter 10. Suggestions for Further Studies

Suggestions for further studies are identified and described briefly.

1 Introduction

1.1 Climate Change due to Tetra Pak

The climate is changing and the concentration of greenhouse gases in the atmosphere is at an all time high. Industrialized countries rely heavily on massive amounts of energy to sustain their way of life. Developing countries, which have a much larger population, are moving fast towards industrialization. These developing countries have limited resources and therefore do not have the privilege to choose sophisticated and expensive solutions that are more climate friendly. Furthermore, emissions that are released today will continue to have effect decades into the future.

Companies are used to maximizing profit within a short time span but must now focus more on long term survival and profits. They are forced to invest resources to modify their business model with much uncertainty about the result. Competing companies may either be ahead of them or choosing to ignore all discussions about climate change. Global companies, such as Tetra Pak, operate in different regions which presents very different challenges. Tetra Pak is a manufacturing company and therefore have large control over their manufacturing process, but because they hire other companies to transport their goods they have a limited control over the transportation process.

There are several actions that are promoted to have a beneficial effect on the climate but they are surrounded by doubt. Companies have limited knowledge and experience of climate mitigation options which makes it difficult to choose the best way of solving or reducing the problem at hand.

Even though the environment and the climate have been well known issues for every company to address, it has not been as visible as it is today. It is especially true for companies that do not offer a specific environmental product or service. This is why there are limited tools and theories that can help global companies to reduce their climate impact while maintaining a business perspective. Companies will need decision making support systems that are optimized for reducing the climate impact. One reason for that are the dynamic characteristics of the problem. Regular decision making theory can be used and modified to help identifying suitable measures. Furthermore, strategy will be of crucial concern for any company that attempts to balance a mission statement. A strategy must make a good compromise between profit maximizing and having several goals. The challenge is therefore to make use of accepted theories, within decision making and strategy, and modify them appropriately to match the problem at hand.

Society and consumers demand that companies try to solve the problem of climate change, which makes it a matter of survival for companies in the near future. Tetra Pak acknowledges this and are also passionate about the climate but are unsure how to address the problem. Their earlier efforts need to be revised and how that is done will be crucial. Compared with other companies, Tetra Pak has lost some of their environmental advantage.¹

1.2 Background

1.2.1 Climate Change

Weather is defined as the atmosphere's current state and climate is defined as the weather's long-term characteristics. The climate is naturally changing but usually fairly slow and today there is no longer a scientific debate whether or not the current climate changes are due to mankind or not.² Mankind has polluted the atmosphere with greenhouse gases (GHG) which has had the affect that more radiation from the sun is absorbed within the atmosphere (*see figure 1*).³ By burning fossil fuels the added amount of greenhouse gases has grown and the increased volume of carbon dioxide (CO₂) released into the atmosphere is the largest of all greenhouse gases. This is the reason why CO₂ has the largest affect on the climate and also why this report will focus on CO₂ as the main gas to reduce. The average temperature is rising but furthermore the climate impact also includes changes in water levels, winds and precipitations.⁴

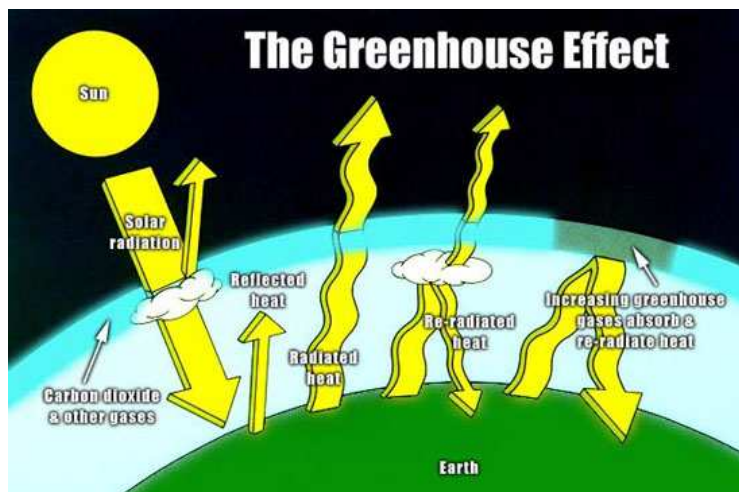


Figure 1. The Greenhouse Effect (Source:

http://www.virtualsciencefair.org/2005/stro5c0/public_html/greenhouse_effect.jpg)

¹ *Folksam's kapitalförvaltning rapport 2006, Folksam's Klimatindex*, Folksam, 2006, page 13

² Al Gore – *An inconvenient truth* - 07-03-05

³ Interview Rapf, Oliver. Senior Policy Officer Climate Change & Business, WWF, 07-02-27

⁴ http://www.ipcc.ch/present/WMEF_FINAL.ppt 2007-04-12

1.2.2 Transportations

There are many ways of transporting goods but most of them can be categorized either under rail, sea, road or air. Each one has different characteristics and it is not always possible to choose freely among them due to cargo, route, time frame or other circumstances. For any manufacturing company, including Tetra Pak, it is also very difficult to be independent of transportations because their core business demands transportations from suppliers and to customers.⁵

Because transportations are mobile, in contrast to factories, there are restrictions on possible modifications that would reduce the climate impact. When conducting business globally a company also must deal with regional differences such as older vehicles, limited technology, limited resources and limited experience. Some means of transportation move over several regions which complicates the issues with regulations and standardizations.

There are many critical views on transporting products from countries far away with lower salaries. Shortening the routes between manufacturers and customers is an obvious goal but it is also necessary to evaluate the means of transportations. Transporting products by road or air within Europe could sometimes have a higher climate impact than transporting goods to Europe from Asia by sea. Although, shipments by sea from Asia normally require other transportation modes to and from harbors.

1.2.3 Tetra Paks focus on Shareholder Value

What drives Tetra Pak to focus on the environment and the climate? Do they think they can sell more or charge a higher price? Will it even be necessary in order to survive as a company? Do they save costs by acting today instead of in five years? Can they attract more skilled employees when they have a better image? How will they use the climate impact as a way to compete? Tetra Pak does not have clear answers to these questions. Other companies also commit themselves to reduce the climate impact with no apparent business goal or because their customers demand it. Is it one company that has started a trend or have society generated a collective conscience? Many consumers are aware of the climate threat and demand products with a lower climate impact. How conscious are those consumers and how many are they? Because Tetra Pak sells packaging material and machinery to other businesses, i.e. B2B, they are not in direct contact with the consumer. Then the question becomes how much does Tetra Pak's customers demand of them today in association to climate change and how will this change in the future? It is possible to build a business advantage by being climate friendly if the company operates business to consumer but what if they are business to business?

⁵ Interview Lundahl, Lars, *Global Environment*, Tetra Pak AB, 07-03-19

1.2.4 Purchase of Transportation by Tetra Laval Group Transport & Travel

How is Tetra Pak responsible for emission associated with the transportation of their goods? If it is agreed upon that it is up to the end consumer to decide whether a product should be on the market or not there are at least two different areas of responsibility. First they have a responsibility to ensure that they fulfill their customer and end consumer needs with a minimum need of transportation. Reduced size, weight and distance from the factory to customers are possible alternatives in this category. This is often in line with conducting business in a sound way. Further, they must ensure that the transportations that are needed are conducted with the least possible impact on the climate. Because Tetra Pak purchases transportation services from other companies they must affect these companies in a way that satisfy Tetra Pak's ambition of reducing their climate impact. They do so by stipulating demands that increases the possibility of being hired if complied with.

Traditionally it has been up to each company in the supply chain to optimize their own business, but this is no longer completely accurate. When comparing forwarding agents, in a procurement decision, demands are stipulated concerning variables such as price, service, quality, safety and the environment. The main challenge is that these companies have limited knowledge about each other and different goals. Further challenges include deciding the level of detail in designing the demands, follow-up on stipulated demands and performing a fair comparison between agents.

1.3 Contribution

The practical contribution of this report is a list of possible measures to be taken against climate change, a tool for assessing them and climate strategies adapted for the use at Tetra Laval Group Transport & Travel (TLGT&T).

As mentioned in chapter 1.1, theories need to be modified to suit the problem at hand. Therefore, the theoretical contribution is the creation of an emission model which describes fossil CO₂ from transportations. Furthermore, a modification of decision making theory is performed in order to adopt it within the problem of climate change. The result is used and integrated in a decision support system called the *Climate Business Scoring* (CBS) tool.

1.4 Purpose

It is the ambition of this report to allow Tetra Pak to focus on the problem at hand and give them the tools to succeed in solving it. Therefore the purpose is to enable a reduction of the climate impact that arises from Tetra Paks transportation of goods, while maintaining a business perspective. This is accomplished by:

- Finding measures for reducing the climate impact.
- Creating an evaluation tool to assess the potential of the measures from a buyer of transportations' point of view. It is referred to as the Climate Business Scoring tool (CBS).
- From suitable measures create a climate strategy for Tetra Laval Group Transport & Travel (TLGT&T).

1.5 Limitations

This report emphasizes on the transportation of packaging material from Tetra Pak to its customers. Furthermore, it will find existing measures and not focus on creating new ones. Those measures are limited to the reduction of CO₂ in the atmosphere, all other gases such as NO_x is neglected because they do not affect the climate as much as CO₂.

2 Methodology

2.1 Methodology approach

This report adopts a qualitative approach based on the characteristics of the problem. There is much information about global warming to the extent that it becomes difficult to assess its usefulness and therefore the research is based mainly on primary data through interviews, informal meetings with employees at TLGT&T and suppliers of transportation. Furthermore, Trivector Traffic AB has supported the development of this report along the way with insight and inspiration. Since climate impact debate is a highly current topic, where quantitative information is uncertain and not acknowledged, interviews appear to be the most suitable approach.

Furthermore, an inductive approach⁶ is selected since the theoretical framework is developed partly after the information gathering. Thus, the theoretical framework supported the development of the CBS tool and the climate strategy documents. To handle the complexity an *Emission model* (see figure 10, page 31) is created, which helps to visualize a complex problem in a simple way. On the basis of the creation of the *Emission model*, a systemic approach⁷ is the most preferable methodology approach since it takes into consideration many aspects affecting the investigation.

⁶ Arbnor, I., and Bjerke, B. *Företagsekonomisk metodlära*, Studentlitteratur, Lund, 2004, page.107

⁷ Björklund, M. and Paulsson, U. *Seminarieboken – att skriva, presentera och opponera*, Studentlitteratur, Lund, 2003, page.59

2.2 Working model

In order to accomplish the indented goals of this research a working model has been created which consists of eight steps (see figure 2). The model shows the work process and facilitates to divide the progress into a step by step approach.

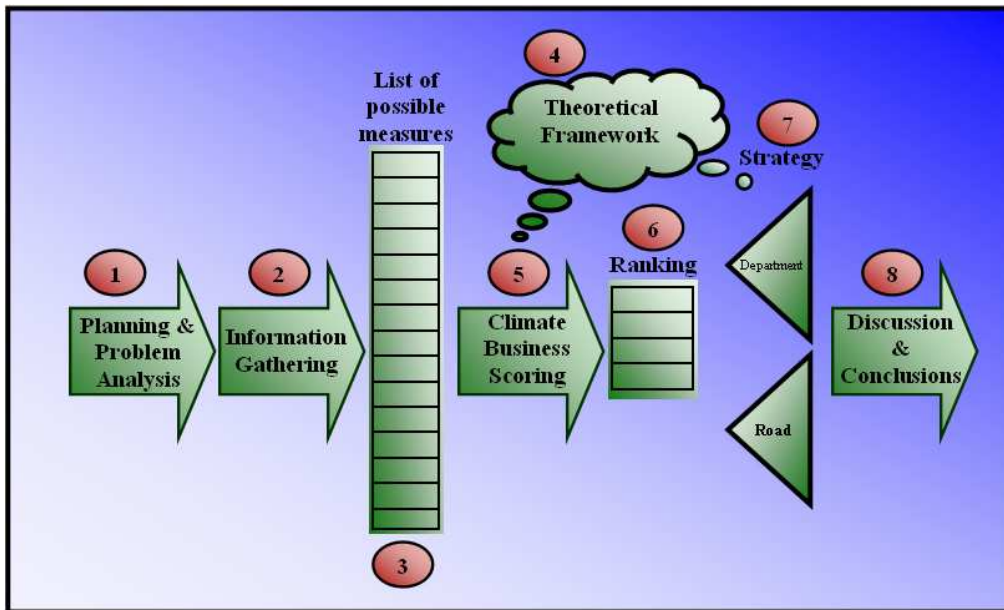


Figure 2. Working Model

Step 1. Planning & Problem Analysis

At the initial stage, focus is to understand the problem TLGT&T is facing with the climate impact and develop a suitable course of action for how it is possible to generate a strategy that can reduce the CO₂ emissions. A project plan is created with the intension to control the process in a way that ensures that the report is proceeding in the desired direction regarding deadlines, activities etc. Furthermore, a working model is created as a illustrative approach of how the work should proceed as a complement to the project plan.

Step 2. Information Gathering

The data is collected by performing interviews, reading articles and literature, participating in transportation summits and searching for information on the internet. The purpose with the information gathering is to build an understanding of the current situation and identify certain actions to be taken. At the initial stage secondary data is read and discussed to get a general understanding. The largest part consists of primary data from personal interviews (*see appendix 12.3*) and telephone interviews, transportation summits and informal discussions. This report is based on interviewing several employees at TLGT&T and representatives, such as environment managers, from the transport industry (SAS, Maersk, DHL, Schenker and Cargonet etc) since it provides a more comprehensive picture of the climate issue. Furthermore, valuable information was also obtained by discussions with supervisors as well as other people engaged in the climate issue. Predefined questions are used, which in some cases are sent to the interviewees in advance in order to make the interview as efficient and successful as possible. The predefined questions are designed to be able to fulfill the purpose but each interview also has specifically related questions. The questionnaire (*see appendix 12.3*) has been created from discussions with Björn Lindahl at TLGT&T and brainstorming.

Since the climate issue is an extensive and complex area to investigate, a process of breaking down the problem is required in order to obtain a clear focus and substance in the report. The course of action is to set up a model which defines the climate impact, *the Emissions Model*, to be able to address the problem. The model is based upon knowledge gathered from experts within transportation⁸ and by analyzing the climate impact, i.e. brainstorming. The validity of the model has been confirmed on numerous occasions with feedback from other experts and transportation summits.⁹

Step 3. List of Possible Measures

At this stage the information from the participation in conferences concerning transportations, brainstorming, interviewing experts and company representatives with environment responsibility is categorized, identifying and presenting all measures that can be used to reduce the climate impact. Thereafter, the measures are summarized.

An objective approach is essential, not trying to evaluate or rank the different measures during the process. Therefore, no evaluation of any kind is performed prior to step 6, where each measure is assessed with the CBS tool. It is the intention to find both the good and the not so good alternatives because this will increase the reader's awareness.

⁸ Transportforum 2007, Linköping. 07-01-10/11

⁹ Meeting CO₂ – network, 07-02-27

Step 4. Theoretical Framework

This report investigates a problem which many companies are facing today, where theories have not been entirely developed yet. Therefore, it is essential to provide a thorough empirical understanding of the problem before finding reinforcing theories. The empirical data decides what theory is required i.e. an inductive approach.

According to the problem analysis in the introduction chapter, the climate impact is identified as a strategic challenge. A theoretical framework is developed, which consist of theories about key factors for creating a successful strategy and making decisions. Product development concepts are used as a complement to Multi Criteria Decision Making. The chosen theories are a tool for generating an effective result and also ensuring the credibility of the results.

Step 5. Development of the Climate Business Scoring Tool

The first step is brainstorming when all ideas are accepted, thereafter discussing the gathered scenarios and finally evaluating them. This enables a creative way of thinking i.e. thinking outside the box. Secondary opinions are gathered from meetings with both Trivector Traffic AB, who supports the project of this report, and employees at TLGT&T. The decision making theory is the starting point for creating the CBS tool to ensure the quality.

Step 6. Evaluate the Alternatives - Ranking

During this step the list of measures is evaluated and ranked with the CBS tool. The alternatives are tested on the basis of three main criteria: climate impact, finance and practicability. The criteria are also appointed certain weights and divided into sub variables. Limited and reasonable estimations are provided and explained for each evaluated measure. This process is iterative and therefore consumes much time. The ranking procedure contains two steps, first a preliminary ranking is performed and then the TLGT&T give their opinions. The stakeholders' opinions are crucial since they contain valuable insight in the organization and extensive experience of transportation characteristics. Hence, they provide credibility to the ranking list.

Step 7. Develop a Climate Strategy

The aim with this step is to develop two strategies from the outcome of the CBS and facilitate the implementation of the actions to be taken. The first strategy is an overall strategy for the TLGT&T department and the second strategy focuses on TLGT&T Road. To ensure the quality of these strategies it is important to make use of strategy theory, the CBS result and, from empirical information about Tetra Pak, ensure that the strategies match Tetra Pak.

Step 8. Discussion & Conclusions

A discussion about the list of measures, the CBS tool and the strategies are presented. Finally, conclusions and suggestions from the report are presented.

2.3 Credibility and Criticism of sources

A critical approach is adopted in order to achieve high credibility throughout the report. Continuously meeting with Björn Lindahl at TLGT&T, Lars J Nilsson at Lund University, Nils Månsson at Lund University and Björn Wendle at Trivector Traffic AB ensures that the report is proceeding as intended. The project was partly initiated by Trivector Traffic AB who also are stakeholders in the result, they have therefore contributed with information and feedback along the way. Furthermore, feedback from presentations along the project has been received twice from a CO₂ network forum¹⁰ and a TLGT&T staff meeting. At these occasions a presentation of the proceeding work was held which was followed by an open discussion where participants could state their opinion. In order to achieve high validity several perspectives are continuously adopted and different sources are used for information gathering and the theoretical framework. Interview is a common method for data gathering in the system approach and it provides information with direct relevance for the purpose of the research¹¹. Interviews also provide an opportunity for a deeper understanding, since the questions can be customized during each interview. Furthermore, to get high validity, both authors were present at all interviews, which consequently decreased the risk of misunderstandings and increased the credibility of the collected data. Afterwards, a summarization of all interviews is done to make sure that the authors agree upon the information gathered. It is taken into consideration that secondary data is gathered for another purpose than the actual purpose of the research. Additionally, secondary data generates a more general pattern.^{12 13} However, in the initial stage, when the subject is relatively unknown, the usual step is to collect secondary data within the subject in order to obtain relevant information.

The sources are evaluated according to the three following criteria: age, tendency and dependency. When it comes to age, the source is evaluated and criticized regarding its present relevance and usefulness. Regarding tendency it is awareness of peoples' inclination to provide subjective information. Therefore, it is always reflected on what the personal interests of the source are regarding the current issue. Finally, the criticism of sources regarding dependency involved scrutinizing that the sources are independent of each other and that they do not stem from the same facts or research.

¹⁰ Partners of CO₂-network(SAS Group, Maersk SEALAND, Arla Food, Schenker, WWF, Tetra Laval)

¹¹ Arbnor, I., and Bjerke, B. *Företagsekonomisk metodlära*, Studentlitteratur, Lund, 2003, page.243

¹² Björklund, M. and Paulsson, U. *Seminarieboken – att skriva, presentera och opponera*, Studentlitteratur, Lund, 2003, page.67

¹³ Arbnor, I., and Bjerke, B. *Företagsekonomisk metodlära*, Studentlitteratur, Lund, 2003, page.241

3 Theoretical Framework

The theoretical framework consists of theories about key factors for creating a successful strategy and making decisions. Product development theory is used as a complement to Multi Criteria Decision Making (MCDM).

The decision making theory is the basis for creating a decision support system (DSS), called the Climate Business Scoring (CBS) tool, in chapter 6. Finally, strategy theory enables the creation of a climate strategy in chapter 7.

3.1 Strategy

What strategy is and how to develop a good one is not easy to answer. Whittington has defined four different approaches: classical, evolutionary, processualists and systemic (*see figure 3*). The oldest and still most influential strategical approach is the classical which relies on rational planning. Furthermore, the evolutionary approaches resemble evolution through natural selection where the law of the jungle determines the strategy. Processualists emphasize the imperfect nature of all human life, a pragmatically accommodating strategy of fallible processes of both organizations and markets. Finally, the systemic approach considers the cultures and the power of local social systems. These four approaches are distinguished along two dimensions: the outcome of strategy and the processes by which it is carried out¹⁴.

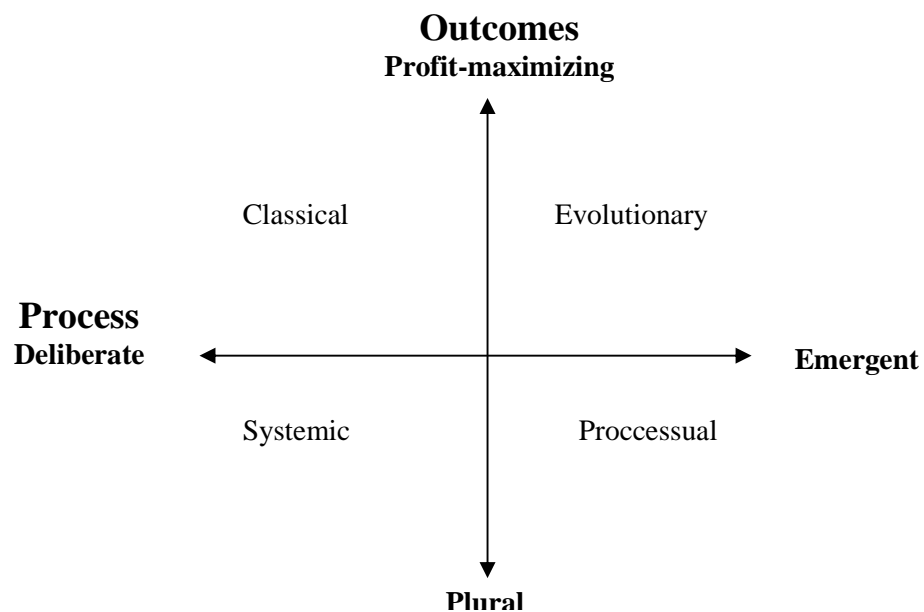


Figure 3. Strategy Approaches

(Source: Whittington, Richard. What is strategy - and does it matter?, Thomson Learning, London, 2001, page 3)

¹⁴ Whittington, Richard. What is strategy - and does it matter?, Thomson Learning, London, 2001, page 2

3.1.1 Successful Implementation of Strategy

Robert M. Grant illustrates a successful implementation of a company’s strategy (see figure 4). The three factors A, B and C determine the effectiveness of the strategy implementation within the organization. Hence, the better the three factors are incorporated the better the overall company strategy will be. A successful strategy is achieved when a company’s goals and visions are pronounced, consistent and on long-term basis. When the goals have been settled and accepted within the organization, a deep and insightful understanding of the company’s competitive environment will be reached. Finally, an evaluation of the internal resources shall be done. It is important that the organization has the right access to available prerequisites.

$$(A + B + C = D) = \text{Successful strategy}$$

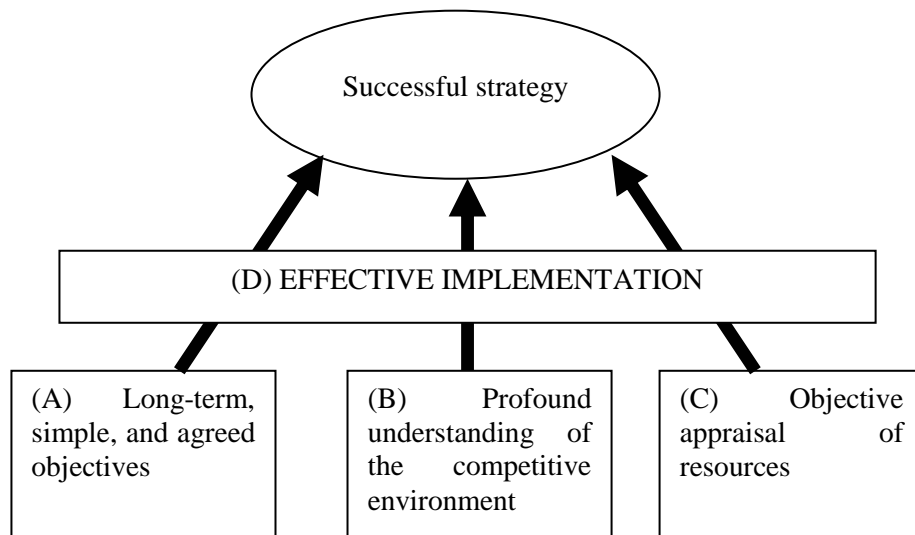


Figure 4. Common Elements in Successful Strategies

(Sources: Grant, Robert M. Contemporary Strategy Analysis: Concepts, Techniques, Applications. 5th edition, Blackwell Publishing, 2004, page 7)

According to Howard Guttman the most efficient approach to implement a strategy within an organization can be summarized by 5 different rules.¹⁵

Rule 1. Make strategy a collective effort

The employees working directly towards the market and the customers are the most suitable to evaluate the credibility of the company strategy. They can decide whether the strategy assumptions set by the management are realistic and reasonable since they have daily contact with the customers and a constant dialog concerning their needs. Therefore, these employees are able to eliminate the risk that a company strategy might be built upon wrong fundamentals. To conclude, a collective contribution from the entire organization is required instead of a top-down approach.

