A CENTRAL GOODS RECEPTION
– an alternative for Scania in Södertälje?


Authors: Andreas Pihl & Stefan Jennersjö
Assignor: Thomas Laghamn, Scania CV AB
Tutors: Eva Eriksson, Lund Institute of Technology
         Björn Kvarnström, Scania CV AB
Acknowledgements

Since the start of this project, in September 2003, we have learned a lot about Scania’s business in general but we have also gained specific knowledge about the goods receiving function at Scania in Södertälje. Many people have helped us to complete the report you are holding in your hand and we would now like to take the opportunity to thank them all.

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Finally the authors hope that this report fulfils the targets presented in the assignment directive and that Scania considers the results as valuable.

The reader should also be informed that the opposition of this thesis was made on a Swedish version of the report.

Södertälje, February 2004

Andreas Pihl                 Stefan Jennersjö
Summary

Centralization has become more and more interesting for many companies during recent years, but mostly with focus on distribution to customer. A warehousing centralization can according to many theories strengthen the logistic competitiveness for a company since it contributes to lower fixed costs and better customer service. These theories have not dealt with the inbound flows to a company and it is therefore interesting to investigate if these positive factors can be applied on a centralization of a goods receiving function.

Today, Scania in Södertälje has a decentralized goods receiving with six independent units. All these goods receptions have their own resources and their own administration. Scania’s consumption controlled material ordering creates small and very frequent orders to suppliers which generates high transport costs. While Scania pays for all goods transports from suppliers, the large transport cost creates a relatively heavy burden for the company. One proposal that Scania believes could lower the transport cost is a central goods reception for Scania in Södertälje. Scania also believes the present structure is not optimal in a resource point of view and they therefore find it interesting to investigate a new structure. This master thesis is one part of the studies about a way to reduce transport costs and the purpose is to compare the present situation with a new configuration consisting of a central goods reception. In order to carry out this comparison, the new structure is described and areas as work procedure, resources and layout are discussed.

To fulfil this comparison, the present goods receiving process at Scania has been thoroughly analysed together with visits and interviews at other companies to investigate their goods receiving function. These visits have been carried out to collect ideas and opinions concerning Scania’s situation. Interviews with logistics managers at Scania were also conducted to collect a clear picture of the consequences if a change in the structure was to be made. Based on the collected information, the comparison has been completed and our recommendations to Scania have been formed.

The result of the study shows that a structure with a central goods reception is possible to implement at Scania in Södertälje. It is however very important that the central reception handles most of the administrative tasks in the goods receiving process to generate as many scale benefits as
possible. The qualitative comparison, that covers areas as lead time, quality and competence shows that the new structure is more beneficial for Scania. However, the comparison also shows that the difference between the two structures is relatively small and the present situation can be seen as pretty good. The economical calculation shows that the saving in personnel for Scania is smaller than the increased costs for forklifts and internal distribution. If a change in the goods receiving structure should be profitable for Scania the external transport cost must be heavily reduced.

The recommendation to Scania is therefore only to carry out the structural change if a profound reduction of the transport cost can be ensured. The transformation is so severe that the economical gain for Scania must be significant.
Sammanfattning

Centraliseringsforskning har under senare år blivit allt mer aktuellt men det har främst fokuserats på distribution till kund. En centraliseringsförändring kan medförta effektivare logistik konkurrenskraft i form av lägre kostnader och förbättrad kundservice. Dessa teorier har dock inte berört ett företags mottagning av gods och det är därför intressant att undersöka om dessa positiva effekter även gäller vid en centraliseringsförändring av en godsmottagningsfunktion.


För att kunna genomföra jämförelsen har dagens godsmottagningsprocess på Scania noggrant undersömts samtlocalt som godsmottagningsfunktionen på andra företag studerats för att erhålla idéer samt åsikter beträffande Scania:s situation. Intervjuer med logistikansvariga på Scania har även utförts för att skapa en tydlig bild av konsekvenserna av en strukturförändring. Utifrån den insamlade informationen har denna jämförelse genomförts och en rekommendation till Scania har utformats.

Studiens resultat visar att ett nytt upplägg med en central godsmottagning inte är omöjligt att införa på Scania i Södertälje. På den centrala enheten skall större delen av de administrativa arbetsuppgifterna i godsmottagningsarbetet utföras för att generera resursmässiga stordriftsfördelar. Den kvalitativa jämförelsen som bl.a. beaktar ledtid, kvalitet och kompetens visar att ett nytt upplägg är mer fördelaktigt för Scania. Dock visar

Rekommendationen till Scania är att endast genomföra en strukturförändring om en kraftig reducering av transportkostnaderna kan säkerställas. Förändringen bedöms vara så omfattande att den ekonomiska vinsten för Scania bör vara betydande.
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1 Introduction

As an introduction to this master thesis, we would like to give the reader an understanding of the problem background and why the situation is interesting to study. Further, the problems we intend to answer are discussed which leads to the purpose of the thesis. Finally, we try to visualise the disposition of the report.

1.1 The authors and the report

This report is the written part of the master thesis that concludes the authors’ studies at the Master of Science Program in Mechanical Engineering at Lund Institute of Technology. During the thesis’ work the authors have been located at Scania in Södertälje which has facilitated the work with the interviews and observations that were performed throughout the study. The thesis has been conducted at the function TPE with Thomas Laghann, process manager external logistics, as assignor. The tutor at Scania has been Björn Kvarnström who works as a transport purchaser.

1.2 Background

The manufacturing industry has for some time been focusing on optimizing their production process, but nowadays an area as logistics has become more interesting. Many companies are now trying to reduce their costs for transports and material handling. The industry’s ongoing development, with new production processes and technologies set demands for transports to be flexible so the customers always can be satisfied. The manufacturing companies have now focused their effort on reducing lead times and lower the tied up capital as well as concentrate on a more consumption driven production. (Lumsden, 1998)

Many companies have also, during recent years, changed their warehouse configuration to a more centralized structure with only a few larger units. These changes have been successful and have often contributed to less tied up capital but subjects as lead time and competence have also been positively affected. Centralization often contributes to a strengthening of a company’s logistic competitiveness since it lowers the fixed costs and adds logistic value to the customer. (Abrahamsson, 1992) Most of these theories about centralization deal with a company’s outbound flow to customer. We therefore find it interesting to study if these theories also are valid for a
company’s inbound flow, which in this thesis means an analysis of a possible centralization of the goods receiving at Scania in Södertälje.

Scania in Södertälje has had a decentralized structure for their inbound flow since the middle nineties. Before that, the administrative goods receiving tasks were carried out at a central unit and physical unloading was only conducted at a few places at the Scania area. This structure was then decentralized so that every function in Södertälje could carry their own costs. Along with this change in structure Scania also modified their material ordering to smaller and more frequent deliveries from suppliers. This contributed to an increased number of performed transports and while Scania with the present agreement pays for these transports, the transport cost increased heavily. This development has caused a burden for Scania and now transport cost is a prioritized area. At the present time there are many ongoing projects aiming to reduce the transport cost and this thesis is one of them. The smaller deliveries from suppliers have also lead to an increased amount of packaging material that follows the goods flow and has made the handling of packaging material more interesting.

There are several different businesses located at Scania’s area in Södertälje today and all of them have a goods reception and a specific delivery address. Every reception functions as an independent unit with its own organisation and resources. Today, when a transport arrives to Scania in Södertälje it is often consolidated with goods to many PRU:s, which affects Scania negatively in many ways. The PRU:s generate empty packaging that is internally transported to Hovsjö for storage and further distribution. The business in Hovsjö is necessary because of Scania’s returnable packaging system, which is used in the entire supply chain.

One of the proposals that arose from discussions about a more efficient goods receiving, was the suggestion of a central goods reception integrated with packaging handling.

1.3 Problem discussion

At discussions concerning the high transport costs, it came up that Scania, because of the decentralized structure, pays for many small consignments to

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1 PRU - Production Unit
2 An area located a few kilometres northwest from Scania’s facilities.
1 – INTRODUCTION

every PRU which in reality is one large consignment to Scania in Södertälje. To gain a more favourable position in the price negotiations with the forwarders, a central goods reception with only one receiving address for Scania in Södertälje, is an option. How can an implementation of a central goods receiving help to reduce Scania’s high transport cost? How much must the transport cost be reduced so a change in structure is profitable for Scania?

At the present time the inbound flow to the different goods receptions varies heavily during the day, which forces the receptions to be over-dimensioned most of the time. This because, the unloading capacity being adapted to the most intensive period. With a central goods reception Scania has the possibility to level out the inbound flow to the PRU:s. Is this adjustment achievable for all receivers and how will this affect the goods receptions’ need for resources?

With the present goods receiving structure, the forwarder is responsible for the goods transport all the way to receiver. A centralized arrangement means that Scania takes over the responsibility for the goods transport from the central goods reception to the PRU:s. How shall this internal distribution be shaped and how much of Scania’s resources are needed? How will Scania be affected by the extra handling that a central goods reception results in?

Today, the goods receiving tasks are often carried out differently between the units. Examples of this are the receptions working in different computer systems and the PRU:s having various demands concerning goods labelling. The present goods receiving structure contributes to a good local competence for the goods receiving personnel but a general knowledge is sometimes missing. Which computer system should be used at a central goods reception and how will a change in structure affect the competence of the personnel? Can a standardized working method for the goods receiving function be introduced and which tasks shall be performed at the central unit?

The facility Scania today has at disposal in Hovsjö for breaking down, storing and distribution of packaging material is not well suited for this kind of business. If Scania chooses to continue with the packaging handling in Hovsjö, there is a need for investments to increase the plant capacity.
Today, the transports of empty packaging are suffering from low utilization and the transport is often empty on the way back to the PRU. How will the transports of empty packaging be affected if a packaging handling function is located close to a central goods reception?

1.4 Purpose

The purpose of this master thesis is to describe a new structure with a central goods reception and from chosen aspects compare the new structure with the present configuration and based on the comparison give Scania a recommendation.

The description mentioned in the purpose should, both structurally and operationally, illustrate how a central goods reception could be adapted to Scania’s business in Södertälje. In the study, a discussion will be held about the parameters we believe are the most essential at a centralization of Scania’s goods receiving process. The report will include:

- A description of which work tasks that will be performed at the central unit and at the local receptions as well as which computer systems that should be used.
- A proposal of how the internal transports of goods and empty packaging will be formed.
- A proposal concerning layout of and location for the central goods reception.
- A table that specifies the resources needed in the goods reception process and for internal transports with the new configuration.
- Arguments regarding why a reduction of the external transport cost could be accomplished and a proposal to Scania how to handle the transport invoices.

The comparison, referred to in the purpose, will be carried out based on the aspects that we believe have the largest value for Scania. The lead time, from unloading at Scania to goods arrival at the goods receptions’ customer, will be compared between the two structures. Quality is also an aspect that will be included in the comparison. In this study quality is seen from a physical as well as logistical point of view. Further, the competence of the goods receiving personnel will be an area that is analyzed for both structures. Security is also an aspect that will be a part of the comparison.
The italic aspects will be included in a qualitative comparison between the present situation and the new described structure.

Besides the qualitative comparison, a quantitative economical comparison will be performed. The parameters that will be included in the economical calculation are the requirements of personnel, forklifts and ground space. Further, costs for external as well as internal transports will be integrated in this total cost analysis.

Based on these two comparisons the master thesis will present a recommendation to Scania about the most suitable goods receiving configuration.

1.5 Focus and delimitations

Figure 1:1 shows the delimitation and focus of the study in relation to Scania’s supply chain.

