Efficiency in distribution
-as a cost saver and environmental impact reducer

Master thesis within Business Administration

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Abstract

The environmental aspect of transportation has got a lot of attention over the past years. It has its origin in the growing awareness of environmental problems such as the global warming. Today the environmental aspect of transportation is widely discussed and is being recognized as a very important question to deal with for everyone involved. In Europe the transportation industry is responsible for 21 per cent of the total emission. While studies of the subject show that an environmental friendly supply chain is considered a success factor for many companies, there is a lack of interest from them to invest in order to obtain it. The question this dilemma raises is what a company can do in terms of reducing its impact on the environment without making big investments.

The purpose of this thesis is to investigate how, from a company perspective, efficient logistics solutions for the distribution of products can reduce transportation costs as well as the environmental impact from a company. To gather data the authors will conduct a qualitative single case study in the form of interviews at a company to create the deep understanding needed to comprehend a company’s distribution system.

The result of the analysis shows that areas considering fill rate and selection of transportation mode are findings that would increase the efficiency, which would reduce the cost of transportation and the environmental impact. Also benefits from the option to outsource the logistics function regarding the distribution of the product to a TPL have been found.

The conclusion suggests that for a company to become as efficient as possible, while at the same time reduce their negative impact on the environment they should try to maximize the fill rate, which brings along that as much goods as possible is being distributed with as limited amounts of transportations as possible. Additional important conclusions from the thesis involve the significance of choosing the most suitable mode of transportation, something that will affect a range of different factors where cost and service are found to be the most important.
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1 Introduction

In the introduction chapter the authors will give a background to the topic of transportation and the environment as well as give the readers an introduction to the master thesis. This will be followed by the problem discussion, purpose, delimitations and concluded by a disposition of the thesis.

1.1 Background

The environmental aspect of transportation has got a lot of attention over the past years, but it is not a new phenomenon. Already in 1998 Joseph R. Carter and Ram Narasimhan put out their paper "Environmental Supply Chain Management" (Reese, 2007), and the phrase “greenness” became a buzzword already in the late 1980s and early 90's. It has its origin in the growing awareness of environmental problems such as the global warming. Today the environmental aspect of transportation is widely discussed and is being recognized as a very important question to deal with for everyone involved. The problem has further been recognized by the Swedish parliament as it in 1999 accepted fifteen goals to improve the environment. Some of the goals directly relate the impact on the environment from transportation and its emissions (Miljömål, 2009).

Due to an increase in demand the transportation industry has grown to become immense. In the EU 2004 only, the transportation sector generated EUR 363 billion and employed 8.2 million people. It represented 7.3 per cent of EU’s non-financial business economy (Eurostat, 2007). Bearing in mind this enormous market, a study considering the environmental impact of transportation is relevant.

By impact on the environment the authors refer to the emissions of green house gases (GHG), being Hydrocarbon (HC), Carbon monoxide (CO), nitrogen oxides (NOₓ), and Carbon dioxide (CO₂). In terms of GHG the emissions from the transportation industry is significant and an issue more and more transportation providers and companies are forced to focus on. In Europe the transportation industry is responsible for 21 per cent of the total emission of these GHG, while 93 per cent of these comes from road transportation, where the freight transport by road has increased by 51 percent between 1990 and 2003. The emissions from air transportation experienced the highest increase in terms of percentage with an increase of 86 per cent between 1990 and 2004 (European Environment Agency, 2007). The statistics illustrate the overall increase of transportation in general and the associated emissions of GHG and the trend of continuous growth of the transportation industry.

While in general the growth of an industry is often positive, the growth of the transportation industry however has some unwanted side effects in the increase of emissions. For this matter reducing emissions is something to strive for and companies dependent on transportation in their business play an important role in settling on a goal to reduce the overall emissions. While studies of the subject show that an environmental friendly supply chain is considered a success factor for many companies, there is a lack of interest to accept any increased costs in order to obtain it. In addition, logistics managers share the view that any extra costs for a green supply chain should be paid for by the customers. The conclusion is that putting a lot of effort on being environmentally friendly is generally not a high priority if no apparent financial benefits can be associated to it. (Capgemini, 2008), and (Preuss, 2005). The problem might especially be apparent in companies where a green logistics channel is not demanded by the customers.
1.2 Specification of problem

Since the level of interest for a company to invest in making its operations more environmentally friendly with no financial benefits associated with it is limited, it is of interest to find a situation where the companies’ interest of financial benefits and solutions that would reduce the impact on the environment is combined. The reason for the lack of interest from the companies to invest in reducing its negative environmental impact is because it is considered to be an uncertain investment where the benefits are unclear in making its processes completely environmentally friendly, and especially if it is not demanded by the customers. This is an understandable dilemma since a company is limited by its resources and is reluctant to invest when the payback is unsure. The questions this situation raises is what a company can do in terms of reducing its impact on the environment without making investments with an uncertain outcome and how the interest of reducing the environmental impact can be increased.

An area of interest where the combinations of financial and environmental benefits might be possible is in the logistics function of a company. In logistics and mainly in the distribution function the impact on the environment is most evident. The distribution of products from a company to its customers usually involves a lot of transportation where the emission of GHG stands for the main concern when it comes to the negative environmental impact.

In order to increase the level of interest for a company to center on reducing its environmental impacts the necessary incentives needs to be present. This is a fundamental condition and without the right incentives the interest to raise an issue remains low. The idea is to investigate how an efficiency increase in logistics saves money for a company by reducing the cost and at the same time reduces its impact on the environment by decreasing the amount of transportation needed in its distribution channel. This link would present the necessary incentives that could increase the interest of this issue.

The thesis will focus on a Swedish company in the manufacturing industry and its method of distributing its products. The company operates mainly on the European market and is heavily reliant on transportation for their distribution. The distance to its customers is far and the distribution system plays an important role for the company. Studying a single company provides the opportunity to gain the deep understanding needed to find the possible financial incentives for reducing the environmental impact.

The problem is topical today when the environmental issues are gaining much attention. Highlighting efficient logistics and its potential in terms of obtaining both financial and environmental benefits, when it comes to a reduction of the impact on the environment from the focal company is a subject that the authors believe will be of strong use in the future supply chain and logistics field as more and more focus tend to raise the problem of the transportation industry’s negative impact on the environment.

1.3 Purpose

The purpose of this thesis is to investigate how, from a company perspective, efficient logistics solutions for the distribution of products can reduce transportation costs as well as the environmental impact from a company.
1.4 Delimitation
Due to the aspect of relevance the authors have decided to delimit their study by not including the pipeline mode, since this mode is not applicable for the type of goods of the industry. The authors will neither include reverse logistics due to the fact that a focus will be on the distribution only. Furthermore the focus will be on the distribution in Europe since it is where a significant majority of the market is situated for the company of the study.

1.5 Disposition
To create a better understanding of the outline of the thesis the authors will here present a disposition of it. The thesis starts by introducing the reader into the subject and the history of it under the introduction. In this section will also be present the problem discussion and the actual problem that will guide the thesis. The next chapter will present the theoretical framework and feature different models and theories related to the work of the thesis. The following section will feature the method used in the performing and writing of the thesis. Subsequent part will present the empirical findings of the study, what the authors have found through their data collection. The empirical findings will then be analyzed with the help of the theoretical framework under the analysis. The last part of the thesis will be a conclusion of what the authors have found during the writing of this thesis. This section will also suggest further research topics to be considered for future studies. The outline of the thesis can be seen in figure 1 below.

Figure 1 - Disposition of the thesis
2 Theoretical framework

In the theoretical framework chapter the authors will present theories and models of importance for the study. The authors will gather the theories from literature relating to how transportation can be carried out more efficiently, the selection of modes, as well as about the environmental aspects of transportation.

2.1 Logistics efficiency as a cost and environmental impact reducer

This section presents the fundamental idea and perspective that will guide the reader throughout the thesis. The connection established in this section between logistics efficiency as a way to reduce cost and the environmental impact is a cornerstone for the thesis.

Aronsson & Huge Brodin (2006) discusses in their paper the connection between logistics efficiency and a reduced stress on the environment. The key factor they identified in order to reduce the impact on the environment is to increase the fill rate of transportation. The increased fill rate would have a cost reducing effect on transportation costs, since the number of transports would be reduced. The impact on the environment would be reduced by a reduction of emissions because of the reduced number of transports needed.

In their study they also found that the impact on the environment can be reduced as a result of making strategic changes to relocate the warehouses and changing the flow of products from the production site to a central place in the area of distribution.

2.2 Logistics management

Christopher (1998) defines logistic management as “the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the organization and its marketing channels in such a way that current and future profitability are maximized through cost-effective fulfillment of orders” (Christopher, 1998, p. 4), meanwhile Grant, Lambert, Stock, and Ellram (2006) defines it as “the part of Supply Chain Management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers’ requirements” (Grant et al, 2006, p. 3). The authors find these definitions to capture the phenomenon well and believe it will help the reader to create an understanding of the matter.

In logistics management the constant struggle for the logistics manager is to find the balance between a high customer service level and the benefits that can be gained from an increase of sales against the cost for providing the high level of customer service (Rushton, Croucher and Baker, 2006). This cost-benefit trade off situation is ever at hand in logistics management and is a problem in need of attention because the customer service depends on a well functioning logistics system.

Coyle, Bardi, and Langley (2003) identify four main dimensions of customer service: time, dependability, communications and convenience. Time is relevant for the customer in order to plan its own operations and is usually in terms of the shorter the time an order takes, the better the customer service. However, without the dimension of dependability a short order cycle time is not particular useful for the customer. In an ideal situation the customer wants to be completely assured that the goods will be delivered on time as agreed. A dependable
supplier is crucial for the customer in terms of planning operations and reduce costs in
areas such as inventory levels, stock outs, order processing and production scheduling. Ad-
ditional aspects of dependence are safe and correct deliveries. Dependable deliveries of
damaged goods or the wrong type of goods which in the end are unusable for the customer
is a negative influence on the level of dependability. Communications is another corner-
stone and considers the information aspects. It is vital that the right information arrives at
the right place and that the information goes both ways, from the customer to the supplier
and from the supplier to the customer. Having the right information at the right place and
from the right source is a proactive way to reduce mistakes, which in the end increases the
level of customer service. The dimension of convenience concerns the flexibility of the lo-
gistics service. At the extreme, the supplier wants to be able to offer a customized service
to each individual customer, this is of course very hard and would be costly.

2.3 Efficiency in transportation

This section presents the idea of efficiency in transportation to the reader. It presents some
important aspects to consider in transportation. However, first a definition of effectiveness
and efficiency will be made.