Rule 2. Make sure that the organization is aligned

To assure that the organization is supporting the company's chosen strategy, it is required that openness and direct communication exist within the organization.

Rule 3. Strategic success hinges on the rapid issue resolution

One of the most important keys to implement a successful strategy is the capability to manage a conflict. A possible scenario of an internal conflict is when employees compete with each other instead of the actual competitors. The consequence of an internal conflict can be loss of market shares and business opportunities. A fundamental condition for a company to survive is how well the employees collaborate and how rapidly and effectively they can make concrete decisions.

Rule 4. Build high-performance teams throughout the organization

Knowledge and experience are both competitive advantages that can not easily be imitated or bought. A high-performance management of people and processes is an unsurpassed competitive advantage that never becomes obsolete. The best way for an organization to achieve this competitive advantage is by creating and fostering high performance teams from the top-down.

Rule 5. Rethink leadership requirements

The list of required qualities a business leader should obtain is often extensive, for example they should be visionary, strategic thinkers and at the same time movers & shakers. However, one ability is often forgotten when it comes to leadership characteristics, namely the ability to manage conflicts. Unmanaged conflict is one of the greatest obstacles to a successful formulation and implementation of a company strategy. It is important to remember that even an excellent profound strategy with a clear vision does not mean that everyone within the organization will embrace it and make it their own.

¹⁵ Guttman Howard M; Hawkes Richard S, New rules of strategic engagement, The Journal of Business Strategy, 2004, Volume 25, page 34-38

3.1.2 Integration of Environment into the Corporate Strategy

Today most companies, and especially the decision makers, assume a passive position concerning the daily environmental work. A general opinion is that environmental work demands a lot of time and finance. A possible solution is to integrate the environmental concerns into the daily activities and finally implement it into the overall strategy.¹⁶ Thus, it is important to take into consideration the strategic fit before implementation. Strategic fit indicates how well the company's mission and strategies fit its internal capabilities and its external environment.¹⁷

Companies face a number of strategic question marks when it comes to how to solve environmental issues and how it should be implemented and integrated into the company strategy. Companies can be reactive in their strategies by simply complying with existing regulations or they can follow a more proactive strategy by developing competitive advantage through environmental initiatives.¹⁸ According to Piasecki these proactive companies are classified as being "corporate environmentalists". In these companies the relation between profit and environment is no longer in contrast to each other but instead seen as opportunities with mutual dependence.¹⁹

When implementing an environmental strategy into any organization it needs to be incorporated within all levels and departments. Within the highest level, where the strategy is determined, the enterprise's executives attempt to describe the basic mission of the company and what role it will play in society. Commonly an integrated environmental strategy and commitment are lacking from the top management because other criteria are more in focus, such as providing value to stockholders and customers.²⁰

At the corporate level the strategy establishes what kind of businesses the company should be involved with, which also should match the strategy of the enterprise. Common decisions at this level are decisions related to products, markets, technology development and business portfolio. The corporate strategy involves allocating internal and external resources to achieve competitive advantages and also integrating the different business functions. Furthermore, environmental strategy involves developing green products and green markets, cleaner technologies and developing green business portfolios.²¹

¹⁶ Reinhardt, F. L. "Bringing the environment down to the earth" Harvard Business Review , Vol 77, Issue 4, 1999, page 152

¹⁷ Grant, Robert M. Contemporary Strategy Analysis: Concepts, Techniques, Applications. 5th edition, Blackwell Publishing, 2004, page 7

¹⁸ Banerjee, S.B. "Corporate environmental strategies and actions" *Management Decision* , Vol 39, No 1, 2001, page 36-38

¹⁹ Piasecki, Corporate Environmental Strategy ,1995, page 124 ff

²⁰ Banerjee, S.B. "Corporate environmental strategies and actions" *Management Decision* , Vol 39, No 1, 2001, page 40-44

²¹ Ibid

Finally, the functional strategy involves planning operating procedures in the different functions, such as marketing or R&D. Common decisions and challenges for this level can be locations for new manufacturing plants or technology development of products, and process design. Suggestions from this level can be green advertisings or emission control.²²

(see figure 5)

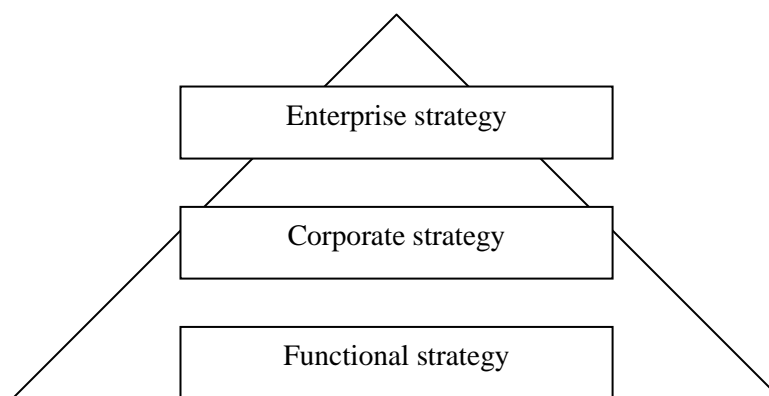


Figure 5. Types of Strategies

3.1.3 Positioning strategy

Today several companies are working with environmental issues to improve their company image. Establishing the image as an environmental friendly company needs a lot of effort and is time consuming.²³

An environmental adjustment can be a choice for a company to diversify the supply of services or products, but it often leads to higher costs regarding investments in equipment, environmental systems etc. However, in turn companies can demand a higher price to cover their initial environmental investment and long-term commitment. This is because of the fact that the customers will agree to pay a higher price for a products or services from environmental friendly companies. A higher price is strongly related to the credibility of the product or the service. Therefore, in order to set a higher price than the competitors the benefits and consequences of the environmental actions must be clearly communicated.²⁴

²² Banerjee, S.B. "Corporate environmental strategies and actions" *Management Decision* , Vol 39, No 1, 2001, page 39

²³ Ammenberg, J. *Miljömanagement*. Studentlitteratur ,Lund, 2004, page 25

²⁴ Reinhardt, F. L. "Bringing the environment down to the earth" *Harvard Business Review* , Volume 77, Issue 4, 1999, page 150

3.2 Decision making

What is a decision? Decisions are *a conscious, irrevocable allocation of resources with the purpose of achieving a desired objective*²⁵. Another definition is *a moment, in an ongoing process of evaluating alternatives for meeting an objective, at which expectations about a course of action impel the decision-maker to select that course of action most likely to result in attaining the objective*²⁶.

Commonly there are two interpretations of decision-making. First, it can be seen as the study of identifying and selecting alternatives based upon the values and preferences of the decision maker. Second, decision-making is the process of sufficiently reducing uncertainty and doubt concerning alternatives, in order to allow a reasonable choice to be made from amongst them.²⁷

3.2.1 Decision Making in Reality

Many different classifications of decision making are available. Two different but similar classifications both have three categories. They both state strategic and operational as key areas, but then have either administrative²⁸ or technical²⁹ as the third category. Strategic decision making is defined as determining the overall direction of an enterprise, its ultimate viability in light of the predictable, the unpredictable and the unknowable changes that may occur in its surrounding key environments.³⁰

²⁵ Skinner, D.C. *Decision Analysis: A Practitioner's Guide to Improving Decision Quality*, 2nd ed. Probabilistic Publishing, Gainesville USA, 1999

²⁶ Harrison, E.F. *The Managerial Decision-making Process*, 4th ed. Houghton Mifflin, Boston USA, 1995

²⁷ Basson, L. Petrie J.G. *An Integrated approach for the consideration of uncertainty in decision making supported by Life Cycle Assessment*, Environmental Modelling & Software 22, 2007, page 168

²⁸ Ansoff, H.I. *Business Strategy*, Penguin, Harmondsworth, England, 1969

²⁹ Walley, N. Whitehead, B. *It is Not Easy Being Green*, In The Earthscan Reader in Business and the Environment, Earthscan Publications, London, 1996, page 43

³⁰ Quinn, J.B. *Strategies for Change*, In The Strategy Process, Prentice Hall, London, 1999, page 5

Decision making is often a nonlinear and recursive process. One part of decision making is gathering information and thereby reducing uncertainty and risk. In an ideal world the decision maker would know every possible alternative and have all the necessary and accurate information. Limitations of resources, such as time, puts constraints on gathering sufficient information but prolonging a decision can also have serious drawbacks. Such drawbacks – e.g. delays in decision-making, selective use of the information to support preconceived alternatives or information overload -can reduce the ability to make decisions due to difficulties assessing the information in its entirety.³¹ Another report even goes as far as stating that the decision accuracy is inversely related to decision speed.³² Even if the decision making procedure is recursive it consist of the following steps which can be addressed back and forth:³³

- 1) **State the problem**
- 2) **List the options**
- 3) **Evaluate each option carefully**
- 4) **List what information that is needed**
- 5) **Make a decision**
- 6) **Develop an action plan**
- 7) **Evaluate the decision**

For the purpose of this report the emphasize is on number 2, 3 and 6. This report has limited influence on TLGT&T and within these variables the highest impact can be gained. Variable number 4, which concerns information gathering, is included before evaluating each alternative. Another reflection on the list of steps is that number 7, evaluate the decision, should be done along with evaluating the outcome of the decision. Every decision must be implemented and the implementation process also have several challenges that is affected by the initial decision. Therefore, adding a step that solely evaluates the outcome, and another step that evaluates the outcome in reference to the initial decision, is favorable.

3.2.2 Environmental Decision Making

“Values and ethics should be included in the decision-making process for three reasons: they are already a major component, although unacknowledged, of how we want to make decisions, ignoring them causes almost insurmountable difficulties in risk communication and because it is the right thing to do”.³⁴

³¹ Lurie, Nicholas, Decision Making in Information-Rich Environments: The Role of Information Structure, *Journal of Consumer Research*, Vol. 30, No 4, 2004, page 484

³² Dane, Erik & Pratt, Michael. *Exploring Intuition and its Role in Managerial Decision Making*, *Academy of Management Review*, 2007, Vol. 32, No. 1, page 33

³³ *7 steps to effective decision making*, *Career World*, Vol. 27, No. 7, 1999, page 13-16

³⁴ Cothorn, C.R. *Handbook for Environmental Risk Decision Making: Values, Perceptions & Ethics*, Lewis Publishers, New York, 1996

Environmental decisions are defined as a decision concerning an environmental issue, or involving an action which could or will foreseeably have an environmental effect.³⁵ There are several tools available for aid in decision making. Many of them aim at reducing the complexity of decision making within environmental concerns. They have a tendency to fail at comprehensively generating the ultimate decision. An aid in the decision making process should instead expand the decision makers' awareness and considerations before making a decision. The tool will reduce the risk of neglecting important concerns and integrate a more complete array of information into the decision process.³⁶

Environmental decision support tools can be divided into qualitative and quantitative. Qualitative tools give insight into the significance of the environment associated with all measures. However, they are qualitative and rely much on the users comprehension of both the problem and the solution. Quantitative tools connect values in both monetary and non-monetary terms.³⁷ This will help to ensure that the approach is as objective as possible and easier to comprehend.

3.2.3 Multi-Criteria Decision Making (MCDM)

Decision making, with a large number of alternatives where a unique choice or a small selection is preferred, is difficult because of the trouble processing all available information and overcoming our own random inconsistency.³⁸ To ensure a good decision making process a systematic approach is favorable. The following steps are needed:³⁹

1. **Evaluate all the favorable and unfavorable evidence related to each possible alternative.**
2. **Determine the relative importance of the different evaluation criteria.**
3. **Rank the alternatives based on an appropriate aggregated score.**

This approach is similar to that of concept scoring within product development theory. Concept scoring and MCDM is used together to ensure an optimum result and an efficient process. Concept scoring is described in 3.2.4.

³⁵ Gray, P.C. Wiedermann, H. S. Hallman, W.K. Feldman, D. Turner, R.S. *The Nature and Challenges of Environmental Decision-making: Case Studies for Policy Improvement*, National Center for Environmental Decision-making Research, Knoxville, USA, 1996, page 3

³⁶ English, M.R. Dale, V.H. van Riper-Geibig, C. Ramsey, W. *Overview of Tools to Aid Environmental Decision Making*, In *Tools to Aid Environmental Decision Making*, Springer, New York, 1999

³⁷ Tulenheimo, V. Thun, R. Backman, M. *Tools and Methods for Environmental Decision-making in Energy Production Companies*, The International Institute for Industrial Environmental Economics at Lund University, Lund, 1997

³⁸ Russo, J.E. *Decision Traps. Ten Barriers to Brilliant Decision Making and How to Overcome Them*, Simon & Schuster, New York, 1990

³⁹ Tsiporkova, Elena. Boeva, Veselka. *Multi-step ranking of alternatives in a multi-criteria and multi-expert decision making environment*, Elsevier, 2005, page 2

Using MCDM to evaluate different courses of actions can be a powerful tool but also time consuming and complicated. The solution is developing decision-support system (DSS), which is any computer system that helps leveraging the different criteria. Providers of DSS software promote the following advantages:⁴⁰

- 1. Increased number of alternatives examined**
- 2. Better understanding of the business**
- 3. Fast response to unexpected situations**
- 4. Improved communication**
- 5. Cost savings**
- 6. Better decisions**
- 7. More effective teamwork**
- 8. Time savings**
- 9. Better use of data resources**

These advantages are not established theoretically but add insight to the market aspects of DSS software which the CBS tool is a part of.

⁴⁰ <http://www.rfp-templates.com/Multi-Criteria-Decision-Making-MCDM.html> 07-04-10

3.2.4 Concept Scoring

Within the field of product development there are similarities that make it useful to re-use some of the results.

The process of developing new products consists of several phases; it begins with planning, followed by concept development. Within concept development several steps are to be taken, such as generating numerous concepts. The generated concepts should thereafter be reduced to the most probable concepts for success. For this purpose the concepts are screened and scored. Focus will be on the scoring process which follows a six-step process:⁴¹

1. **Prepare the selection matrix**
2. **Rate the concepts**
3. **Rank the concepts**
4. **Combine and improve the concepts**
5. **Select one or more concepts**
6. **Reflect on the results and the process**

Preparing the matrix includes finding variables and adding weights according to importance. When rating the concepts, a scale from 1 to 5 is recommended. The scale could be more extensive but that will require more time and effort. It is also possible to determine a concept for reference but it is not necessary. The aggregated ranking is thereafter determined by:⁴²

$$S_j = \sum_{i=1}^n r_{ij} w_i$$

Where

r_{ij} = raw rating of concept j for the i :th criterion

w_i = weighting for i :th criterion

n = number of criteria

S_j = total score for concept j

⁴¹ Ulrich, Karl. Eppinger, Steven. Product Design & Development, 3rd ed. McGraw Hill, 2004, pages 9, 125, 134-136

⁴² Ibid

4 Information Gathering

Information Gathering → *List the Options* → *Evaluate* → *Develop an Action Plan*

4.1 Tetra Laval Group and the Environment

4.1.1 Tetra Laval Group

As illustrated in the organisational chart below Tetra Laval Group consists of three independent business groups: Tetra Pak, DeLaval and Sidel. Tetra Laval Group Board, situated in Lausanne, Switzerland, has the main responsibility for the three business groups' long-run performance and strategic development (*see figure 6*). The main task for Tetra Laval International is to assist the Tetra Laval Group Board with financing, risk management, monitoring and overall investment support⁴³.

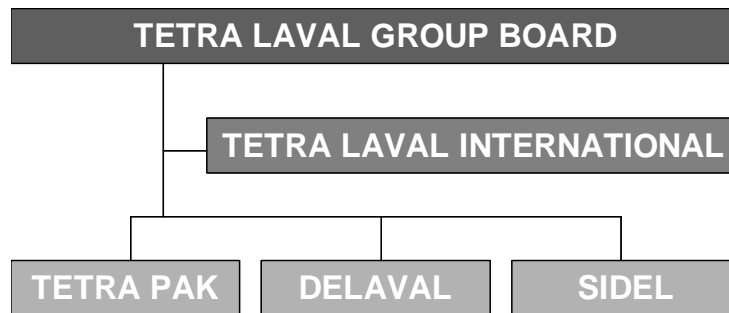


Figure 6. Tetra Laval Group's Organization Structure
(Source : www.tetralaval.com 07-02-10)

Tetra Laval Group is a highly international organization with operations in approximately 165 countries and 30,170 employees situated all over the world. Tetra Laval is not listed and the foremost company when it comes to providing overall solutions in food processing and packaging. It reported a net sales of 9712(M€) in 2006. Tetra Laval Group is characterized as a highly decentralized organization which presuppose clear corporate visions and business guidelines.⁴⁴

4.1.2 Tetra Pak

In 1951 Ruben Rausing and Erik Wallenberg founded Tetra Pak in Lund. The same year their new revolutionising packaging system was acknowledged and opened up new business opportunities. Since the foundation of the organization it has gone through various phases and has launched numerous new products and expanded both nationally as well as internationally.⁴⁵

⁴³ www.tetralaval.com. 07-02-10

⁴⁴ Annual report Tetra Laval Group, 2005

⁴⁵ www.tetrapak.com 07-02-10

Reduced Climate Impact from Tetra Paks Transportations

Today, Tetra Pak is one of the world's leading companies within food processing and packaging systems. Tetra Pak is involved in the entire chain from developing to manufacturing and finally *marketing* their food processing and packaging systems. The company has expanded to include more than the packaging of liquid food and now packages products such as fruits, vegetables, cheese and ice-cream.⁴⁶

The overall company vision is “to make food safe and available everywhere”. Tetra Pak contributes to the largest share of the three business groups both when it comes to number of employees, net sale and its share of transport volumes. Tetra Pak is global with operations in 165 countries and sale offices present in 60 countries. Headquarter is located in Lausanne, Switzerland.⁴⁷

Tetra Pak is organized as a matrix organization which consists of three different subgroups; Tetra Pak Carton Ambient, Tetra Pak Carton Chilled and Tetra Pak Processing Systems. Tetra Pak Group also has seven departments supporting the three subgroups (*see figure 7*).

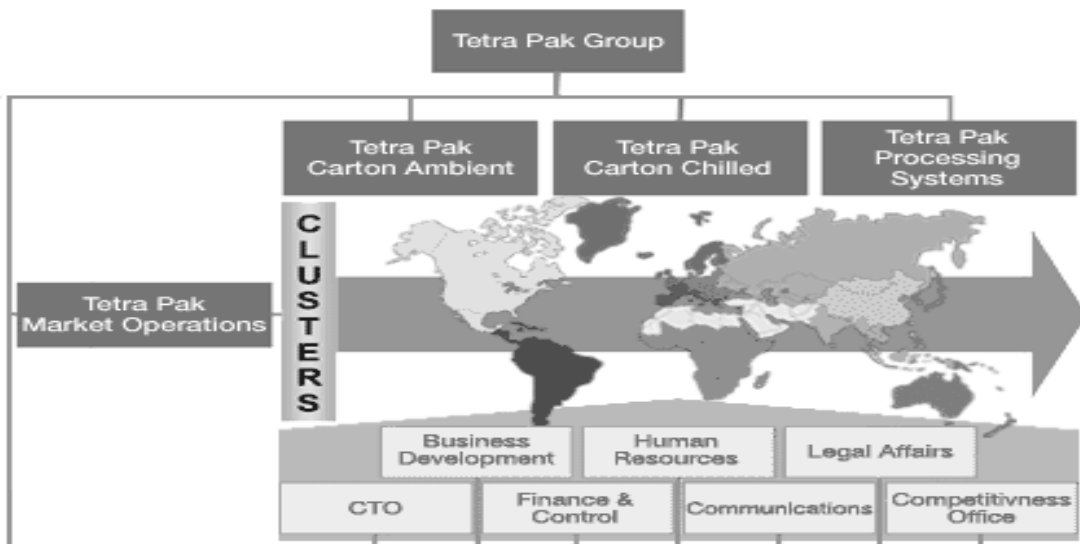


Figure 7. Tetra Pak Group Organisational Chart
(Source: PowerPoint Presentation Tetra Laval 07-02-06)

⁴⁶ www.tetrapak.com 07-02-10

⁴⁷ Annual report Tetra Laval Group, 2005

4.1.3 Tetra Laval Group Transport and Travel

Tetra Laval Group Transport and Travel's (TLGT&T) main task is to manage the strategic part of Tetra Pak's, DeLaval's and Sidel's transports and shipments, including negotiating, contracting and planning the transport routes. TLGT&T is a non-profit business unit of the organization where the main interest is to satisfy the stakeholders. It finances its operations by taking out fees from the three subgroups and the fee is based upon the degree of involvement TLGT&T has in the logistic issues in the respective subgroup.⁴⁸

In the beginning TLGT&T were most concerned with transportations by sea, road and rail but over the years focus has also included employee travels and employees moving. Today, TLGT&T is also more focused on air transport and different express delivery solutions.⁴⁹

TLGT&T mission is to provide transport and travel solutions to the Tetra Laval Group. The transport department of TLGT&T is divided into Road/Rail, Sea, Air and Express. 15 people are working in the department with different responsibilities such as travel management, transport solutions, global contracting, performance evaluation, management reports, removals, supervision and quality standards.⁵⁰

4.1.4 Environmental policy

Tetra Pak is committed to running its business in an environmentally sound and sustainable manner.⁵¹ TLGT&T shall supply transport solutions which satisfy the customer's need and at the same time minimize the impact on the local, regional and global environment. In all the transport and travel agreements the environment aspects shall be measured and taken into consideration, where it is possible and reasonable from financial and technical points of view as well as ecologically defensible.⁵²

⁴⁸ Meeting with Lindahl, Björn. 07-02-05

⁴⁹ Ibid

⁵⁰ PowerPoint Presentation, Tetra Laval 07-02-06

⁵¹ PowerPoint Presentation, Tetra Pak Code of Business Conduct 07-02-06

⁵² PowerPoint Presentation, Environment Achievements. 07-02-06

4.1.5 Current Environmental status at TLGT&T

TLGT&T has a long history of high environmental concern and have performed supplier assessments for several years as a part of their sourcing and contracting process. Currently they are preparing for their negotiating process for road with their forwarding agents, which will be held in the fall of 2007. Environment is a part of this assessment and each supplier is graded red, yellow or green. Red suppliers need to make improvements to be able to supply transport services to Tetra Pak in the future, yellow suppliers are classified as acceptable and green are preferred suppliers (*see figure 8*). The same questions have been used regardless of transportation mode but that is soon about to change. The types of conditions that have to be met to be able to achieve a good score is if a company has adopted an environment policy or, for example, if they are certified according to ISO 14001. Green suppliers are unfortunately not always preferred over a yellow or red because of other criteria such as price.