The delimitation presented in figure 1:1 results in an exclusion of Scania’s suppliers in this thesis and the study will also exclude all the work conducted after the goods reception’s customer has been served. We believe that a central goods reception will not affect Scania’s suppliers in an initial state, as the material ordering is not changed. However, shown in figure 1:1, a minor part of the suppliers’ work will be mentioned in this report due to the information flow in goods transports that partly affects the supplier. The focus of the study will however be at the goods receiving process at Scania, which embraces all activities from unloading to distribution to customer. Furthermore, the study will focus on the physical flow as well as the flow of information. Some part of the financial flow will though be mentioned in the report as the handling of transport invoices is discussed.
In the study, no effort will be made to analyse Scania’s internal computer system but the report will present which system that should be used at a central goods reception. A delimitation made in this thesis is that when system changes are proposed, no analysis of how these changes should be handled is presented. This delimitation is done because we believe that a deep system analysis is not relevant for the thesis. To further delimitate the depth of the study, only a shallow description of the work tasks in the goods receiving function will be performed which means that no detailed work description is presented. We consider this not to affect the result of the study since this thesis only deals with a possible change in structure. Further, no environmental issues will be discussed in the report as the environmental area is relatively complex and the authors do not have enough knowledge in the area.

The goods transports that are dealt with in this thesis are transports from external suppliers, which results in the exclusion of internal goods flows. These flows are however often already optimized and they should therefore not be handled by a central reception. All information collected for the study is gathered from today’s production volumes and the new structure is therefore based on present situation. This results in no deeper analysis being made concerning future changes in production volumes.

A further delimitation is that the study will not include DynaMate’s packaging handling in Hovsjö and only focus on the flow of empty packaging. An assumption made in the thesis is that the packaging handling can be located close to a central goods reception and this assumption will not be questioned.

The economical comparison includes a simplification since only a few cost areas are contained in the economical calculation. The contained costs are relatively easy to visualize and calculate for the new described structure. A further simplification that will be made is that all costs are recalculated to a fixed monthly cost, which means that no concern was placed on depreciations and interest rates. However, we assume that these simplifications will only have a minor affect on the result of the calculation.

Finally, the study has no intention to make a thorough analysis concerning how Scania should carry out a change in structure since this is not included in the assignment directive.
1 – Introduction

1.6 Target group
The area of interest for this report lies mostly with persons and companies that in some way are affected by or have interest in the goods receiving process at Scania in Södertälje. Further, we believe that the report could be useful for persons with a general concern for logistic projects.

1.7 The disposition of the report
To give the reader a general view about the disposition of the report and the structure of the study, this section presents a short description of all the chapters and how they are connected.

Figure 1:2 General structure of the report

Figure 1:2 shows a schematic picture of the report layout. The dotted lines mark the three major parts of the report. The introduction part contains chapter 1, 2 and 3. When reading these chapters, the reader should acquire good knowledge about the problem and how the purpose should be fulfilled. In the first chapter the reader should obtain an understanding about which theories that are relevant with consideration into the problem discussion. Chapter 2 presents general information about Scania, which is necessary for
1 – Introduction

the comprehension of the empirical study. The method chapter describes, among other things, how the empirical study and the analysis work were conducted.

The three chapters that follow represent the main part of the thesis. Based on the presented theory, together with the description of the present situation as well as the information from the benchmarked companies, the reader should be able to follow the analysis presented in chapter 6. The reader should then relatively easy understand the conclusions and recommendation stated in chapter 7.

The final part of the thesis, which consists of chapter 7, presents the recommendation the authors would like to give Scania about how a future goods receiving function in Södertälje could be formed. This chapter is concluded with a generalization and the authors’ final words.
2 General information about Scania

In this chapter, we would like to give the reader a short presentation about the company and a rough description of the areas related to Scania which will be treated in the report.

2.1 Scania – the company

Scania develops, manufactures and sells heavy trucks and buses as well as engines for industrial and marine use. Scania also offers its customers a broad range of services, service-related products and financing. (Scania Annual Report 2002, p. 2)

Scania is the world’s fourth largest manufacturer of heavy trucks today. In the year 2002 the turnover reached SEK 47 billions and the company has a total of 28 230 employees worldwide. Scania is represented in about 100 countries through a widely spread service and dealer network.

2.1.1 History

Scania’s history goes back to the 19th century. It all began in 1891 when a new company was created, Vagnfabriks Aktiebolaget i Södertelge, Vabis, which among other things manufactured trucks and marine engines. In 1911, Vabis was merged with the truck and engine manufacturing company, Maskinfabriksaktiebolaget Scania, and the company AB Scania-Vabis was created. Scania-Vabis grew from a small company to a multinational corporation and was in 1969 sold to Saab. The corporation changed name to Saab-Scania and continued to grow until 1995 when Scania became a separate company. The following year, Scania was listed on the stock exchange and today the largest stock owners are Volkswagen, Volvo and Investor.

2.1.2 Products and markets

Scania’s core business is to manufacture and develop trucks with a gross vehicle weight of more than 16 tonnes for long-haulage, construction haulage and distribution of goods. During the year 2002 approximately 40 000 trucks were delivered to customers all over the world. Scania’s bus operation is a relatively small product group and Scania has, also in this group, focused the production on the heavy segment. The major part of the 3 800 buses which were produced during 2002 were finished by external specialist bodybuilding companies. Scania also has a small production of
2 – General Information about Scania

industrial and marine engines. These engines are manufactured according to the same production concept as for trucks and buses but then adapted to industrial and marine use.

Besides being a manufacturing company, Scania also offers the customers service-related products and financing which in recent years has become more important for the business. A distribution of the turnover for 2002 by product area is shown to the left in figure 2:1. Scania’s strategy is to focus on long-term growth markets and the company today has Europe, Latin America and Asia as main markets.

![Figure 2:1 Information about Scania’s product and market area (Source: Scania Annual Report, 2002, p. 2)](image)

To the right in figure 2:1 Scania’s deliveries by market area for 2002 are shown which illustrates that Western Europe is the most dominating market. Scania has according to their strategy chosen not to establish their brand on the North American market.

2.1.3 Production

Scania has concentrated the production to Europe and Latin America and figure 2:2 shows where they have chosen to locate the production facilities.
Despite the fact that Scania is a global company, they have chosen to locate a major part of their production in Sweden, which can be seen in figure 2:2.

2.2 The Scania Production System

Scania has like many other companies developed their own basis for improving and developing the production. The Scania Production System, SPS, is inspired by Toyota’s well known production philosophy, developed to combine mass production with customer unique products. To illustrate how SPS is constructed, Scania has created The Scania house where the production system’s basic elements are included as building blocks, see figure 2:3.
SPS is based upon four main principles which reflect Scania’s business. All functions within the company work after these principles, which makes it easier to improve the process and for improvements to be spread within the organisation. The four main principles are:

**Normal situation – standardized working method**
All working processes performed at Scania should be standardized and documented. A normal situation according to Scania, is that work assignments are carried out in the same way every time they are performed, in right tact time and with a levelled flow through the production.

**Right from me**
This principle is based upon the idea that errors and abnormal actions are identified so adaptation to the causes can be done before it happens again.

**Consumption controlled production**
Scania does not start to produce until the customer has signalled a need. This principle should permeate Scania’s entire supply chain, from material ordering to final assembly.

**Continuous improvement**
This is the main target with SPS and it implies that a new better normal situation always must be aimed. To achieve this, it is essential to eliminate waste and liberate resources.

### 2.3 Information systems

#### 2.3.1 eQuality
To reduce the amount of disturbances in the production process Scania has created a web based system, eQuality, for reporting quality deviations. eQuality is available internally at Scania as well as externally at established suppliers. Among the external suppliers who have access to eQuality are the forwarders Scania uses for goods transports.

When Scania detects a quality deviation, this is reported into the system and a quality report is sent to the concerned supplier. The supplier must respond with a plan of measures within a specific time period to avoid further consequences. All quality deviations are stored and can then be used for follow-ups. Today eQuality has approximately 2 000 users of which more than half are external suppliers. The total number of quality reports produced every week is around 200. Scania has decided that eQuality
should be the global quality system and today there are several ongoing projects aiming to increase the functionality and the capacity of the system. For example, a new module for reporting transport deviations is under construction.

2.3.2 Webstars

Scania has also developed a web based system, Webstars, to create a better control of the material ordering and goods transports. In this administration tool, every concerned party within a goods transport shall register information about the status of the transport. Information about Scania’s delivery schedules to the suppliers is presently sent to Webstars from one of Scania’s internal systems. The suppliers use Webstars for transport booking as well as goods dispatch registration. The forwarders use the system to confirm picked-up goods and to indicate specific truck contents. Scania registers when a truck arrives and when the goods are unloaded. The content of the consignment should be verified at every register so that deviations can be detected early. Figure 2:4 shows the different registrations entered in Webstars during a goods transport to Scania.

![Figure 2:4 The different registrations entered in Webstars](image)

At the moment, only British suppliers and the forwarder Ewals are external users of Webstars. These users represent a minor part of possible users but in the future Scania wants all their suppliers and forwarders to use Webstars.

2.3.3 Internal computer systems

In the beginning of the nineties, Scania started to leave their old central computer system, AROS, in favour of a more adapted information system. The reason why Scania left their old central system was the idea to form information systems to fit the different production units. The locally adapted system was the beginning of the MONA-concept which today is used by all Scania’s PRU:s. This system is more suitable for producing units which is the reason why Scania’s spare part function, Scania Parts Logistics, still
uses AROS. All PRU:s have local installations of MONA, which today consists of four different information systems that are used to deal with the daily work.

- MONA Assembly (MA) describes the assembly structure
- MONA Material (MM) is used for economic control
- Material Control (MC) is used for material planning and material ordering
- SIMAS\(^3\) is utilized in the internal material handling

SIMAS is the system, within the MONA-concept, that deals with material handling and it is therefore used by the different goods receptions. The receptions use SIMAS for arrival registration, storing and for creating goods labels. The goods reception at Scania Parts Logistics performs these tasks in AROS.

2.4 **DynaMate**

DynaMate is fully owned by Scania but works as an independent company. The company has departments located at several of Scania’s production locations in Sweden where they have the responsibility for e.g. internal transports and maintenance. On these locations they also operate packaging pools\(^4\) for Scania. The pool in Södertälje is as previously mentioned located in Hovsjö. The business in Hovsjö consists of breaking down, storing, distribution as well as washing and repairing of packaging material. In this study, DynaMate is considered as a part of Scania’s business.

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\(^3\) Scania International Material Administration System

\(^4\) A packaging pool performs operations as repairing, washing and storing of packaging material.
3 Method

Here are the different method theories that we believe are relevant presented, together with how we relate to these theories in this thesis. The diverse data collection methods that have been used are described and analysed and finally the research procedure is presented.

3.1 Scientific approach

To be able to analyse and work with the collected data, a reflection about how the authors’ scientific approach affected the performed interviews and observations is necessary. The following approaches described are stated by Arbnor & Bjerke (1994).

3.1.1 Analytical approach

This approach is the oldest of the three described and it is therefore the most common in method literature and scientific research. The analytical approach has the basic idea that the sum of all parts equals the total system. This means that scientists with the analytical approach can describe and understand a total system only by isolating and study small parts of the whole. The target with this approach is to always describe an objective reality. The knowledge generated from the analytical approach should not be affected by subjective experiences.

3.1.2 Systems approach

As a reaction to the analytical approach, a new approach was developed in the middle of the 20th century which was named the systems approach. This approach has grown rapidly during recent years and it is today the most used approach in science research.

The systems approach differs heavily from the analytical approach when it comes to describing reality. Based on the systems approach, the sum of all parts do not equal the whole. This means that consideration is taken into effects of synergy, both for the better and for the worse. The knowledge developed for this approach is closely connected to the investigated system. This means that the systems approach tries to describe and understand the parts based on the characteristics of the total system.
3 – Method

3.1.3 Actors approach
The actors approach is the most recent developed approach of the three described and it states, opposite from the systems approach, that the whole can be described and understood based on the different characters of the included parts. In this approach, no objective reality is assumed and it is presumed that the reality is a social creation caused by individuals. According to Persson (1982), the actors approach has its starting point, when describing reality, in individual experiences and actions. This contributes to the fact that the actors approach often is referred to as individual dependent.