Drucker (1994) identified effectiveness as *doing the right things*, meanwhile efficiency is de-
defined as *doing things right*. From this definition one can comprehend that effectiveness is to
do something necessary for your business, but not necessarily do it in the best way possi-
ble. Efficiency on the other hand would be to execute the focal business in an actual best
way possible. The best way would be to achieve a goal with the least amount of inputs of
resources as possible.

Efficiency in transportation has the starting point in a theoretical ideal situation of how
goods are being transported from the origin to the destination. According to Samuelsson
and Tilanus (1997) the theoretical maximum transportation output for goods is a “non-
stop movement between point (A) and (B) and back, along a minimum distance route, at
maximum speed, with a full load.” (Samuelsson & Tilanus, 1997, p.141)

The following formula explains the overall efficiency in goods transportation.

\[ E = T \times D \times S \times C \]

Where \( E \) represents the percentage of the maximum theoretical output achieved in a trans-
portation situation. \( E \) represents the product of the other four factors in the formula which
consists of *time* (\( T \)), *distance* (\( D \)), *speed* (\( S \)) and *capacity* (\( C \)).

*Time* efficiency refers to the actual time the vehicle used for a transportation is in use. An
ideal situation is where the vehicle is in use 24 hours a day. In practice this is not possible
since eventually the vehicle will have to stop for maintenance and to refuel. Any factor
which results in the vehicle not being in use means a detraction from the theoretical maxi-
mum. (Samuelsson & Tilanus, 1997)

*Distance* efficiency is derived from the ideal route to the final destination, the ideal situation
being the shortest route between the origin and destination. Any deviation from the ideal
route for whatever reason, for example infrastructure changes, reduces the distance effi-
ciency. (Samuelsson & Tilanus, 1997)

*Speed* efficiency is related to the speed during transport. Maximum efficiency is achieved by
keeping an accurate speed according to the speed regulations of the route or the speed limi-
tations of the vehicle. Any deviation affects the factor of speed efficiency. In practice, the maximum speed efficiency is achieved when driving at the maximum allowed speed on a given route. However, if the environmental costs are considered when calculating the optimum output it might change the factor of speed efficiency since a higher speed incurs an environmental cost as well an increased use of resources. (Samuelsson & Tilanus, 1997)

Capacity efficiency relates to the utilization of load capacity of the vehicle for example in terms of weight or size. An example of this is a less-than-truckload transport where 60 m³ is used while the capacity of the vehicle is 120 m³. This would result in a capacity efficiency factor of 0.5. Efforts should be put into increasing the capacity efficiency, the fill rate, because of the possibilities of reducing the use of resources. (Samuelsson & Tilanus, 1997)

### 2.4 Aspects of fill rate

While striving for a high capacity efficiency rate is important, a challenge is the combination of capacity efficiency and time efficiency. This is referred to as true fill rate and illustrates how time efficiency and capacity efficiency interacts showing the true fill rate and utilization of a vehicle. Fill rate can further be described as how, by planning and conducting, space can be used more efficient and fewer trucks (or other modes) can carry out the same transport work (TFK, 1998). As illustrated below, in figure 2, the true fill rate is calculated by considering fill rate during transportation (capacity efficiency) and time efficiency.

![True fill rate diagram](image)

If the fill rate for a truck is 70 per cent, but the truck stands still (as a result of loading, unloading, traffic jams etcetera) for 20 per cent of the time, the true fill rate will be only 56 per cent (0.8 multiplied by 0.7).

Besides fulfilling better efficiency, increasing the fill rate will decrease the amount of transportation, something that will have a positive impact on the environment due to less emission. For these reasons the authors feel it is an important part to include in the theoretical framework.

A higher fill rate can be achieved by purchasing larger amounts less frequently and hence increase the fill rate (Björnland, Persson, Virum, & Hultkratz, 2003). It can also be
achieved by logistic consolidation that is being discussed below in part 2.5. An issue to consider while maximizing the fill rate is that the procurement of larger amounts can lead to larger inventories, a logistical cost many times tried to be kept low (Glasserman, & Wang, 1999).

The issue is further discussed by Aronsson and Huge Brodin (2006) in their argument that the logistical infrastructure, such as centralization of distribution, as well as reduction of number of warehouses can generate changes in fill rate. An increase of fill rate will lead to a decrease in kilometers run by vehicles as well as less fuel consumption.

Most of the literature about fill rate focus on the truck mode, but it is important to understand that it can also be applied to the other modes of transportation (Aronsson & Huge Brodin, 2006).

### 2.5 Logistics consolidation

Hall (1987) defines consolidation as “the process of combining different items, produced and used at different locations and different times, into single vehicle loads” (Hall, 1987, p. 57). Brewer, Button, and Hencher (2001) define the phenomenon as “bundling flows of passengers or goods from different origins and/or different destinations on common parts of their routes” (Brewer et al, 2001, p 239). The authors believe these definitions give a clear understanding of consolidation as they capture the core idea of it.

Consolidating transport is a common practice within transportation since larger shipment sizes in general leads to reduced cost. Consolidating small shipments into one larger will give a lower average cost per unit transported. Ballou (2004) suggest that consolidation is usually achieved in any of the following four ways: inventory, warehouse, temporal and vehicle consolidation. Meanwhile Hall (1987) exclude temporal and instead of warehouse introduces terminal consolidation as the equivalent.

**Inventory** consolidation allows for large or full vehicle loads to be made into the inventory which serves outgoing orders. **Warehouse/terminal** consolidation is adopted when items from different origins are collected and taken to a single location where they are sorted, reloaded into new vehicles for transportation to its final destination (Hall, 1987). **Temporal** consolidation involves holding customer orders to achieve fewer and larger shipments instead of many smaller shipments. There is a trade off situation between cost saving and customer service using temporal consolidation where the cost saving advantages are evident but it might have a negative effect on the customer service level. **Vehicle** consolidation involves less-than-truckload pickups and deliveries. The smaller pickups are placed on the same transport for a more efficient transport. It requires vehicle routing and transport scheduling are tools to increase the efficiency of vehicle consolidation. These different types of consolidation can with benefit be further combined and used together. Successful consolidation moreover has a direct effect on the overall efficiency because it improves the capacity efficiency factor presented under section 2.3.

Consolidation can be divided into three different forms depending on the structure, being; the “normal” consolidation already described, as well as mixing and breakbulk. Mixing is consolidation where different shipments is collected in a terminal, sorted and then transported to more than one final destination. Breakbulk is the part of consolidation involving the receiving of large shipments transported over longer distances into a terminal, and then sorted and further transported over shorter distances to its final destinations. (Mentzer, Myers, and Stank, 2007)
Waters (2003) also suggests similar descriptions of consolidation and breakbulk. An illustration of the two can be seen below in figure 3.

Figure 3 - Consolidation and breakbulk (Waters, 2003)

Consolidation can nevertheless also imply a few negative aspects such as the inventory consolidation require items being stored while waiting for being transported, something that will increase inventory. Vehicle consolidation requires vehicles to drive extra routes in order to make extra stops, something that implies longer transit times and longer vehicle routes. Additionally terminal/warehouse consolidation requires the construction of terminals, extra time and personnel for sorting, and the extra loading and unloading process. For this matter consolidation has to find the balance between benefits and counter benefits.

If a company is unable to achieve an acceptable fill rate or lacks the resources to conduct efficient consolidations on its own, outsourcing of logistics functions or the use of a third party logistics provider (TPL) might be the solution. In a section 2.7 below this will be presented more thorough.

2.6 Postponement

The characteristics of the products that are being shipped in terms of size and shape are what determine the amount of space needed to transport them. This is a basic reasoning considering transportation of products and will be discussed in section 2.8. However, at what point the transportation takes place is an interesting aspect since the product has different shapes at different points in the production process. Products assembled into their
final shape in general require more space compared to products not already assembled into their final shape. Transportation of goods at an earlier stage in the production process can thus have a positive effect on the fill rate of the transport. The idea of delaying the finalization of the products and the effect on fill rate will now be further discussed.

Hensher & Brewer, (2001) describes postponement as a process where configuration of products through component assembly, testing, cleaning or packaging just before it is needed. Gourdin (2001) suggests that “postponement involves modifying or customizing products after the main manufacturing process is complete. Final configuration of products can be delayed until the distribution cycle, or even performed after delivery” (Gourdin, 2001, p.74). These two descriptions and meanings are interesting to consider when it comes to the effects they would have on the consolidation and the fill rate of transports.

Zinn and Bowersox (1988) discusses in their work five different types of postponement and what type of firms that might be interested in applying them to their organizations. The five different classifications of postponement are; labeling, packaging, assembly, manufacturing and time.

Labeling postponement starts with the assumption that the same product is being marketed under different brand names. Hence, it is possible to delay the labeling of the products in order to match it against the current demand of the product. The products are being labeled as customer orders are placed which reduces the level of uncertainty in terms of quantity demanded. Another benefit is the reduction of safety stock where duplication is not necessary as long as the products remain unlabeled. (Zinn & Bowersox, 1988)

Packaging postponement involves packaging of the products at a later stage where the benefits are a reduced number of stock keeping units. The idea is to keep the product in bulk for as long as possible. As the customer orders are placed the product is packaged according to the specifications. (Zinn & Bowersox, 1988)

Assembly postponement can be of interest if the products consist of a number of parts which are being assembled according to unique customer specifications. The customer specifications are small in comparison to the main manufacturing of the product. The biggest gain possible here, are cost reductions from inventory consolidation and reduced transportation cost since the products are shipped unassembled to the warehouse. Negative aspects of assembly postponement can be longer delivery times if the final assembly at the warehouse is complex. (Zinn & Bowersox, 1988)

Manufacturing postponement involves the assembly of different parts at a warehouse. Compared to assembly postponement the manufacturing postponement involves heavier assembly where the parts can come from multiple sources while in assembly postponement the parts come from the same source. The parts are shipped to the warehouse in anticipation of customer orders and then assembled. (Zinn & Bowersox, 1988)

Time postponement relies on forecasts which determine the scheduled distributions of the products. The products are being shipped from a centralized warehouse as orders are placed, which results in an increase of transportation cost since there is an increase of LTL transportation. (Zinn & Bowersox, 1988)
2.7 Outsourcing of logistic functions

Outsourcing the logistics functions gives the company the possibility to focus on their core competences. The possibility to focus and spend resources on the core competence is one of the principal driving forces for outsourcing logistics activities according to van Laarhoven, Berglund and Peters (2000). What type of logistics activities suitable for outsourcing differs between companies and depends on the type of operations the individual company is performing. The following examples of logistics activities are the most frequently outsourced and are ranked according to popularity. Most common is warehousing, followed by outbound transportation, freight bill auditing/payment, inbound transportation, freight consolidation/distribution and cross docking (Coyle et al., 2003).