The process of evaluating suppliers was innovative to the extent that the Carl Mannerfelt Environmental Award 2004 was bestowed upon Ralph Höglund, who at the time was department manager of TLGT&T. The challenge today is how to continue to be a leader within the environment field when many forwarding agents have implemented many of the stipulated demands (*see figure 9*). Which new demands should be presented, how shall the demands be designed, how should they be communicated to the forwarding agents or how shall TLGT&T otherwise address climate change concerning emissions from transportations? In an attempt to answer a few of those questions, TLGT&T has been an active participant in a CO₂ network that aims at reducing the emissions of CO₂.⁵³ Further ambitions have been displayed through Tetra Pak's participation in WWF program for climate saviors.⁵⁴

⁵³ Meeting CO₂ – network, Lund, 07-02-27

⁵⁴ <http://www.worldwildlife.org/climate/projects/climatesavers/companies.cfm> 07-04-13

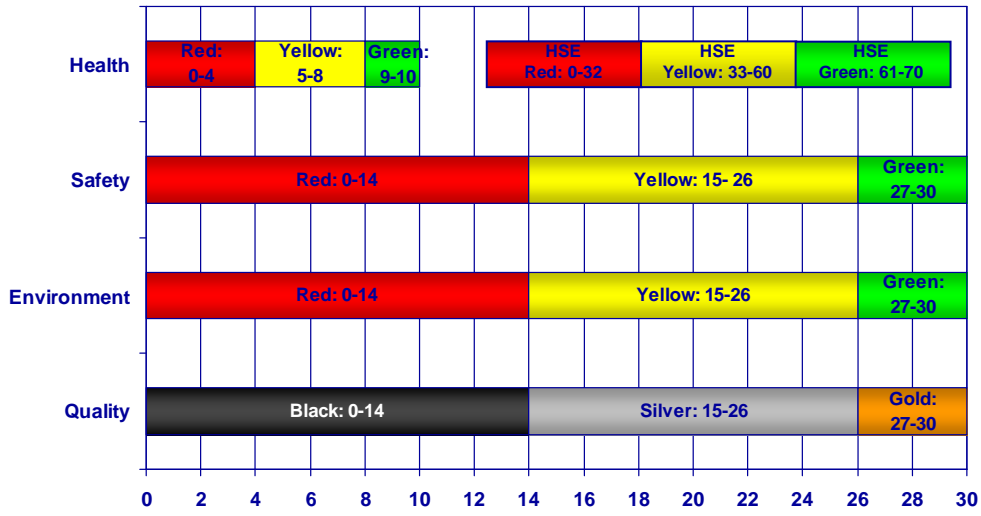


Figure 8. Supplier Classification

(Source: PowerPoint Presentation, Quality Supplier Assessments, 07-02-07)

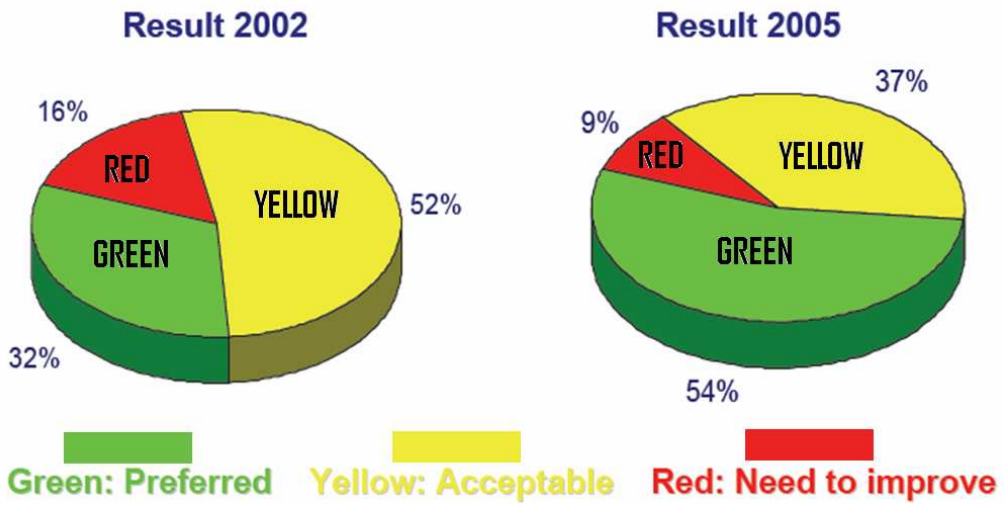


Figure 9. Result Supplier Base Development

(Source: PowerPoint Presentation, Environment Supplier Assessment, 07-02-07)

4.2 Transportations

Due to the complexity of emissions causing climate change, the need for a structured and systematic approach is evident. The lack of a complete emission model, describing the entirety of the problem, made it necessary to create one. The emission model enables an understanding of the problem and a premonition of the implications. The model describes where and how emissions occur, what factors influence emissions and how economy relates to emissions (*see figure 10*). Creating and utilizing the model is valuable when identifying possible measures to reduce the climate impact. For a description of how the *Emission model* has been developed, by the authors, in this report, see step 2 in the methodology chapter 2.2.

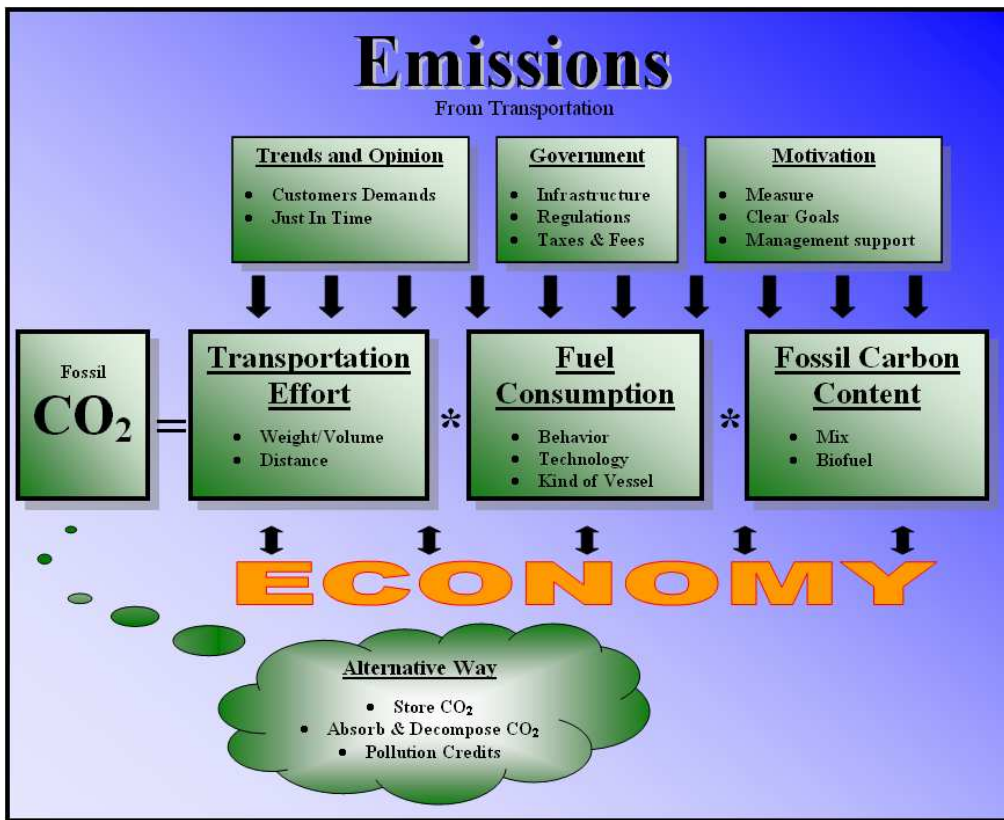


Figure 10. Emissions

Emissions from the manufacturing process are directly related to Tetra Pak and the emissions from transportations are indirectly related to Tetra Pak. Tetra Pak has taken upon themselves to take responsibility for the emissions caused by transportations. If calculating all emissions from Tetra Pak and including transportation of goods, almost half of all emissions can be derived from transportations.⁵⁵

⁵⁵ Meeting TLGT&T, Lund, 07-01-16

Reduced Climate Impact from Tetra Paks Transportations

Air is the worst transportation mode per tonkm (see figure 11). Road has much larger quantities (see figure 12), which makes it the largest contributor to the amount of CO₂ from transportations of goods (see figure 13). Even though rail and sea is used for most transportation of goods they do not emit a lot of CO₂.

The transportation sector is characterized by path dependency and lock-in effects.⁵⁶ This means that it is hard to change the characteristics of the industry and explains the dependency on fossil fuel and also why transportation services are very cheap. The low prices are also why efforts for increased efficiency often are focused elsewhere.⁵⁷
⁵⁸

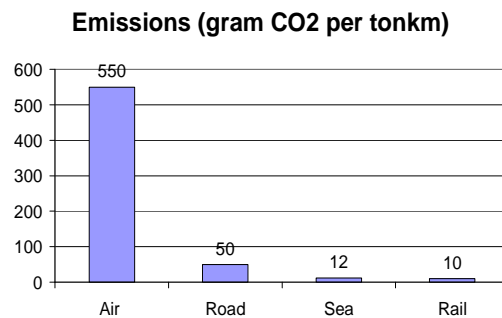


Figure 11. Emissions

(Source: PowerPoint Presentation, TLGT&T, 07-01-16)

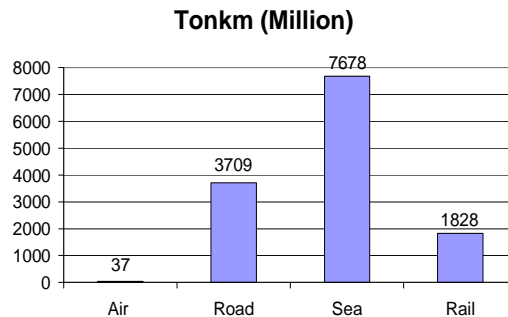


Figure 12. Transportation

(Source: PowerPoint Presentation, TLGT&T, 07-01-16)

⁵⁶ TransportMistra, Stockholm, 07-04-18

⁵⁷ Interview Nilsson, Evert. *Senior Lecture*, LTH, 07-02-05

⁵⁸ Interview Enell, Magnus. *CEO*, Sustainable Business Hub, 07-02-07

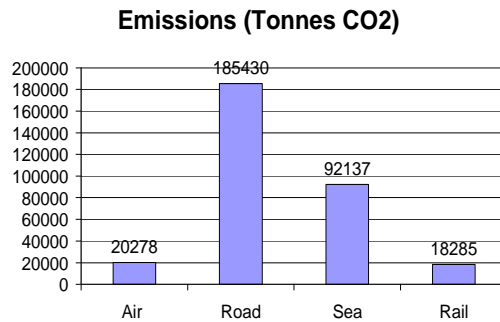


Figure 13. Aggregated Emissions
(Source: PowerPoint Presentation, TLGT&T, 07-01-16)

4.2.1 Rail

Rail is characterised by being very climate friendly because of low energy consumption. The train has a very small area which is in contact with the rail, which leads to low friction and therefore low fuel consumption. The distances travelled are often long with few accelerations and retardations. Many routes are equipped with electrical cables so that the train can run on electricity instead of diesel. This is not necessarily a more climate friendly approach as it depends on the production of electricity. If the electricity can be derived from renewable energy sources it makes the train a very clean way of travelling and transporting goods.⁵⁹

Rail is a good alternative for transporting goods which is why many transportation buyers have a desire to utilize the rail more than they do today. There are several reasons why these buyers do not already utilize rail heavily. First of all there is a need of rail from origin to destination which is rarely met. This can be avoided if another means of transportation can be used short distances but that puts focus on places for reloading. Though electricity can be a very good way of operating a train it is not used everywhere which calls for the need of diesel. Normally, retardations rarely occur but it happens, which means huge amounts of energy are wasted and can not be used again. The average speed in which goods move from its origin to its destination when using trains is often very low. The reasons for this are few flexible and effective reloading points, limited expansions of the railway and limitations caused by the preference of using the tracks to transport persons rather than goods.^{60 61}

The railway industry in Europe is categorized by few big actors in each country, generally the government have a certain ownership in this company.

⁵⁹ Interview Rapf, Oliver. *Senior Policy Officer Climate Change & Business*, WWF, 07-02-27

⁶⁰ Interview Nilsson, Evert. *Senior Lecture*, LTH, 07-02-05

⁶¹ Interview Enell, Magnus. *CEO*, Sustainable Business Hub, 07-02-07

4.2.1.1 Tetra Paks Utilization of Rail

Tetra Pak utilizes rail as a transportation mode to various degrees according to a region's or a factory's different characteristics. For example, in Scandinavia rail is a suitable transportation mode for transporting raw material such as paper to Tetra Pak's factory in Lund. Tetra Pak has rail all the way to its factory in Lund which facilitates the use of rail and makes it very efficient. Green Cargo AB and CargoNet AB are the biggest actors who offer train solutions for the goods companies in the Scandinavian. From the beginning Green Cargo AB was a train company but today they are trying to offer package solutions for the customer. They are focusing on taking care of the whole distributions from the import, customs declaration and storage of the goods, to transportations to the merchandise stores. Green Cargo AB owns CargoNet AB with 45% of the stocks and sees CargoNet as a complementary company which can focus on smaller and more specialized customer's errands. CargoNet's vision is to be like a subway system i.e. higher frequencies of departures every day.

The suppliers of paper are the buyers of transportations which then deliver it to Tetra Pak in Lund. Because of high volumes these shipments are handled by Green Cargo. Tetra Pak's customers prefer lower volumes, deliveries that are just-in-time and also has limited railway connections which makes it harder to utilize rail.

4.2.2 Sea

Ships can carry huge loads and travel great distances, which makes it ideal for the transportation of goods. Ships are only dependent on the existence of water which is met by the fact that water is covering 70 % of the earth's surface.

When transporting goods by sea it is necessary to plan ahead because it takes a relatively long time for the goods to arrive. Another drawback is that transportation door to door is limited to the proximity of oceans, seas, rivers or ports. Transportations by sea also have another problem which is the fuel used in the engines. This does not really change the amount of CO₂ but it has a very negative affect on other GHGs and the environment. The worst kind of fuel is heavy fuel oil, which sometimes is called residual fuel oil because it is what is left of the crude oil after gasoline and other distillate have been extracted.⁶²

Ships have different origins and are controlled by different nations' legislation but they travel all over the world. This produces a problem when efforts are made to enhance the performance of ships and also set minimum requirements. The industry is slowly evolving but is said to be very conservative.⁶³

⁶² www.bunkerworld.com, 2007-02-13

⁶³ Interview Ahlbom, Jan. Duus, Ulf. *Project leaders*, Clean Shipping, 07-02-05

Ships must be a fully functioning society in its own because of long durations at sea but coming in to port does not change that. The crew must still work on the ship and therefore use energy. This means that even though a ship has made port it still runs its auxiliary engines to generate electricity.⁶⁴

4.2.2.1 Tetra Paks Utilization of Sea

Tetra Pak has many factories in the world that are specialized to some extent. These factories need to be supplied with raw material and then transport the finished product around the world. Tetra Pak therefore uses sea as a transportation mode to a great extent. Paper is a very heavy product which makes sea and also rail suitable alternatives and likewise with the machinery that Tetra Pak produces and delivers to its customers which often are large in volume. Tetra Pak largest supplier of transportation services by sea is Maersk but Tetra Pak have agreements with 36 more.⁶⁵

TLGT&T has identified a need to be able to compare different shipping companies with a comprehensive number that reflects on the ships emissions.⁶⁶

4.2.3 Road

Transporting goods by road is quick and easy. The infrastructure of roads is extensive and there are seldom problems moving goods from door to door with a large amount of forwarding agents and road carriers.

Trucks are often driven with less than a full load and the goods that are being moved are not always moved with minimizing distance and fuel consumption in mind. Implementing new renewable fuels in trucks have proven difficult with problems such as finding room for more equipment and building a functioning infrastructure with filling stations.

⁶⁴ Interview Johansson, Ingemar. *Environment Manager*, Maersk Line, 07-02-27

⁶⁵ Meeting Jansson, Hans. Team Sea, TLGT&T, Tetra Laval, Lund, 07-01-30

⁶⁶ PowerPoint Presentation, Team Sea TLGT&T. 07-02-06

4.2.3.1 Tetra Paks Utilization of Road

Road is the dominant transportation mode which is common in the industry. Many different forwarding agents are used but Schenker is hired more than others by Tetra Pak. Tetra Pak evaluate all forwarding agents according to their environmental efforts.^{67 68} It is common in Scandinavia to have specific demands on how forwarding agents should operate their business.^{69 70 71 72} Though it would be better if it were possible to stipulate demands and have a dialog that enabled the agent to find the best way of fulfilling climate improvements. However, the market has not reached enough maturity within the climate field yet to do so.^{73 74 75 76}

4.2.4 Air

Time is of the essence when transporting goods with aircrafts. Reasons for that could be if the nature of the goods makes it necessary to deliver it as soon as possible or if some unforeseen event has made it necessary. Either way, the price will be high when sending airfreight.

Aircrafts are usually powered by jet engines and therefore uses jet fuel which is a form of kerosene. Kerosene is one of many fuels that can be extracted from crude oil and is therefore not a renewable fuel. It is possible to manufacture kerosene with the use of biomass but it is not yet authorized for use in aircrafts because it first has to be proven to be at least as reliable as standard jet fuel.

Unforeseen events will always occur but companies' readiness for those events can reduce the need for airfreight. Even though airfreight can be seen as an extremely fast way of transporting it might take longer than most realize. The transportation itself takes very little time but sending the goods to a terminal, preparing it for airfreight, loading, unloading and transporting it to its final customer can take several days.⁷⁷

⁶⁷ Meeting Borglin, Johan. TLGT&T, Tetra Laval, Lund, 07-03-14

⁶⁸ Telephone interview Melin, Agneta. *Environmental Manager*, Nordic Tetra Pak AB, 07-02-20

⁶⁹ Interview Hammarberg, Ulf. *Head of Corporate Citizenship*, DHL Express Sverige, 07-02-08

⁷⁰ Interview Jadsen Holm, Monica, *Environment Manager*, Schenker, 07-02-13

⁷¹ Interview Johansson, Christel. *Environment Manager*, DSV, 07-02-26

⁷² Interview Carlsson, Christian, *Supply Chain Management*, Findus AB, 07-02-26

⁷³ Meeting Ljungberg, Christer. *CEO*, Trivector Traffic AB, 07-03-02

⁷⁴ Interview Wickenberg, Björn. *Trafikmiljöenheten*, Gatukontoret, Malmö Stad, 07-02-01

⁷⁵ Interview Enell, Magnus. *CEO*, Sustainable Business Hub, 07-02-07

⁷⁶ Interview Bengtsson, Magnus. *Project manager*, Vägverket, 07-02-28

⁷⁷ Interview Hultberg, Richard. *Key Account Manager*, SAS Cargo Group, 07-02-12

4.2.4.1 Tetra Paks Utilization of Air

Tetra Pak seldom uses air as a transportation mode for shipments of packaging material such as paper but uses it more frequently when shipping spare parts or maintenance material. Tetra Pak has identified that around 30 % of all air shipments of machine parts are due to machine failure, which is hard to foresee, but as much as 70 % are due to planned maintenance that are scheduled months in advance.

5 Develop Alternatives

Information Gathering → **List the Options** → *Evaluate* → *Develop an Action Plan*

Decision making begins with accumulating enough information to enable a development of alternatives. These alternatives, or concepts as they are referred to within Concept Scoring, are thereafter evaluated in chapter 6. This chapter uses gathered information from participation in conferences concerning transportations, brainstorming, interviewing experts and company representatives with environment responsibility to generate the needed alternatives. It is the intention to find both the good and the not so good alternatives because this will increase the reader's awareness. The list of alternatives represents the current situation, which will evolve over time and make it necessary to redo or modify the result accordingly.

Much of the information concerning each measure is described in the appendix (*see appendix 12.4*) along with the scores generated in chapter 6. In this chapter a summary of that information is presented to enable an overall view of the alternatives, explain how the information is structured and clarify what can be gathered from the information.

5.1 Measures

43 alternatives have been developed (*see Table 1*). Category is divided into *indirect, all, road, air, rail* and *sea*. *Indirect* measures are those that do not reduce CO₂ on their own but can have beneficial affect in the process. *All* are those alternatives that have an affect on all transportation modes. *Road, air, rail* and *sea* are in reference to what transportation mode that is being used. Actions are described as; *do, demand* or *lobby*. This is in reference to what action is suitable for Tetra Pak if management deem it has potential. *Do* means that Tetra Pak can carry out the measure themselves, *demand* means that they can implement the measure in collaboration with external parties, such as forwarding agents, and *lobby* indicates that it is not merely up to companies themselves and that government must be influenced.