3.1.4 Discussion concerning the three approaches
The analytical approach is based on the idea of an objective reality without any effects of synergy. The authors believe this to be quite strange and from this study’s point of view not correct. Research performed with the analytical approach is probably still very common in many areas and several of the topics that have been studied during the authors’ education contain theories based on the analytical approach. It is likely that our approach is influenced by own experience and knowledge. The analytical approach is however based on an idea that is hard to apply to this thesis.

The approach that the authors consider to be the most suitable for this kind of study is the systems approach. The conducted work at Scania deals with a very complex situation where many small actions collaborate and form a total system. Persson (1982) states, that the systems approach is the most suitable for research in the logistic area. This approach was developed at the same time as material administration, or logistics as it later was referred to, became a prioritized area and the approach was then adapted to the fact that personnel with different background were forced to work together. From a logistic point of view, an effective organisation can not just be explained with a description of the different functions. Instead, the organisation must be seen as a complex unity where the effectiveness is formed from a close teamwork between the different functions. When performing an analysis of a process in a company it is not possible to study the ingoing activities isolated and the process must be seen as a whole with a logistical view. (Persson, 1982)

A description of a process with the actors approach is, what the authors believe, not applicable to this thesis. On the other hand the idea of the
approach is partly logical when it is obvious that different people see the world in different ways. Also, Persson (1982) believes this approach not to be the most suitable for logistic research but he also points out that this approach probably will be more frequently used in the future.

3.2 Creation of knowledge

Scientific research can generate knowledge in a number of various ways which is illustrated in figure 3:1. Arbnor & Bjerke (1994) argues that reality can be divided into two separate parts, the theoretical and the empirical. The lower part of figure 3:1 symbolizes scientists studying reality through observations and interviews and the upper part represents the theoretical reality consisting of mathematical models and logical connections.

Lundahl & Skärvad (1999) describe the practical research process with the following work procedure:

1. A phenomenon following some kind of pattern is observed.
2. A large amount of data is collected to investigate if the pattern can return.
3. A theory is developed to explain the phenomenon. This knowledge creation is called *induction* – to draw conclusions based on empirical data, see the left arrow in figure 3:1.
4. The theory is then used to make predictions, i.e. new theories. This process is called *deduction* and is illustrated in figure 3:1 by the horizontal arrow.
5. The in theory made predictions are then tested and compared with observations from reality. The differences are then identified, which is known as verification, see the right arrow in the figure 3:1.

The knowledge creation mainly used in this study is induction, since the recommendation to Scania is based on observations and interviews in the empirical world. One example of inductive knowledge creation is the conclusions supported by the many interviews that have been performed with Scania personnel. One part of the analysis can however be seen as deductive as the recommendation to Scania also is based on the conducted literature study.

### 3.3 Choice of research method

To better describe the structure of this thesis, the following three sections present a short description of the technical layout and how the authors relate to each area.

#### 3.3.1 Type of study

When deciding the general technical layout, it is important to know the main purpose of the study. To simplify, there are three major types of aims with a study; to analyse a specific case thoroughly, to perform a wide research of different conditions in many companies or to study a specific case during a longer time. These three types can be referred to as case study, cross-sectional study and time-series study. (Lekwall & Wahlbin, 1993)

**Case study**

With this type of study the aim is to conduct a detailed and thorough investigation in the specific case. This type of onset has for a long time been poorly accepted in the academic world but the method’s general application has developed strongly in recent years. (Eriksson & Wiedersheim-Paul, 2001). According to Ellram (1996), case studies are well suited for projects that concern areas of logistics and procurement. Ellram points out that case studies are especially well fitted for investigations concerning organizational changes in a logistical function. The results from a case study can also be generalized but tend to be quite specific. Ellram also states that a quantitative generalization often is the most suitable when analysing a case study.
Cross-sectional study
When the aim is to perform a wide research in one specific area, the onset of the study is usually cross-sectional. An example is when a specific function is compared between several companies. For the result to be trustworthy, a relatively large number of companies must be included in the study.

Time-series study
In this type of study, data is analysed during a certain time period. This can for example mean that a present situation is compared with historical data to get an idea about the change and then be able to create future scenarios.

The study at Scania
To analyse the possible structural change at Scania’s goods receiving in Södertälje, the most appropriate research method is case study. According to the theories that have been studied, a case study is well suited for projects in the logistic area. Considering the visits made at the benchmarked companies, the study can also be seen as a cross-sectional study where the goods receiving process is investigated at several companies. However, it is believed that this thesis mainly can be seen as a case study.

3.3.2 Qualitative or quantitative research?
According to Holme & Solvang (1996), the choice of method should be made from which questions the study aims to answer. All methods have different strength and weaknesses. Therefore, it is necessary with a detailed explanation of the two major types of research methods to understand the choices that were made. Science usually distinguishes between two types of research onsets; qualitative and quantitative methods.

Lekwall & Wahlbin (1993) define a qualitative investigation as a method where data is collected, interpreted and analysed and where the data can not be expressed in numbers. The most common type of qualitative investigation is the case study. Lekwall & Wahlbin further state that a quantitative research is characterized by that the collected data can be expressed in numbers. Cross-sectional and time-series studies are examples of common types of studies used in a quantitative investigation.

Identifying which type of investigation that is most appropriate for the study is not easy. Therefore, a combination of the above mentioned research methods is often a good choice when their advantages can be combined. The study at Scania has included both quantitative and qualitative methods for
data collection and analysis. This can according to Holme & Solvang (1996) strengthen the investigation because the different kinds of information complement each other.

### 3.3.3 Primary and secondary data

The data gathered during the work procedure can be divided into two categories; primary and secondary data. Lekwall & Wahlbin (1993) describe primary data as information collected for a specific study. Further can secondary data be explained as information that is already collected for another purpose. In this study, both primary and secondary data has been used. Examples of different kinds of data adopted in the study are information from interviews (primary data) and existing statistics from forwarders (secondary data).

When information is used in a study, it is very important to consider its origin. It is also important to reflect over the possible connections between the source and the situation in point. When secondary data is used in a study it is important to use the information carefully since it is collected for another purpose. (Holme & Solvang, 1996)

### 3.4 Collection of data

This section presents the different methods used in the study. Advantages and disadvantages for the chosen methods are described and an explanation of how they were performed is made.

#### 3.4.1 Interviews

An interview is a method for data collection when information is gathered through questions to or in a dialogue with the interviewed, the so-called respondent. (Lundahl & Skärvad, 1999)

Arbnor & Bjerke (1994) divides interviews into different types; private, telephone as well as mail and group survey. They also mention terms as standardization, which means that all respondents are interviewed with the same questions, and the opposite term non-directed interview which denotes a low level of standardization. Lundahl & Skärvad (1999) argue that the latter is much more flexible as it is adaptable to different types of situations. Lundahl & Skärvad make a further division, in structured and free interviews, where consideration is taken into what kind of answering possibilities the respondent is given. Structured interviews are information
orientated and the interviewer has a clear aim with the interview. A free interview is not just formed after the desired information but also after the specific person that is interviewed. The free interview has an aim to, besides information gathering, also collect opinions and values from the respondent.

The main source of primary data has during this study been private interviews but they have also been complemented with telephone interviews when it was not necessary for a private visit. By using these kinds of interviews, the opportunity was always given to modify the questions during the interview occasion. Furthermore, a private interview gives the interviewer the chance to really understand the topic in question. According to Björklund & Paulsson (2003), private interviews have an advantage when individual signals, for example body language, can be interpreted. In the work with the mapping of the present situation, the conducted interviews at the different goods receptions have been standardized and structured, see appendix A for the questionnaire. These types of interviews have been chosen so that no question will be forgotten during the interview but also to avoid the respondent’s personal opinions reflecting the answers. In the following work with the analysis, more free interviews with key persons have been conducted to collect thoughts and opinions. These key persons have been selected through discussions with tutor and assignor as it is important to get in contact with the right persons.

3.4.2 Observations

An observation is, according to Holme & Solvang (1996), that the investigators during some time stay together with the group they intend to investigate. Lekwall & Wahlbin (1993) explain direct observations as when the investigator himself observes the functions of interest for the study. This method has the obvious advantage that the observer gain access to the information directly without any unnecessary handling by an additional party. One disadvantage with this method is that only actions can be studied, not knowledge, opinions etc. A further weakness is that only the ongoing process can be investigated and it is therefore not possible to gain knowledge about the past or the future. (Lekwall & Wahlbin, 1993)

An observation can be conducted in two ways; open or hidden. An open observation means that the observer clearly shows his presents and informs the involved parties about the observation taking place. The opposite is
valid for a hidden observation as the observed people are not aware of the ongoing observation. (Holme & Solvang, 1996)

The observations performed at the goods receptions at Scania to collect primary data have been direct and opened. The disadvantage that Lekwall & Wahlbin (1993) mention with an open observation, is that the observers often affect the studied function by their presents. This disadvantage has hopefully only had a minor affect at the performed observations since the aim was to map the work process and not to measure parameters as time, efficiency etc.

It has been discovered that there are relatively few theories concerning the goods receiving process and therefore information has been collected from other companies. Thus, four visits were made to other companies besides Scania. These visits can be resembled to benchmarking where the purpose of the observations was to provide the authors with ideas and thoughts about how a central goods reception could be applied to Scania in Södertälje. Christopher (1992) defines benchmarking as:

... the continuous measurement of the company’s products, services, processes and practices against the standards of best competitors and other companies who are recognized as leaders.

(Christopher, 1992, p. 80)

This definition does not fully equal the observations conducted at other companies in this study. However, these observations will be denoted benchmarking since the purpose was to compare the goods receiving process at Scania with other companies’ goods receiving. The benchmarked companies have been elected together with tutor and assignor at Scania. Besides the observations made during the company visits, interviews were also performed to obtain opinions and comments concerning a central goods reception for Scania in Södertälje, see appendix B for a questionnaire.

3.4.3 Existing statistics
To acquire an understanding of the size of the inbound flow to Scania in Södertälje, consignments statistics have been collected from Scania’s three largest forwarders. To simplify the work with the statistics, only consignments from March 2003 have been included, see appendix C. The statistics being based on the month March was decided together with tutor at
3 – Method

Scania because this specific month had a normal production level and did not contain any vacation.

3.4.4 Literature study
In this study, already existing data that is relevant for the thesis has been collected. In the cases when the information is not directly created for the goods receiving process, theories have been adapted to fit the study at Scania. Information has been collected from libraries in cases where books and articles were needed. The authors had also access to different databases from which information was collected. Internet and Scania’s LAN\(^5\) have also worked as a tool in the search for relevant information.

3.5 Methods of analysis
Based on the collected information, advantages and disadvantages have been identified for the two goods receiving structures. These benefits and shortcomings have thereafter been evaluated in the qualitative comparison between the structures. The qualitative comparison is focused on the aspects mentioned in the purpose of the study. The authors would like to point out that the identified advantages and disadvantages are based on our academic knowledge as well as the general opinion at Scania. This means that a reader without these preferences can see the presented benefits and shortcomings differently.

To carry out a more thorough comparison, an economical calculation has been conducted based on a total cost model. This to create a high-quality basis for the recommendation to Scania. The economical calculation has also answered the question of which reduction of the external transport cost that is necessary for a profitable result for Scania. In addition to the calculation, a risk analysis has been performed. The risk analysis visualizes possible risks and estimates possibility of occurrence, if Scania would implement a central goods reception.

The result of the analysis has thereafter shaped the recommendation to Scania presented in the concluding part of the report.