A company can outsource its logistics functions to a logistics provider that offers a standardized solution or to a TPL which can provide a more customized service. If the company usually sends volumes which are less-than-truckload (LTL) the use of a transportation provider can lower the transportation cost. Doing so might have the advantage of the transportation provider being able to consolidate goods from its different customers to achieve a higher fill rate, which results in a lower cost for transportation. (Waters, 2003). The consolidation process follows the procedures presented above under section 2.5.

Definitions of TPL and what it involves are many; the following examples are a couple of them.

“A TPL provider is an external provider who manages, controls, and delivers logistics activities on behalf of a shipper.” (Hertz & Alfredsson, 2003, p.140)

Another definition of TPL is.

“relationships between interfaces in the supply chains and third-party logistics providers, where logistics services are offered, from basic to customized ones, in a shorter or longer-term relationship, with the aim of effectiveness and efficiency”. (Bask, 2001, p.474)

The above definitions are rather broad; however it is appropriate since they are supposed to cover a variety of services offered by TPL service providers such as transportation, warehousing, distribution and financial services. In addition some TPL providers are specialized in managing multiple logistics activities and offer an overall logistics solution. (Coyle et al. 2003)

TPLs are further categorized by Hertz and Alfredsson (2003) according to their general problem solving ability and ability of customer adaptation. The following figure illustrates the categorization. It also shows the general ability of problem solving and ability of customer adaptation of more traditional and standardized activities.
The quadrant divided into four sections shows another level of categorization still in relation to general problem ability and ability of customer adaptation. The types of TPLs described there are: Service developer, customer developer, standard TPL provider and customer adapter.

Service developer offers advanced value-added services. For example, forming specific packaging, track and trace and cross docking. The services are packaged into modules out of several standardized activities to meet the customer demands. (Hertz & Alfredsson, 2003)

Customer developer involves high integration with the customer by taking over its whole logistics operation. The extensive focus on every customer limits the number of customers a customer developer can handle. The customers are offered the knowledge, the methods of development and the design of the supply chain. (Hertz & Alfredsson, 2003)

Standard TPL provider offers standardized services, for example, warehousing, distribution and pick and pack. (Hertz & Alfredsson, 2003)

Customer adapter takes over customers’ existing activities, for example, taking over the warehouses with the goal to improve the efficiency. It does not develop the services much. (Hertz & Alfredsson, 2003)

What type of logistic solutions suitable for a company depends on its activities. In the following section factors affecting the choice of transport will be presented.

### 2.8 Factors affecting the choice of transportation

Choosing the most suitable mode of transportation is an important choice for a company since transportation connects a series of fixed points and bridges buyers and sellers (Coyle et al., 2003). When deciding the most suitable mode of transportation a trade off situation can arise where a number of different factors of a company are compared. Slater (1990) suggests a thorough approach for transportation mode selection where five factors are taken into consideration. These factors are: company characteristics and philosophy, market structure,
The company characteristics and philosophy concern the company’s marketing, financial and operations strategies. The marketing strategy determines the parameters for the customer service offer. It influences the performance levels which need to correlate with the service offer. The financial strategy reflects the view of how profit objectives are to be met. An issue here is the strategy to invest in core versus non-core capabilities. An investment can be necessary in order to secure the control of a function. For example investments in a function if there is a need to secure service deliveries. The operations strategy influence in terms of the characteristics of the company. Economical but effective deliveries are suitable when the production process results in high volume output, such companies are at an increasing rate centralizing their manufacturing which amplifies the service responsibility of the transport function. (Slater, 1990 cited in Gattorna and Walters, 1996)

The market structure of the company concerns two factors, the competitive structure and the geographical structure of the market. When selecting suppliers the customers consider delivery as a key factor, in highly competitive markets it is especially important to fulfill customer expectations in terms of transportation, otherwise the customer will be lost. The geographical structure considers the size of the market, where the market spans over large areas and even national borders, having a corresponding transportation structure is then of crucial importance to achieve customer satisfaction (Slater, 1990 cited in Gattorna and Walters, 1996)

The product characteristics determine the appropriate type of transportation. What factors to consider depends on what type of product it is but examples of possible product characteristics factors to consider are weight, robustness, shelf-life, size and shape. A miss-match between the type of transportation and type of product can cause major problems when distributing the goods. (Slater, 1990 cited in Gattorna and Walters, 1996).

The customer characteristics involve the specific requirements of the customer. The transportation provider needs to fulfill the customer need and delivery specifications. The delivery specifications includes for example: time constrains, order cycle and customer availability expectations, customer capabilities and customer after sales requirements. Slater (1990)

The environmental issues have the potential to influence the choice of transportation in various ways. Government regulations, infrastructure policy and subsidizing of specific modes influences the selection and can make one alternative more attractive compared to another. Another factor is the continuous technology development, which in the short and long run can assist in the planning of transportation decisions. Some forms of transportation are more environmental friendly compared to others. (Slater, 1990 cited in Gattorna and Walters, 1996).

Gattorna and Walters (1996) discusses three different tradeoff possibilities and their influence potential on over all cost. The different tradeoff possibilities discussed are: horizontal, vertical and lateral. Horizontal tradeoffs mean comparing the different modes available for performing the same task. For example, air versus sea and road versus rail. Vertical tradeoffs arise when there is a change in a transport activity, which leads to a greater benefit to another area of the logistics function. A situation like this can arise, for example, when new infrastructure investments occur which decrease the time needed for transportation between two locations. Lateral tradeoffs occur when transportation cost is compensated by

product characteristics (current and future), customer characteristics and environmental issues (cited in Gattorna and Walters, 1996).
lower costs in other areas. An example here is an outsourcing situation where long distance transportation cost is high; however, it is compensated by lower labor costs.

The factors influencing the transport selection are associated with the carrier selection decision since the carrier has to be able to provide the type of transport selected. The carrier selection decision process is described in the following section.

### 2.9 Carrier selection decision

The carrier selection decision is the process of deciding upon a suitable and appropriate carrier for your transportation system. These selections will then affect both cost and time aspects, but also inventory level (a mode with longer transit time require larger inventory to prevent stock out), service quality and security (Coyle et al., 2003).

![The Carrier Selection Decision](image)

**Figure 5 - The Carrier Selection Decision (Coyle et al., 2003)**

The first selection to execute is the modal choice, to choose between a basic and an intermodal transportation mode. The basic modes include truck, railway, water, air and pipeline (pipeline will from now on be excluded from the thesis in regard to the delimitations), meanwhile the intermodal involves using two (or more) of the mentioned basic modes, for example truck and rail (Piggyback) (will further be discussed in section 2.10.5. Usually this choice is based on which alternative generates the lowest logistic costs. Next step is related to the legal decision where options range from private carriers to different kinds of for-hire solutions. The different options of carrier involve different legal carrier types (as common, regulated, contract, exempt or private) or the choice of an individual carrier. The last step in the process is then the preference of specific transportation provider. (Coyle et al., 2003)

The selection process includes several determinant factors such as transportation costs, transit time, reliability, capability, accessibility, and security. Transportation costs used to be the dominant carrier selection determinant, but has lately changed to the focus of cost trade offs between the services a carrier provides and operation costs. Meanwhile, the most important carrier selection determinants nowadays are reliability followed by cost and transit time. (Coyle et al., 2003)
2.10 The different modes of transportation

As mentioned above the different transportation modes are truck, rail, water, and air. A combination of these is called intermodal service. Every mode has its advantages respectively disadvantages. The different modes are further presented below.

2.10.1 Truck

Truck or motor carrier is part of most firms logistic supply chain since they almost always at some point need to transport their goods over the road network. The benefit of the truck mode is the high accessibility; the carriers can provide services to almost all locations and is the most accessible transport mode. (Coyle et al., 2003)

The transport mode is characterized by high variable and low fixed costs, together with the fact that the government maintains its links (roads) this has lead to a large number of small carriers constitute the market. The transit time for trucks is rather low in the sense it can operate independently from other shipments and hence reaches its destination faster. Other negative aspects are the reliability, which can exist because of dependency on weather conditions and the high costs being present. The goods being transported by trucks can be low valued, but most often being goods of rather high value with a rather small size of the shipment. (Coyle et al., 2003)

2.10.2 Rail

The rail mode consist of a small number of large firms controlling the railroads, a mode requiring large investments in terminals and tracks before being able to begin operations. The railroads are mainly transporting large volume of low valued goods of high density, over large distances. This is to spread the fixed costs over greater distance and size of goods. The major advantage of rail is the cost, which are relatively low, as well as the high capability being able to provide service to all shippers. (Coyle et al., 2003) The rail mode is also more environment friendly compared to many other modes due to contributing less to emissions (Pienaar, 2003) (see table in figure 9). On the downside are the low accessibility due to actual railroad have to be connected to a firm for the rail mode to be able to provide service there, and the rather long transit times for the mode. (Coyle et al., 2003).

A problem for international shipment when it comes to railway might be different railway standards that sometimes differ between countries. Differences between countries in Europe (and in the rest of the world) is the rail gauge (distance between rail tracks), and an investigation shows that in Europe the former soviet states, Spain and Portugal are the ones that differ from the standard gauge that is used throughout the rest of Europe (Thomas, 2009).

2.10.3 Water

Another mode of importance is water, it is a mode characterized by rather low average cost (far lower compared to the other modes), primarily used for longer distances and with capacity for large shipments. The downside to water carrier are the longer transit times it generates as well as being highly affected by weather conditions. Another negative aspect of the water carrier mode is the limited accessibility due to requirement of presence next to water and a suitable harbor for being able to make use of it. (Coyle et al., 2003)
2.10.4 Air

The freight shipment is only a very small part of the complete air carrier traffic, being the movement of passengers taking up the majority of it. The air industry consists of a limited number of carriers that are dominating the business. The air carrier mode is characterized by high cost, but also for a very short transit time. Hence the typical shipment or transfer is of high value and/or needs a fast delivery. The accessibility of this mode is also rather limited, forcing either a presence to an airport or the use of a land carrier to transport the goods to and from an airport. Another negative aspect is the influence of weather conditions; meanwhile a positive feature is the high security associated with air transits. (Coyle et al., 2003)

<table>
<thead>
<tr>
<th>Performance Rating of Modes by Selection Determinant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modes</strong></td>
</tr>
<tr>
<td><strong>Selection Determinants</strong></td>
</tr>
<tr>
<td>Cost</td>
</tr>
<tr>
<td>Transit time</td>
</tr>
<tr>
<td>Reliability</td>
</tr>
<tr>
<td>Capability</td>
</tr>
<tr>
<td>Accessibility</td>
</tr>
<tr>
<td>Security</td>
</tr>
</tbody>
</table>

1 = Best, lowest, 5 = Worst, highest.