Reduced Climate Impact from Tetra Paks Transportations

Name	Category	Action	Appendix
Assign Responsibility	Indirect	Do	12.4.1
Build Networks	Indirect	Do	12.4.2
Cooperate with Universities and Scientist	Indirect	Do	12.4.3
Create Competitive Advantage	Indirect	Do	12.4.4
Enter Climate on the Agenda	Indirect	Do	12.4.5
Highlight Management Support	Indirect	Do	12.4.6
Incentive for Climate Achievements	Indirect	Do	12.4.7
Introduce a Fee for Fossil CO2	Indirect	Lobby	12.4.8
Measure CO2	Indirect	Do	12.4.9
Set Climate Goals	Indirect	Do	12.4.10
Share Knowledge	Indirect	Do	12.4.11
Buy Emission Rights	All	Do	12.4.12
Change Customer Behavior	All	Do	12.4.13
Develop Light Products	All	Do	12.4.14
Exchange Goods	All	Do	12.4.15
Improve Planning	All	Do	12.4.16
Improve Production Flexibility	All	Do	12.4.17
Improve Routes	All	Do	12.4.18
Improve Utilization	All	Do	12.4.19
Plant Forests	All	Do	12.4.20
Prevent Damaged Goods	All	Do/Demand	12.4.21
Reduce waste	All	Do	12.4.22
Relocate	All	Do	12.4.23
Renew Vehicles	All	Demand	12.4.24
Store CO2	All	Do	12.4.25
Utilize Hybrid Vehicles	All	Demand	12.4.26
Educate on Heavy Ecodriving	Road	Demand	12.4.27
Optimize Tire Pressure	Road	Demand	12.4.28
Reduce Road Utilization	Road	Do	12.4.29
Utilize Biodiesel/FAME/RME	Road	Demand	12.4.30
Utilize Larger Trucks	Road	Lobby	12.4.31
Utilize Route Planning and GPS	Road	Demand	12.4.32
Biogas	Road	Demand	12.4.33
Fuel Cells	Road	Lobby	12.4.34
Synthetic Diesel	Road	Lobby	12.4.35
Bio Jet A1	Air	Lobby	12.4.36
Reduce Air Cargo and Express Freight	Air	Do	12.4.37
Single Sky	Air	Lobby	12.4.38
Utilize Green Approach	Air	Demand	12.4.39
Railway Development and Standardization	Rail	Lobby	12.4.40
Reduce the Ships Speed	Sea	Demand	12.4.41
Skysail	Sea	Demand	12.4.42
Utilize Shore-Side Electricity	Sea	Demand	12.4.43

Table 1. List of Measures

5.2 Exemplification of a Measure

Each measure is briefly described in the appendix (*see appendix 12.4*), along with the scores set in chapter 6, according to the example of heavy ecodriving (*see 5.2.1 or appendix 12.4.27*). To have a fairly good understanding of each measure becomes crucial when attempting to grade them. First, every measure is described in general terms. Secondly, the climate potential is estimated. Thereafter, the financial implications are estimated. Finally, the steps necessary to implement the measure is described.

5.2.1 Educate on Heavy Ecodriving

Heavy Ecodriving aims at educating drivers so that they can be able to drive more fuel efficiently and thereby also drive more economically.⁷⁸ The average fuel saving for drivers who have no prior experience of ecodriving is 13 %. Additional benefits such as lower wear on breaks, driveline and tires can be drawn but also improved safety.⁷⁹

Climate potential: It will lead to a reduction in the use of fossil fuels.

Finance: Fuel cost reduces with 13 %. Fuel makes out for one third of the costs for a road carrier which means that the price of transportations can be reduced with more than 4 %. Further savings are possible due to less wear and tear but there will also be an initial investment in educating all drivers.

Implementation: To be able to implement ecodriving, Tetra Pak should require ecodriving from all its supplier of road transport services. Furthermore, Tetra Pak should ensure that the savings the road carriers are able to make reflects in their prices. It is not likely that all the savings will be reflected in Tetra Pak's income statement. Ecodriving is widely available in Scandinavia but not all over the globe. The concept of economical driving is easy to export and therefore does not constitute a large obstacle to overcome.

⁷⁸ Rapport 2000:7, Method for Socio-economic analyses of environmental measures, Naturvårdsverket, Örebro, 2000, page 88

⁷⁹ http://www.ecodriving.se/vad/vanliga_fragor.asp?level_01=01&level_02=05, 07-02-15

5.3 Reflection

Road, all and indirect measures are more frequently represented than rail, sea or air. All and indirect measures is dominated by actions that are categorized as do. Measures that are categorized as all could be added to each of the first four categories. (To be able to get an outline of the distribution of measures see figure 14)

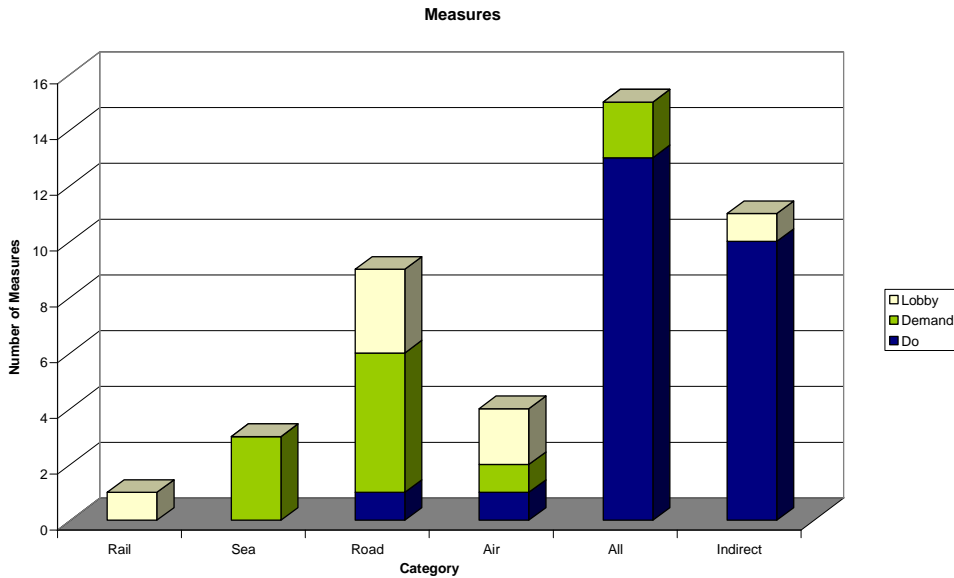


Figure 14. Measures

Many of the measures imply a need for standardization and possibly even exclusions from other alternatives. Agreeing on standards is very challenging in a global environment. Because air and sea are transportation modes that often travel over different continents they are the most affected. Industrialized countries with a high awareness surrounding climate concerns are willing and able to increase climate efforts. Other countries can be opposed to a collective effort for different reasons. It is important to note that in some cases a semi good solution that everyone adopt can be much more effective than a great solution that only a few players agrees upon.

5.3.1 Measures Concerning Biofuel

There are many different measures that incorporate some sort of biofuel. It can be different kinds of biodiesels, biogas, ethanol, biojet A1 or more. The main advantage, obviously, is the reduction or elimination of fossil CO₂ emissions but there are several views that oppose their excellence. Most biofuels consume some fossil fuel in the manufacturing process and the energy efficiency is lower than if the biomass would be used in a power plant. Even though biomass is renewable there is not an infinite supply because large amounts of fuel are needed for the transportation sector and cultivable areas are also needed for the production of food. Another possible problem is if biofuel will lead to increased transportations because it is regarded as a sound environmental way of transportation.

It is not surprising that there are problems concerning biofuels but what is the alternative? There is a limited supply of potential biomass but it is still possible to increase the production plenty without reaching the limit. The energy efficiency is not as high as in a power plant but it is also important to proceed with the development to enhance the efficiency rate in the future. It takes a lot of energy to refine fuels like rapeseed methyl ester (RME) or ethanol, which is used in E85, but it does so with fossil diesel or gasoline also. Tractors used in harvesting crops that constitute the raw material in biofuels probably use fossil diesel today but how can that be a reason for not continuing with biofuels? It is highly plausible that the development in biofuels will also include its use in tractors and other harvesting machines. Some farmers even manufacture their own biodiesel today.

5.3.2 The Cost of Measures and Possible Savings

Many measures are associated with some allocation of resources in the beginning and thereafter some cost savings are possible. Who should pay for implementing those climate impact solutions and thereafter reap the benefits, when demanding it from a forwarding agent. The forwarding agent wants to be able to receive a price premium even for solutions that can optimize their own operation. The transportation buyer does not want to pay for solutions but still be able to get a part of possible savings. There are many players involved and it is difficult to negotiate an agreement between parties concerning resources associated with a solution. The easiest way is likely letting the market forces operate freely i.e. demanding improved operations concerning the climate and letting players continue competing with price and quality. A probable scenario would be no immediate increase of cost for transportation buyers and after measures have been implemented the profit margin for transportation companies would remain unchanged. That would ultimately lead to even cheaper transportations. Measures following this course of line would likely be heavy ecodriving, optimize tire pressure, route planning systems and GPS. Measures that change the transportation sector fundamentally are harder to predict because of political influence, global agreements and uncertainty surrounding technologies. Measures under that category could be utilizing more rail, biofuel, single sky and fuel cells.

6 Evaluate Alternatives

Information Gathering → List the Options → Evaluate → Develop an Action Plan

–
“de gustibus non disputandum” – there is no arguing taste

The list of measures gives no indication of how suitable each measure is in reference to Tetra Pak. Tetra Pak is not only helped by knowing which measures have the highest potential, but also knowing which measures not to focus on. Therefore, the first step is to develop an evaluation tool, called the CBS tool, and thereafter perform an evaluation of all the measures.

6.1 Decision Making and Concept Scoring

The CBS tool has been developed with decision making theory in mind but the starting point was product development theory. Concept scoring, which is a decision tool within product development theory, has proven to be an easy and comprehensive method. Concept scoring has been extended to incorporate several more aspects from decision making theory, such as supporting iterative evaluation. The CBS tool and the entire process of deciding suitable alternatives is a mix between both theories. Concept scoring could also be viewed as an implementation of decision making theory which is easy to modify for other areas.

6.2 Developing the Climate Business Scoring Tool

Environment is or should always be a part of every decision and the climate is a large environmental issue. The CBS is a standalone decision tool for measures against climate change and a method for this report to be able to assess each measure as objectively as possible. Although, it could be used as a dynamic tool for decision making (*see figure 15*).

The CBS tool is a computerized software because it facilitates when aligning the theoretical findings with the functions of the CBS. Such findings are to be able to handle the entirety of the alternatives, supporting an iterative approach and enabling a prompt process.

The theories define decision making as the process of identifying, evaluating and selecting alternatives. Furthermore, decision making aims at reducing uncertainty and risk concerning alternatives. These functions are integrated in the CBS tool with the exception of identifying alternatives. This function must be performed prior of using the CBS tool. After finding new measures they can be added to the CBS and after new development or technology breakthroughs grades can be altered.

According to the theoretical framework, decision makers do not have all the necessary information due to constraints on time and resources. The CBS tool is developed with few, but highly relevant variables to ensure that the decision maker searches for the most important information without wasting neither time nor resources. The CBS tool does not aspire to be completely accurate. There should always be a balance between accuracy and speed, and this tool notes the importance of speed because of higher probability for implementation. This should not be seen as an abandonment of accuracy because it is often inversely related to decision speed. Delaying the decision process could lead to other drawbacks mentioned in the theoretical framework, such as selective use of information and supporting preconceived alternatives.

Many decision tools fail in generating the best possible solution and according to theory it is not the tools' mission to do so. The decision makers should make the decisions and the tool should help to visualize the problem, reduce the complexity and ensure that the decision maker reflects about every solution in its entirety. The CBS tool is developed with this in mind and therefore encourages the decision maker to view each alternative from different angles. The decision maker's own intuition is a part of the process but the tool incorporates a mix of both qualitative information and quantitative. It generates a ranking of possible alternatives which should only be used as a guideline for the decision maker. If a certain measure scores very poorly but the company wants to perform it anyway, they can consider it twice and perform a more extensive research before executing it. The CBS is a tool that falls in between intuition on one hand and a full investigation on the other.

Decision making is interpreted as identifying and selecting alternatives based on the preferences of the decision maker. Therefore, different preferences must be taken into account and in the CBS it is possible to adjust to individual prioritization. It is possible that some decision makers modify the importance levels to be able to promote their preconceived alternative. It would be possible to prevent this course of action but that could be a disadvantage. Intuition and individual opinions are a large part of decision making and should not be hindered. By modifying the importance levels in a way that promotes those alternatives that the decision maker favors, it is informative to learn what those importance levels are.

In a decision support system, such as the CBS tool, it is an advantage if it could be used iteratively when forming an opinion. An iterative approach is therefore possible within CBS although there is a risk that this will enable modifications of the final result.

Decisions that are made by one person have the drawback that the rest of the group must be persuaded to follow that ruling. When a group makes a decision, they do not have to be persuaded afterwards, because they themselves have been a part of the process. The problem, when trying to get a group to decide a course of action, is that there are many different opinions and lots of information to deal with. By breaking down the problem into sub variables, like those in the CBS tool, it is easier to reach consensus. Using the CBS tool can also be a record of how the decision maker based his or her decision.

To further underline the credibility of the CBS tool a comparison with MCDM is caused for. MCDM is a theory which attempts at solving this specific problem of having numerous alternatives. The CBS tool follows the principal of MCDM to a great extent even though calculations have been simplified slightly. Both the MCDM theory and the CBS tool evaluate each alternative, adjust for preferences or importance levels and rank the alternatives according to the aggregated score.

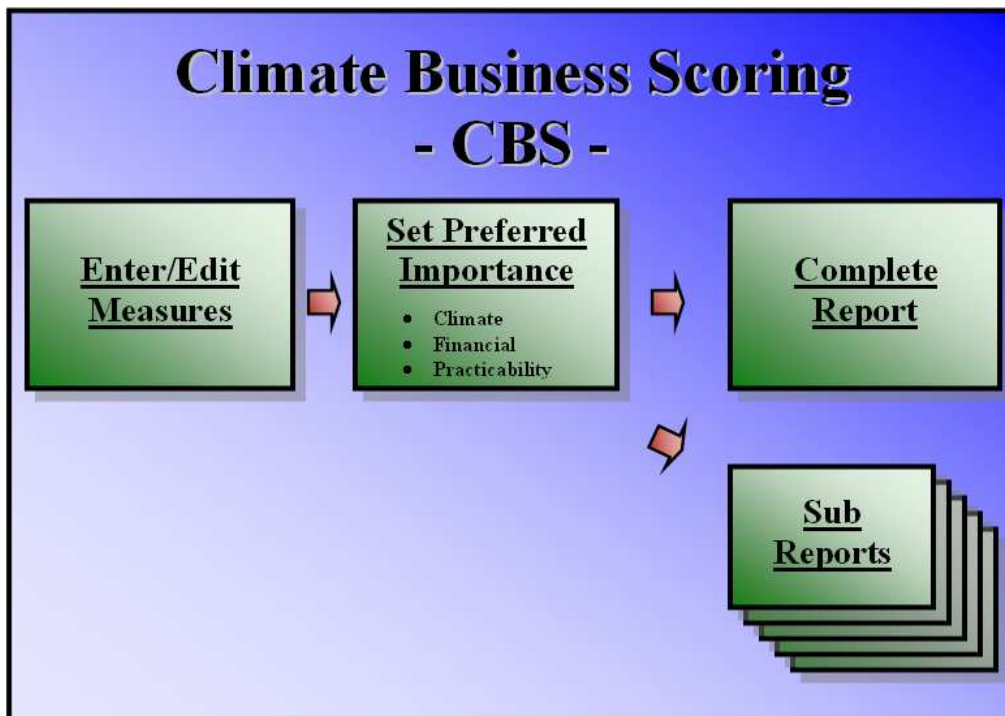


Figure 15. Climate Business Scoring Tool

6.2.1 Finding variables

In collaboration with TLGT&T and Trivector Traffic the following main variables were listed; *climate*, *finance* and *practicability*. These variables are seen as important factors to make an action successful. It could be argued that the only factor that has any real meaning is *climate*, which is somewhat true but not realistic today. In the future it will probably be necessary and meaningful to carry out actions that are not financially sound or easy today. The issue of climate change has been debated for several decades but has only recently gained large credibility and that is why there have not been large collective measures taken against climate change until now. That is also why there are a lot of measures to be taken and a reasonable approach is to begin with those that actually have an economic value and is relatively easy to carry out. With further development *finance* and *practicability* can have reduced importance but they will always be included. Along with companies changing so will society, which can imply that governments make climate actions easier and more cost effective.

It is also possible to argue that *finance* is the crucial variable which all companies should strive for achieving good result within. This is also true but it is part of a company's everyday goal and not the purpose of this report.

Sub variables were found for each main variable. *Climate* was divided into *reduced tonkm* and *reduced fossil CO₂ emissions per tonkm*. *Finance* was divided into *reduced costs*, *increased income* and *required investments*. *Practicability* was divided into *simplicity internally*, *simplicity externally*, *available* and *tested*. *Simplicity internally* is in reference to how much effort is needed by Tetra Pak. *Simplicity externally* means how much effort is needed by the parties that are affected by the measure, for example forwarding agents or customers. *Available* means the availability of technology and methodology. *Tested* imply whether the measure already have been used or tested. The theoretical framework states the importance of rating the risk associated with each alternative, which is incorporated partly within *practicability* in the CBS tool.

6.2.2 Importance Levels

It is impossible to agree on one importance level that works for everyone and everywhere. This is because different preferences of individuals and prerequisites of companies. Therefore all importance levels are changeable but a default level has been agreed upon as a starting point (*see table 2*).

Climate	40 %	
	Reduced tonkm	50 %
	Reduced fossil CO ₂ per tonkm	50 %
Finance	40 %	
	Reduced costs	40 %
	Increased income	40 %
	Required investments	20 %
Practicability	20 %	
	Simplicity internally	30 %
	Simplicity externally	30 %
	Availability	20 %
	Tested	20 %

Table 2. Importance Levels

6.2.3 Calculating Grades

Each sub variable is being graded between 0 and 5 where 5 is the optimum grade. The reason for not grading between 1 to 5 as recommended in the theory is because some measures do not affect all variables and therefore rating them as 0 is more pedagogical than 1. Extending the scale of grades further would not contribute value to the evaluation. Each variable has specific criteria to better be able to reduce the individual preferences. Scoring allows for personal opinions but with the CBS tool the user has to reflect on every sub variable before a grade can be presented. The calculations are similar to those of concept scoring. Each sub variable is then multiplied with its sub importance to be able to present a grade for each main variable. Thereafter each main variable is multiplied with its main importance to be able to present a total score. For example the climate grade is derived in the following manner:

$$\text{Climate} = ((\text{Grade}_1 * \text{Sub importance}_1) + (\text{Grade}_2 * \text{Sub importance}_2))$$

Correspondingly finance and practicability is derived. Then total score is derived as follows:

$$\text{Total Score} = ((\text{Climate} * \text{Importance}_{\text{climate}}) + (\text{Finance} * \text{Importance}_{\text{finance}}) + (\text{Practicability} * \text{Importance}_{\text{practicability}}))$$

6.2.4 Information Outcome

A complete list can be generated with all measures being presented but for different purposes it can be valuable to sort out groups of measures. The following selections are possible:

Rail	Do	Short
Sea	Demand	Intermediate
Road	Lobby	Long
Air		
All		
Indirect		

Table 3. Report Categories

6.3 Actual Climate Business Scoring Tool

Microsoft Access has been used to create a comprehensive and easy to use tool. Screenshots from the actual program is visualized to understand how it can be used. The CBS startup frame allows the user to switch between tasks (*see figure 16*).

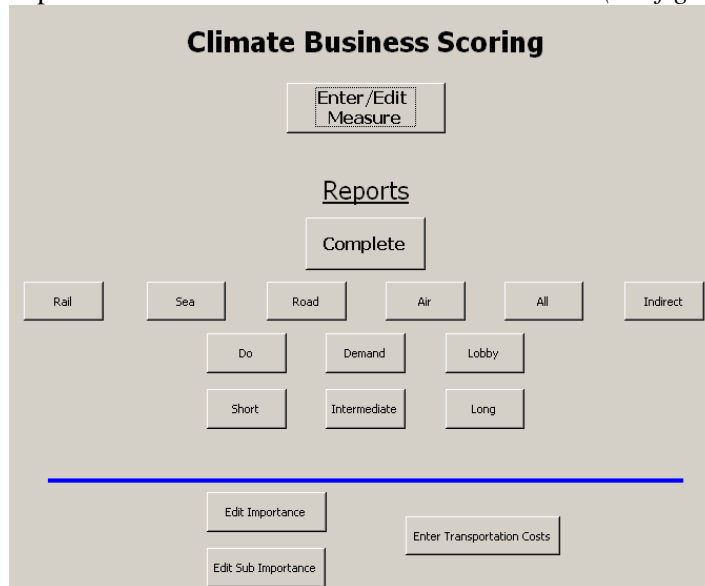


Figure 16. Climate Business Scoring – Startup

Reduced Climate Impact from Tetra Paks Transportations

Then to be able to change the main importance levels between climate, finance and practicability the user presses *Edit Importance*. The total sum must always be 100 % (see figure 17).

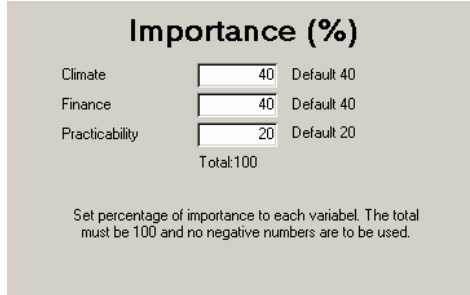


Figure 17. Climate Business Scoring - Importance

If the user also wants to change the sub importance levels he or she presses the *Edit Sub Importance* button (see figure 18).

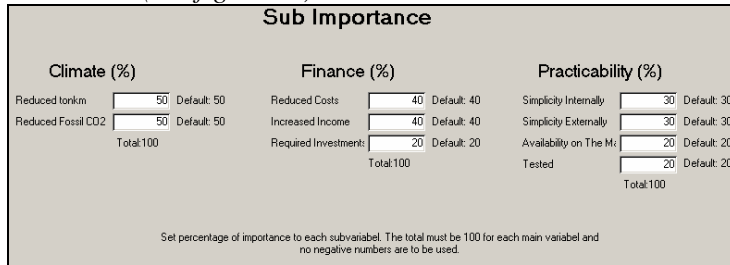


Figure 18. Climate Business Scoring - Sub Importance

When finding a climate action the user presses the *Enter / Edit Measures* button (see figure 19). The user enter a name for the measure and chooses which category it belongs to, which action is suitable for Tetra Pak if they are to execute the measure, within what time frame it is possible to start implementing the measure and finally setting appropriate scores for each sub variable.

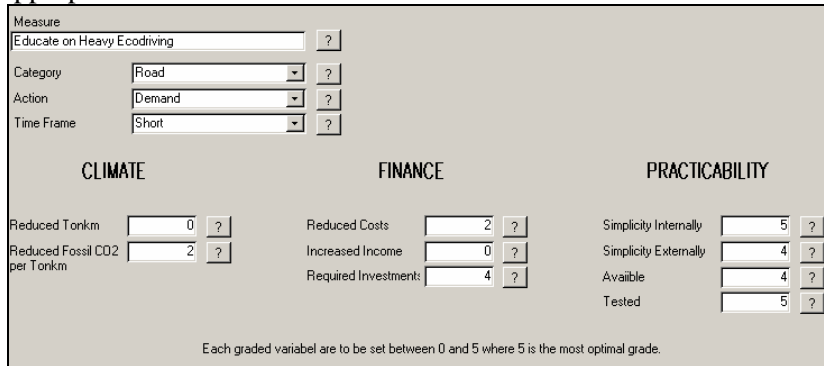


Figure 19. Climate Business Scoring - Entry Form

Reduced Climate Impact from Tetra Paks Transportations

Thereafter it is possible to get the tool to generate different reports, for example a complete list of all the entered measures (see figure 20).