\(^5\) Local Area Network
3 – Method

3.6 The quality of the study

3.6.1 Possible sources of errors

It is almost impossible to achieve a perfect study, there are always errors and limitations affecting the result. The effect of many errors can be reduced and it is therefore important to consider what possible errors that can occur during the work process and what that can be done to minimize their negative effect. According to Lekwall & Wahlbin (2001), there are some steps an investigator can follow to increase the quality of a study:

- Establish what kind of errors that might occur.
- Try to eliminate or reduce the errors’ affect on the study.
- Clarify what sort of affect the remaining errors have on the result of the study.

A severe source of error that can heavily affect the study’s result is when assignor and the assignees have different opinions concerning the target of the study. When the authors of this report believe that the targets have been completed Scania may have another opinion. To avoid this error, a detailed project definition with a clarification of purpose and delimitations was written. The document was then reviewed by assignor and tutor at Scania to secure that the authors and Scania agree about the purpose and the scope of the thesis.

One further identified source of error, is incorrect choices of methods to fulfil the purpose. Maybe the chosen methods are not the most optimal for this specific study or perhaps the selected methods can not collect enough data which is necessary to fulfil the purpose. The authors believe used data collecting methods to be well suited for the study, but the methods could possibly have been complemented with for example a survey to gain further information. It is however decided that the performed interviews and observations have fulfilled the information requirements. If not enough information has been gathered throughout the empirical study, it is likely that the recommendation to Scania is incorrect.

A consequence of all collected statistics from forwarders being based on March 2003, is that the fluctuations over the year are neglected. This can therefore be seen as a source of error. However, the month of March reflects Scania’s normal production levels and it is therefore reasonable to believe
the result of the study as reliable. Nevertheless can this simplification affect the capacity of the central goods reception, as it is possible that the reception is over-dimensioned during some months.

3.6.2 Validity and reliability

When deciding a study’s credibility it is important with a review of terms like validity and reliability. According to Arbnor & Bjerke (1994), the term validity can be explained with the question: “Is the result a correct description of the reality, i.e. is it true?” If the answer is yes, the result has high validity. In concise can validity be a measurement of how well the study measures what it is supposed to measure (Björklund & Paulsson, 2003).

To achieve a high validity in this study, all the gathered empirical data has been verified against concerned parties and thereby eliminating any errors or misconceptions. The questions that were asked during the interviews were formulated so that the respondent only in a minor extent was affected by the opinions of the interviewer. We believe this has contributed to the fact that the information presented in the report is a realistic description.

Björklund & Paulsson (2003) state that reliability is the level of trustworthiness in a measurement tool. If this statement is applied to a research study, the investigation has a high reliability if the result is the same when the investigation is repeated. There is, according to Arbnor & Bjerke (1994), two different ways of testing a study’s reliability; test-retest and parallel test. When a test-retest is performed, the same study is conducted several times to examine if the results are repeated. A parallel test means that two similar tests are conducted at the same time to explore if the results are the same.

In this study, no specific reliability test was performed as the authors did not find it necessary. However, we believe that a similar result would have been achieved if the study at Scania was repeated.
According to the definition, a high validity means a high reliability. The opposite reasoning is though not valid as a high reliability does not mean a high validity, which is shown in figure 3:2. In this thesis, the aim has been to achieve both a high validity and a high reliability but the focus has been to obtain a high validity.

3.6.3 Objectivity

Another important term, when deciding a study’s quality and reliability, is the author’s objectivity. This expression can be explained with in which extent the author’s values and own opinions affect the study and its result. (Björklund & Paulsson, 2003) A value can, according to Eriksson & Wiedersheim-Paul (2001), be the idea of a desired state or a wished target. They point out that an investigation never can be totally objective but a certain level of objectivity must always be strived for. For example, the investigation must try to present reasonable and well supported conclusions as well as a neutral analysis.

It is obvious that the study is affected by our values and opinions but the choices being made during the work procedure are discussed in the report which makes it possible for the readers to judge the objectiveness of the thesis for themselves.

3.7 The work procedure

This thesis has passed through several different phases and in this section these phases are presented together with their connection to the used methods.
In figure 3:3 it is visualized which methods that are connected to the different phases of the thesis. The introduction part of the report is mainly based on conversations with assignor and tutors, both from Scania and Lund Institute of Technology. To obtain the general information that was necessary for the company presentation, a few interviews were performed. The literature study has been used continuously during the most part of the work procedure. Observations at Scania have been performed to collect data for the empirical part of the report. The performed observations are mainly visits at the different goods receptions to create a general view of the present situation. In this part of the report, interviews with concerned personnel also played an important role. Interviews have also been used for the analysis where personnel’s thoughts and opinions were discussed. One much appreciated method was the benchmarking that was used mainly in the analysis. The situation of the benchmarked companies is presented in the empirical part but the information is later used and evaluated in the analysis. This concluding part also includes a total cost analysis and a risk analysis.
4 Theoretical framework

In this chapter, we give the reader the theoretical framework necessary to understand the analysis and to comprehend the conclusions that are stated in the final chapter. In the beginning of this chapter theories are described that will give the reader a basic knowledge about the studied area. Thereafter theories are presented that are needed for the discussion presented in the analysis.

4.1 General logistic terms

4.1.1 Supply chain management

To create an understanding of the term supply chain management, an accurate review is needed of how the supply chain is structured and designed. There are several different descriptions of the supply chain and one of the more detailed definitions is given by Christopher (1992).

The supply chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer.

(Christopher, 1992, p. 12)

Schary & Skjøtt-Larsen (2001) define the supply chain by identifying three major components; activities, processes and organisations, which all are affected by internal and external elements, see figure 4:1.
Schary & Skjøtt-Larsen mean that these components, first of all, are ruled by a company’s supply chain management. The components in the supply chain are also affected by corporate management that presents strategic decisions and finally, by the external environment, such as political decisions and new technologies. The activities constitute the foundation of the supply chain and can be defined as a series of actions adding value and changing the characteristics of the product flow. Organizational units, both internal and external, perform activities. This component also provides the supply chain with resources and takes the responsibility for performing the activities. By linking several activities, processes are created that often crosses organizational boundaries. Activities, organization and processes together become a system called the supply chain.

To understand the significance of the supply chain, it is important with a detailed description of the process term. Ljungberg & Larsson (2002) expand Schary & Skjøtt-Larsen’s description of a process to the following:

*A process is a repeatedly used network of in order linked activities that consume information and resources to transform ”object in” to ”object out”, from identifying to fulfilling the needs of the customer.*

*(Ljungberg & Larsson, 2002, p. 44, translated from Swedish)*
4 – THEORETICAL FRAMEWORK

The term supply chain management has in recent years become popular and there exist a lot of definitions of its meaning and extension. Lambert et al. (1998) are focusing on integration and define supply chain management as:

Supply chain management is the integration of business processes from end user through original suppliers that provides products, services, and information that add value for customers.

(Lambert et al., 1998, p. 504)

The supply chain is dynamic in the sense that it always must be changed and improved. For example, activities that do not generate any added value must be eliminated, processes improved and organizations be reconstructed to create an efficient supply chain. (Sehary & Skjøtt-Larsen, 2001)

4.1.2 Logistics management

Logistics management can be described as a part of supply chain management. This type of management is more focused on making the flow within the supply chain more efficient and is defined by The Council of Logistics Management as:

Logistics Management is that 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.

(http://www.clm1.org, 2003-11-28)

Figure 4:2 illustrates how logistics management connects logistics activities as material handling and storing, to management activities, which creates an added value for the customer.
In this study, a focus on logistics management has been made since this type of control is more suitable for a change of the goods receiving structure at Scania. Since the purpose of this thesis is to analyse a part of Scania’s supply chain, we consider logistics management to be the most appropriate term. This study shall be seen as a part of a possible improvement of Scania’s supply chain.

4.1.3 Logistic quality

Logistics can also be described as the work procedure to create time and space benefits for the customer. Often when this description is presented “the seven R:s” is used to explain the expression more thorough. Logistics is then used to secure the availability of the right product, at right quantity, in right way, in right time, to the right customer and to the right price. Other areas that also should be observed in logistic work are quality, service and cost. (Persson & Virum, 2001)

It is often easier to secure the quality of products than of services, which results in logistic quality sometimes becoming less prioritised than the quality of the product. Several quality definitions are focused on satisfying the need for the customer and one of them are:

*All combined features of a product that generates its abilities to satisfy the spoken or unspoken needs of the customer.*

*(Lumsden, 1998, p. 60, translated from Swedish)*
Persson & Virum (2001) mean that the most essential within logistic quality are:

1. Communication between the customer and the supplier
2. Delivery and communication at the right time and without errors
3. Rapid and correct service after delivery
4. Correct information transferring at the right time between every concerned party

To achieve a good logistic quality, it is important to understand the customers’ demands and expectations as well as having a strategy to enable them.

4.2 Theories of flows

To be able to perform a correct investigation of Scania’s goods receiving process, it is fundamental to have a good theoretical basis of which flows existing in the supply chain. Storhagen (2003) consider that logistics can be explained as flow efficiency within and between organisations. The different kind of flows that, according to Storhagen, exist between customer and supplier are illustrated in figure 4:3.

![Figure 4:3 The flows between suppliers and customers in the supply chain (Source: Storhagen, 2003, p. 35, modified)](image)

To achieve an effectiveness of the physical flow, it is important to focus on both the internal flow as well as the flow between customer and supplier to create a fine integration and in that way obtain an effective unity. The financial flow between different organisations in the supply chain is one of the flows that has to be studied to get an overall view. Large profits can often be made if the financial flow between two parties is made more effective. The flow of information points, in contrast to the other flows, two ways and is closely linked to the physical and financial flow. According to
Mattsson (1999), the information flow was earlier considered as a one way flow towards the supplier, but has recently been redefined because of a greater need of flexibility and shorter lead times. Nowadays, all efficient information flows are considered as flows in two directions, which makes it possible for concerned parties to improve other flows. Mattsson points out that the information flow these days often is considered as the most essential flow forming the other ones.

4.2.1 Transports
A part of the physical flow between supplier and customer is the transport needed to transfer material from sender to receiver. According to Tarkowski et al. (1995), an extra flow is generated when a transport is carried out. There is then, besides the earlier mentioned flows, also a flow of resources between the sender and the receiver. Lumsden (1998) means that this flow includes all resources needed for the transfer. However, Tarkowski et al. (1995) consider the material flow to be the most essential when a transport is performed.

A large part of the physical flow in this study is transports of material from external suppliers to receivers at Scania in Södertälje. This flow of material is considered as a flow of goods when it takes place between producers and consumers in the supply chain. The flow of goods between these parties is divided into consignments which can be described as:

Goods contained and presented on a freight document that is meant to be transported from a goods sender to a goods receiver on one loading unit and at the same time.

(Tarkowski et al., 1995, p. 149, translated from Swedish)

The transfer of information needed for sending a consignment is often complicated and comprehensive. A well functional system is necessary to fulfil all parties’ need of information. Figure 4:4 shows some of the information sent between the involved parties, when a consignment is delivered from a sender to a receiver.
To obtain goods transports with high quality, it is vital to have an efficient information system that can be used for tracking, quality deviations etc. (Lumsden, 1998). With an efficient information system, there are many opportunities to co-ordinate matching flows, which often leads to a reduction of executed transports. In order to make the co-ordination possible, some part of the flows must be transported on a shared distance.