Figure 6 - Performance Rating of Modes by Selection Determinant, (Adapted from Coyle et al., 2003).

The table above illustrates the four different modes previously described with a grading according to their performance in six different factors. These factors are what differ between the different modes, and hence what companies may need to take into consideration when deciding upon a specific mode.

2.10.5 Intermodal transportation

Brewer et al. (2001) defines intermodal transportation as “those integrated movements involving at least two different modes of transport under a single through rate…where its goal is to provide a seamless transport system from point of origin to the final destination under one billing and with common liability” (Brewer et al., 2001, p. 142). Murphy Jr and Wood (2004) define it as “two modes or more work closely together on a regular basis, utilizing the advantages of each.” (Murphy Jr & Wood, 2004, p. 162). Meanwhile Coyle et al. (2003) defines it as services using two or more carriers of different modes in the through movement of a shipment. These definitions correspond well with each other and explain the idea of intermodal transportation well.
The intermodal transportation service is not necessarily something that decreases the negative impact on the environment, but depending on how you carry out your intermodal transportation it is possible. By switching from using only trucks, to use trucks and rail will decrease the amount of emission, and introduce distance covered with no emission (the part of rail), and hence reduce the environmental impact. (Blinge, 1998)

As mentioned above, many times the use of one mode requires the use of another mode to get access to that specific mode (airport, seaport etcetera), the transportation would be intermodal. The issue of getting access to a certain location (whether it is the starting point for another transportation mode or to a certain market) is one of the major reasons for the use of intermodal transportation. Another reason is the possibility to overcome a given modes disadvantages and retain the modes basic advantage, usually low cost. To combine two (or more) modes maximize their advantages and minimize their disadvantages. However, the mixing of modes will have both the positive and negative aspects of the chosen modes, for example by using railway and airplane will have a shorter transit time compared to using only rail, but a longer transit time than all airplane, likewise there will be a lower cost instead of only using airplane, but higher cost compared to only using rail. The use of intermodal transportation also adds the issue of transshipment which has to be taken into consideration when bearing in mind the use of this mode. This adds cost and time to the transportation. Another negative aspect of intermodal transportation is the carriers’ reluctance to participate. If a carrier has the possibility to transport the shipment all the way by himself, the carrier might hesitate to coordinate with other carriers because that will generate less earnings. (Coyle et al., 2003)

There exist various types of intermodal transportation services while the most common being; truck-rail (Piggyback), truck-water (Fishyback), and truck-air (Birdyback). The reason for the frequent use of truck in the intermodal transportation service is the high accessibility of this mode. Piggyback combines the accessibility of truck with the low cost of rail, Birdyback combines the accessibility of truck with the speed of the air mode, and Fishyback combines the lower average cost of water carrier with the accessibility of truck. Intermodal transportation is especially popular in international shipments, where almost all shipments take use of more then one mode to move from its origin to its final destination. (Coyle et al., 2003)

![Types of Intermodal Services](image)

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Figure 7 - Types of Intermodal Services (Coyle et al., 2003).

In the Piggyback service one can either place the container or the trailer of the truck on board of the railway carrier (container on flatcar (COFC) and trailer on flatcar (TOFC)), or
there is the option of rolling road trains, an innovative concept to the Piggyback service introduced in 1990 where the whole truck and its trailer is loaded on the railway carrier. This option is an advantage when there is a time limit due to its rather fast loading and unloading procedure, but a downside is the extra weight and sometimes the extra height constituted by the truck (Grant et al., 2006).

As mentioned above the intermodal transportation service is mostly used in international transportations and for these kinds (international transpots) the Fishyback or Birdyback services are most common, while within nations in Europe the Piggyback is the most used one. When using the different services internationally one have to consider the different taxes, subsides, regulations, government ownerships of carriers, as well as geography differences that can be the case and constitute different solutions (Grant et al., 2006).

Another form of intermodal transportation is the landbridge. The landbridge is used when the shipment of a water transportation cross land, and hence is transferred from water to some sort of land transportation mode (usually train) for delivery over the land to a port on the other coast for continual transportation over water to its final destination. (Waters, 2003).

2.11 Standardizations

Shipments and deliveries can be standardized to save cost and improve the lead time. Some of the most frequent standardizations include containers, pallets, and trailer measurement, the last applying only to trucks. While for the rail mode the gauge also can, and is standardized for to large parts of Europe (see separate heading above (2.10.2) (Brewer et al, 2001)

Pallets are something being used all over the world, while in Europe so called *Euro pallets* is the norm (a pallet measuring 1200 X 800 mm). Other pallet solutions involve the industry pallet that measures 1200 X 1000 mm which previously was the standard pallet in the United Kingdom, half pallet measuring 800 X 600 mm and the quarter pallet measuring 800 X 400 mm. Additionally to this, pallets can be custom made to fit larger/longer, as well as smaller/shorter goods (Penman, 1997). Another benefit with standardized pallets is that they are constructed to fit and be handled by logistic tools such as forklifts (Coyle et al., 2003). An alternative for the pallet is the use of loading ledges, plastic sustainers or uphelders put under the shipment and then attached with the help of straps. The loading ledge has the advantage of being cheaper, as well as taking up less size and weight. (Fresh Patents Online, 2009)

Nowadays the utilization of containers is widely used (70 per cent of all freight movements), since its advantage of possible time savings when it comes to intermodal transportation. In the 1960s before the use of containers more than half the time of the ship were spent in ports loading and/or unloading goods, something that has decreased tremendously because of the use of containers (approximately one day compared to about three weeks before). Other advantages of containerization include a much simpler transport and flow of goods, fast and easier handling, possible door to door service, reduced damages and losses, reduced costs of packing, and lower insurance costs (Waters, 2003). However a few negative aspects are also present for the containerization such as the high degree of terminal activities in intermodal terminals, such as massive cranes and gantries, as well as the forcing of economics of scale for the different modes due to the permission of much higher stacking densities (Brewer et al., 2001).
2.12 Green approaches

The authors will now discuss different approaches on how companies and their transportation as well as distribution can become more environmental friendly. There are a lot of options and alternatives that one can bear in mind, all which to some extent contribute to a more environmental friendly transportation industry. This section is included to present factors that can be considered to reduce the impact on the environment from transportation.

An important part of green approaches when it comes to logistics is the transportation; green transportation. As can be seen below, transportation brings along several negative impacts on the environment, but there are ways to reduce them. Rushton et al. (2006) put forward several methods and techniques to achieve this. They suggest the importance to educate drivers in how to drive more fuel efficient (eco-driving). According to a study made by Schenker, reductions of fuel consumption as a result of implementation of eco-driving can be as high as 17 per cent (Schenker, 2005). This is a good way to reduce the impact transportation has on the environment. Another option is the consideration of alternative fuels, which involves switching to a less polluting fuel for the truck, such as bio gas or new techniques in engine performance. Further, one can monitor the fuel consumption of the vehicle and through feedback develop ways to improve excessive levels of fuel consumption. One can also use a more efficient fuel dispensing system, which is another way to reduce fuel consumption by introducing systems or techniques that diminish the fuel consumption, and hence consume less. It is also of importance to be thorough when carrying out the vehicle selection and selection of engines (with a higher “EURO standard”) which are more modern, contribute less to emissions and in general are more environmental friendly. Below a table compares the different EURO standard engines in terms of emissions of GHG.

![PM NOx trade off](chart)

<table>
<thead>
<tr>
<th>Norm</th>
<th>Year</th>
<th>CO</th>
<th>HC</th>
<th>NOx</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE R49</td>
<td>1982</td>
<td>14.00</td>
<td>3.50</td>
<td>18.00</td>
<td></td>
</tr>
<tr>
<td>EURO 1</td>
<td>1992</td>
<td>4.90</td>
<td>1.10</td>
<td>9.00</td>
<td>0.40</td>
</tr>
<tr>
<td>EURO 2</td>
<td>1995</td>
<td>4.00</td>
<td>1.10</td>
<td>7.00</td>
<td>0.15</td>
</tr>
<tr>
<td>EURO 3</td>
<td>2001</td>
<td>2.50</td>
<td>0.70</td>
<td>5.00</td>
<td>0.10</td>
</tr>
<tr>
<td>EURO 4</td>
<td>2005</td>
<td>1.50</td>
<td>0.46</td>
<td>3.50</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Figure 8 - Emission from different engines categorized in engine standards (EURO). CO = Carbon Monoxide, HC = Hydro Carbons, NOx = Nitrogen Oxides, PM = Particles (International Road Transport Union, 2003).

ECR Europe (2007) also suggests that one can design vehicles to maximize carrying capacity and minimize fuel emission. This aspect is related to the one of maximizing fill rate in the sense to design the loading platform (or other form of transportation of goods) to be able to carry as much goods as possible. The same can be done in regard to the fuel emission, by designing the vehicle to consume less of this matter. Also one can consider alterna-
tive modes since different modes from an environmental aspect can be better compared to others, and hence favoring the use of more environmentally friendly modes is a good way to decrease the negative impact from transportation on the environment.

### 2.13 Emissions in the transportation industry

In order to introduce the reader to the extent of the emissions the transportation industry contribute with, and what this can lead to, the authors will here present a section of emission where these data will be presented and include some examples of effects on the environment because of GHG.

As already stated above the transportation industry is responsible for a very big part of the emission to the environment. Meanwhile the emission from most sectors decreased after 1990, the emissions from the transportation industry instead increased, and quite a lot, because of the growth of the transportation industry. Even though the most harmful emissions are decreasing due to strict emission standards, the emissions are increasing (European Environment Agency, 2007). The emissions from the transportation industry consist of pollution in the form of GHG (Rushton et al., 2006). In Europe the transportation industry is, as previously mentioned, furthermore responsible for 21 per cent of the total emission of these greenhouse gases, while 93 per cent of these come from road transportation, where freight transportation has experienced a growth of 51 per cent between 1990 and 2003. The emissions from the air mode are the one increasing the most (86 per cent between 1990 and 2004) (European Environment Agency, 2007).