Complete

<i>Total Score</i>	<i>Measure</i>	<i>Category</i>	<i>Action</i>	<i>Time Frame</i>	<i>Climate</i>	<i>Finance</i>	<i>Practicability</i>
2,34	Improve Planning	All	Do	Short	1,5	2	4,7
2,32	Reduce Air Cargo and Express Freight	Air	Do	Short	2	2,4	2,8
2,3	Improve Utilization	All	Do	Short	1,5	2	4,5
2,28	Utilize Route Planning and GPS	Road	Demand	Short	1,5	2	4,4
2,22	Improve Routes	All	Do	Short	1,5	2	4,1
2,18	Prevent Damaged Goods	All	Do	Short	1,5	2	3,9
2,12	Relocate	All	Do	Long	2	1,4	3,8
2,1	Utilize Larger Trucks	Road	Lobby	Intermediate	1,5	2	3,5
2,02	Improve Production Flexibility	All	Do	Long	2	1,4	3,3
2	Railway Development and Standardization	Rail	Lobby	Long	2	1,4	3,2
1,98	Exchange Goods	All	Do	Short	1,5	2	2,9
1,96	Reduce Ships Speed	Sea	Demand	Short	1,5	1,2	4,4
1,94	Change Customer Behavior	All	Do	Short	1,5	2	2,7
1,94	Educate on Heavy Ecodriving	Road	Demand	Short	1	1,6	4,5
1,74	Utilize Biofuels	All	Demand	Short	2	0,6	3,5

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Figure 20. Climate Business Scoring – Report

6.4 Result of Climate Business Scoring

An understanding of the problem and of the alternatives was generated from the process of gathering information and therefore the authors graded each alternative according to their opinion. Thereafter, in collaboration with TLGT&T the grades were checked and modified to ensure their accuracy (see table 4 & appendix 12.4 for the underlying motive behind the grades). Note that the climate grades for indirect measures are deemed upon the measures potential of promoting or contributing to the process of reducing emissions. The following ranking was achieved:

Reduced Climate Impact from Tetra Paks Transportations

Total Score	Measure	Category	Action	Time Frame	Climate	Finance	Practicability	Potential (M€)
2,64	Reduce Air Cargo and Express Freight	Air	Do	Short	2	2,4	4,4	
2,46	Highlight Management Support	Indirect	Do	Short	2	1,8	4,7	
2,4	Build Networks	Indirect	Do	Short	2	1,8	4,4	
2,34	Cooperate with Scientists and Universities	Indirect	Do	Short	2	1,6	4,5	
2,28	Set Climate Goals	Indirect	Do	Short	2	1,6	4,2	
2,26	Relocate	All	Do	Long	2,5	1,4	3,5	
2,16	Utilize Larger Trucks	Road	Lobby	Intermediate	1,5	2,2	3,4	5,74
2,12	Measure CO ₂	Indirect	Do	Short	3	1,4	1,8	
2,04	Incentive for Climate Achievements	Indirect	Do	Short	1	1,6	5	
2,04	Assign Responsibility	Indirect	Do	Short	1	1,6	5	
2	Enter Climate on The Agenda	Indirect	Do	Short	1	1,8	4,4	
1,98	Utilize Biodiesel/FAME/RME	Road	Demand	Short	2	0,8	4,3	
1,98	Create Competitive Advantage	Indirect	Do	Short	2	1,4	3,1	
1,82	Railway Expansion and Standardization	Rail	Lobby	Long	1,5	1,8	2,5	
1,78	Improve Routes	All	Do	Short	1	1,4	4,1	
1,76	Utilize Route Planning and GPS	Road	Demand	Short	1	1,2	4,4	
1,76	Share Knowledge	Indirect	Do	Short	1	1,2	4,4	
1,76	Improve Utilization	All	Do	Short	1	1,2	4,4	
1,7	Improve Production Flexibility	All	Do	Long	1,5	1	3,5	
1,7	Educate on Heavy Ecodriving	Road	Demand	Short	1	1	4,5	3,28
1,68	Reduce Road Utilization	Road	Do	Short	1	1,4	3,6	
1,64	Sky Sail	Sea	Demand	Intermediate	1,5	1,4	2,4	
1,64	Change Customer Behavior	All	Do	Short	1	1,6	3	
1,62	Optimize Tire Pressure	Road	Demand	Short	0,5	1,2	4,7	0
1,56	Improve Planning	All	Do	Short	0,5	1,2	4,4	
1,56	Buy Emission Rights	All	Do	Short	1,5	0,2	4,4	
1,52	Biogas	Road	Demand	Short	2,5	0	2,6	
1,44	Prevent Damaged Goods	All	Do	Short	0,5	1,2	3,8	
1,42	Renew Vessels	All	Demand	Short	1	0,6	3,9	
1,4	Reduce Waste	All	Do	Short	0,5	1,2	3,6	
1,38	Plant Forests	All	Do	Short	0,5	0,6	4,7	
1,38	Reduce Ships Speed	Sea	Demand	Short	1	1	2,9	
1,3	Introduce a Fee on Fossil CO ₂	Indirect	Lobby	Long	2	0,2	2,1	
1,26	Utilize Hybrid Vessels	All	Demand	Intermediate	1,5	0,8	1,7	
1,24	Synthetic Diesel	Road	Demand	Short	2	0,2	1,8	
1,24	Green Approach	Air	Demand	Intermediate	0,5	0,8	3,6	
1,2	BioJet A1	Air	Lobby	Intermediate	1,5	0,8	1,4	
1,16	Utilize Shore Side Electricity	Sea	Demand	Short	0,5	0,4	4	
1,1	Fuel Cells	Road	Lobby	Long	2,5	0	0,5	
1,08	Exchange Goods	All	Do	Short	0,5	1	2,4	
1,02	Single Sky	Air	Lobby	Long	1	0,6	1,9	
1,02	Develop Light Products	All	Do	Intermediate	0,5	0,8	2,5	
0,58	Store CO ₂	All	Do	Intermediate	0,5	0	1,9	

Table 4. List of Ranked Measures

6.5 Reflection

The highest ranked measure has only an aggregated score reaching halfway on the scale. Likely, this depends on the complexity of the problem and that there are not yet any solutions that solves the problem altogether. Another similar aspect is noticeable when looking at the differences between *climate*, *finance* and *practicability* where *practicability* in averages scores higher than the others. The possibility, not only to distinguish an aggregated score gives more information and a better perspective to the user. Sadly, there was only a minority of measures where it was possible to estimate an economic potential.

Each alternative for reducing fossil CO₂ emissions has no apparent market value in it self and is unlikely to motivate higher revenues. But by combining several solutions and effectively communicating progress to the market an indirect increase of revenue is possible. It will not be easy though, because Tetra Pak operates business to business.

The list of alternatives is a mix between measures that TLGT&T have an influence over or not. They are also not sorted according to who should implement them. It should be noted that the list of measure is a representation of the current state, which will change rapidly. How can it be used to develop a long-term initiative?

7 Develop a Climate Strategy

Information Gathering → *List the Options* → *Evaluate* → **Develop an Action Plan**

A plan of action that is just applicable for the near future holds limited value. The challenge is to develop an approach that can be used and altered over several years. Each measure taken must be in line with the entire approach against global warming. TLGT&T's current status is that they are preparing their negotiating process for road with their forwarding agents, which occurs in the fall of 2007. Therefore, developing strategies are currently very relevant.

TLGT&T requests a wide spectrum of measures, including measures that are out of their control, for the purpose of understanding the problem better. This has proven insightful but to increase the chances for implementation it is useful to develop a strategy that is directly applicable to TLGT&T. Measures that are not within TLGT&T responsibility have a worth elsewhere in the organization and should therefore not be forgotten. In this chapter a general climate strategy for TLGT&T is created along with an exemplification of a climate strategy focusing on one transportation mode. There are, of course, some differences between strategies concerning different transportation modes but the structure is similar, which will make it easy for TLGT&T to develop the remaining strategies themselves. Road has been chosen because it has the highest cumulative emissions and is also highly relevant because of their negotiating process in the fall of 2007 (*see figure 13*).

It is important to ensure a successful strategy implementation (*see figure 4*). How is it possible to convey a profound understanding of the competitive environment and build a foundation for developing climate strategies?

7.1 Key Denominator

Strategy should have long term, simple and agreed objectives. Enabling a long term approach to a complex question that is developing continuously is difficult and it becomes crucial to find key characteristics and common denominators. During the information gathering and evaluation of measures a deep understanding of the problem was attained. Finding key elements was done by brainstorming and in cooperation with TLGT&T. The basis for this search was the ranked list, the information gathered and the theories about strategy. *Figure 10* was particularly helpful, especially for the climate strategy concerning road transportation.

The following key elements were generated concerning the overall climate strategy for TLGT&T:

- **Continuous improvements**
- **Climate awareness**
- **Commitment**
- **Dialog with stakeholders**

The following key elements were generated concerning the climate strategy for TLGT&T Road:

- **Reduce the energy consumption**
- **Increase renewable energy sources**
- **Reduce the need for transportation**

Several more could be found but it is also important to have a fixed focus. Reducing the need for transportation is a very important element but TLGT&T Road has limited influence over that, which is why it is not used further.

7.2 Creating Climate Strategies

TLGT&T current state is that they are willing, but unsure, how to incorporate a climate strategy. They need a vision that challenges them in a positive way and objectives which can be achieved through implementation of a strategy (*see figure 21*). It is of great importance that all these elements can be used without large modifications for several years. Measures are incorporated in the strategy as actions that can be put into practice immediately. Over time these actions can, and should, change as development continuous and progress has been made.

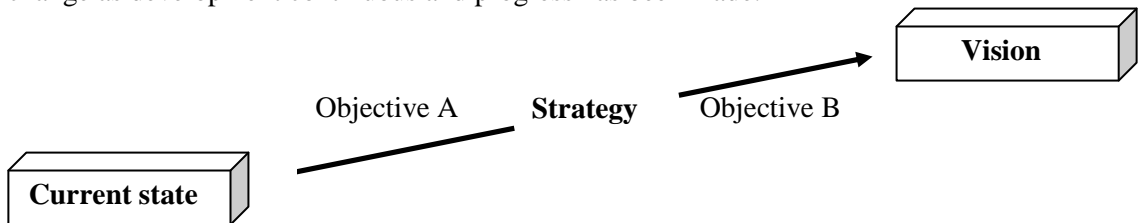


Figure 21. Strategy

Strategic fit is crucial both for implementation and the result, which is why it has been developed in collaboration with TLGT&T to the highest possible extent. The reason for that is to make it a collective effort and to ensure high commitment to the chosen strategies. These strategies do not solely maximize profits and they are a mix between a deliberate process and an emergent path. That is why they are a mix between a processual approach and a systematic approach. To enable an effective approach it is important to address the problem from several angles. Therefore, actions should be a mix of *do*, *demand* and *lobby*.

7.3 Outcome – A Climate Strategy for Tetra Laval Group Travel & Transport

Vision:

TLGT&T shall become the best solution provider of climate neutral transportations.

Objectives:

A: Reduce CO₂ emissions, per tonkm, from Tetra Pak:s transportation.

B: Reduce absolute CO₂ from Tetra Pak:s transportations.

Strategy:

TLGT&T shall strive for **continuous improvements** and search for new solutions to improve their contracting process. They shall encourage their employees to continuously being curious and innovative. TLGT&T shall be a department with **high commitment and great awareness** of the climate issues through clear and open communication. TLGT&T shall continuously **maintain a dialog** with its suppliers and together lead the way towards sound climate development

Actions:

Continuous Improvements

1. Measure CO₂ from all transports (Do/Demand)
2. Set climate goals (Do)

High commitment and great awareness

- Highlight management support (Do)
- Assign responsibilities and create incentives for the climate achievements (Do)

Maintain a dialog

- Build networks (Do)

7.4 Outcome – A Climate Strategy for Tetra Laval Group Transport & Travel Road

Vision:

TLGT&T Road shall become the best solution provider of climate neutral road transportations.

Objectives:

A: Reduce CO₂ emissions, per tonkm, from Tetra Pak:s road transportation.

B: Reduce absolute CO₂ from Tetra Pak:s road transportations.

Strategy:

TLGT&T Road shall work towards **reducing energy consumption** for road transports. TLGT&T Road shall continuously reduce the use of fossil fuel and **increase the use of renewable energy sources**.

Actions:

Reduce the energy consumption

- Utilize larger trucks (Lobby)
- Improve utilization (Demand)
- Utilize route planning systems and GPS (Demand)
- Educate on heavy ecodriving (Demand)
- Shift transportation mode towards rail and sea (Do)

Increase the use of renewable energy sources

- Utilize biodiesel or synthetic diesel produced from biomass (Demand)
- Be open for new forms of biofuels such as biogas (Do)

7.5 Reflection

The strategies have a varying degree of flexibility. On the one hand they are broad, which does not exclude that there are other alternatives and they can therefore be used several years ahead. On the other hand the listed actions can easily be exchanged when they are implemented or as new and better alternatives arise.

The general strategy for the department is of higher importance than the specific road strategy. That is because the general strategy is fundamental for all further climate measures. That is not to say the road strategy is not important, because it has potential of making improvements in the short future. Because their negotiating process is at hand they are looking for easy measures that can be presented to the forwarding agents shortly. For this reason, demanding a high degree of chauffeurs educated on ecodriving is of interest along with asking forwarding agents to what degree they utilize renewable energy sources such as biodiesel. Demands about ecodriving could be stipulated within several countries in Europe but also globally as the concept of ecodriving is easy to export. Biodiesel is currently fairly available in Sweden, Germany, the USA and Brazil but can also be found elsewhere. Because the potential of biodiesel is limited due to limited production capacity it is not suitable for replacing fossil diesel altogether but a moderate use should be encouraged (*see appendix 12.4.30*).

TLGT&T pointed out that buying emission rights was excluded from the strategies. It does lower the global aggregated amount of emission but it is the authors' opinion that if there are measures available that can reduce a companies own emissions they should be performed first. The concept of buying companies freedom with emission rights has several drawbacks. Emission rights will become more expensive and is just a temporary solution. If no actions are taken the need for more emission rights will increase and it is an instantaneous cost that will not repay itself. On the other hand, they can be used as a mean to add a cost to emissions. The strategy could therefore be paying for emission rights but at the same time actively trying to reduce emissions and therefore also reducing the cost for emission rights, i.e. scenario A (*see figure 22*).

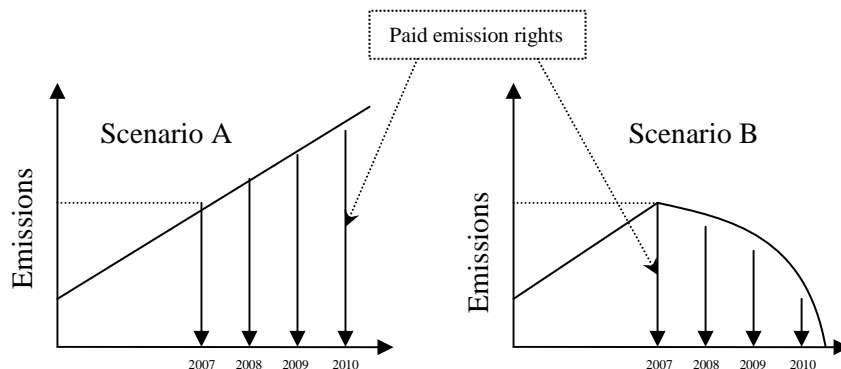


Figure 22. Emission Rights

7.5.1 Level of Detail in Demands

The transportation company can see a business potential in offering transportation services that has a lower climate impact but they do not want their customers to give them detailed instructions on how to conduct their business. Would providers of transportation services have developed as far as they have without these demands? Most definitely not! The market for transportation services is ancient but the market for transportation services with a lower climate impact is new. This implies that the later market has not reached maturity yet and therefore needs to be influenced more strongly. With further development there probably is room for less detailed demands but they are currently still needed. Although using detailed demands from a transportation buyer should be done with great caution. Because the transportation company is more likely to have a better insight in its own business than an outsider, wrong demands could have a negative affect. It is also dangerous to push a transportation company in a certain direction if that direction is later proven wrong. To conclude the level of detail: it is important to have great awareness of the problem before stipulating detailed demands or consult someone with that awareness.

Because of the limited maturity of the market, demands are stipulated and removed. It would be beneficial for a better and more open dialog between buyers and providers of transportation services. A method of asking today and demanding tomorrow would be advisable, giving the transportation providers a chance of adapting and also displaying the intention of the transportation buyers.

TLGT&T have a clear ambition of distinguishing themselves within the environmental aspects and specifically the climate impact. They do not forget about other aspects, such as health and safety but the question is if they are as important as the environment? Today they merge the results from the environment questioner with those dealing with health and safety, where environment makes out 43 % of the aggregated score. It is questionable if there should be an aggregated score at all. If a strong focus is to be made on the environment and the climate they should be an independent part of the assessment process.

7.5.2 Tetra Laval Group Transport & Travel

Do TLGT&T have a reactive or proactive approach against climate impact? There is no doubt that it is proactive because what Tetra Pak does today is not regulatory. Can they position Tetra Pak as a green brand, with emphasis on climate? No they can not. They need to incorporate climate strategies within the entire organization and be able to position themselves as climate friendly in the eyes of the consumer. Building a climate strategy within TLGT&T creates an option where the company can take advantage and exploit their business model further on.

With a history of great environmental achievements the department has come to a crossroad. They are unsure how to proceed but they maintain an ambition of being a leader within the environmental field. Climate is presently the most important environment issue which is why TLGT&T are recommended to pursue their ambition with climate impact as their main issue. The strategy should build a foundation for enabling powerful actions to be taken.

Specified reductions, such as percentages or absolute amounts of emissions are not mentioned in the strategy chapter. It is recommended that this will be done, incorporating the whole department do develop realistic but ambitious levels of improvements.

Tetra Pak is a huge company in Lund, a large company in Sweden and one of many globally. When changing the way transportations are made size means influence. If cooperating with other companies a greater size can be won and thereby influence.

7.5.3 Tetra Laval Group Transport & Travel Road

A main concern for the road department must always be on reducing the overall emissions from transportation and not sub optimizing emissions from road transportation. It is important because both sea and rail are better alternatives when addressing the climate impact. The first category of possible actions that addresses reduced energy consumption is easier to monitor because lower fuel consumption is always good. Increasing the use of renewable energy sources is more complex because it has to be monitored closely. The consequences of introducing biofuels are still relatively unknown and the technologies are numerous and rapidly changing.

The same line of argument used for the goals for TLGT&T is applicable. The specified goals should be set by the road department or the management to create high motivation for reaching those goals.

8 Discussion

The result of this report is a list of possible measures, a decision making tool called CBS and climate strategies for TLGT&T. These outcomes are discussed concerning drawbacks, improvements and benefits.

8.1 List of Measures

Information that reaches companies concerning climate measures is often vague and unsorted. The list of measures in this report brings structure and systemizes the information. Likely, there are more measures that are not included in the list and there will certainly emerge new ones. Since the list is structured there are no difficulties adding new or removing obsolete measures.

There is a wide spread of different measures in the list because it adds great value for understanding the problem. The drawback with this approach is a reduction of depth in certain areas of measures. Not knowing in advance in which area of measures lays the greatest potential for reaping emission reduction, it is important to shift the balance between a broad approach and narrow focus, towards a broad approach.

Maintaining a business perspective is important because otherwise companies would not have any interest in implementing measures. Most measures in the list present an opportunity to reduce emission as well as costs, not many present an opportunity to increase income. It would be interesting to find more measures with a potential of both reducing emissions and increasing income.

8.2 Climate Business Scoring

With more effort the CBS could be further developed with focus on it being simple and user friendly. This does not exclude adding more features to the program such as adding the reduction of greenhouse gases in quantitative units. One feature that could be beneficial would be to add a textbox for comments, though it would be difficult to make that a part of the scoring process.

In this report there has not been made a sensitivity analysis of the result from the CBS tool. Performing a sensitivity analysis would better ensure the ranking of measures and a feature to add to the program could be a tool for performing this procedure. Although, by changing the levels of importance it is possible to make sensitivity analysis fairly easy.

The equations used in presenting an aggregated score are simple within the CBS because focus has been on making it easy for the user to understand the method. Within multi criteria decision making there are more advanced models that could be used by an experienced user if it would be desirable.

8.2.1 The CBS:s Applicability

It is very likely that the CBS tool will be applicable to other organizations than Tetra Pak, especially other organizations that purchase transportation services. Smaller modifications could be suitable, mainly if an alternative is classified as *do*, *demand* or *lobby* which will have different implications for different organizations.

8.3 Climate Strategy

Are the developed climate strategies realistic? Yes, because TLGT&T has already implemented some of the aspects and measures. The presented strategies are a proposed outline of how the final strategies, which will be implemented by TLGT&T, would look like. The strategies are simple and concrete but are limited to solving climate change while maintaining a business perspective. Measures presented in the strategies are suitable for implementation but are far from solving climate change altogether.

8.4 Further Aspects

To make the question of reducing the climate impact even more complex it is reasonable to include factors that can be affected by having a sincere climate ambition. The most obvious parameter is price; will a climate effort lead to higher prices? Other factors could be environmental effects, customer relations, relations with suppliers and product quality. CO₂ is the only GHG that is included in this report but other gases such as NO_x have a notable affect as well. When optimizing or minimizing the emissions of CO₂ it is common that an increase in NO_x is visible.

It is probable that the lack of apparent business value for climate solutions undermine the process towards climate neutral transportations. That makes it crucial to be effective when communicating with customers and suppliers. When a supplier's climate achievements are commendable it is important to link climate with business. If more business is given to that supplier it should be clearly stated that it was because they have invested in the climate. The synergies are likely to be the supplier's understanding that climate achievements leads to higher revenues and hopefully Tetra Paks customers will do the same towards Tetra Pak. It would even be conceivable to ask customers if they give more business to Tetra Pak because the company is regarded as climate friendly.

Transporting goods is not expensive compared to the price of altering the induced climate change. There is an obvious link between price and transportations, but a price increase is not guaranteed to reduce transportations though it would eventually cool down the demand. It would be reasonable to increase the connection of climate cost to what causes the climate change. The transportation costs are more linked with fuel price which is determined by supply and demand. The existing taxes due to climate impact are lower than the actual cost for climate change. Increased transportation costs would also make more expensive climate measures financially sound.

9 Conclusions

Today it is possible to make changes that will reduce both emissions and costs.

The risks associated with global warming are so extensive that they pose a business threat as well as a threat to humanity. Taking measures against climate change is therefore necessary to ensure long-term shareholder value. Many of the most suitable alternatives for reducing the climate impact also imply a reduction in costs. A mentality that would allow companies to charge a higher price for climate friendly, or neutral, transportation would accelerate the development towards a sustainable society. Although, the strongest force is still cost efficiency and when, not if, cost for fossil fuel will increase, the pressure on companies to focus on the climate will be high. Furthermore, large costs related to the consequences from global warming will put pressure on companies.

This report offers Tetra Pak a starting point for helping them on their way to climate neutral transportation. It does so by questioning what measures there are, which measures have good potential and finally which measures should be implemented. The answers to those questions are represented by the list of measures, the CBS tool and the climate strategy. This course of action put equal focus on each part of the process and avoids that important aspects are forgotten. It has been very helpful when investigating an area with no prior experience and offers a systematic approach to solving the problem at hand. Another factor that has contributed much to ensure a clear focus and inspiration through the project is the *Emission model* (see figure 10) created in the report.

The list of measures is a current illustration of how the industry can reduce fossil CO₂. It offers a starting point but for a continuous effort it must be revised regularly. It is universal for both buyers of transportations and forwarding agents.

Developing the CBS tool was made on basis of product development theory, which offered a practical approach and high usability. Decision making theory clarified many of the important aspects when making a decision, which then could be taken in consideration when creating the functionality of the tool. Although, the aspects from decision making theory had to be customized to suit the problem at hand. In this report the CBS tool is used to evaluate each measure without being too subjective. Although, it can be used in the future as an easy and comprehensible decision making tool concerning climate at TLGT&T. It could also be used by other companies that are buyers of transportation services but need modification if it were to be used by forwarding agents. The next step in developing the CBS tool should be a improved version that would be incorporated in the *Enterprise Resource Planning* (ERP) system.