Figure 4:5 describes two different types of co-ordination. The example to the left shows co-ordination with a consolidation point while the example to the right shows co-ordination with return transports. Co-ordination of flows with opposite directions is often performed to level out the unbalance in a goods flow. Unbalance means that two opposite flows between two destinations are not equal. (Tarkowski et al., 1995)

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6 Tracking means that the goods orderer can follow the goods during transport.
4 – THEORETICAL FRAMEWORK

4.3 Goods terminals

In this thesis, a central goods reception is analysed which in many cases can be compared to a goods terminal. To obtain a better utilization of transports, forwarders often co-ordinate small consignments to many customers in a goods terminal. In an external material flow, the goods are often handled in several goods terminals, the first one consolidate several consignments, while the last goods terminal distribute the goods to the customers in smaller batches, see figure 4:6. (Lumsden, 1998 and Persson & Virum, 2001)

![Figure 4:6 The goods terminal’s role in an external material flow (Source: Lumsden, 1998, p. 498)](image)

Lumsden (1998) makes a basic definition of a goods terminal as:

... a breaking point in a material flow system, where material flows are consolidated and divided.

(Lumsden, 1998, p. 500, translated from Swedish)

This definition is very light and usually a number of other activities are performed in a goods terminal except for the consolidation and dividing of material flows.

4.3.1 Activities in a goods terminal

Besides consolidation, other activities such as co-ordination, sorting, sequencing and storing are performed in a goods terminal. To make the work effective, arrival and departure times for different kinds of transports must be co-ordinated. This can for example be done by time schedules that every transporter must follow. It is also important to control the inbound and outbound flows so that they are levelled out over time. Many goods terminals also perform some kind of sorting of the arriving goods. A frequent used type of sorting is sorting by destination, meaning goods to the
same customer are gathered together for a common transport. In some cases the customer wants the goods received in a specific order and the goods must then be sequenced in the goods terminal. When goods must be sequenced, some kind of storing activity is often performed. The goods can be stored for a short time, temporary, or for a longer time, permanent, depending of the customer’s needs. The possibility to store goods temporary makes the planning of arriving and departing transports easier. (Lumsden, 1998)

A warehouse can in many cases be similar to a goods terminal as the activities performed at a warehouse only slightly differ from the ones performed in a terminal. Lambert et al. (1998) means that a warehouse has three fundamental functions; transportation, storing and information transfer. Within the category transportation, receiving and cross-docking are included. Lambert et al. describe receiving as unloading, registration, inspection and comparison with placed order, while cross-docking is described as a direct movement of the goods from arriving to departure without intermediate storing. For the transfer of information, it is important to work towards increased information quality and higher transfer rates, for example with EDI\(^7\) and bar code scanning. Persson & Virum (2001) make a somewhat different classification of the activities performed at a warehouse and mean that there are four main groups:

1. Unloading and loading of the vehicle
2. Receiving and handling of goods
3. Storing and inventory
4. Picking and preparation of consignments to be sent

Persson & Virum point out that the selection of loading and unloading method affects issues like for example ways of transports, goods volumes and layout of the facility. They also mention several work tasks included in the goods receiving process such as quantity inspection, detection of visual defects as well as updating the inventory level. Before storing, the goods shall have a localisation address and an identity.

Aronsson et al. (2003) also include arrival registration and labelling in their description of a goods reception. They state that goods labels often are automatic produced when the goods are registered in the system. If the

\(^7\) Electronic Data Interchange
arrival registration also functions as an adjustment of the inventory level, a deviation creates temporary faults in the inventory level which can lead to problems. The arrival inspection performed at goods arrival can either be a quality or a quantity inspection. A decision must be made concerning how extensive this inspection should be. With a resource demanding quality inspection, it is profitable for many companies to reduce the inspection and instead let their supplier be quality secured. For a quantity inspection, the most suitable way of working is to count the number of arrived pallets. (Aronsson et al., 2003)

4.3.2 Information systems in a goods terminal

As mentioned earlier, a well functional information system is vital to achieve effective transports. This is also valid for controlling and administrating a goods terminal since it is important to have correct information available at the right time. The work to obtain a more computerized information transfer with EDI and bar code scanning, is something that is of interest for all goods receiving functions. (Lambert et al., 1998)

Tarkowski et al. (1995) mean that with a more effective information system and increased automation level, the receiving function in a goods terminal can be less personnel intensive. For example, automated sorting equipment with bar code scanning is mentioned as an alternative with high potential. Automatic scanning requires the goods to be labelled correctly. The identification system is an important component in the information flow through a company and especially in goods receiving. This is illustrated in figure 4:7.
4 – THEORETICAL FRAMEWORK

4.3.3 The layout of the goods terminal

There are several different layouts of goods terminals, all suited for a certain type of goods flows. It is mainly the need of flexibility, with consideration into the ability of handling different types of goods flows that decides how it should be designed. Lumsden (1998) has divided the layout of goods terminals into four main groups and in this thesis three of them are described. The group that has been excluded focuses on goods terminals with train connection and is not relevant for this study. Flowing type is the layout focusing on short internal transport distances. With this layout, every transport way is fixed which results in all arriving and departing transports having a dedicated docking station. As a consequence, goods terminals of this type often get heavy over-dimensioned. A principle figure of a terminal designed like this is shown in figure 4:8.

Figure 4:8 A goods terminal of flowing type (Source: Lumsden, 1998, p. 502)

To avoid the large amount of crossing flows that arise from the flowing type layout, the internal goods flow can be formed as a central circulating flow, for example with a conveyor system. This type of goods terminal can be
described as one of *circulating type* without fixed arriving and departure docking stations, see figure 4:9.

![Diagram of a goods terminal of circulation type](image)

**Figure 4:9** A goods terminal of circulation type (Source: Lumsden, 1998, p. 503)

With a circulating layout, the number of gates can be reduced but the lead time for the goods from arrival to dispatch increases. If the goods terminal shall be able to store goods, it is important that the layout is adapted so storing can be effectively performed. A storing system must then be installed which can include a circulating transport system distributing the goods to right storage position. This kind of goods terminal is called *flow storing* and a principal layout is shown in figure 4:10.

![Diagram of a goods terminal of flow storing type](image)

**Figure 4:10** A goods terminal of flow storing type (Source: Lumsden, 1998, p. 504)

According to Lumsden (1998), a problem with the layout of a goods terminal is that the level of utilization varies heavily. The burden is often larger in the morning and in the beginning of the week which contributes to an over-capacity of the goods terminal if it is dimensioned according to these peaks.

### 4.3.4 The ultimate transport

According to Lumsden (1998), the ideal transport is to move the goods in one unit directly from supplier to customer. Since the goods then are handled at a minimum level as well as transported the shortest or the fastest
way, should result in the ultimate transport. Lumsden however states that if only ultimate transports were performed, it would cause a low level of transport utilization which would contribute to higher costs. Storhagen (2003) means that if all transports should be of this kind the increased number of transactions would contribute to an increased total cost. In figure 4:11 it is shown how a goods terminal can reduce the number of transaction between supplier and customer.

![Diagram showing reduction of transactions with a goods terminal](source: Storhagen, 2003. p. 156)

An introduction of a goods terminal in the goods flow does not only create advantages but also disadvantages such as extra handling and high terminal costs. It is therefore important with a careful study of both advantages and disadvantages before a decision of structural changes is made.

### 4.3.5 Delivery and transport pattern

There are several different alternatives of how a goods delivery between two companies can be performed. To decide which structure a company shall have on their material supply is often an important part of a company’s supply strategy. Different kinds of delivery patterns are shown in figure 4:12.
Flow 1 and 3 illustrates delivery patterns where the supplier delivers ordered material directly to the customer without intermediate handling. In flow 1 the supplier delivers the material to the customer’s warehouse for later usage. In flow 3 the goods are, as apposed to flow 1, not handled in storage since the goods are transported directly to the production. This type of transport is often executed when the customer has a consumption controlled production. Flow 2 describes a flow where material is handled in a logistics centre before it is transported further to customer. The logistics centre often works as a consolidation point where goods are stored, picked and delivered based on the customer’s needs. (Mattsson, 2002)

When it concerns transport of material from supplier to customer, many different transport patterns can be selected. The transport pattern deals with, from a transport point of view, the shape of the material flow between supplier and customer. This shape is affected by the size and frequency of the material flow and it is important for a company to closely analyse their transport pattern. The classical shape of a transport pattern is when material is transported from a supplier to a customer without co-ordination. This type of pattern is very flexible but at the same time not cost efficient for small and frequent deliveries. For this type of deliveries a low transport utility is obtained but this can for example be solved with a consolidation centre or a goods terminal. In such a transport pattern, a goods terminal can be managed internally or externally by a third party logistic provider. (Mattsson, 2002)

### 4.4 Centralization or decentralization?

Since this thesis deals with a possible change from a decentralized to a centralized structure, we consider it important with a description of these terms. Many of the theories in this area treat storing activities for
distribution to customer. However, we believe that they also can be interesting in this study. Abrahamsson (1992) points out that centralization can contribute to lower fixed costs for personnel, warehouses and administration since the number of allocations is reduced. Abrahamsson further states that the planning and controlling of the physical flow can be easier and that centralization also creates the possibility to form customized distribution solutions. Centralization of a function can according to Lambert et al. (1998) give large cost reductions via scale benefits, if the company can perform common activities centrally. The scale benefits Mattson (1999) refers to can for example be found in the external and internal transport function where a centralization makes it possible for a more efficient optimization.

Studies concerning centralization, from an organisational point of view, shows that communication, enthusiasm and work satisfaction are lower in centralized organisations than in decentralized. Moreover, the personnel in decentralized organisations react, according to some studies, more rapidly on orders from higher instance because of better communication. However, it is considered to be easier to achieve co-ordination and control in a centralized organisation. (Hatch, 1997)

To decide if a function shall be centralized or stay decentralized depends on the company and the specific function’s responsibility. Aronsson et al. (2003) point out that delivery service and total cost must be taken into consideration and it is often the lead time that is the determining parameter regarding a centralization.

4.5 Total cost analysis

When planning a logistical change, it is important to analyse all possible costs the change can cause. A change in the structure will probably contribute to some costs being reduced while others will rise. To obtain a correct basis for a decision, it is important to perform an accurate analysis of the cost consequences, which a structural change can result in and then compare the total cost with the present. (Aronsson et al., 2003) The goal for every organisation must be to reduce the total logistic cost instead of focusing on every isolated activity. (Lambert et al., 1998)

The costs included in a total cost analysis vary from case to case. Aronsson et al. (2003) mention four costs that they consider are affected by most of
the logistical changes. *Storing costs* are simply the costs a company has to carry for having material, articles and products stored. This cost can often be divided into risk costs and costs for tied-up capital. Risk costs can for example be costs for insurances and costs for obsolescence. Cost for tied-up capital is the alternative cost the company has for capital locked-up in stored material instead of having the funds available for possible investments. *Warehouse costs / handling costs* are the costs for owning and operating a warehouse. Examples are cost in personnel and material resources which are needed in the material handling. Aronsson et al. also mention *transport costs* as an important cost in a total cost analysis. In this group, every expense for administrating and performing transports is included. Since many companies do not perform their own transports nowadays, these costs are often obvious for the company. *Administrative costs* can for example be costs for invoicing, follow-ups and ordering. The proportion of these costs can be difficult to estimate but they are often important for a correct judgement of the economical consequences concerning a change in the structure.

If a total cost model shall be well functioning, it has to be adapted to the specific situation. Aronsson et al. (2003) have formulated four tasks to follow when performing a model for a total cost analysis.

- Describe how the present logistic system will be affected by the change. This task decides how successful the analysis will be and it is therefore vital that the person who performs the description has a good general overview.
- Make a preliminary total cost analysis where all affected costs are included.
- Perform an estimation of how the change will influence the different costs.
- Revise the model and eliminate the costs that are negligible. This is often a central action as it reduces the complexity as well as saves time.