<table>
<thead>
<tr>
<th>Mode</th>
<th>HC</th>
<th>CO</th>
<th>NO\textsubscript{x}</th>
<th>CO\textsubscript{2}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>0,06</td>
<td>0,24</td>
<td>0,7</td>
<td>53</td>
</tr>
<tr>
<td>Rail (10 wagons)</td>
<td>0,01</td>
<td>0,0007</td>
<td>0,005</td>
<td>3,6</td>
</tr>
<tr>
<td>Air (6000 km)</td>
<td>0,2</td>
<td>0,7</td>
<td>1,5</td>
<td>396</td>
</tr>
<tr>
<td>Water</td>
<td>0,1</td>
<td>0,04</td>
<td>0,45</td>
<td>13</td>
</tr>
</tbody>
</table>

Figure 9 - Emission in the transportation industry mode by mode (Lenner, 1999)

The negative influences from the emission of greenhouse gases include first and foremost an increased temperature in the world by because a phenomenon called the green house effect. (Växthuseffekten.org, 2009). Other negative aspects from greenhouse gases are a thinning of the atmosphere (American Geophysical Union News Release, 2004), as well as the gradual diminishing of the polar ice (Revkin, 2006).
3 Method

This chapter intends to present and discuss the methods the authors used to fulfill the purpose of the thesis. In the final section reflections regarding the methods can be found.

3.1 Research approach

When performing a research one usually differ between two courses of action; deductive and inductive method. The deductive method can be described as the way of proof and is the most formalized of the two. It includes, through a coherent system deducting new hypothesis and try these by means of empirical studies (Holme & Solvang, 1997). The inductive method is usually described as the way of discovery and the result of this method would be the formation of a new theory (Saunders, Lewis, & Thornhill, 2003). The authors in this thesis performed an inductive research and with opinions and beliefs from our respondents the authors came up with knowledge about efficient logistics solutions and its contribution to cost- and environmental impact-reduction.

3.2 Choice of method

There are two main research methods used for collecting data and they are qualitative research methods and quantitative research methods. The qualitative research method is suitable when the goal is to increase the understanding of a particular issue. In order to gain a deep understanding of a particular issue data is collected by using a small number of respondents and many variables. (Maylor & Blackmoon, 2005)

In this thesis the qualitative research approach is the most suitable one because of the complexity of the business environment, which enhances the need for multiple variables in order to gain the suitable level of understanding needed to fulfill the purpose of the thesis. The nature of the problem involves achieving a deep understanding of the company investigated which will be achieved by using a small number of sources in combination with a large number of variables.

3.3 Case study

Maylor & Blackmoon, (2005) describes the case study method as not being ‘pure’ because the collection of data probably comes from multiple sources and using several methods. However it is the research method chosen for this thesis since it is not rigid when it comes to collecting and analyzing data. A case study approach can answer exploratory, descriptive, analytic research questions (Maylor & Blackmoon, 2005). For the purpose of gaining the deep understanding needed in this thesis in regards to deep knowledge of an individual company’s system it is the most suitable research method. This is further strengthened by Creswell (1997) in his assumption that case studies are appropriate for developing an in-depth analysis of either single or multiple cases.

Examples of other research methods are surveying, experiments and archival research (Yin, 1994). Surveys are particular useful when the reason for the research is to capture facts, opinions, behaviors and attitudes and is a good tool when the goal is to gather data from a large number of respondents. In the thesis the authors gathered information from a small number of sources, hence surveying was not a method suitable for this task. According to Maylor & Blackmoon (2005) experiments are suitable for testing hypotheses for cause-and-effect relationships. In this thesis the focus is on understanding a logistics system why an
experiment approach is not suitable. Archival research involves using data already collected for the same or for other purposes. The data can be found at government departments, trade associations, market research associations, commercial research organizations, academic research units, newspapers and businesses. These were some examples where it was possible to find data already collected. In this thesis it is of great importance that the data collected originates from the individual company and is up to date, these facts makes archival research impossible.

For this thesis the authors carried out a single case study, based upon a company found suitable for the purpose of this thesis. According to Barzelay (1993) a single case study can be used to analyze how problems being structured and framed, but even more to support empirical generalizations. The single case study performed by the authors will be based on interviews at the focal company. The interview method will be further discussed in more detail below in section 3.4.1.

### 3.4 Data collection

Data can be classified as either primary or secondary based on its origin (Holme & Solvang 1997). Primary data is new data collected by the authors themselves, something that can be made by the help of interviews, questionnaires or observations. The data collected are then to be used for the analysis carried out in the thesis (Befring, 1994). Secondary data on the other hand is data already collected by others, for different purposes in for example scientific articles, databases or from statistics (Lundahl & Skärvad, 1999). The disadvantage of the secondary data is the problem to secure its quality and usefulness, since the purpose of the collection of secondary is most likely different from the focal purpose of the thesis (Befring, 1994).

To be able to fulfill the purpose the authors have in their thesis used both primary and secondary data. The primary data of use was based on interviews carried out by the authors with different key persons of interest for the purpose. The authors chose to perform interviews based on the strengths of this method, being specifically targeted and directly focused on the focal topic, as well as being insightful and providing apparent casual conclusions (Yin, 1994). The secondary data the authors primarily retrieved from articles as well as other published literature and from web pages.

#### 3.4.1 Interviews

As stated above the authors carried out interviews as they found this the most convenient method for the focal purpose and due to the possibility to truly focus on the specific topic. The authors also found this method to bring along the most valuable information and for the possibilities of creating a better understanding with follow up questions and having respondents more freely express thoughts and reflections. The interviews were carried out with persons holding different key positions at the focal company, that the authors found being able to possess the kind of, for the purpose vital knowledge or experiences.

Holme and Solvang (1997) classify interviews as either respondent- or informant- interviews. In respondent interviews the respondent is himself involved in the phenomenon studied, such as a logistic manager when studying the storage activity in a company. In the informant interviews on the other hand the respondent is not involved, but rather outside or closely connected to the phenomena studied, and has a lot to say about it. To relate to the previous example a respondent in the informant interview could be a person working
on a different position at the company, but who still in some way closely connected to the logistic activities. (Holme & Solvang, 1997). In this thesis the authors used respondent interviews due to the fact they have a good contact with key persons in the company as well as they found it hard for possible informant respondents to possess any useful information.

Interviews can further be divided into structured, unstructured as well as semi structured (Holme & Solvang, 1997). The structured interviews are the most strictly formulated form and in this type of interviews the respondents are asked the exact same questions in the same order, without including any resulting questions or additional perspectives. The unstructured interviews are quite the opposite from structured interview with no prepared questions only using the focal topic as a guideline (Halvorsen, 1989). The semi structured interview is hence a mix between the other two, with carefully prepared questions, but allowing for a high degree of improvisation and follow up questions to the respondents answers. (Holme & Solvang, 1997) The authors have in their thesis used semi structured interviews since they found this method to be the most suitable one, letting both them, as well as the respondents respond to different answers and hence better able to capture the essence of the interview. It could be of preference to have the respondents' talk freely about the topic (Halvorsen, 1989), which was the case, but to ensure the capture of all essential data prepared questions are vital and hence the semi structured interview is the best option.

According to Holme and Solvang (1997) there are four elements responsible for the success of an interview, being themes, roles, actors, and coulisses. The theme of the research (and hence the interview) is decisive for the result in the reaction of the respondent. In this thesis the authors sense the theme aspect was not an issue since the questions asked were only related to professional matters. The role is referring to the different expectations both parts have on each other, and can be different if personal relationships or status differences are involved. This can be a problem if the respondent wants to avoid to disappoint the researchers and hence try to give answers he or she believe the researchers wants to hear. As a researcher you have to be aware of this and try to avoid it at as much as possible. Letting the respondent be aware that it is his opinions and nothing else you want to hear, and, as stated above, take the role as the listener in the interview process and let the respondent talk freely can complete this. This is an issue with high relevance and the authors will try to avoid or diminish the risk of this behavior as far as possible. The role of the actors, being the researchers in the interview process is to ensure the right mood is maintained, which include not rushing through the interview as well as avoid pressuring the respondent in answer something he does not want to. Finally the coulisse refers to the environment where the interview takes place, including aspects such as time, place and preparations etcetera. These are aspects the authors will have to plan carefully and will together with the respondents decide upon a proper and mutual agreement for performance.

Furthermore the actual performance of the interviews can take different forms based on aspects such as time, commitment, and availability. Saunders et al. (2003) mentions the most common ones to be face-to-face interviews, telephone interviews and focus groups. Telephone interviews can be to prefer if shortage of time and/or long distances are problematic issues. However the authors found the more personal face-to-face interview to be more useful since it will lead to less misunderstandings and generate a deeper trust and hence the credibility of the interview. The authors in the interview process carried out interviews face-to-face when possible, and at one occasion when this was not possible a telephone interview was used. To capture what is said in an interview the researcher can either take notes or record what is being said. According to Ejvegård (1993) interviews carried
out this way however has an inhibited effect on the respondent and to reduce this risk create a more relaxed situation it can be of great value to ensure the anonymity of the respondent as well as only make small notes and reminders during the interview and then after summarize the result afterwards when the interview is carried out.

The matter of anonymity can be a problem and it is easy to reveal too much data jeopardizing the anonymity. To try to reduce this the authors will keep the results anonymous if the respondents desire that. When constructing the interview guide the researchers furthermore excluded suggestions and alternatives to let the respondent come up with totally own reflections and not accidentally get mislead by the researchers. The interview guide for this thesis can be found in appendix A.

### 3.4.2 Choice of respondents

The sample of the study is an important part of the research and the wrong people can lead to that the whole thesis being inaccurate (Holme & Solvang, 1997). The purpose with qualitative studies should be to increase the value of the knowledge and create a deeper and broader understanding of the focal topic. The sample is hence decided upon to satisfy certain criteria that are theoretically and strategically defined. Strategically refer to include not only the norm, but a more varied sample to get a broader perspective of the topic, and theoretically refer to the sample being made based upon previous knowledge and understandings. The authors have taken these aspects into consideration and will include what they find to be the best possible and available respondents.

As already stated in the introduction the authors wanted to study a manufacturing company acting in the business-to-business (B2B) market due to the belief of less interest of focusing on reducing environmental impact from transportation without economic benefits. The authors already had an established relationship with such a company for why the authors decided to carry out their thesis together with them.

In many cases it is of great importance to include the biggest breadth of a sample as possible (Holme & Solvang, 1997), but the authors sense in this specific case there are only a limited number of individuals of interest as well as a rather restricted time limit, which will bound the number of respondents. The authors have together with a person holding a key position in the focal company, come up with four individuals with whom they will carry out the interviews. These respondents are the supply chain manager, the logistic manager, the environmental manager and the manager at the German CDC.