The final stage, in developing a climate strategy, utilizes strategy theory as a starting point. The theoretical framework has provided the strategy with key success factors to make a good implementation possible at TLGT&T. The theories have also made it possible to get a better understanding about TLGT&T situation, concerning strategy issues. Not all climate strategies are specific but by using prior experience, generated by authors within the strategy field, it has facilitated in making the strategies usable and comprehensible. The department has already partly incorporated the climate strategy, which establishes its usefulness and that the previous steps were reasonable. Although, an evaluation of the outcome, from implementing the strategies, remains before definitively stating its accuracy. This can not be done within the timeframe of this report. Even though the climate strategy can be of much use for companies other than Tetra Pak when developing their own climate strategy, it must be modified to that company's certain characteristics to ensure a strategic fit.

Tetra Pak is on their way towards sustainable transportation and with this report they have good prerequisites to reduce their climate impact. It is of the utmost importance, and also the final recommendation of this report, that Tetra Pak shall develop their process of measuring fossil CO₂ emissions and set goals to reduce fossil CO₂.

10 Suggestions for further studies

CO₂ has been the only focus within this report and the correlation between CO₂ and other emission varies. Further studies could involve emissions such as NO_x and sulfur to get a universal understanding of the problem. Other causes of emission could also be included, such as Tetra Pak's subsidiary companies and Tetra Pak's transportation of people.

Further studies could also define a strategy of how it would be possible to measure emissions. This would not only be beneficial to Tetra Pak but to most large companies.

The result of this report shows predominance for alternatives that reduces cost along with emission. The market for environmental friendly products and services is said to have great potential. A likely advancement would be to investigate the possibility of increasing income as a result of climate achievements.

Because alternatives for reducing the climate impact are unsure and constantly changing it is desirable with a systematic approach that can handle all uncertainties. The CBS tool is a step in that direction, but a standardized tool that is applicable for several businesses and possible to integrate with an Enterprise Resource Planning system would be an enhancement.

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12 Appendix

12.1 Glossary

CBS	Climate Business Scoring
CO ₂	Carbon Dioxide
ERP	Enterprise Resource Planning
FAME	Fatty Acid Methyl Ester
GHG	Green House Gas
GPS	Global Positioning System
MCDM	Multi Criteria Decision Making
RME	Rapeseed Methyl Ester
TLGT&T	Tetra Laval Group Transport & Travel

12.2 Criteria for Grades in the Climate Business Scoring Tool

<ul style="list-style-type: none"> • Reduces tonkm • Increases income • Simplicity internally • Simplicity externally • Availability • Tested 	
Grade	Criteria
0	None
1	Very low
2	Low
3	Medium
4	High
5	Very high

<ul style="list-style-type: none"> • Reduces costs 	
Grade	Criteria
0	0 %
1	1-5 %
2	6-15 %
3	16-30 %
4	31-50 %
5	51 % →

<ul style="list-style-type: none"> • Required investments 	
Grade	Criteria
0	Very high
1	High
2	Medium
3	Low
4	Very low
5	None

12.3 Questionnaire

1. Hur ser er bakgrund ut och vad är dina tidigare erfarenheter inom miljöarbete?
2. Hur ser du på klimatproblematiken och hur ställer ni er till transportsektorn specifika utmaningar?
3. Hur ser ert klimatarbete ut idag?
4. Vad är ert syfte till att engagera er för miljön och klimatfrågan?
5. Vad har ni gjort tills dags datum och vad ser ni som nästa steg?
6. Vad hade ni velat göra mer för miljön men, av olika anledningar, ser ni som osannolikt?
7. Vilken hjälp erbjuder ni företag som önskar minska sin klimatpåverkan?
8. Vilka parametrar styr ert miljöarbete?
9. Vilka aspekter är viktiga när ni utvärderar ert klimatarbete?
10. Beskriva viktiga aspekter när miljöarbete mäts, utvärderas och följs upp.
11. Hur rekommenderar ni att ett företag mäter sina emissioner.
12. Vilka är de största hindren för ett ännu mer aktivt miljöarbete och hur skulle dessa kunna övervinnas?
13. Skulle ni vilja beskriva transportbranschens specifika förutsättningar utifrån ert synsätt.
14. Hur kopplat är miljöarbetet till ett affärsmässigt perspektiv?
15. Hur kommunicerar ni ut er position inom miljöområdet till marknaden?
16. Hur många arbetar aktivt med miljöarbete i er organisation?
17. Hur gör ledningen för att visa att de står bakom satsningen på miljön?
18. Hur väl förankrad är er miljöfilosofie i organisationen?
19. Varifrån kommer förslag till de olika miljöinsatserna (ledningen, kunderna, produktion, underavdelningar)?
20. Vilka miljömål finns och hur fördelas dessa ut på de olika avdelningarna?
21. Vilka planer har ni för att införa ett klimatmål för transportererna?
22. Hur aktiva är ni för att ingå nätverk med andra företag i syfte att minska miljöpåverkan?
23. Är det stora skillnader mellan olika transportörers miljöarbete?
24. Vilka företag eller organisationer tycker ni har utmärkt sig extra inom klimatområdet?

12.4 Measures

12.4.1 Assign Responsibility

Assigning responsibility is crucial for being able to focus on complex issues, such as the climate impact. Assigning part time responsibility is a step in the right direction but most suitable is to have employees working full-time with reduced climate impact as the main goal. This does not imply that it should not be every employee's responsibility to assist in reducing the climate impact.

Climate potential: This does not reduce the climate impact in itself but lays the foundation for doing so.

Finance: This is an investment but one that can be financially beneficial if communicated correctly to the market.

Implementation: Finding a dedicated person that can handle the complexity of the company together with the climate issue is crucial and then assigning appropriate resources.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	1	Assigning responsibility creates awareness and increases efforts.
Reduces fossil CO ₂ per tonkm	1	Same as above.
Reduces costs	1	Has the potential of reducing costs but uncertain.
Reduces costs (%)		No data.
Increases income	1	Has the potential of increasing income but very uncertain.
Requires investments	4	Allocate employees to deal with the climate issue.
Simplicity internally	5	Easy to realize with management support.
Simplicity externally	5	Awareness and visibility is created which facilitates the interaction between organizations.
Availability	5	Skilled professionals are available.
Tested	5	It has been done before.

12.4.2 Build Networks

To be able to make demands on forwarding agents, a network consisting of fellow buyers of transport services could facilitate. It is even difficult for large companies to set standards and forwarding agents and carriers can be ambivalent about which demands to follow because the demands can be contradictory. Networks consisting of other stakeholders than the buyers can also be beneficial.

Climate potential: This measure does not reduce the CO₂ by itself but when the right demands have been manifested they can have a strong impact if implemented through a network. If the network is large enough it will set the standard for the whole market.⁸⁰

Finance: A company must invest time and devote effort to building a network and then maintaining it. The effort is shared by the participants and the manifested demands have the potential of cutting costs.

Implementation: The founding company must first analyze which other companies could be strategic allies in building a network. Then these companies must be contacted and be presented with the concept. Regular meetings must be held and a consensus over suitable actions should be reached.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	2	By cooperating with other organizations and exchanging knowledge a faster learning curve is possible.
Reduces fossil CO ₂ per tonkm	2	Same as above.
Reduces costs	1	Has the potential of reducing costs but uncertain.
Reduces costs (%)		No data.
Increases income	1	Has the potential of increasing income but very uncertain.
Requires investments	4	Some resources are necessary, such as time.
Simplicity internally	4	Other organizations must commit but otherwise fairly easy.
Simplicity externally	4	Same as above.
Availability	5	Several networks are existent today.
Tested	5	TLGT&T are currently involved in a network.

⁸⁰ Interview Hadders, Gunilla. *Project leader*, Blicc, 07-02-02

12.4.3 Cooperate with Universities and Scientist

By being able to take part of the latest knowledge within the area as well as implementing techniques and technologies significant progress can be made.⁸¹ It is also beneficial to have a mutual dialog with Universities to be able to influence their research.

Climate potential: No reduced climate impact can be gained solely by cooperating but it can facilitate to find the right measures.

Finance: Cooperation with universities does not necessarily mean large costs because Universities also have a mutual reason for cooperating. Investments or contributions to studies conducted through Universities tend to be less expensive than doing them themselves.

Implementation: It is preferable to be located in the proximity of a University for this kind of action and also to find one that is dedicated to similar research that the company is interested in.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	2	New ideas and concepts can be gathered and put to use. The latest research will be available.
Reduces fossil CO ₂ per tonkm	2	Same as the above.
Reduces costs	1	Has the potential of reducing costs but uncertain.
Reduces costs (%)		No data.
Increases income	1	Has the potential of increasing income but very uncertain.
Requires investments	4	Cooperation with universities is often a cheap source of knowledge.
Simplicity internally	5	No obstacles other than resources, time and distances which in Tetra Pak's case is relatively low.
Simplicity externally	4	Offer a mutual cooperation with gains on both sides. The forwarding agents can be affected by the outcomes of the cooperation's.
Availability	4	Universities are open for cooperation's.
Tested	5	It has been done before.

⁸¹ Meeting Wendle Björn, Consult, Trivector Traffic AB, 07-03-02

12.4.4 Create Competitive Advantage

By using a company's position as environmentally friendly and having a low impact on the climate a competitive advantage can be created. Not only is this good from a business point of view but it also forces the company to be one step ahead of its competitors, thereby having an extremely low impact on the climate.

Climate potential: This does not in itself reduce the climate impact but can be a motivation tool for doing so.

Finance: It would cost money to first earn the position and then communicating it to the market but the possibility of being able to sell more products is very much sought after. By being able to make money by reducing the climate impact have a strong probability of success.

Implementation: Constantly finding new ways of reducing the climate impact is necessary along with implementing them. Although most important is being able to communicate this to the market and always ensuring that the own company's brand is conceived as having a lower climate impact than its competitors.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	2	With a competitive advantage that positions the company as climate friendly puts constant pressure of always outperforming ones competitors within the climate issue. First mover advantage will generate sales which partly can finance climate investments
Reduces fossil CO ₂ per tonkm	2	Same as above.
Reduces costs	1	Has the potential of reducing costs but uncertain.
Reduces costs (%)		No data.
Increases income	2	With a competitive advantage increased income should be achieved.
Requires investments	1	To be better than others it is necessary to invest money and also prepare for setbacks.
Simplicity internally	2	The entire organizations must be devoted.
Simplicity externally	3	This will put high demands on forwarding agents.
Availability	4	Many organizations want to position themselves as climate friendly but currently no single organization distinguish themselves.
Tested	4	Experience is available but none have reached all the way.

12.4.5 Enter Climate on the Agenda

When having weekly, monthly or yearly meetings it is important to devote time to discuss the climate and to create awareness. Meetings are also an instrument for getting input on new ways of finding measures against climate change.

Climate potential: This measure is an indirect tool that will facilitate in finding ways of dealing with the problem.

Finance: Time will have to be devoted to this action.

Implementation: Creating a routine among the management and employees to be willing to discuss the climate on a regular basis.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	1	With increased awareness new ideas can be generated.
Reduces fossil CO ₂ per tonkm	1	Same as above.
Reduces costs	1	Has the potential of reducing costs but uncertain.
Reduces costs (%)		No data.
Increases income	1	Has the potential of increasing income but very uncertain.
Requires investments	5	No extensive investments necessary.
Simplicity internally	4	It is easy to have a climate discussion on every meeting.
Simplicity externally	4	The forwarding agents can be affected by the outcomes of the meeting.
Availability	5	Highly available.
Tested	5	Tetra Pak discusses the climate on several meetings

12.4.6 Highlight Management Support

Without management support any effort of reducing the climate impact has a low chance for success. Therefore, management support should be clear and highly visible.

Climate potential: This will facilitate in finding measures and implementing them.

Finance: Costs are minimal.

Implementation: An active awareness and effort should be noticeable within all levels of management.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	2	Without management support it is very difficult to make real change.
Reduces fossil CO ₂ per tonkm	2	Same as above.
Reduces costs	1	Has potential of reducing cost but uncertain.
Reduces costs (%)		No data.
Increases income	1	Has potential of increasing income but very uncertain.
Requires investments	5	Investments are not necessary.
Simplicity internally	5	Management needs to communicate their commitment.
Simplicity externally	4	The forwarding agents can be affected by the results followed by changes within the organization.
Availability	5	Management is aware of their impact on the organization.
Tested	5	Same as above.

12.4.7 Incentive for Climate Achievements

By adding some sort of reward when finding ways of reducing climate impact can be effective. Complex issues like the climate impact do not have one easy solution but an abundance of small ones. It is necessary to involve everyone in the company to be able to use everyone's unique knowledge to make a difference.

Climate potential: It will not reduce the climate impact directly but it can help find ways of doing so.

Finance: An incentive does not have to be large or expensive to be effective. The actions found can even prove to be cost effective as well.

Implementation: Introducing an incentive, perhaps in cash, for all employees that find a suitable way of reducing the climate impact and at the same time communicating this to the staff.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	1	By encourage employees to always have the climate in mind, it is possible to find solutions not visible for everyone.
Reduces fossil CO ₂ per tonkm	1	Same as above.
Reduces costs	1	Has potential of reducing cost but uncertain.
Reduces costs (%)		No data.
Increases income	1	Has potential of increasing income but very uncertain.
Requires investments	4	Small incentives are enough.
Simplicity internally	5	Easy to implement.
Simplicity externally	5	Does not affect.
Availability	5	This approach has been used in other areas.
Tested	5	Same as above.

12.4.8 Introduce a Fee for Fossil CO₂

Being environmental friendly and also reducing a companies climate impact does often go hand in hand with cost efficiency. Otherwise it would be difficult to achieve progress without going out of business. Some measures, however, are hard to implement because they are costly. By introducing a cost for all CO₂ generated it would be in a company's best interest to reduce their CO₂. If a company already have come far, even farther than their competitors it would be desirable with such a fee. It would make their product relatively cheaper than their competitors.⁸²

Climate potential: No reduction of CO₂ is directly gained by this measure but it would have a large impact on companies and their way of doing business.

Finance: A climate friendly company with low climate impact would, with high probability, be a prospering company.

Implementation: This would have to be implemented by governments simultaneously to be able to avoid unfair competition.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	2	By being forced to pay for all emission will put high pressure on both trying to reduce tonkm and emissions.
Reduces fossil CO ₂ per tonkm	2	Same as above.
Reduces costs	0	It does not reduce costs.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	1	It will increase cost significantly.
Simplicity internally	2	Difficult to get commitment within the organization.
Simplicity externally	1	Difficult to influence governments to impose taxes and fees.
Availability	1	There are some fees on fuels connected with emissions.
Tested	5	Taxes are a common political instrument for influencing a society.

⁸² Lidgren, Karl. *Industriell miljöekonomi*, Liber Ekonomi, Malmö, 1993, page 101-103, 167-213

12.4.9 Measure CO₂

Implement a system that makes it possible to evaluate the amount of CO₂ that Tetra Paks transportations are responsible for. It is important to have a system with a short lead time which makes it possible to see results from actions taken not long ago.⁸³ Another benefit with such a system would be the possibility to compare different alternatives before making final decisions.⁸⁴

Climate potential: Transports that are carried out with an above average impact on the climate will be used fewer times. What gets measured also gets improved. Without measuring the actual emissions it is difficult to grasp the problem and to motivate a change. With a tool that has the capability to present information about which forwarder can carry out a particular consignment with the least emissions gives the buyer the ability to make a wiser choice.

Finance: Initially this action will be an investment for the future.

Implementation: Much information is needed from the companies that are responsible for transporting goods. It is also necessary to develop a standard for this information and setting up an interface. This would have to be done for rail, sea, road and air with comparable variables. Even though there are many companies in Europe willing and able to share this information this is not true globally. Another problem that mainly exists within the road sector is that there is a large amount of haulage contractors and therefore a fragmented market with many participants that lack advanced IT-systems. Tetra Pak would have to develop its Enterprise Resource Planning (ERP) system further.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	3	Measuring CO ₂ has a motivational impact on reducing both tonkm and emissions. It facilitates further climate achievements.
Reduces fossil CO ₂ per tonkm	3	Same as above.
Reduces costs	2	It is possible that it facilitates in finding cost efficient solutions.
Reduces costs (%)		No data.
Increases income	0	Does not affect.
Requires investments	3	Some effort is needed.
Simplicity internally	3	Same as above.
Simplicity externally	1	General calculations are used. Tools and standards are almost nonexistent.
Availability	1	Same as above
Tested	2	Different attempts have been performed.

⁸³ Interview Nilsson, Evert. *Senior Lecture*, LTH, 07-02-05

⁸⁴ Interview Jansson, Hans. Team Sea, TLGT&T, Tetra Laval, Lund, 07-01-30

12.4.10 Set Climate Goals

A great motivation for actual change is to set goals that people can aspire to. Goals should be set in a way that they are challenging though feasible.

Climate potential: The potential of setting goals is linear to the goals set.

Finance: Setting goals in itself does not cost anything, achieving them can cost money but not necessarily.

Implementation: Goals should be set after carefully analyzing the circumstances in a way that the level of difficulty is appropriate.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	2	Organizations and employees strive for reaching set goals and the goals makes the working process easier.
Reduces fossil CO ₂ per tonkm	2	Same as above.
Reduces costs	1	Has potential of reducing cost but uncertain.
Reduces costs (%)		No data.
Increases income	1	Has potential of increasing income but very uncertain.
Requires investments	4	It is necessary to investigate what the reasonable goals are and to motivate how they are set.
Simplicity internally	4	Same as above.
Simplicity externally	4	The forwarding agents can be affected by the organization trying to reach the goals.
Availability	4	Goals are highly available but are constrained by finding the correct goals.
Tested	5	Goal is a common tool to make something happen.

12.4.11 Share Knowledge

Being a prominent player within the climate field makes it possible to share knowledge with not so prominent players. When acting at the forefront further measures can be hazardous and not so beneficial. Then sharing the expertise gathered through prior experience to other organizations can have greater impact on reducing the climate impact.

Climate potential: Even though climate change has been a debated topic for some time, many companies have not yet taken actions to reduce their impact and are unsure how. By helping these organizations reducing their emissions the climate has a lot to gain.

Finance: This would not require large resources and some strategic gain can be achieved, if carried out with that in mind.

Implementation: This can be realized either by letting organizations establish contact or by actively contacting other organizations.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	1	Other organizations can gain knowledge and experience of good practice in concerns involving the climate.
Reduces fossil CO ₂ per tonkm	1	Same as above.
Reduces costs	0	Does not affect.
Reduces costs (%)		No data
Increases income	1	By building relations with other organization it is possible to gain more business and thereby increase sales.
Requires investments	4	No necessary investments are required other than being open to communicate what Tetra Pak's experiences are.
Simplicity internally	5	Rather easy to communicate prior experience.
Simplicity externally	3	Organization must implement Tetra Pak's measures but can work with the awareness of them being tested.
Availability	5	Tetra Pak share knowledge to other organizations today.
Tested	5	Same as above.

12.4.12 Buy Emission Rights

The trade with emission rights started in 2005⁸⁵. The concept is that facilities, such as factories, that create CO₂ emissions will be given the right to release a certain level of emission with a yearly reduction. If one factory have a cheap way of reducing its emissions greatly they can do so and then sell the unused emission rights that makes out the difference between actual and allowed emission. Another factory which would have to make considerable investments to reduce their emission and that releases more emissions than allowed can buy emission rights from the first factory. The purpose of this concept is to ensure that the best and most cost beneficial solutions will be performed in the nearest future and that it does not matter where the reduction takes place, the important aspect is that it gets made. It also creates an opportunity for everyone to buy pollution credits and not using them, so that the environment can benefit further.⁸⁶

Climate potential: Buying an emission right and not using it ensures that somewhere a reduction in CO₂ emission occurs. This can offset the actual emissions caused by freight transportations. It is important to note that this is not the solution to the problem but a tool for getting there. It should not be used as a mean for not taking the proper responsibility for ones action.

Finance: It will be considered as a cost but it can be cheaper than taking other actions for reducing CO₂.

Implementation: A calculation of the present level of emissions caused by the company will be necessary to buy a suitable amount of emission rights to offset the generated amount of CO₂.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	3	It is possible to offset all emissions but it can be questioned how large the actual climate gain will be. It can not be seen as a final solution.
Reduces costs	0	Does not affect.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	1	It is necessary to always offset emissions and have a system for measuring actual emissions and trading emission rights.
Simplicity internally	4	Fairly easy to demand or to buy offsets oneself.
Simplicity externally	4	Does not affect other than the necessity of suitable system for measuring emissions.
Availability	5	Several companies offer and use emission rights.
Tested	5	Same as above.

⁸⁵ <http://www.analyskritik.press.se/energipolitik/Utslappsrattigheter.htm>

⁸⁶ Interview Porsgaard, Martin. *Environment Manager*, SAS Group, 07-02-27

12.4.13 Change Customer Behavior

Customers have implemented concepts such as Just in Time, JIT, which stresses the importance of reducing inventory and instead getting the goods when they are needed. Customers therefore demand that it should be possible to receive the goods with short notice. This should be considered as a deviation from the original concept which stresses the need of getting the goods at the right time and not the fastest way possible. By opening up for a dialog with a company's customers and cooperating in a way that makes it possible to get an early notification of orders and therefore have longer time-spans for delivery. This would simplify the planning process and thereby introduce new possibilities, such as utilizing slower but more climate friendly transportation modes.^{87 88}

Climate potential: By being able to optimize logistics it is possible to reduce the transportation effort thereby reducing the amount of fossil fuel used. Also by being able to use means of transportations with a lower climate impact an improvement is achieved.

Finance: If implemented correctly a cost cutting effect would be achievable.

Implementation: Establishing a dialog with customers is crucial and then to influence customers to adjust their ordering praxis. This can be done by explaining the cost benefits and climate benefits associated with improved flexibility.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	2	Some flows of goods can change transportation mode and thereby reduce emissions considerable. For most goods a smaller reduction can be achieved by increasing the utilization of capacity.
Reduces costs	2	Same as above.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	4	No large investments necessary.
Simplicity internally	3	Increased commitment within the organization and communication with customers.
Simplicity externally	1	Customer must change their way of planning and ordering.
Availability	4	Knowledge and tools are available.
Tested	5	It has been done before.

⁸⁷ Interview Johansson, Ingmar. *Environment Manager*, Maersk Line, 07-02-27

⁸⁸ Interview Nilsson, Evert. *Senior Lecture*, LTH, 07-02-05

12.4.14 Develop Light Products

By reducing the weight and size of products the need for transportations is lessened

Climate potential: Reduced transports will lead to a reduction in the use of fossil fuels and less waste of packaging materials can lead to lower deforestation.

Tetra Paks packaging material has already been improved by reducing the weight needed to make one container. If there is a possibility to continue to reduce the weight of packaging materials it would have a large impact on transportations. Reducing the size and weight of machines and equipment would also be beneficial but would not have the same impact because they are not sold in those large quantities.

Finance: Cost of raw material and cost of transportations would decrease but most importantly it would be a competitive advantage that could increase market share.