Besides an evaluation of the economical consequences, qualitative aspects and risks must be included in the basis for the decision before a change is carried out.
4.6 Risk analysis

When decisions of investments must be made, it is important to analyse the potential problems that a change can cause. A risk analysis is a discussion concerning reasons and probability of problems that may arise and it should contain proposals of how to minimize the negative consequences. (Scania Basics, 2002)

A risk analysis can be described as a structured process to identify risks and probabilities of occurrences that for example a facility or a system can cause. There are a lot of different models for identifying risks but no general analysis model has been developed. However, a classification can be made into qualitative and quantitative models. Qualitative models are mainly used to identify risks and the probability judgement is simplified to a rough estimation. The measurements that often are used in these types of models are high, low and medium. The theory section in this report only treats qualitative models as their purposes correspond to the performed risk analysis made in the analysis chapter. Examples of models for qualitative risk analysis are checklists, rough analysis and risk matrixes. Checklists are based on experience and are used to identify already known risk sources. Rough analysis aims at giving the reader a rough estimation of possible risks without focusing on details. Risk matrixes are used to estimate frequency as well as the consequences of certain possible actions. (Nilsson, 2003)
5 The empirical study

The following chapter presents the conducted empirical study. As an introduction, the present situation for Scania in Södertälje is described followed by an explanation of the goods receiving process. The chapter finishes off with a presentation of the benchmarked companies and their situation.

5.1 The present situation in Södertälje

5.1.1 General information about Scania in Södertälje

In Södertälje, Scania has production of trucks, bus chassis, engines and components for engines and gear boxes. Scania has also chosen to locate their head quarter and their research and development department as well as a central warehouse for spare parts in Södertälje. The business in Södertälje employs approximately 5 900 people.

The production is divided into five different production units, PRU:s, which all work as independent functions. All PRU:s, together with the central warehouse, have an own goods reception which makes a total of six separate goods receptions for Scania in Södertälje. In this thesis, the central warehouse has been considered as a PRU to simplify the structure of the report. Five of the goods receptions are located at Scania’s main area and one is placed on a smaller area a few kilometres from the others. Figure 5:1 shows a simplified map over Scania’s areas in Södertälje and the different locations of the goods receptions are marked with a cross.
Scania’s PRU:s in Södertälje have specific building numbers which are presented in figure 5:2.

<table>
<thead>
<tr>
<th>PRU</th>
<th>Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis</td>
<td>230</td>
</tr>
<tr>
<td>Engine 1 &amp; 3</td>
<td>003</td>
</tr>
<tr>
<td>Engine 2</td>
<td>150</td>
</tr>
<tr>
<td>Parts Logistics</td>
<td>210</td>
</tr>
<tr>
<td>Transmission</td>
<td>075</td>
</tr>
<tr>
<td>Industrial &amp; Marine Engines</td>
<td>062</td>
</tr>
</tbody>
</table>

**Figure 5:2 The PRU:s and their building number**

The following part of the report will use the PRU:s’ building number, instead of the PRU name, to make figures and tables more structured for the reader.

### 5.1.2 Scania’s material ordering

Every PRU is responsible for the own material call-offs to suppliers, which means that if a supplier delivers to several PRU:s, many delivery schedules will be obtained. A delivery schedule contains information about the exact date and time when the material should be ready for delivery. It is also the
supplier’s task to book the goods transport. This booking shall be made before 12:00 the day before pick-up and placed to the forwarder that Scania has decided. Together with the transport, the supplier must enclose transport documents which usually consist of a consignment note and a delivery note. The consignment note contains general information as e.g. number of pallets and the delivery note contains more detailed information. An invoice must also be sent together with the consignment if the supplier is located in a non EU country. After the goods pick-up the supplier must send an electronic delivery note, a so-called aviexp, to receiving PRU at Scania. This dispatch advice is performed only by Scania suppliers who are equipped with EDI. Some transports are also pre-adviced by the forwarder which gives Scania information about which consignments will arrive with a specific transport. A simplified illustration of the different flows between Scania, supplier and forwarder in the material ordering process are shown in figure 5:3.

If a transport booking is made from a supplier that delivers to several PRU:s, the forwarder will consider the delivery to be numerous consignments, one for each receiver. According to statistics from MC, based on August 2001, more than half of Scania’s suppliers deliver to more than one PRU in Södertälje.

5.1.3 Transport pattern
Almost every transport to Scania in Södertälje is performed by one of the three large forwarders; DHL, Schenker and Ewals. In figure 5:4 the distribution between the forwarders is presented. The diagram in the figure
is based on the collected consignment statistics with the unit pay weight\(^8\), see the summary in appendix C.

![Figure 5:4 Share of pay weight to Scania for each forwarder (Source: DHL, Schenker and Ewals)](image)

Pay weight is the common unit that all forwarders use for invoicing. It is important to point out that all goods deliveries to Scania in Södertälje are performed with trucks. Figure 5:5 describes the forwarders transport pattern from supplier to Scania.

![Figure 5:5 Alternative ways for goods deliveries to Scania](image)

As can be seen in figure 5:5, there are several ways the goods flow can take from supplier to Scania. One alternative is that goods from many suppliers are consolidated in goods terminal A. From this location the goods can either pass by another consolidation point, goods terminal B, or be transported directly to Scania. A different option is goods from one or more suppliers being delivered directly to Scania, which today is the case for approximately 10 per cent of the arriving transports. What decides if the goods should be handled in a goods terminal or not is the consignment’s pay weight. This limit varies between the forwarders and it also depends on if the goods terminal is located in Sweden or abroad. An effect of most

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\(^8\) Pay weight is the maximum weight of real weight and voluminous weight. The latter weight is calculated with a factor that varies between the forwarders.
5 – THE EMPIRICAL STUDY

transports to Scania pass by a goods terminal is that the arriving trucks often are consolidated with goods to several PRU:s.

DHL and Schenker are responsible for transports from Swedish suppliers, but they also handle most of the transports from foreign suppliers. Schenker is in charge of transports from Eastern Europe and DHL carries out the transports from Western and Southern Europe. Ewals is on the other hand responsible for the goods transports from British suppliers. The pick-up structure that today exists on the Swedish market forces the goods deliveries to always take place in the morning and early afternoon. Transports from foreign suppliers do not follow the same pattern and therefore, Scania tries to direct the arrival of these transports to evenings and late afternoons. In figure 5:6 is the number of arriving trucks to Chassiporten, during its opened hours from 06:00 to 22:00, shown. From the collected statistics it is calculated that approximately 88 per cent of all arriving transports reach Chassiporten before 16:00.

![Graph](image)

**Figure 5:6** Number of goods transport arrivals per hour (Source: Statistics from Chassiporten)

Common for the three mentioned forwarders is that they use trailers for transports from foreign suppliers and a truck with two loading units for transports from Swedish suppliers. A trailer has a maximum weight capacity of 24 tonnes and it can handle volumes up to 100 m$^3$. Corresponding figures for a truck with two loading units are 40 tonnes and 130 m$^3$.

**Ewals**

Ewals consolidates the goods to Scania in a goods terminal in Great Britain where they are sorted by receiving PRU. The goods are consolidated to
achieve a better utilization on the transports, which causes many of the transports to Södertälje to be loaded with goods to several PRU:s. After the sorting in the goods terminal, the goods are shipped to Gothenburg for further transportation to Södertälje. Ewals only use trailers for their transports to Scania.

**DHL**

Goods from both Swedish and foreign suppliers can be delivered to Scania according to the different transport patterns presented in figure 5.5. One way for goods from foreign suppliers is via a regional goods terminal and then further to the DHL goods terminal in Helsingborg. The goods can also be distributed directly to Scania from the regional goods terminal. When there are large consignments, the transport can be directed straight to the goods terminal in Helsingborg or in some cases, immediately to Scania. The same structure is valid for transports from Swedish suppliers but it is unusual that the goods pass through two goods terminals. DHL has a guideline to only consolidate goods to no more than three PRU:s on one truck in order to reduce the unloading time at Scania.

**Schenker**

Schenker’s transport pattern is built up in the same way as DHL’s. When transports are carried out from foreign suppliers the goods are consolidated in Ystad and then distributed to Scania. Schenker’s largest goods flow to Scania is from Swedish suppliers. The most of these transports are direct deliveries from one or more suppliers and deliveries that are handled in only one goods terminal.

**5.1.4 Slot-times**

To even out the inbound flow of goods transport, many of the PRU:s have created fixed times for when a truck is allowed to unload at the goods reception. The fixed times are actually time windows of different sizes, often 15 minutes, and are called slot-times. The slot-times have been created together with the three mentioned forwarders and the times have been adapted to fit the different transport patterns. At present, most of the arriving trucks have slot-times to follow.
5.1.5 *Scania’s transport agreements*

Scania purchases most of their automotive products with the delivery agreement FCA\(^9\), which means that Scania pays the transport cost. Scania has their own transport tariffs that have been created from negotiations with the contracted forwarders. These tariffs are formed differently depending on if it is transports from Swedish or foreign suppliers. All negotiated tariffs are dedicated to a specific area, for example post code unique in Sweden. For domestic transports, the tariff is divided into three different levels depending on the consignment’s pay weight:

- consignment \( \leq 100 \text{ kg} \)
- \( 100 \text{ kg} < \text{consignment} \leq 10 \text{ tonnes} \)
- consignment \( > 10 \text{ tonnes} \)

Most of the Swedish consignments have a pay weight that places the price in the middle category which means that Scania pays a price per kilogram. For consignments in the other two categories Scania is obliged to pay a fixed price no matter the actual weight.

For transports from foreign suppliers, Scania always pays a variable price per kilogram. An example of how the price varies with the pay weight of the consignment is shown in figure 5:7.

\[\begin{array}{c|c}
\text{Pay weight (kg)} & \text{Price per kg} \\
\hline
150 & 2500 \\
2500 & \\
\end{array}\]

\[\text{Figure 5:7} \quad \text{The price in relation with the consignment’s pay weight (Source: Björn Kvarnström)}\]

For smaller consignments, the price is fixed to a certain breaking point, which usually is approximately 150 kg. Thereafter the price drops for larger

\(^9\) Means Free Carrier and it is an international common term (Incoterm) used for transport agreements.
consignments until it reaches the next breaking point. This point usually occurs for consignments with a pay weight round 2.5 tonnes. For larger consignments the price returns to almost a fixed level.

Goods transport from one supplier to several PRU:s in Södertälje contains several small consignments and because of that, Scania is charged a higher price than if it was considered as one large consignment. This fact is clearly seen in figure 5:7, where the price per kilogram is much higher for small consignments.

In the transport agreements Scania demands that the goods on every truck shall be sorted by receiving PRU and correct loaded so the goods labels are visible when unloading.

5.1.6 Transport invoices

Each week, every goods orderer at Scania receives a transport invoice from the forwarders that have been used. This invoice is consignment specified which means that pay weight and price for every completed consignment is presented. The invoice inspection is very complex and extensive for large goods orderers. The inspections that should be performed are a check if the goods really have arrived and if the invoiced amount is correct. The goods orderer should also check so that the invoice has not already been paid. The present invoice inspection is made by personnel at the PRU:s but they only perform random checks as a comprehensive inspection is far much resource demanding.

5.2 The goods receiving process

The first action performed when a truck arrives to Scania is that the driver announces his arrival at the gate. This announcement is made in either Chassiporten or Tvetaporten, see figure 5:1. The gate registers the arrival of the truck and which goods receptions it will visit. At the correct slot-time the truck is allowed into the area to deliver the goods. The gate also registers when the truck leaves the area after unloading of the Scania goods. For Ewals transports the gate also makes registrations in Webstars. Figure 5:8 shows the number of unloading trucks based on registrations made by Chassiporten during March 2003.
According to the statistics, in average 78 arriving trucks per day are registered in Chassiporten for unloading. Figure 5:8 shows that Mondays is the most intensive day and that the arriving intensity decreases during the week. Notable is that Chassiporten only is opened daytime on Fridays which makes the intensity relatively high during the opened hours.