### 3.5 Reliability vs. Validity

Reliability concerns the repeatability of the study, which means that if another researcher would conduct the same study the findings would be the same. (Maylor & Blackmoon, 2005). Some threats to the reliability of a study are presented by Robson (2002), cited in Saunders et al., (2003). The first threat to the reliability is participant error, which relates to the mood of the participants involved in the survey. The survey or interview should be conducted at a neutral time where the mood of the participants is balanced. The second threat is subject or participant bias concerns the problem of the interviewees giving answers they believe their bosses want them to give. The third and fourth concerns the observer in terms of error and bias. The authors took the above threats to reliability under consideration and made sure the threats was avoided to as a high degree possible.
Validity of the study concerns whether the findings are true and are what they appear to be about (Saunders et al., 2003). For the validity of this thesis it is important that the interview questions are accurate and prepared in a way that will provide the necessary foundation for the analysis of the thesis. In order to secure the validity the authors analyzed the questions before the interviews were taking place and took extra caution when carrying out the interviews.

3.6 Method criticism

There are always alternative ways to accomplish a thesis or study, and this is the case even for this thesis were some different possibilities and methods for constructing and writing would have been possible. The method of choice has its negative aspects while the most critical one being the fact that the authors could have carried out the case study on more than one company to create a deeper understanding and a broader picture. However due to the fact that the authors wanted to create a deeper understanding from one specific company, and the time frame made it very hard to adopt the idea to more than one company.
4 Empirical study

In the following section the authors will present their empirical findings revealed mainly through interviews. First the company used in the study will be presented to let the reader create a better understanding of the thesis.

In this version of the thesis sensitive data and information has been hidden by the request of the focal company.

4.1 Company presentation

Company A is company and subsidiary in business group A security group, a group of suppliers of integrated security solutions for a variety of industries. Business group A has an annual turnover of 730 million Euros and around 6,800 employees. The company of Company A was founded in Hillerstorp, Sweden in 1955 and now consists of 360 employees and has an annual turnover of about 65 million Euros. (Company A, 2009)

Company A manufactures and supplies industrial panel and partition systems for different safety solutions. They are active in three different market segments, being automation and robotics industry, material handling and logistics, and property protection. (Company A, 2009) To help the readers create an understanding of what kind of products Company A are manufacturing the authors have included a few examples illustrated in appendix B.

4.2 Empirical findings

The empirical findings will be presented divided based upon the authors interview questions in the interviews. No special order or classification on who said what will be made.

4.2.1 Distribution

The distribution at Company A is structured in the way that the head office and distribution center (DC) is located in Hillerstorp, Sweden, where the goods are further distributed to a few central distribution centers (CDC) owned by Company A that carries standard assortment and components for smaller assemblies. The CDCs are located in England, Germany, France, and Spain. From the CDC the goods are being distributed further to their specific markets and customers. The CDC in England covers the markets in England and Ireland. The CDC in Germany covers Germany, Belgium, the Netherlands, Austria, Switzerland and the eastern European market. The CDC in France covers France and Italy. The CDC in Spain covers Spain and Portugal. Additionally there are a few small warehouses in Norway, Denmark and Finland. Moreover some goods are distributed directly to its final destinations, without passing by a CDC. The distribution structure in Europe can be seen in figure 10 below.
Figure 10 - Company A distribution structure

Figure 11 below shows a mapping of the distribution structure, and it demonstrates how the distribution can be seen to take its start from the DC in [blank] where it is shipped off to a smaller warehouse, CDC, or the distribution center of the transportation provider of the company in [blank]. From [blank] the goods are later redistributed to either the smaller warehouses or CDC’s, or can even be sent to a final customer. From the smaller warehouses and CDC’s the goods are distributed to its final destinations in a local market around Europe.
The volume of the outgoing goods is rather similar to all of the CDCs, while the volume to the smaller warehouses in comparison is small. The exact numbers of the volume delivered to the various countries can be seen below in figure 12. It is important to understand that the deliveries through a CDC can also signify delivery from XXXXX, meanwhile the direct delivery refer to deliveries direct to end customer (and hence not through a smaller warehouse or CDC).
The deliveries are distributed all over the world, while Europe being the major market with the most deliveries being distributed here. The longest distances are to southern Europe with the direct deliveries to Portugal being the furthest.

The frequency of the deliveries is rather similar for all CDCs. For every CDC there are about two trailers per week destined for each CDC. Additionally to this every day two trucks for national deliveries and further two trucks for international deliveries are sent for picking up smaller shipments (up to 3m³) for consolidation at the distribution center of the transportation provider used by Company A. About 60 per cent of the pickups occur on Thursdays and Fridays, meanwhile Monday has a much lower frequency of out bound shipments.

The delivery time for the shipment at Company A depends on the destination the goods are shipped. For deliveries to the CDC in Germany delivery is about two days, to the CDC in England three days, and to the CDC in France around four days. The deliveries can further vary two or three days depending on traffic and/or other unexpected events that might occur. The products at Company A are additionally classified in A, B, C classes where A products get delivered the same day, B needs five days for assembly, and C needs between ten and fifteen days.

The goods delivered by Company A are the goods from their product range, from which different kinds of bars and special doors being their most used products.

4.2.2 Transportation mode

At this moment Company A is only using the truck mode, and in some rare cases where time is of high essence the air mode, for its distribution in Europe. There is a possibility for using train, but due to well known problems with the mode regarding shipments temporary getting lost the company has never evaluated it. Company A also expresses that their shipped volumes are rather low and hence using train as a transportation mode would be
an expensive option. The water mode is not used due to the well established network of roads in continental Europe as well as to limit the extra lead time that the water mode brings along. For deliveries to England a boat is used for a roll-on-roll-off option. The use of truck and air further imply the use of the Birdyback intermodal transportation type service, to be able to combine the two when air is to be used. The truck mode is being chosen due to its relatively low cost and its wide accessibility, while air is being used for its fast delivery.

4.2.3 Efficiency

The fill rate at Company A is, according to them, rather low. The best fill rate been calculated for England and measured per cent, meanwhile the general fill rate being slightly lower than that. A reason for the relative low fill rate is the direct deliveries of goods that gives a much lower fill rate and hence decrease the average fill rate for all shipments. To increase the fill rate Company A has for the deliveries going to the CDC in England, if there is space available in the truck, decided to fill with deliveries for the following week. Holding back deliveries to increase the fill rate has never been considered.

Preparations of the deliveries work in such a way that the outgoing goods are when finished put for storage until one day before, or for some specific occasions when possible, the same day as delivery day, and are placed on the loading platform together with the other goods to the same destination. This is to ensure that the goods are ready for loading as the truck comes for the pickup.

The goods are packed on either euro pallets when possible, but more often on custom made pallets due to the form of their goods. The goods are put on smaller and longer pallets on its height and wrapped in plastic and additional boards for support are added. The goods are packed to take up as little space as possible. Most of the transports are different, but there are a few standardized solutions sent for inventory at CDCs. Company A prepare the loading process in the way already discussed in this section and the necessary time for the loading process is different based on its size and its type of goods, but is carried out as fast as possible.

The trailers picking up smaller shipments have specific times when they are to arrive and pick up a shipment. Larger shipments to CDC’s are collected upon by trailers that also have more or less specified times, but can sometimes arrive at the same time and hence have to wait to be loaded. The shipments are not being consolidated at Company A, but they presuppose that this is being done at the distribution center of their transportation provider. Due to this being made by the transportation provider to Company A, they cannot answer how the consolidation process is carried out. However Company A are working towards being able to consolidate with other organizations in business group A to be able to achieve a better fill rate. For example to combine a shipment with the relatively light weighted products of Company A with shipments of more heavy safes from that another company in the business group. The shipments are being consolidated at the distribution center of the transportation provider, located at Sweden, approximately 20 kilometers from the distribution center of Company A in Sweden.

Furthermore containers as a standardization process are not being used at or by Company A due to the fact that the size of the containers are smaller than to those of trucks and hence will lead to less amount being able to be shipped.
4.2.4 Transportation provider

At Company A they use a transportation provider for their deliveries. No cooperation with the external transportation provider is being carried out to accomplish a better fill rate, hence this is left for the transportation provider to accomplish themselves. The criteria for choosing a transportation provider to Company A are based on a few characteristics. The most important aspects when selecting a transportation provider is customer service followed by price. An environmental aspect is also of great importance, but not at the expense of customer service or price.

However for Company A it is important to use a transportation provider with high environmental standards. Alternatives to accomplish and/or support this can be the use of modern cars and engines, as well as less polluting fuels. The transportation provider of Company A does have an expressed environmental profile, which was one of the reasons Company A did choose this provider. Furthermore the transportation provider of Company A works actively with improving environmental factors by working towards improved preparatory work with eco driving, lowered instantaneous velocity, new vehicles, new fuels, intermodal transportation, increased fill rate, and smart city logistics (Schenker, 2009).

When asked about how Company A thinks a bigger priority of the environment would affect their operations, they start by pointing out that for Company A to hold down the expenses and delivery times are of most importance. A bigger priority of environment in the Company A organization would only affect the cost. “It is all a matter of expenses” ( personal communication, 2009-04-05). Furthermore other aspects would most likely not be affected as a result of such a priority.

The transportation provider charges Company A based on trailer meter, and when a certain weight limit is reached, per ton. The choice of transportation provider was taken based on a list of criteria, where cost, service and the environment where some of them ranked high.

4.2.5 Other

A problem for Company A is the far distance to its foreign market. To improve this Company A work to be more structured and implementing different set of regulations, structure the transportations with deliveries on specific days and so forth. Furthermore to reduce the transportation Company A tries to optimize its transportation by working continuously with improving the fill rate of transports.

During the writing of this thesis an ongoing global economic crisis is present that might affect the work of the thesis. This crisis has made Company A put less effort in prioritizing environmental aspects, since customers these days prioritize cost much more than environmental issues. Hence, considering the present situation, Company A will not make any investments to minimize the environmental impacts of their distribution if it would not generate a lower cost or an improved efficiency.

When asked if there is anything else Company A think they could do in order to decrease the negative impact on the environment. They suggest that for Company A one of the most important aspects to work upon in this matter is the increase in fill rate. To be able to increase of the fill rate for their transports both the efficiency and the environmental aspect will be positively affected, and hence something that can be seen as very important to work with in the future. Company A further states that investing in solutions that would reduce
the negative impact on the environment without a reduction of cost or increase of efficiency is not something companies in a B2B industry would consider since customers are not willing to pay extra for this. For this reason neither Company A will make these kinds of investments.
5 Analysis

The authors will in this section conduct the analysis guided by the theoretical framework. The analysis is based on the empirical findings from the thesis.