Implementation: Research and development within Tetra Pak continuously tries to develop their products so this measure is not something new. If it is seen as crucial or if it is thought to have high potential it could be nurtured further by education and informing the employees in R&D and assigning resources to make it possible for them to focus even more.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	1	A reduction in weight is an equivalent reduction in tonkm. Further reduction possibilities are limited.
Reduces fossil CO ₂ per tonkm	0	Does not affect.
Reduces costs	1	Reductions in transportation costs as well as material costs are achievable but limited due to previous improvements.
Reduces costs (%)		No data.
Increases income	2	Improved product.
Requires investments	2	Further reductions can be costly.
Simplicity internally	2	R&D must further enhance the product line.
Simplicity externally	5	Does not affect.
Availability	4	Knowledge and tools are available.
Tested	5	Common R&D challenge.

12.4.15 Exchange Goods

Companies that are being supplied similar goods as another company or supplying similar goods as other companies can initiate a collaboration. By reducing unnecessary long distances the transportation effort reduces. See Figure 23.⁸⁹

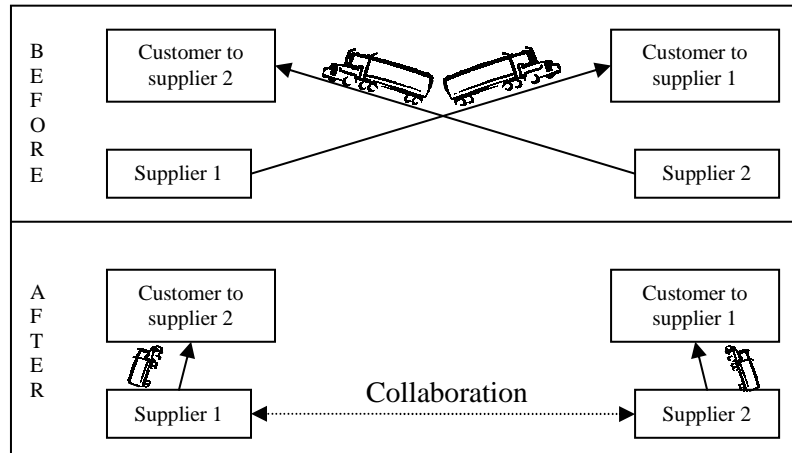


Figure 23

Climate potential: Exchanging goods will lead to a reduction in the use of fossil fuels.

Finance: Reduced need for transportations will lead to lower transport costs.

Implementation: It is necessary that the goods that will be exchanged have no important differences. It also would be preferable if both companies had an equal gain in the collaboration. Then it would be wise to decide if it is necessary that an identical amount of goods must be exchanged or if it would be agreeable if a possible difference could be compensated in monetary terms.

⁸⁹ Transportforum 2007, Linköping. 07-01-10/11

Reduced Climate Impact from Tetra Paks Transportations

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	1	Finding suitable goods and compatible organization can reduce those emissions greatly but these flows are few.
Reduces fossil CO ₂ per tonkm	0	Does not affect.
Reduces costs	1	Same as <i>reduces tonkm</i> .
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	3	Building a close relationship with organizations with similar raw material can demand much effort.
Simplicity internally	2	Mutual understanding and cooperation between organizations.
Simplicity externally	2	Same as above.
Availability	1	Suitable partners are difficult.
Tested	5	Shell and Statoil has successfully implemented this measure.

12.4.16 Improve Planning

By implementing systems for gathering information and using it effectively can facilitate in the ability to plan actions. A company that only knows what happens in the nearby future has little flexibility and is therefore restrained of using costly actions which have large impact on the climate.⁹⁰

Climate potential: By not being forced to use modes of transportations with high emissions the climate impact can be reduced⁹¹.

Finance: Planning can help cutting cost and making a company more competitive.

Implementation: Installing advanced systems can be one part of the solution but the most important one is having a fruitful dialog between different parts and functions of the company in a way that makes it possible for more people to enhance their understanding of the situation.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	1	By being able to switch transportation mode for some of the goods it is possible to reduce emissions.
Reduces costs	1	Cheaper transportations modes can be used.
Reduces costs (%)		No data.
Increases income	0	Does not affect.
Requires investments	4	Systems, routines and attitudes ought to improve.
Simplicity internally	4	Same as above.
Simplicity externally	4	Same as above.
Availability	5	Knowledge and logistical tools are available
Tested	5	It is being performed.

⁹⁰ Meeting Lindahl, Björn, Team Road, TLGT&T, Tetra Laval, Lund, 07-02-05

⁹¹ Rapport 2000:7, Method for Socio-economic analyses of environmental measures, Naturvårdsverket, Örebro, 2000, page 88

12.4.17 Improve Production Flexibility

Large companies often have several factories around the world not doing the exact same product but very similar ones. These products are then shipped around the world even passing another factory before reaching the final customer. By improving the flexibility within production a factory can manufacture a wider range of products, thereby provide the customers close by with the products they need without being forced to ship them round the globe.

Climate potential: This measure has potential of greatly reducing the need for transportation thereby reducing the climate impact. It should be noted that it is not just the distances traveled but also the transportation mode. Therefore it is not always true that reduced distance naturally means lower emissions because those distances could be transported with ships thereby not having a great impact on the climate.

Finance: Improved flexibility can mean increased investments, but reduced cost for transportation and better being able to fulfill customer satisfaction can greatly outweigh the drawbacks.

Implementation: First of all a mapping is necessary to identify the different products being manufactured, the unique distinction between those products, the flow of transportation and its emissions. Then an improvement in the machinery and production process would follow.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	3	Tetra Pak has several plants globally which transports over long distances. By increasing flexibility and thereby enabling to supply all products to customers in the proximities the need of transportation can be reduced.
Reduces fossil CO ₂ per tonkm	0	Does not affect.
Reduces costs	2	Reduced transportation cost.
Reduces costs (%)		No data.
Increases income	0	Does not affect
Requires investments	1	Can be large because of need for complex manufacturing equipment and increasing demands on planning.
Simplicity internally	1	Same as above.
Simplicity externally	4	Does not affect other than new routes must be established
Availability	5	Knowledge and tools are available.
Tested	5	It has been done before.

12.4.18 Improve Routes

Large transportation companies have means for optimizing the transportation of goods handled by them. Even so, they do not control variables such as quantity, time of notification, time to delivery, address for pick up and delivery. By improving routes in collaboration with the forwarding companies, unnecessary deviation can be avoided and an optimal flow can be created.^{92 93 94}

Climate potential: Reduced transportation means lower climate impact.

Finance: Optimizing routes often mean minimizing costs.

Implementation: Always ensuring optimal flow of goods requires appointed employees working daily with optimizing logistics and being responsible for having a creative dialog with forwarding companies.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	2	Improving routes reduces the distance traveled.
Reduces fossil CO ₂ per tonkm	0	Does not affect
Reduces costs	2	Improved fuel consumption as well as needed time.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	3	Systems and personnel are needed to always ensure optimal routes.
Simplicity internally	3	Same as above.
Simplicity externally	4	Does not provide a large obstacle for providers of transportations services.
Availability	5	Knowledge and tools are available.
Tested	5	Tetra Pak are dedicated to ensure optimal routes.

⁹² Interview Hammarberg, Ulf. *Head of Corporate Citizenship*, DHL Express Sverige, 07-02-08

⁹³ Interview Jadsen Holm, Monica. *Environment Manager*, Schenker, 07-02-13

⁹⁴ Interview Johansson, Christel. *Environment Manager*, DSV, 07-02-26

12.4.19 Improve Utilization

Forwarding agents and their customers must work continuously to utilize as much of the cargo capacity of each vehicle as possible. For example, this is done by increasing the amount of orders that make use of entire trucks or finding goods that can be loaded together with Tetra Pak's goods.

Product design and packaging design have large impacts on the utilization of cargo carriers. By optimizing products ready to be shipped the largest possible quantity can be carried with the vessel. If the product does not occupy the whole cargo space of the vehicle it is important to make it compatible to other products being shipped.⁹⁵ Bookings can also be made more efficient by having a rewarding dialog with ones customers and suppliers⁹⁶.

Climate potential: Improved utilization means lower fuel consumption per tonkm.

Finance: By simplifying the work effort needed for the forwarding agent, costs can be reduced.

Implementation: It is crucial to involve all steps in the supply chain to make it possible for the most efficient utilization of cargo space.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	2	Very important to ensure that every truck is being used optimally.
Reduces costs	1	Fuel consumption makes out 1/3 of the transportation costs.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	4	Improved planning and general logistics.
Simplicity internally	4	Some changes can be necessary
Simplicity externally	4	They need to constantly try to optimize utilization.
Availability	5	Knowledge and logistical tools are available.
Tested	5	It is being performed.

⁹⁵ Interview Johansson, Christel. *Environment Manager*, DSV, 07-02-26

⁹⁶ Rapport 2000:7, Method for Socio-economic analyses of environmental measures, Naturvårdsverket, Örebro, 2000, page 88

12.4.20 Plant Forests

Trees have the ability to transform and to absorb CO₂. By planting more trees and increasing the global vegetation more CO₂ will be removed from the atmosphere.

Climate potential: In the long-term it is important not to diminish the global vegetation and even increasing it but the process of removing CO₂ from the atmosphere this way works very slowly.

Finance: This will be an investment.

Implementation: First of all land with little vegetation have to be found. Because the trees will have to be there for a long time to have a chance of being productive, the owner of the land must guarantee the continued intention of letting a forest occupy the land. The easiest way of doing that is by procuring the land. Buying a large amount of small trees is fairly cheap but the process of planting them can be more expensive. The forest can then grow as primeval forest without much supervision, otherwise a caretaker must tend to the forest. One alternative would be to donate the land and the forest to the government with the condition of not letting it be used for another purpose.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	1	Large areas are needed which must be undisturbed for hundreds of years.
Reduces costs	0	Does not affect.
Reduces costs (%)		No data
Increases income	0	Does not affect sales.
Requires investments	3	The plantation of trees is very cheap but costs are linked to purchasing of land and paying for forestry.
Simplicity internally	4	No great obstacles are visible other than investing effort outside a company's core business.
Simplicity externally	5	Does not affect.
Availability	5	Highly available.
Tested	5	Several companies plants forests today.

12.4.21 Prevent Damaged Goods

Damaged goods lead to increased need of transportation. First goods are being sent and when it arrives it is being identified as damaged which means that another transport is necessary.

Climate potential: Reducing the need for transportations reduces the climate impact but to what extent? It depends on how often damage goods occur today and how serious the damages are.

Finance: Reducing damage goods does not just reduce the transportations needed from a factory to one customer but also the transportations to the factory from its supplier. It also reduces the amount of goods that needs to be manufactured and the administration concerning damaged goods.

Implementation: Reducing damaged goods can be done in collaboration with suppliers, customers and the companies providing transportation services. Together system and routines can be implemented in a way that all can benefit from.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	1	Every damaged goods leads to more transportations but luckily the amount of damaged goods are low.
Reduces fossil CO ₂ per tonkm	0	Does not affect.
Reduces costs	1	Not only are reductions in transportation costs achievable but also manufacturing costs and material costs.
Reduces costs (%)		No data.
Increases income	0	Does not affect.
Requires investments	4	It is mainly about routines and attitudes.
Simplicity internally	3	Changing attitudes are a challenge.
Simplicity externally	3	Same as above.
Availability	5	Knowledge and quality tools are available.
Tested	5	It is a common operational challenge.

12.4.22 Reduce waste

By minimizing all waste that is being produced it is possible to reduce unnecessary transportations.

Climate potential: Reduced transports will lead to a reduction in the use of fossil fuels and less waste of packaging materials can lead to lower deforestation.

This measure is closely tied to the amount of waste being produced today. With very little waste being produced it will be difficult to improve material efficiency without increasing cost.

Finance: By minimizing waste along the value chain, unnecessary transports can be made redundant but the main saving associated with reducing waste lies in decreased cost of material.

Implementation: Tetra Pak already have a very low average of waste but because it is not zero it can be improved. It would be important to evaluate Tetra Paks supplier of raw material, the manufacturing process and their customers handling of Tetra Paks products. Tetra Pak supplies both machines and material, which makes it possible to improve the machines in a way that they do not cause waste of material.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	1	Reducing waste has been a priority for a long time and further reductions is limited.
Reduces fossil CO ₂ per tonkm	0	Does not affect.
Reduces costs	2	Reduction in tonkm as well as raw material and finished products.
Reduces costs (%)		No data
Increases income	0	Does not affect
Requires investments	2	There are both low cost measures and expensive measures to reduce waste.
Simplicity internally	1	Changing employee's behavior and machines characteristics will acquire much effort.
Simplicity externally	5	Does not affect.
Availability	4	Knowledge and tools are available.
Tested	5	Common operational challenge.

12.4.23 Relocate

Setting up factories and warehouses at logistical junctions and thereby reducing the distance which the goods need to travel.⁹⁷

Climate potential: Relocation will lead to a reduction in the use of fossil fuels. Even though it is possible to reduce the needed transports there are many other factors that are seen as more important when choosing a suitable location for a factory.⁹⁸

Finance: The cost of transportations would be reduced but what happens with the total cost is uncertain.

Implementation: It would have to be a critical factor when choosing where to locate its business. Furthermore there would be a need of analyzing where a suitable location could be by evaluating the value chain.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	5	Locations for factories and warehouses are fundamental for distances between suppliers and customers.
Reduces fossil CO ₂ per tonkm	0	Does not affect
Reduces costs	3	Savings in transportation costs are highly visible.
Reduces costs (%)		
Increases income	0	
Requires investments	1	Several variables other than transportation cost are crucial when selecting location.
Simplicity internally	1	Relocation implies a large change for any organization.
Simplicity externally	4	Large changes in the flow of goods require the forwarding agent to adjust its operation.
Availability	5	Knowledge and tools are available.
Tested	5	Common management challenge.

⁹⁷ Meeting with Lars J Nilsson, Senior Lecture, LTH 07-03-12

⁹⁸ Interview Lundahl, Lars, *Global Environment*, Tetra Pak AB, 07-03-19

12.4.24 Renew Vehicles

Newer vehicles can take advantage of improved technology know-how and they have to comply with the latest environmental demands.^{99 100}

Climate potential: By renewing a company’s fleet of vehicles a reduction in fuel consumption as well as an even higher reduction of emissions can be possible.

Finance: Newer vehicles are an investment but from a financial point of view a vehicle should not be kept after its economic lifespan.

Implementation: Purchaser of transportation services makes demands on its haulers to have a modern fleet of vehicles. The supplier of transportations services constantly renews old vehicles and replaces them with newer ones.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	2	Newer vehicles, with some exceptions, have better fuel economy.
Reduces costs	1	1/3 of the transportation costs are from fuel.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	1	New vessels are a large investment for the provider of transportation services but are usually a profitable investment in the long term.
Simplicity internally	5	Easy to implement as a demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	2	The simplicity depends on the age structure of the fleet of vessels but can be considered expensive.
Availability	4	New vessels are available but ships takes years to build. Trucks are easier but at the moment the time before delivery is relatively long because of lack of capacity from manufacturers.
Tested	5	Established concept.

⁹⁹ Interview Henstedt, Anna. *Product Specialists*, Scania, 07-13-14

¹⁰⁰ Interview Sandberg, Helena. *Supply Chain Management*, Scania, 07-13-14

12.4.25 Store CO₂

There are different technologies of capturing CO₂ and transform it to liquid form. Then it would be possible to use dried up oil fields to pump down liquid CO₂ and storing it there.

Climate potential: If done in very large scale this would remove the excess CO₂ from the atmosphere thereby minimizing the affect on the climate.

Finance: This would be a huge investment if done in a large enough scale.

Implementation: First a technology that is cheap enough would be essential and then adopt it for large scale CO₂ capturing. Thereafter the CO₂ have to be stored for a very long time and finding that stable storing facilities would also be very challenging.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	1	Large scale operations not in use.
Reduces costs	0	Does not affect.
Reduces costs (%)		No data.
Increases income		Does not affect sales.
Requires investments	0	Large barriers need to be overcome before it can be realistic.
Simplicity internally	0	Same as above.
Simplicity externally	5	Does not affect
Availability	1	Research is being made.
Tested	1	Same as above.

12.4.26 Utilize Hybrid Vehicles

Hybrid is a functional unit in which two or more different technologies are combined to satisfy a given requirement. For transport vehicles hybrid is commonly a vehicle which uses both electricity and combustion for propulsion. There are different kinds of hybrid technologies, for example series hybrid, parallel hybrid and power split hybrid. By using a series hybrid, a combustion engine is used to rotate a generator which gives electricity to an electrical engine. The advantages are that the combustion engine is only used when necessary and furthermore the engine can run on optimum RPM. Other vehicles have none or little ability to reuse energy from retardations but with an electrical hybrid it is possible to store the energy that normally gets lost when breaking.¹⁰¹

Climate potential: Reduced fuel consumption will lead to a reduction in the use of fossil fuels. If the combustion engine runs on renewable energy the emission of fossil CO₂ will be eliminated further.

The technology is not widely available for heavy trucks, although many prototypes are being tested. According to Volvo they will have hybrid heavy trucks on the market in 2009.¹⁰²

There are trains and ships that already uses hybrid technology but not to a large extent.¹⁰³

Finance: The vehicles with hybrid technology are more expensive to buy but have the potential to save money by reducing fuel costs. The highest potential is for vehicles which normally have high fuel consumption and are being used much. Furthermore a long economic lifespan will increase the possibility of pay back.

Implementation: Hybrid heavy trucks are not available yet but will be in a few years. Then all that is required is that the road carriers buy them. Buyers of transportations services which focus on the environment and the climate should prepare their supplier that they are interested in buying transportation services that make use of hybrid technology in a few years.

¹⁰¹ Transportforum 2007(Volvo), Linköping. 07-01-10/11

¹⁰² Ibid

¹⁰³ Transportforum 2007(Vägverk/Banverk), Linköping. 07-01-10/11

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<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect
Reduces fossil CO ₂ per tonkm	3	By better utilizing the energy stored in fuels, a better fuel consumption can be achieved.
Reduces costs	2	Reduced cost of fuel.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	0	Very expensive today.
Simplicity internally	5	Easy to implement as demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	0	Not available and therefore not possible to implement.
Availability	0	Same as above.
Tested	1	Some projects has tested the technology.

12.4.27 Educate on Heavy Ecodriving

Heavy Ecodriving aims at educating drivers so that they can be able to drive more fuel efficiently and thereby also drive more economically.¹⁰⁴ The average fuel saving for drivers who have no prior experience of Ecodriving is 13 %. Additional benefits such as lower wear on breaks, driveline and tires can be drawn but also improved safety.¹⁰⁵

Climate potential: It will lead to a reduction in the use of fossil fuels.

Finance: Fuel cost reduces with 13 %. Fuel makes out for one third of the costs for a road carrier which means that the price of transportations can be reduced with more than 4 %. Further savings are possible due to less wear and tear but there will also be an initial investment for educating all drivers.

Implementation: To be able to implement ecodriving, Tetra Pak should require ecodriving from all its supplier of road transport services. Furthermore, Tetra Pak should ensure that the savings the road carriers are able to make reflects in their prices. It is not likely that all the savings will be reflected in Tetra Pak's income statement.

Ecodriving is widely available in Scandinavia but not all over the globe which reduces the potential.

Variable	Grade	Explanation
Reduces tonkm	0	Same number of tonkm
Reduces fossil CO ₂ per tonkm	2	13 % fuel savings
Reduces costs	1	13 % fuel savings, fuel makes out 1/3 of the cost for transportation → $13\% * \frac{1}{3} \approx 4,3\%$
Reduces costs (%)	4,3	4,3 %
Increases income	0	Does not affect sales
Requires investments	3	Various costs around 300 - 500 € per driver. Ecodriving with included follow-up systems are more expensive.
Simplicity internally	5	Easy to implement as demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	4	The technique is tested, available, profitable and easy. The only obstacle is how wide-spread it is globally.
Availability	4	It is very available in Northern Europe and should be relatively easy to transfer globally.
Tested	5	It is been tested thoroughly.

¹⁰⁴ Rapport 2000:7, Method for Socio-economic analyses of environmental measures, Naturvårdsverket, Örebro, 2000, page 88

¹⁰⁵ http://www.ecodriving.se/vad/vanliga_fragor.asp?level_01=01&level_02=05, 07-02-15

12.4.28 Optimize Tire Pressure

By ensuring that the tires on a truck always have the optimum pressure is a crucial factor for not adding unwanted friction. If the pressure is too low the fuel consumption goes up¹⁰⁶.

Climate potential: Correct tire pressure will lead to a reduction in the use of fossil fuels if it is assumed that it is not correct already.

Finance: Optimum tire pressure saves money because of lower fuel consumption.

Implementation: A purchaser of road transportations can stipulate a demand that the haulers ensure correct tire pressure. The hauler can then either create a daily routine for checking tire pressure or have a system in the truck that constantly supervises the pressure.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	1	3 % lower fuel consumption for those trucks with wrong tire pressure is achievable. Assume 10 % of all trucks drive with wrong tire pressure. That means a total reduction by 0,3 %. $3\% * 10\% = 0,3\%$
Reduces costs	1	Fuel makes out 1/3 of the transportation costs and therefore costs reduces by 0,1%. $0,3\% * \frac{1}{3} = 0,1\%$
Reduces costs (%)	0,1	Same as above.
Increases income	0	Does not affect sales.
Requires investments	4	Systems or routines need to be implemented.
Simplicity internally	5	Easy to implement as demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	4	Should be easy enough but some trucks still drive with wrong tire pressure.
Availability	5	High availability.
Tested	5	Same as above.

¹⁰⁶ Rapport 2000:7, Method for Socio-economic analyses of environmental measures, Naturvårdsverket, Örebro, 2000, page 88

12.4.29 Reduce Road Utilization

Reducing the road utilization in favor for sea and most preferably rail would reduce fuel usage per tonkm.¹⁰⁷ By improving possibilities for reloading and actively seek out opportunities for changing transportation mode, more climate friendly transportations can be used. Problems still remain because of difficulties of reaching everywhere with trains and ships. Therefore, some road utilization will be necessary in most cases but for certain routes it can be acceptable.

Climate potential: Changing transportation mode from road to rail or sea has potential of reducing the climate impact greatly. This is under the assumption that there is free rail capacity on the railroads or a sea route operating the alleged route. The largest difference will occur if the trains use electricity that has been generated from renewable energy sources but even a diesel train would be an improvement compared to trucks.

Finance: It would also be considered as a much cheaper way of transporting goods if reloading does not constitute a large problem. Possible drawback could be with what flexibility and speed the goods are being shipped with.

Implementation: Suitable routes have to be identified and the companies operating the railroads and sea routes must be contacted. The process of writing agreements and solving possible obstacles can be considered more difficult for rail than for road transportations.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect
Reduces fossil CO ₂ per tonkm	2	Enabling a change to other transportation modes that have less emissions will reduce the total emission considerable but it will not be possible for all transportations.
Reduces costs	2	Same as above.
Reduces costs (%)		No data.
Increases income	0	Does not affect
Requires investments	3	Makes transportations more difficult and the internal planning more complex.
Simplicity internally	3	Same as above.
Simplicity externally	5	Does not affect.
Availability	1	Difficult to find suitable alternative for road utilization for most flows of goods.
Tested	5	Have been done before.