The work procedure differs slightly between the six goods receptions but there are some main tasks that are always performed. When a transport arrives to the goods reception the goods are unloaded, inspected, registered, labelled, sorted and distributed to customer. In the goods receiving function a process has been identified, see figure 5:9.

This process agrees in general with the process definition made by Ljungberg & Larsson (2002). However, they point out that a process is a network with in a specific order linked activities. This differs slightly from the identified goods receiving process in which the activities sometimes can be performed in various order. For example, registration can occasionally be completed before unloading.
5 – THE EMPIRICAL STUDY

5.2.1 Unloading
At the goods receptions there are specific marked spots where arriving transports are parked when unloading the goods. The goods are unloaded with forklifts from ground level and most of the time from the side to simplify the unloading activity. Goods from a certain truck are placed on a particular area to make the following inspection easier. On some PRU:s there are several locations for unloading, besides the one at the goods reception, to enable unloading as close to the customer as possible. Unloading is performed on these places to reduce unnecessary handling of heavy and bulky goods. The main part of the goods that arrives to the goods receptions is packed in Scania’s own packaging material, which simplifies the goods handling.

5.2.2 Inspection
The inspection conducted after goods unloading consists of a manual counting of the number of pallets. The counted number is then compared with the consignment note and possible deviations are noted. This inspection is made by all goods receptions to have a proof of what really has arrived if disputes would occur. One goods reception makes a more detailed inspection before the consignment note is signed and the truck leaves the area. The more detailed inspection also includes a part number and quantity comparison with the delivery note.

5.2.3 Registration
All goods receptions, except the one at Parts Logistics, use SIMAS for arrival and storing registration. When performing an arrival registration the delivery note number is entered and if the consignment is pre-advised from supplier with aviexp, see figure 5:3, information about the contents of the consignment is shown. If the consignment is not advised the personnel must enter part number and quantity manually. If the consignment includes goods that have to be declared by customs, additional information must be entered. The goods reception can also store the goods in the system, which is usually made when goods labels are generated by SIMAS. Parts Logistics performs all these goods receiving activities in a similar way in AROS.

All goods receptions also register arriving Ewals transports in Webstars. Registrations are made when the transport arrives and when it departures from the goods reception. Together with these registrations, the personnel enter how many pallets for each part number that were unloaded.
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5.2.4 Labelling

The one activity that differs most between the six goods receptions is the labelling of arriving goods. It is the internal material handling at every PRU that decides how the goods must be labelled. Some PRU:s demand that every arriving pallet is equipped with a new goods label when other PRU:s only perform labelling in a minor extent. The information on the new goods label is similar to the information that already is noted on the label created by the supplier, but additional information about for example storing position has often been added.

The labelling activity also functions as a more accurate arrival inspection of the consignment. At the same time the pallets are marked with the new labels, it is also checked if the part number and quantity matches the labels from the supplier.

5.2.5 Sorting

Sorting is only necessary on some goods receptions and then due to the following material handling. If the goods reception handles a large amount of goods, a sorting has to be conducted to make the distribution effective. Another reason for performing a sorting of goods is when a large number of distant customers shall be served.

5.2.6 Distribution

The responsibility to distribute the goods to customer varies between the receptions. Some goods receptions are only responsible for the transport to storage and others handle the transport all the way to consumption place. At the smaller goods receptions the resources are often shared with other functions to increase the utilization. Most of the transports are performed with forklifts but for example Chassis’ goods reception also uses small wagons.

The minor transports conducted between the different PRU:s in Södertälje is today handled by a forklift together with a wagon that passes through a predetermined loop connecting the PRU:s. This function is only used in a minor extent today and then mainly for goods that have been unloaded at the wrong reception.
5 – THE EMPIRICAL STUDY

5.2.7 Other activities

All the goods receptions have created work routines for handling deviations in the goods receiving process. Examples of reported deviations are missing delivery notes, missed slot-time and incorrect loading of goods. The deviation reporting is usually carried out when time is given and rarely in real time. All quality deviations shall be reported in eQuality, but the work with this system is not yet fully established at all goods receptions.

The material planning function at the PRU:s is responsible for informing the goods receptions about urgent goods deliveries. When urgent transports occur, is it the material planner’s task to contact the forwarder to get information about the status of the delivery.

One work task common for all receptions is the registration of consignments containing goods for customs declaration. When the customs goods are registered in SIMAS or AROS, a customs-id is noted, which is a specific number for a consignment from a non EU supplier. The forwarder is in charge of the notification to customs and when this is accomplished a document with a customs-id is received. After the registration at the goods reception, the customs document must be marked with a cargo-id, which is generated by the SIMAS or AROS system, and together with the invoice be sent to the customs department at Scania for declaration. If the customs-id is missing on the consignment note, the goods are not allowed to be unloaded at the Scania area and it is the forwarders responsibility to obtain the missing information. If an invoice is missing, it is the goods reception’s task to arrange the right documents for the customs department.

5.2.8 What differs between the goods receptions?

The work procedure and the resource supply for goods receiving differ between the PRU:s. Figure 5:10 presents a summary of the collected information from the six goods receptions.
5 – The empirical study

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Figure 5:10 Summary of the data gathered from the goods receptions

All goods receptions are opened both day-time and evenings on weekdays except on Fridays. After that Chassiporten is closed at 22:00, the goods receptions remain opened for a few hours more until the trucks that are already on Scania’s premises have left. The transports to Engine 2 (150) can arrive as late as 23:00 because there is only one PRU in that area. Some of the PRU:s have their goods receptions opened in evenings though the production is not working. Notable is that Engine 1 & 3 (003) only has its work up function, and not the assembly line, running on the evening shift.

The work force at the different goods receptions can be changed due to the size of the inbound flow which contributes to the labour force being larger on day-times compared to evenings. Because of the area of responsibility
differs between the receptions, see figure 5:11, the total work force is larger at Engine 2 than for Chassis (230) as the former is responsible for more internal transports. Most of the goods receptions have one person assigned for only administrative assignments. At Parts Logistics (210), the work force can be varied on the evening shift depending of the amount of work that has to be done. Notable is that this PRU only is responsible for placing some goods in storage location, which is illustrated with the marked area in figure 5:11.

Figure 5:11  Schematic figure over the different areas of responsibility

As the summary in figure 5:10 states, the amount of unloaded pallets varies between 60 and 1 000 for the different goods receptions. The Chassis workshop has the reception that receives the most goods every day and Transmission (075) and Industrial & Marine Engines (062) handle the smallest amounts. The information about received pallets is collected through interviews with the personnel at the receptions. A summary of the consignment statistics, see appendix C, shows a similar picture but some deviations can be noted. In figure 5:12, the number of pallets and the pay weight per day are presented for each receiving PRU, based on the forwarders statistics from March 2003.
The number of pallets in the left diagram is based on a calculation with some simplifications, see the note in appendix C, as the statistics received from Schenker and in some extent DHL were missing information about transported pallets. The biggest deviation from the goods receptions’ information was noted on the inbound flow to Engine 1 & 3. This deviation is caused by misleading information in the forwarders’ statistics and therefore the goods reception’s data of approximately 400 arriving pallets every day is used in the study.

The goods reception at Engine 1 & 3 unloads goods to other functions than its own and in that way it functions as a central goods reception in a minor scale. For example, goods for material control, exparts and various parcels are unloaded at this unit. This type of goods represents approximately 10 per cent of the inbound flow today. As a consequence of this, the goods reception at Engine 1 & 3 handles a great deal of express deliveries which contributes to the large number of arriving transports to this PRU. This is also the only goods reception with the ability to unload at a loading platform. The need of forklifts is, likewise the need of personnel, very dependent on the responsibility of the goods reception. For example, electricity driven forklifts are necessary for indoors handling because of the fact that diesel driven forklifts only are allowed for outdoor usage. Three of the goods receptions have the possibility to unload under a roof, which makes the unloading activity easier in bad weather. The number of unloading locations at the PRU often corresponds to the amount of large customers of the goods reception. Chassis has, besides the goods reception, two further unloading locations for goods to one of the two side stores. At present time, approximately 25 per cent of the goods to Chassis’ goods
reception are addressed to any of these side stores. All of the larger goods receptions use slot-times to level out the inbound flow which results in most of the arriving trucks having fixed unloading times. The two PRU:s not using slot-times have a much more uncertain inbound flow which makes it difficult to plan the daily work.

After unloading, the received goods are always inspected before the truck can leave the PRU. But only Engine 2 performs a more detailed inspection before the transport can depart. All goods receptions in Södertälje perform some kind of inspection but the work procedure is not standardized in the Scania world, for example is no inspection normally conducted by the PRU in Oskarshamn.

SIMAS is the system used by the most of the PRU:s for goods registrations, however, the AROS system is sometimes used at the same time. For example, AROS is used at Engine 1 & 3 for registration of non automotive products and exparts. As Parts Logistics use AROS, and not the MONA-system, they can not adopt the new Webstars system since it needs to communicate with MC. All goods receptions have a high share of goods that are pre-advised with aviexp except from Parts Logistics that only receives aviexp on half of their arriving goods which contributes to a large amount of manual work.

All the PRU:s today have different demands concerning goods labels which results in that no common labelling standard has been formed. The different goods labels created in SIMAS have the same structure but the presented information differs since it is adapted to the local needs of the PRU. Some goods receptions label every arriving pallet but for example Chassis reception does not label their sequence flows. Direct deliveries from suppliers are often treated differently by the goods reception which reduces the work for the operative personnel. The PRU:s today receiving direct deliveries are Chassis, Engine 1 & 3, Engine 2 and Transmission.

There are only Chassis and Engine 1 & 3 that perform a sorting by customer of the arrived goods. For Chassis, this sorting activity is necessary because of the following distribution system and due to the large amount of received pallets. The reason why Engine 1 & 3 conducts a sorting is their many and distant customers. On these PRU:s together with Transmission, the forklift distribution has been complemented with wagons and swapbodies.
Engine 1 & 3 distributes its export goods and the goods to material inspection with DynaMate, in average two times daily respectively three times weekly. More than half of the goods unloaded at Transmission’s goods reception are directly transported to heat treatment before placement in storage.

The frequency of the usage of eQuality, as well as for how long time the system has been in use, varies between the receptions. Engine 2 has been using the system for quite some time but personnel at Parts Logistics are relatively new users. All the PRU:s have eQuality but the goods reception at Industrial and Marine Engines use an own reporting system and leave the reporting in eQuality to another function.

The routines concerning urgent goods on Parts Logistics differ from the other PRU:s in many ways. They divide urgent goods into two categories, low stock level and VOR\(^\text{10}\). The latter results in that the goods are directly delivered to goods dispatch. The goods reception is informed about low stock levels via the AROS system and by telephone if the goods are VOR.

### 5.2.9 Problems at the goods receptions

One of the most common problems for the personnel at the goods receptions is missing delivery notes. This occurs daily at the larger goods reception and it complicates the registration activity and causes a lot of extra work for the operative personnel. In most cases, the problem is solved by a check of the goods label from supplier or else is the material planning function contacted. It is the supplier’s responsibility to enclose a delivery note with the consignment but it is today hard to identify who caused the missing note since the forwarder seldom checks the transport documents at pick-up. Sometimes, the invoice is also missing for non EU consignments which also cause trouble. One further problem for the personnel is the time consuming work registration that has to be performed when no aviexp is delivered.

When goods are loaded incorrectly on transports it causes problems for the unloading personnel. Examples of different kinds of incorrect loading are when the goods labels are not visible in the unloading activity, the goods are too closely placed and when the consignments are not correct sorted. A

\(^{10}\) Vehicle Off Road. A case of extreme urgency indicated by the customer when ordering a spare part.
consequence of all the stated deviations is that it makes the unloading activity more time consuming.