Considering the financial and the environmental benefits of efficient logistics in the distribution from a company perspective it is important to fully understand the activities and product characteristics the company is involved with. The first part of the analysis will focus on the internal activities of the company and analyze what possibilities exist to increase the efficiency of the logistics activities connected to the distribution. It considers factors that can be applicable to the focal company of the thesis as well as other companies. The aspects of customer service and cost tradeoffs will be present since it is crucial for a company’s well being that the customer is satisfied. The second section will emanate from the selection of carrier and mode of transportation for the possibility to improve efficiency and impact on the environment these options are associated with. It contains issues of the selection of mode that can be of interest to companies in general. The third section holds an analysis of the possibility to include a TPL for an overall solution of the distribution in terms of efficiency and impact on the environment.

5.1 Improving the fill rate of transports

Samulesson and Tilanus (1997) discuss a theoretical optimal logistics efficiency definition which describes a situation where the fill rate of transportation is maximized. This situation is assumed to be the optimum in a combination of financial benefits and environmental benefits. This is because a situation like this means that as much goods as possible is being transported per transport, which is cost efficient, and the least amount of transportations as possible are used, which reduces the amount of emissions from the transportation of goods. This connection between cost reductions and reduced impact on the environment as a result of an increased fill rate of transports has previously been made by Aronsson & Huge Brodin (2006). For Company A the current fill rate at best is measured to 42 per cent which makes this an area of interest to investigate in detail. An increased fill rate for the transportation of products at Company A would probably mean a possibility to reduce the cost of transportation and reduce the environmental impact as well. In order to improve this it is important to identify the factors influencing the fill rate in the transports.

Starting at the core, there are the product characteristics which according to Slater (1990) have a big influence on the transportation. The characteristics taken into consideration are weight, robustness, shelf-life, size and shape. If the product can be combined and fit together with other products to increase the fill rate is also an aspect to consider (cited in Gattorna and Walters, 1996). The products being transported from Company A are rather slim but require a large area in their shape as panels, however along with them come additional smaller parts that are being used for fitting and assembly of the products at the customer location. The additional parts have the potential to increase the size of the package as the delivery is being customized according to the customer order. This means that the finished product along with the additional parts stands for the relevant product characteristics to consider when working with the fill rate of transports.

The customer orders are put on pallets as they are being prepared for transport. When it is possible Company A uses the standardized Euro pallet, however for more customized orders and in general when necessary, customized pallets are used which are more suitable for the shape of the individual order. The available sizes of the pallets at Company A vary in
terms of width. This situation of multiple variations of pallets does not work in favor when it comes to increasing the fill rate of a transport. Ideally the products should be packed in standardized and similar pallets, however the product characteristics does not allow for this to be implemented to the fullest extent, especially when it comes to customized customer orders. This is one source to the rather low fill rate experienced today and is identified as one of the biggest sources that can be improved. The result of an improvement in the routines for packing the products would increase the fill rate and reduce the need for transportation which would save cost and reduce the emissions from them.

This raises the question of what the options are for Company A in terms of increasing the standardized packaging which would increase the fill rate of its transports. An increase of standardized pallets requires a different strategy of assembly of their products. This presents the possible option of using postponement as a way to further the use of standardized pallets. Postponement involves, in one definition by Gourdin (2001), the delay of the final assembly of the products. This could mean that the products (depending on the type) in their shape have a higher compatibility to be packed together if postponing the final assembly and packaging would be implemented. Keeping the products unassembled makes them less bulky. This would reduce the space-intensive customized packaging and increase the possibility to use standardized pallets, which are easier to pack efficiently to increase the fill rate compared to the customized pallets. The ideas presented by Zinn & Bowersox (1988) of packaging postponement and assembly postponement which involves keeping the products with their core characteristics for as long as possible and assembling them as close to the customer as possible would present an opportunity to use standardized pallets where the panels are packed together which would increase the fill rate significantly and later assembling them at the CDC. Postponing the packaging would mean that the customized customer orders would be finalized at the CDC where they would be placed on the customized pallets along with the parts needed for the final assembly. Postponing the assembly would mean the same change of the routines as described for postponing the packaging. Once this is finalized the deliveries would be distributed from the CDCs around Europe to the customers within their respective region. A successful implementation of postponement would increase the fill rate which would decrease the number of transports on the longest transport stage from (DC) to the CDCs in Europe (England, France, Germany and Spain).

In the situations where the transports do not involve a full truckload, the transports are being consolidated by the transportation provider at their terminal in . During the interview the authors investigated whether any cooperation with the transportation provider was made in order to facilitate an increased fill rate in the transportation and it turns out there is not. This fact rise the interest what Company A can do that would decrease the transports when the goods are being consolidated. In a situation like this the principles of postponement of packaging and postponement of assembly would be of interest again. The effects of it have been previously discussed. Using the same principles which would facilitate the use of standardized pallets would have the effects of reduced need for transportation which would decrease the costs as well as decreasing the emissions from the transportation.

A combination of postponement and consolidation would be where the authors indentify the greatest potential for saving on cost as well as reducing the emissions from transportation. A model has been developed where it is illustrated how such a design of the distribution could be designed. The model can be seen below in figure 13. If this model was to be applied on Company A, the company would be placed among the suppliers, together with
other suppliers using the same transportation provider. The suppliers would then deliver (or have their shipments delivered) to a warehouse, in this case the distribution center by the transportation provider in Värnamo. In Värnamo the goods would be consolidated and shipped together over the longest transportation stage to a CDC closer to the local market (in this case somewhere in continental Europe or England). At the CDC’s the goods is then assembled if necessary and then delivered to a local customer. As already mentioned this would probably have a positive effect on the transportation cost and brings along a lesser impact on the environment by having a more intact distribution further along the distribution chain.

Figure 13 - Illustration of the combination of consolidation and postponement

The time aspect in combination with fill rate is presented in the frame of reference as the true fill rate of a transport. Coyle et al. (2003) discusses customer service and the time aspect of it as a very important side of logistics because of its impact on customer service when it comes to delivery time. It is established that time plays an important role in a company when it comes to transportation; the shorter time needed, the better the customer service, which in the end makes the products more attractive to the customer. For Company A the time aspect is handled in the way that the customer orders are being prepared a day in advance (or in some cases when possible earlier the very same day) and put on the loading platform in pre-assigned places. This maximizes the time efficiency for the pickup as trucks are arriving and has a positive impact on the delivery time and the true fill rate of the transport. The authors find that Company A has established good routines when it comes to preparing the deliveries for the pickups in time to reduce the time needed for loading the trucks at the loading platform and making it time efficient as well as reducing the time when the trucks stands idle and emits exhausts.

5.2 Choice of mode

A very important choice for a company is the choice of carrier because this is a selection that has an impact on first and foremost cost and lead-time, but also on inventory, customer service, security as well as environmental aspects (Coyle et al., 2003). Choosing the right mode for a company is vital and is a process where a thorough evaluation of the different options is necessary. When relating to the overall cost Gattorna and Walters (1996) refer to this selection as horizontal tradeoff where one should compare the different modes available for carrying out the same assignment, however also other aspects (besides cost) need to be taken into consideration. To make the right choice of mode can also improve a company’s efficiency to a high degree (Coyle et al., 2003) and for this matter, together with the
possible impact it can have on the environment (Lenner, 1999), the authors is convinced it is a significant part of this thesis.

When a company is to select a mode they need to take the decisions whether to use only one single mode, or whether to use an intermodal service. Which option is the best for the specific company can depend on a lot of different factors, such as type of product, demands on lead time, cost, security, and accessibility, etcetera. The choice can also be affected by factors outside the control of the company, such as the delivery over an ocean often require the use of intermodal service since the goods might have to be transported, by for example truck or train to a port or airport for transportation over the ocean, and then some mode of transportation for final delivery to the customer (Coyle et al., 2003). Other aspects such as accessibility have to be taken into consideration as well, whether the desire for it is there or not (considering for example the lack of sea access and harbor makes it impossible for the choice of only using a water carrier) (Coyle et al., 2003). Company A have made the choice to only use trucks and in a few cases air carriers to transport their goods. The authors’ think that the use of rail would normally be a very good option in terms of its low environmental impact, but considering the location, far from a railway and railway terminal, and more important the quite small sizes of every shipment of Company A, makes the use of truck carriers a much better option. Still, in many cases companies’ costs could decrease since in general the rail mode is cheaper (depending on the volume) compared to truck (Coyle et al., 2003) and the environmental aspects could profit from the choice of railway in front of truck since the emissions from rail are lower (Lenner, 1999). Still one has to consider that every case is unique and no general rule can be determined that can apply to everyone when it comes to selecting the most suitable mode. A final choice is on what specific carrier or transportation provider the company wants to use, that as with the option of modal choice can be affected by various factors, similar to those already mentioned (Coyle et al., 2003). In conclusion the company needs to identify the factors discussed above affecting the modal choice, so the most suitable solution is applied.

When a company is to select mode of transportation and carrier, a useful idea can be to establish a list of criteria containing factors that are important for the focal company. According to the interview this is something Company A did in their process of selecting transportation provider, and for them cost and service was seen as the most important factors. The authors agree that both service and cost are among the most important ones because of the following reasons. The service criterion can appear to be important due to the fact that it will directly affect the customer service of the distribution. A weak quality of the service may jeopardize the trust of the customers and cause them to turn elsewhere for acquiring the products and services (Coyle et al., 2003). Cost can be seen as having such an importance due to that most companies strive to keep down their costs and limit their expenses.

As stated before, the environmental aspect is a factor that can lower the cost as well, and hence make it an even more crucial criterion to consider. The choice of truck or boat instead of air, and/or to choose rail instead of truck, will not only have a lower negative impact on the environment (Lenner, 1999), but also provide the possibility to save on cost as well (Coyle et al., 2003). Of course as already implied such alternatives would affect other aspects such as delivery time and reliability (Coyle et al., 2003). Another connection between the environmental aspects and cost, and also efficiency is the fact that some modes have the possibility to carry larger amounts of goods per shipment, which will lead to fewer deliveries, and hence have a lower impact on the environment (Coyle et al., 2003). Efficiencies that would reduce cost and the environmental impact can be achieved in increasing the
scale of the transportations. The truck and air modes are in comparison to the water and rail modes smaller and might not be able to achieve the scale needed to experience the benefits of cost and environmental impact reductions found in the water and rail modes. The scale of the shipments from Company A is small and their statement that the truck mode is most suitable for them can be considered correct. But for companies experiencing larger scale shipments might find the above mentioned efficiency benefits appealing.