¹⁰⁷ Interview Enell, Magnus. *CEO, Sustainable Business Hub*, 07-02-07

12.4.30 Utilize Biodiesel/FAME/RME

Biofuels are extracted from biological materials such as wood, sugar cane, sugar beet, rape or corn. They emit as much CO₂ as fossil fuel but the difference is that during its growth the biological material absorbs and decomposes the equivalent amount of CO₂.¹⁰⁸ Growing and combusting biofuel is almost a closed circle and does not contribute much to increasing the amount of CO₂. Refining biofuel is a critical issue because much energy is needed within the process but this is also true for the process of refining fossil fuels. Diesel is widely used within heavy vehicles, ships and trains because of high fuel efficiency and the equivalent biofuel is biodiesel. Rapeseed Methyl Ester or RME is a biodiesel that is common in Europe and is produced from rapeseed, in the USA corn and soy is often used to produce other types of biodiesel.

Climate potential: Biodiesel has the potential of profoundly reducing the impact on climate though many problems remain. It takes a lot of energy to transform biomass to liquid fuel that is suitable for engines and the overall energy loss is substantial. This would not be a problem if there was an abundant quantity of biomass but there is not. When a material is limited it can be augmented that it should be used where it can be utilized with the highest efficiency, which is in power plants where the efficiency ratio is much higher.

Finance: With higher oil prices due to shortages, biodiesel can be a very economic alternative. Today the difference in cost between using fossil diesel and biodiesel is small within the road sector which would facilitate a shift towards biodiesel. Ships have the ability to use different fuels such as no. 6 fuel oil which is also called residual fuel oil or heavy fuel oil. This fuel is much cheaper than biodiesel why it is harder to motivate a shift within the shipping industry as well.

¹⁰⁸ <http://www.biodiesel.de/> http://www.uppfinnaren.com/2006/nr4_06/ageratec.htm, 07-03-14

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Implementation: There is a limited supply and capacity for producing biodiesel but it is available. Regular trucks can shift to biodiesel without making large modifications because the fuels are very similar. The main difference from fossil diesel is that biodiesel can act as a solvent on rubber and some older trucks must therefore change all gaskets and hoses. Some newer trucks for example from Scania do not need any modifications at all. Biodiesel is a superior fuel to fossil diesel because it is cleaner and has better lubrication but this can also be a problem when shifting to biodiesel. Old deposits from fossil diesel within the fuel line can be cleaned with biodiesel and flow onwards and cause blockages in the fuel injectors. Few filling stations offer 100 % biodiesel which is not a large obstacle because trucks travel a few thousands kilometers between every filling which together with the existing filling stations mean that it is possible to solely rely on biodiesel. Large haulage firms have an own filling station which can supply the company's vehicles with biodiesel. Before demanding that a company's transportations will be carried out using biodiesel it is advisable to investigate the local conditions to ensure the existence and practicability of biodiesel. Then to check the current fuel price differences is advisable to know what the consequences of demanding biodiesel will be. Biodiesel have trouble operating at temperatures below -21° Celsius which implies that fossil diesel should be used under those circumstances. Increasing demand would probably also push the research forward to develop better trucks and fuel qualities.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect
Reduces fossil CO ₂ per tonkm	4	No fossil CO ₂ is being released when utilizing biodiesel but some fossil CO ₂ can have been used in the manufacturing process.
Reduces costs	0	Does not affect today. With higher oil prices it could be a favorable alternative.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	4	Some relatively small investments can be necessary for most trucks but some trucks need no investments.
Simplicity internally	5	Easy to implement as a demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	4	Necessary to modify a company's trucks and also secure the supply of biodiesel.
Availability	3	It is available in Europe, Brazil and the USA but not to the same extent as fossil diesel.
Tested	5	Some trucks run on 100 % biodiesel today and almost all run on at least 2 %.

12.4.31 Utilize Larger Trucks

Most countries do not allow for combinations of truck and trailer longer than 18,75 m. Some countries such as Sweden allow up to 25,25 m. The added length means that fewer trips will be necessary because one vehicle can transport more goods without a proportional increase in fuel consumption.^{109 110}

Climate potential: Larger trucks will lead to a reduction in the use of fossil fuels.

Finance: Trucks that can carry more goods will cut cost such as the number of transports needed and the amount of fuel used per tonkm.

Implementation: There are vehicles available up to 25,25 m. Truck drivers who are qualified to drive a shorter trailer are also qualified for longer vehicles. There are few hurdles along the way besides legislation.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect
Reduces fossil CO ₂ per tonkm	3	By lengthen the loading area of the truck from 13 m to 21 m a general increase in fuel consumption from 35 l/100km to 45l/100km is likely. $\frac{4,5}{3,5} \frac{21}{13} \approx 0,8$. A reduction of 20 % in fuel consumption has been accomplished.
Reduces costs	3	20 % reductions in fuel costs that make out 1/3 of the transportation cost imply a 7 % reduction in costs. $20\% * \frac{1}{3} \approx 7\%$
Reduces costs (%)	7	Same as above.
Increases income	0	Does not affect sales.
Requires investments	5	Purchase larger trucks rather than regular trucks. Larger trucks are cheaper than regular trucks per square meter.
Simplicity internally	5	Easy to implement as a demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	1	Only a few countries allow larger trucks.
Availability	3	There are several manufacturers offering larger trucks. Few countries accept the use of larger trucks today.
Tested	5	Has been utilized for many years in Sweden, Finland and Australia.

¹⁰⁹ Interview Enell, Magnus, CEO, Sustainable Business Hub, 07-02-07

¹¹⁰ Hultberg, Richard. Key Account Manager, SAS Cargo Group, 07-02-12

12.4.32 Utilize Route Planning and GPS

The shipping agent will be able to determine where the truck and the driver are at all times which improves the agents' ability to plan and make good decisions. The driver gets improved knowledge of position and the optimal route to his or hers destination. This will save both fuel and time. It is important that the system includes a mode for the most fuel efficient route.¹¹¹

Climate potential: Route planning will lead to a reduction in the use of fossil fuels.

Finance: This is a fairly large investment for a forwarding agent but it also reduces fuel, time and improves the flexibility of a business.

Implementation: The systems are fairly advanced and expensive which makes it difficult for all forwarding agents and road carriers to adopt it all around the world. Many road carriers are one-man businesses on a large fragmented market which makes it complicated to involve everyone.

Most GPS navigators have three alternatives; fast route, short route or dynamic route and the last alternative implies that it has the ability to avoid traffic stockings. It is not yet common to have a fuel efficient mode which is not always the shortest route because of accelerations and retardations.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	2	An optimal route reduces distance.
Reduces fossil CO ₂ per tonkm	0	Does not affect
Reduces costs	2	Reduces both fuel and time.
Reduces costs (%)		No data.
Increases income	0	Does not affect
Requires investments	2	Considerable investments are necessary both in every truck but also a central system for logistics.
Simplicity internally	5	Easy to implement as a demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	3	Must implement a completely new system.
Availability	5	Several providers offer similar systems.
Tested	5	Same as above.

¹¹¹ Transportforum 2007, Linköping. 07-01-10/11

12.4.33 Biogas

When biological waste is degraded by microorganisms in an environment free from oxygen, biogas is being produced. This can then be used as a fuel for cars, buses and trucks.¹¹²

Climate potential: Biogas does not release fossil CO₂.

Finance: There are some countries that subsidize the use of biogas but mostly when used in cars. The price of buying a truck operating on gas is very expensive, up to 50 % more than a regular truck.

Implementation: Most trucks must be modified after purchase because the manufacturers do not offer any heavy trucks running on gas. There is limited amount of filling stations which is critical because gas trucks have shorter range from one tank. Although there are examples where there is a surplus on biogas and where power plants use the remains. An important advantage with biogas is that it uses less area for cultivation relative the fuels energy efficiency compared to other biofuels.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	5	It is not only eliminating fossil CO ₂ within the fuel itself but it is also does not requiring much energy in manufacturing it.
Reduces costs	0	Does not affect
Reduces costs (%)		No data.
Increases income	0	Does not affect
Requires investments	0	Very expensive to purchase and modify trucks.
Simplicity internally	5	Easy to implement as a demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	1	Because vehicles are not yet available direct from the manufacturer it poses as an obstacle.
Availability	1	Same as above.
Tested	3	They are being used in small scale today.

¹¹² Interview Bengtsson, Magnus. *Project manager*, Vägverket, 07-02-28

12.4.34 Fuel Cells

Fuel cells can be powered by different fuels but most common is hydrogen. A regular combustion engine is limited by the Carnot cycle efficiency which states that the efficiency at its best reaches $\gamma = \frac{T_H - T_L}{T_H}$ where T_L is the temperature of the fuel

when entering the combustion chamber and T_H is the temperature of the combustion. This states that it is very difficult to reach a high efficiency for combustion engines but because fuel cell engines do not operate in a similar manner it can reach much higher.¹¹³ Hydrogen fuel cells convert electrochemical energy and only emit water. Hydrogen is not an energy source but an energy carrier. By manufacturing hydrogen gas using renewable energy sources, fuel cells can be a very good solution for transportations. Some of the existing problems are the volume of storing hydrogen, cost of fuel cells and the efficiency, especially when managing heavy loads.

Climate potential: No emissions except water are created when using a fuel cell but emissions do occur when manufacturing hydrogen but this can be done with the use of renewable energy.

Finance: So far fuel cells are more expensive than regular vehicles and are not competitive yet.

Implementation: There are prototype buses that currently use fuel cells but they are not commercial available. Fuel cells have large potential but have not reached far enough in development. The current most realistic approach is to be open to act as a company willing to participate in fuel cells projects, to further developing the technology, and supporting research within this field.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	5	Fuels without any fossil CO ₂ can easily be used in fuel cells and if renewable energy is used to manufacture the fuel, no fossil CO ₂ is being emitted at all.
Reduces costs	0	Does not affect.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	0	Enormous investments are necessary.
Simplicity internally	1	Difficult to demand something that is not yet commercially available on the market.
Simplicity externally	0	Fuel cells are in the developing phase and not yet available.
Availability	0	Same as above.
Tested	1	Some tests have been performed on buses.

¹¹³ Lutz, Andrew. Larson, Richard. Keller, Jay. *Thermodynamic comparison of fuel cells to the Carnot cycle*, International Journal of Hydrogen Energy 27, 2002, page 1103-1111

12.4.35 Synthetic Diesel

Synthetic diesel is manufactured by using the Fischer-Tropsch process. The process begins with the gasification of raw materials such as coal or wood and then the gas comes in contact with a catalyst consisting of either iron or cobalt which results in a liquid fuel. Other raw materials such as natural gas or biogas can also be made into liquid by the Fischer-Tropsch process.¹¹⁴

Climate potential: No climate advantage is gained by using synthetic diesel that has been manufactured from coal or other fossil materials. But if the synthetic diesel has its origin from biomass it has a much lower impact on the climate.

Finance: Synthetic diesel is more expensive than regular diesel and is only used in environments where there are high demands on emissions.

Implementation: There are companies that offer synthetic diesel but they are few. Only in South Africa is synthetic diesel common because of an embargo that was active during the apartheid regime. When actively trying to reduce the climate impact it is critical to ensure that the synthetic diesel used can be traced back to biomass.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	4	No fossil CO ₂ is being released when utilizing synthetic diesel but some fossil CO ₂ can have been used in the manufacturing process.
Reduces costs	0	Does not affect.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	1	Expensive to develop synthetic diesel for a commercial market.
Simplicity internally	3	Difficult to make demands on something that is not yet widely available.
Simplicity externally	1	Not yet developed for a commercial market.
Availability	1	Same as above.
Tested	2	Some tests have been made.

¹¹⁴ Jun, Ki-Won. Roh, Hyun-Seog. Kim, Kyong-Su. Ryu, Jae-Seong. Lee, Kyu-Wan. Catalytic investigation for Fischer-Tropsch synthesis from bio-mass derived syngas, Elsevier, 2003

12.4.36 Bio Jet A1

Of all transportation modes, aircrafts are the one that is accountable for most CO₂ per tonkm. By switching to a non fossil fuel a great improvement would be gained. It is possible to produce a biofuel suitable for jet engines as has been proven with Bio Jet A1¹¹⁵. This fuel is not approved commercially but has been tested with much lower emissions as a result.

Climate potential: With a reduction or elimination of fossil CO₂ within aviation the climate impact will be reduced plenty. Even if aviation does not emit most of the fossil CO₂ they emit much more per tonkm than any other transportation mode.

Finance: Because it has not been finally approved it is difficult to speculate over the difference in price but some argue that Bio Jet A1 will be cheaper than regular Jet A1. The fuel is also compatible with existing jet engines and with higher oil prices a biofuel within the aviation business is highly welcome.

Implementation: Permission to use Bio Jet A1 commercially is of course crucial. Then it would be necessary to investigate if there are some modifications that should be performed before switching fuel. The supply is also an uncertainty factor.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	3	Biofuel reduces the fossil CO ₂ substantially and the only remaining fossil CO ₂ are from manufacturing and possible remaining amount of fossil fuel being mixed with biofuel.
Reduces costs	0	Does not affect until oil prices increases dramatically.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	4	Some modifications can be necessary such as supplying a different fuel for aircrafts.
Simplicity internally	1	It is easy for Tetra Pak to make demands on biofuel when it has been approved as a fuel for jet aircrafts.
Simplicity externally	1	Because it is not yet approved it is very difficult today.
Availability	1	Bio Jet A1 is developed and exists but is not yet commercially available.
Tested	3	Several tests have been performed.

¹¹⁵ http://www.luftfartsstyrelsen.se/templates/LS_InfoSida_70_30_35452.aspx, 07-03-17

12.4.37 Reduce Air Cargo and Express Freight

When using aircrafts to transport goods it is often because the goods have to arrive very quickly. It is likely that there will always be some goods under that category but with increased planning and improved working methods some of the goods can be shipped earlier thereby making it possible to use different modes of transportation.¹¹⁶

Climate potential: If air freight were reduced, being a very pollutant way of transporting goods, a large reduction of emitted fossil CO₂ would be made.

Finance: Reducing air freight, being a very expensive way of transporting goods, would mean that a reduction also represents a large cost saving measure.

Implementation: Improving IT-systems, working more proactively and obtaining knowledge from all necessary parts not only within the company but also from ones suppliers and customers would make it possible to win crucial time and thereby being able to use different kind of transportation modes.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	4	For those flows where it is possible to change transportation mode a large reduction is possible but they are few.
Reduces costs	4	Same as above.
Reduces costs (%)		No data.
Increases income	0	Does not affect.
Requires investments	4	Better systems and routines for planning.
Simplicity internally	3	Needs to change attitudes.
Simplicity externally	5	Does not affect.
Availability	5	There are other modes of transportation available if the necessary time is available.
Tested	5	Same as above.

¹¹⁶ Meeting Borgelin, Johan. TLGT&T, Tetra Laval, Lund, 07-03-14

12.4.38 Single Sky

The utilization of airspace over Europe is divided into pieces. This makes it difficult to always plan the most efficient route for every plane occupying the European airspace. By merging these pieces of airspace together into a single airspace and unite the air traffic controllers will facilitate in making it possible for better routes, less detours and less waiting time in the air. ¹¹⁷

Climate potential: By ensuring that the most optimum route is being used fuel consumption will be reduced.

Finance: This will probably be a cost effective solution but some governments are afraid of losing jobs to other countries.

Implementation: This is a very complex issue and for further understanding readers are referred to EUROCONTROLS ¹¹⁸ website. Companies supporting this action can promote it by writing articles or influencing politicians through lobby organizations.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	2	Reduced distance and thereby fuel according to SAS. ¹¹⁹
Reduces fossil CO ₂ per tonkm	0	Does not affect.
Reduces costs	1	Fuel makes out a large part of the transportation costs.
Reduces costs (%)		No data.
Increases income	0	Does not affect sales.
Requires investments	1	Expensive to enable single sky.
Simplicity internally	4	Lobbying is difficult but single sky is being carried through in the near future.
Simplicity externally	1	Large changes are necessary.
Availability	1	Not yet realized.
Tested	1	Same as above.

¹¹⁷ Interview Porsgaard, Martin. *Environment Manager*, SAS Group, 07-02-27

¹¹⁸ http://www.eurocontrol.int/ses/public/standard_page/sk_ses.html

¹¹⁹ Interview Porsgaard, Martin, *Environment Manager*, SAS Group, 07-02-27

12.4.39 Utilize Green Approach

Improved communication between the flight control and the pilots makes it possible to land by gliding through the air and not using the engines to the extent that is common. Increased planning also makes it less necessary for planes to circle the airfield waiting for permission to land.¹²⁰

Climate potential: Each landing done with Green Approach reduces the amount of CO₂ used with 150 kg.

Finance: Saving fuel also saves money but it will imply investments in education and better planning.

Implementation: Green Approach is already used at Arlanda airport in Sweden and up to 1500 landings have been performed. To be able to use it elsewhere, pilots and the flight control need to be educated and better systems for planning and communicating can be necessary.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect
Reduces fossil CO ₂ per tonkm	1	150 kg CO ₂ per landing is relatively small amounts.
Reduces costs	1	Same as above.
Reduces costs (%)		No data
Increases income	0	Does not affect sales
Requires investments	2	Technologies to be able to utilize green approach require large investments in communication systems, computer systems and planning.
Simplicity internally	5	Easy to implement as demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	1	Several organizations must cooperate to make green approach possible.
Availability	4	Arlanda Airport currently utilizes green approach.
Tested	5	Same as above.

¹²⁰ CO₂ – network day. 07-02-27

12.4.40 **Railway Development and Standardization**

Using trains for transporting goods within a country can be proven complicated not to mention cross several countries. The capacity of most countries railway is lower than the demand and passenger trains have higher priority than freight trains¹²¹. Different regulations, tracks, volt and signaling systems make it complicated to travel over borders¹²². Few companies have their own tracks drawn all the way to their warehouses or production facilities and there are, too few, and not efficient enough common loading points along the railway. Altogether, this means that in many cases the railway is not a realistic alternative. To make it realistic rail needs more tracks, better loading areas and standardization across borders that could facilitate to make the railway an attractive alternative for transport services.^{123 124}

Climate potential: With more goods being carried by trains the energy usage would be reduced greatly. If the energy supplied to the railway were to come from renewable energy sources the affect on the climate would reduce significantly.

Finance: Transporting goods on trains are often much cheaper than by trucks which means that savings will be just as great. Especially if higher oil prices are predicted it would be important to secure transportations by railway and thereby keeping costs low.

Implementation:

It is possible to improve the cross-boundaries functionality by opening a dialog between all concerned parties in the respective countries. Another way would be to create a network of other associates with the same agenda and thereby influence countries and the European Union.

¹²¹ Rapport 2000:7, Method for Socio-economic analyses of environmental measures, Naturvårdsverket, Örebro, 2000, page 88

¹²² Interview Berg Labor, Magnus. *QES Manager*, Cargonet AB, 07-03-23

¹²³ Interview Bengtsson, Magnus. *Project manager*, Vägverket, 07-02-28

¹²⁴ Interview Enell, Magnus. *CEO*, Sustainable Business Hub, 07-02-07

Reduced Climate Impact from Tetra Paks Transportations

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	3	Enabling a change from other transportation modes that have more emissions will reduce the total emission considerable. Especially when electrical engines are used instead of diesel engines. It won't be possible to transport all goods on trains.
Reduces costs	3	Cost for the distance traveled with trains will be reduced significantly but costs for transportations and loading will be necessary.
Reduces costs (%)		No data
Increases income		Does not affect sales.
Requires investments	3	Large costs are linked with railway development but for Tetra Pak the main cost will be for long term lobbying efforts.
Simplicity internally	3	Some degree of lobbying effort combined with commitment within the organization is required.
Simplicity externally	0	This issue is complex because every single country has its own railway system and changes in those systems are costly.
Availability	3	Several technologies are highly available but organizations in different countries disagree.
Tested	5	Same as above.

12.4.41 Reduce the Ships Speed

Increasing speed means an even greater increase in fuel consumption. By reducing speed fuel consumption can be minimized.¹²⁵

Climate potential: Less fossil fuel will be used thereby reducing the climate impact.

Finance: Transports could be made slightly cheaper.

Implementation: Identifying goods that do not need to be transported quickly should be done to be able to create and operating low speed routes for that goods.

Variable	Grade	Explanation
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	2	By reducing speed, emissions will reduce even more.
Reduces costs	0	Maersk ¹²⁶
Reduces costs (%)		No reduction.
Increases income	0	Does not affect sales.
Requires investments	5	Investments not necessary.
Simplicity internally	4	Increased planning is necessary to make it possible.
Simplicity externally	1	It is easy to reduce the speed technically but extremely difficult with a business perspective in mind.
Availability	2	Acceptance and comprehension is not widely spread.
Tested	5	Lower speed = Lower fuel consumption

¹²⁵ Interview Johansson, Ingmar. *Environment Manager*, Maersk Line, 07-02-27

¹²⁶ CO₂ – network day. 07-02-27

12.4.42 Skysail

By using sails on ships operating long distances the fuel consumption can be greatly reduced. The height above water and large area of the kite makes it a powerful propulsion tool.¹²⁷

Climate potential: The sail uses renewable energy and therefore has no impact on the climate. Engines still have to be used but with reduced fuel consumption which means that the total climate impact will be reduced.

Finance: Skysail demands an initial cost but ships traveling long distances with a possibility of high utilization can save a lot of money in cost of fuel.

Implementation: Retrofitting is highly possible but the system has not been used to a large extent. It also fails in being useful in all wind directions.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	3	According to SkySails. ¹²⁸
Reduces costs	2	Fuel consumption makes out a large part of the transportation costs.
Reduces costs (%)		No data
Increases income	0	Does not affect sales.
Requires investments	3	The needed skysail is fairly inexpensive.
Simplicity internally	5	Easy to implement as demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	1	It is a new approach and not much experience has been gained in the use of sky sails yet.
Availability	1	Same as above.
Tested	2	Same as above

¹²⁷ <http://www.skysails.info>, 07-03-02

¹²⁸ <http://www.skysails.info/index.php?id=8&L=1>, 07-03-02

12.4.43 Utilize Shore-Side Electricity

Ships use auxiliary engines to run generators even when they are in port. By using electricity generated on land there would not be a need for this anymore. This action would be more suitable for ships operating short distances and being in port more often than those covering great distances.

Climate potential: Shore-side electricity will lead to a reduction in the use of fossil fuels if the electricity generated on land is made from renewable energy sources.

Finance: Both ports and ships will have to make initial investments to make this feasible. Cost savings is not very likely due to little price difference between buying electricity and generating it by burning cheap fuel.

Implementation: Ports will have to draw new power lines and create an interface close to wharf. Ships need to make it possible to connect the ships electricity to the ports interface. Some ships using large quantities of electricity can constitute a problem for certain ports that have difficulties supplying sufficient amount of power.

<u>Variable</u>	<u>Grade</u>	<u>Explanation</u>
Reduces tonkm	0	Does not affect.
Reduces fossil CO ₂ per tonkm	1	Some improvements while the ship is in port are achievable if the electricity supplied has been generated from renewable energy sources.
Reduces costs	0	It is not certain that any reduction in costs are achievable, it all depends on electricity being cheaper than the oil price.
Reduces costs (%)		
Increases income	0	Does not affect sales.
Requires investments	2	Both ships and harbors need to make investments.
Simplicity internally	5	Easy to implement as demand in agreements with forwarding agent. No obstacles internally.
Simplicity externally	3	Familiar technology but different standards and an uncertainty about supplying sufficient electricity.
Availability	3	Same as above.
Tested	5	The harbor of Gothenburg offer shore side electricity.