If the reason for a company not to use rail is the location (for example the company not being close to a railway terminal) for their transportation an alternative is the use of Piggyback, to be able to connect the distribution center and the terminal. Piggyback would many times be both cheaper (depending on size and type of goods) (Coyle et al., 2003) and better for the environment (Lenner, 1999) compared to using only truck, and hence could be a good option to evaluate as a distribution option for companies.

Besides the horizontal tradeoff consideration, Company A, or any company, should also reflect upon the vertical tradeoff possibility. According to Gattorna and Walters (1996) the vertical tradeoffs become topical when there is some kind of change in a transport activity, which lead to an alternative bringing along greater benefits, something any company constantly should be aware of. Implementing a mode, because it is considered to be the most suitable one for your operations, does not meant that this mode will stay the most suitable forever. Alternatives to the present transportation solution must frequently be evaluated. Company A has not evaluated other alternatives to the truck mode, such as rail, since they consider this option to cause a lot of problems and the volume of the goods distributed from Company A is to low in order to become an alternative. However the authors want to emphasize the importance of always evaluate the different alternatives available to always try to come up with the mode of choice most suitable for the specific company’s transportation solution at the moment.

When it comes to the use of standardized solutions such as containers and/or pallets, even this is of great value in relation to make the distribution process more efficient (Waters, 2003). Company A is a company where no containers are being used due to the fact that they constitute a smaller size in comparison to the loading capacity on trucks. However the authors believe that other companies may consider this if they have other packing solutions and above all and more important if they have many international shipping’s where the use of containerization would make the distribution process a lot more efficient. For example a company sending a vast amount of goods overseas to the United Kingdom, the use of containers would make the process much easier. The company would as an example, freight the containers loaded on trucks for delivery to a harbor, as the description of the Fishyback intermodal service, transship the container to a boat for delivery to the United Kingdom where a new transshipment to a truck or railway for delivery to its final destination. The use of standardized pallets is also something that could improve the efficiency for companies since they are designed to fit a lot of equipment for easier handling and tools such as forklifts, truck cargo space, and inventory solutions (Coyle et al., 2003). This would speed up the process of delivery as well as fill rate.

5.3 Involvement of a TPL

The distribution system at Company A has previously been presented with its DC in and ownership of CDCs around Europe in England, France, Germany and Spain. The analysis in a previous section describes what Company A can do in order to increase its efficiency resulting in cost reductions and a decreased environmental impact in their dis-
The fill rates at Company A of the transports have been calculated to a maximum of 42 per cent and have been identified as an area where improvements probably are possible to be made. Currently Company A are outsourcing the transports of the products out bound from the DC in Hillerstorp to the CDCs and warehouses around Europe. Outsourcing of other logistics functions will in this part be analyzed and discussed whether the use of, and the effects from a TPL to provide the necessary services for the distribution of Company A products from the DC in Hillerstorp.

The principal reason for a company to outsource logistics functions to a TPL is according to van Laarhoven et al. (2000) the possibility for a company to focus and spend more resources on their core competence. Company A has already outsourced the transportation function and is regaining the possession of the goods after the transportation at the CDCs around Europe where the products are being further customized and distributed to the final customer.

The question is where would it be suitable to involve a TPL for an overall logistics solution, is it a good idea and what would the effects be considering the purpose of the thesis that through efficient logistics solutions cut costs as well as reduce a company’s impact on the environment? The main concern is the fill rate and consolidation possibilities of the products from Company A. This is where the authors have identified that the main benefits can be found in terms of saving cost and reducing the environmental impact from the company. Previous findings show that a higher fill rate might be achieved of the transportations if postponement of packaging and assembly is implemented which would mean that the products can be shipped using standardized pallets which is more efficient compared to using customized pallets for customized customer orders. Considering this, the interest falls on the warehouse functions at the CDCs around Europe where the postponement processes and final distribution to the customers would take place.

At the warehouses some orders are being customized further while some customer orders are put together. These functions are under the control of Company A. Outsourcing the warehouse functions to a TPL, which would take control over the final customization of customer orders would be a possible development of outsourcing other logistics functions. In a situation like this the TPL would fall under Hertz and Alfredssons (2003) definition of customer adapter, as presented in section 2.7, since it would take over the existing logistics activities and the benefits would be the improved efficiency in handling the products. The improved handling would be an increased efficiency in terms of fill rate of the transports from Hillerstorp as well as improved packaging and assembly of the customized customer orders at the CDCs. Possible benefits from improved packaging and assembly routines at the CDCs would be optimized fill rates in the distribution to the customers.

In the figure 14 below the previous model of Company A distribution has been adapted to show where a TPL would take over if both the transportation and warehouse functions were to be outsourced.
Figure 14 - Illustration of the combination of consolidation and postponement with outsourcing to a TPL.
6 Conclusion

In this section the authors will present the conclusion they have come up with while working with the thesis. The conclusion will summarize the findings in relation to the stated purpose. In this chapter the authors will also reflect on their work and present suggestions on further studies.

The purpose for this thesis is to investigate efficient logistic solutions and see how they can reduce transportation costs as well as the environmental impact of a company. Based on this purpose the authors have come up with the following conclusion:

For a company to become as efficient as possible, while at the same time reduce their negative impact on the environment they need to try to maximize their fill rate, which brings along that as much goods as possible is being distributed with as limited amount of transportations as possible. To be able to perform operations with a higher fill rate companies can increase their standardizations for its packaging in order for the goods to better fit the loading area of the carrier. Standardizations in the distribution process will further speed up the process and make it more efficient. Further solutions can be to carry out postponement where the company should keep their products with their core characteristics for as long as possible and assembling as well as packaging them close to the customer. When the transportations do not fill a full truckload, companies or their transportation providers can consolidate; and share the transportation with other companies for a further increase of fill rate. The authors suggest that one of the greatest possibilities for cost savings and reductions of the environmental impact would be to postpone assembly and packaging to be done at a point as close to the customer. This would enhance the fill rate by facilitate the consolidation further. This solution would incur a more intact distribution along the distribution chain, and the company would have their products distributed to a distribution center where it would be consolidated with other products from other companies. From there the goods would further be delivered over the longest transportation stage to a warehouse close to the final customer where it would be assembled and packaged if necessary and then delivered to the final customer. This would lead to fewer deliveries over the longest transportation stage and hence bring along reductions of costs and emissions.

Additional important conclusions from the thesis involve the significance of choosing the most suitable mode of transportation as well as carrier for distribution of goods. When performing the selection of mode all available alternatives should be considered and the selection process should continuously be evaluated due to the circumstances surrounding the phenomenon change over time. The mode of choice will affect a range of different factors where cost and service are found to be the most important. Choosing one mode rather than another can also allow for larger amounts of goods being transported which will also generate fewer deliveries. The selection of mode further involve alternatives of intermodal services which can equally as choice of mode bring along further benefits in factors such as time, cost, service and environmental aspects. When selecting upon a specific carrier a good alternative would be to establish criteria based on the needs and requirements for the company, and then carry out the selection based on this.

For the distribution to be carried out in the most efficient way an alternative would be to outsource it to a logistics provider. To outsource the transportation and warehouse activities can bring along a higher fill rate being achieved, as well as better consolidation of the goods, compared to caring out the distribution process inside the company. As stated above this would induce fewer transportations and hence a reduction of cost and a reduced environmental impact.
6.1 Reflections

The authors feel that they have fulfilled the purpose of the thesis and are pleased with the outcome. However they would have wanted to conduct additional interviews with more respondents to broaden the empirical findings. Attempts were made to find more interview respondents, but unfortunately the attempts were unsuccessful. The limited amount of time was another reason why not more respondents was included, and the authors believe that if additional time was to be available, the chance to find further interview respondents would have been greater.

The authors further believe that they in the early stage after agreeing on a final purpose could have conducted an introduction interview with a company representative to create a better understanding of what theories to include in the theoretical framework of the thesis.

6.2 Suggestions on further research

During the writing of this thesis various suggestions and ideas on further research have emerged. One thing the authors find to be interesting would be to include reverse logistic, due to this being a very important part of logistics, a part with strong environmental connections. To include efficiency within reverse logistics, or investigate only this, the authors find to be a very interesting subject and something that could be useful for a range of companies applying some sort of reverse logistic processes.

Another topic to investigate would be that from a third party perspective investigate a logistics provider’s or a TPL’s role in finding efficient logistic solutions for distribution that would lead to a reduction of transportation costs as well as the environmental impacts. The authors have in this thesis investigated what a company can do in this matter. Doing the same from a transportation provider’s or a TPL’s perspective could lead to further and/or different conclusions and is also a very interesting area according to the authors.
7 References


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8 Appendix A – Interview guide

Distribution

1. How is the distribution structured?
2. How large is the volume of outbound goods?
3. How far are the distances for the outbound deliveries of the goods?
4. How often are there outbound deliveries of goods?
5. What are the destinations for the outbound goods?
6. What are the delivery times for the outbound goods?
7. What types of goods are delivered?

Transportation mode

8. What are the selection possibilities in terms of transportation mode?
9. What type of transportation mode/intermodal service are you using?

Efficiency

10. What is the current fill-rate?
11. How are the outbound goods being prepared for loading? E.g. are the goods packaged in a way to make the loading procedures easier? Are all the transports different? Is it possible to plan the loading process considering the nature of the products? Are the products being package in a way to make consolidation easier? How long does the loading process take?
12. Do you have specific times set for pick up?
13. Are the outbound goods being consolidated for transport?
14. How are the transports being consolidated?
15. Who consolidates the transports?
16. Where are the transports being consolidated?
17. Do you to any extent use containers?
18. Do you or your transportation provider use any kind of delays to be able to accomplish a better fill rate?

Transportation provider

19. Do you use a TPL for your distribution?
20. Do you to any extent cooperate with them (the transportation provider) in regard of fill rate?
21. What are the criteria for choosing a transportation provider? (e.g. cost, delivery, environment, lead time etcetera)
22. What are your demands regarding the environment for your transportation provider?
23. Does your transportation provider have an expressed environmental profile? In what way? What aspects are touched upon?
24. How do you think a bigger priority of the environment would affect your operations? (Impacts on e.g. cost, lead time, quality etcetera)
25. How does the transportation provider charge for its services? E.g. per delivery, volume, weight, or special agreements etcetera.
26. Why did you choose the transportation provider in question? Where you ever responsible for your own distribution?

Other

27. In one of your brochures one can read that you work towards reducing your transportation, how do you do that?
28. How has the economic crisis affected the transportation for Company A? How has it affected the environmental perspective of the transportation? Have you seen any direct effects?

29. Is there anything else you think Company A could do to reduce the negative impact on the environment?