When a pallet is not labelled by the supplier or when the goods label is demolished during transports problems are created for the goods receptions. If a pallet arrives without a goods label, the operative personnel are forced to check the content of the pallet to create a correct new label. When the receiving address on the goods label is incorrect it is likely that the goods are unloaded at the wrong reception. If the goods for example only are marked with Scania, it is hard for the personnel to decide where the goods should be unloaded. Inaccurate information is also a problem for the customers of the goods receptions in cases when no additional labelling is performed. Today, approximately 40 per cent of the pallets registered with bar code scanning at Chassis’ storage function are not readable by the equipment. Another problem is consignments sometimes being divided and transported to Scania on different trucks. This is not made deliberately by the forwarder but happens when a pallet is forgotten at pick-up and has to be collected by another truck. This results in that the goods reception often waits for other arriving trucks before a missing pallet is reported.

5.3 The flow of empty packaging

As material is used in the production, empty packaging is created that has to be transported to the local collecting areas and there loaded on swapbodies. Besides the collecting areas nearby the PRU:s, three additional areas are used for collecting empty packaging. The flow from these places is however not as large as the ones from the PRU:s. See figure 5:13 for the locations of the collecting areas, marked with triangles, at Scania’s premises.
DynaMate is responsible for the transports from the collecting areas to the packaging pool in Hovsjö. Some PRU:s break down the packaging material before it is transported to Hovsjö but the main part of the transports are loaded with undownfolded material. A few PRU:s carry a small stock of packaging material which is used for repacking and when more pallets are needed it is ordered from Hovsjö. The packaging flow back to the PRU:s from Hovsjö is however relatively small which makes the total flow unbalanced.

The empty packaging is picked-up by DynaMate from every collecting area in a modified 2B-system\(^{11}\) with trucks serving a specific PRU or pass in a loop between the areas. In figure 5:14, the pick-up frequency and the shape of the flow are presented for each collecting area.

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\(^{11}\) A modified 2B-system means that when a loading unit is full, it is picked up by a truck that at the same time places an empty loading unit at the same place.
DynaMate has at present time three trucks dedicated for transports of empty packaging to the pool in Hovsjö. Two of these trucks serve a specific PRU, 230 and 150, while the third circulates in a loop between the other collecting areas. At the largest creators of empty packaging, 230 and 150, the collecting areas have been equipped with two swapbodies to reduce the pick-up frequency.

### 5.4 The benchmarked companies

The benchmarked companies presented in this section of the report have been chosen for different reasons but we believe the benchmarked situations to be relevant for the study. Schenker’s goods terminal is described because the structure of a central goods reception would be similar to a goods terminal. SKF has recently performed a centralization of their goods receiving function and it is therefore an interesting company to study. One company in the same business as Scania is Volvo Trucks. They let a part of their inbound flow pass by the goods terminal in Arendal, Gothenburg, operated by the logistic company Volvo Logistics. Trollhättans Terminal AB, TTAB, is the company that Saab has contracted to manage their goods receiving. The Saab-TTAB situation can be resembled to a central goods reception for Scania in Södertälje and it is therefore an interesting situation to investigate.

#### 5.4.1 Schenker

Schenker is one of the forwarders that Scania has contracted to perform goods transports and in Sweden, Scania is one of Schenker’s biggest customers. The company itself does not conduct any goods transports, it only act as an intermediary between Scania and the transporters. Schenker is a company within the Stinnes group in which the biggest owner is Deutsche Bahn. The company is wide spread around the world and one of Sweden’s
largest forwarders. All over Sweden, Schenker operates ten goods terminals where goods are consolidated and distributed.

Schenker’s largest goods terminal in Sweden is located in Lunda, a few kilometres outside Stockholm. This goods terminal is mainly used for consolidation of goods to customers in the Stockholm region. Every 24-hour period approximately 28,000 consignments are handled and 350 trucks are unloaded at the facilities. The goods terminal is opened around the clock, from Sunday afternoon to Friday evening. The work tasks differ during the working period, since arriving goods are unloaded and sorted in the afternoon, evening and night and then loaded and distributed in the morning. All activities in the goods terminal are based on the consignment note enclosed with the consignment by the goods sender. Schenker themselves, do not create any new documents as they only handle the consignment and delivery notes created by the consignor. In the goods terminal, the arriving pallets are marked so that customer or area of delivery clearly can be viewed which simplifies the sorting activity.

When a goods transport is carried out, the physical flow is closely linked to the information flow, which is illustrated in figure 5:15. The figure shows Schenker’s process from a transport booking done by one of Scania’s suppliers in Gnosjö to goods delivery at Scania. The physical flow is in the illustration defined as a movement of a vehicle and the flow of information indicates a registration in an administrative system. When a supplier makes a transport booking it is registered in Schenker’s central system (1). Thereafter, the order is forwarded to a goods terminal nearby the supplier (2). Personnel at the goods terminal then decide which truck that will pick-up the goods. After pick-up and arrival at the goods terminal, a further registration is performed (3). After the goods are sorted, they are loaded on a truck and Schenker registers the goods dispatch (4). The goods are then often transported directly to Scania but in some cases these pass via another goods terminal, indicated with the goods terminal in Lunda in figure 5:15, for additional goods pick-up. In the latter case the work procedure is similar the one performed at pick-up, with registration (5), sorting and dispatch registration (6). When the truck returns after delivery, the goods transport is registered as completed (7).
Schenker believes that their business only marginally would be affected if a central goods reception was implemented at Scania in Södertälje. The most important positive effect for Schenker would be the less time consuming unloading at Scania due to only one unloading location. The negative effect is an economical aspect and therefore very obvious for the company. Today Schenker charge Scania for every delivered consignment, even if they are transported on the same truck, which is much beneficial for Schenker. If introducing a central goods reception in Södertälje, Scania could reduce the number of consignment with preserved volumes, when a transport to Södertälje could be seen as one large consignment. Schenker also observe a risk in a too lean dimensioned goods reception, which would cause queues and long waiting hours for the transporters.

5.4.2 SKF

SKF is a global company with a leading position in bearing manufacturing. They have located their production in 22 countries divided into 83 factories. The production in Sweden is placed in Gothenburg where they manufacture roller bearings. SKF Sverige AB in Gothenburg employs about 2 400 people and their four factories are spread on an area similar to Scania’s main area in Södertälje.

A relatively new function within SKF in Gothenburg is Terminal & Transport, which is responsible for receiving of goods and raw material, internal transports as well as storing of non production products and spare parts. This function was created during the so-called Terminal200 project, which was initiated in the beginning of the year 2000. The target of the project was to co-ordinate the handling of non production products and spare parts in a goods terminal. During time, the project evolved to also
include an improvement of the goods receiving process. The project was conducted together with the logistic company Alfakonsult AB and lasted for two years. Before the project there were 72 minor storages spread around the SKF premises, which resulted in that factory having several storing locations for non production products and spare parts. The factories were also responsible for their own goods receiving and there were several different receptions for each factory. Compared to Scania, SKF does not pay for the goods transport from supplier and the standard transport agreement is free SKF.\footnote{12}

With the former structure, SKF had large difficulties in controlling the different storages. For example, a huge number of spare parts for already scraped machines were stored. The same types of parts were also stored in numerous locations which contributed to unnecessary tied-up capital. The large number of storages were also very resource demanding and SKF saw a possibility to an improved utilization in a structural change.

Before the initiation of the project, every factory was also responsible for the transports of raw material to the own production. That personnel from each factory were responsible for the material transport from the unloading location, caused a low transport utilization and a lack of control.

When the project was finished in the end of year 2002, the new function Terminal & Transport had been formed and the main part of SKF’s non production products and spare parts were handled and stored in a goods terminal located within the SKF premises. Besides the centralized goods receiving, the handling of arriving raw material was improved. Nowadays all spare parts and some components are ordered from the new function which also is responsible for the internal distribution.

The function Terminal & Transport employs today 55 persons and 5 000 pallets arrive to the goods terminal on a yearly basis. SKF does not use slot-times for the transporters, which makes the daily work difficult to plan since there is no control of when the transports will arrive. The goods terminal has two docking stations where trucks are unloaded. In the terminal building there are certain areas for unloading/labelling, distribution and storing.

\footnote{12} Means that SKF includes the transport cost in the purchase price.
After goods unloading an arrival inspection, consisting of personnel manually counting the pallets, is made. The personnel at the goods reception only handle consignment and delivery notes as the customs documents are handled by another function at SKF. The arrival registration is then performed with a purchase number and it is when doing this registration the personnel is informed about urgent deliveries. After registration, the goods are marked with new labels containing information about storage position. When the customers of the goods terminal order material, the internal distribution is conducted with a small truck or a forklift. The truck passes through a pre-determined loop between the goods orderers meanwhile the forklifts are used for transports to closely located customers. A time schedule has been developed for the internal distribution in order to give the customers information about when the goods are to be unloaded. This information contributes to the fact that resources do not need to be tied-up at a specific location during a full work day. The goods terminal has 50 internal customers and another function is responsible for the distribution to external customers. A problem for the Terminal & Transport function is that the goods are not registered as delivered when a goods transport is performed. When deviations occur, the personnel can not prove that the delivery is completed. One solution to this problem is to introduce a system that registers pick-ups and deliveries and this could for example be done with bar code scanning.

The biggest benefits that SKF has achieved with the structural change are a better control of stored spare parts and non production products together with less tied up capital. Due to the change, SKF has a possibility of better utilization of personnel, spaces and equipment. A further advantage has been a standardization and a simplification of the goods receiving process. An example of an improvement is all internal orders for spare parts and non production products passing through an order central. Better follow-up possibilities have also been achieved together with more effective unloading due to only one unloading location on the SKF area for external transports.

5.4.3 Volvo

Volvo Trucks is a company within the Volvo Group and has a structure similar to Scania. Both Volvo and Scania have equal market shares in Sweden and Western Europe but Volvo Trucks is, as opposed Scania to, also represented on the North American market. Volvo has focused their European production of trucks to Gent in Belgium and to Tuve in
Gothenburg. The production is equally divided between these two factories and the total production in the Tuve plant is 25 000 trucks. The business in Tuve employs approximately 2 300 people. Concerning logistic matters, Volvo Trucks cooperates with Volvo Logistics that is a service company within the Volvo Group. Volvo Logistics has their head quarter located in Arendal, Gothenburg, where they also operate their largest goods terminal.

Every day, it arrives 80 to 90 goods transports to the factory in Tuve. Transports containing storage material and some sequence deliveries are handled by the goods reception meanwhile components together with bulky goods are unloaded as close to consumption place as possible. The arriving transports have often fixed arrival times which make the inbound flow relatively constant during the day. The goods reception is opened on both daytime and evenings from Monday to Thursday but only daytime on Fridays. Many of the arriving transports are pre-adviced which gives Volvo information about trailer-id, number of pallets and scheduled time for arrival. This provides Volvo with a basis for resource allocation as well as a possibility to plan the daily work for the involved functions. Volvo Trucks pays, just like Scania, for all goods transports from suppliers. The transport agreements are negotiated by Volvo Logistics and they are also the party receiving the transport invoices. The invoice inspection is conducted so that both the amount and the consignment number match the existing agreements. Volvo Trucks is thereafter internally invoiced for the performed goods transports with an additional rise for administration and goods handling.

When a truck enters the Tuve area, an arrival registration at the gate must be made, which takes place when the driver hands over the transport documents. The goods reception has, just like Scania, obtained information about the consignments via avioexp and the personnel uses the information for the registration activity. Approximately 80 to 90 per cent of the goods are pre-adviced from the supplier and it is only the small suppliers that do not send avioexp. When an avioexp is sent with a consignment, the work burden is reduced for the administrative personnel. After the registration, an unloading list is generated which makes it possible for the unloader to inspect the consignment in detail. Unloading lists are only printed for consignments unloaded at the goods reception. The level of the goods inspection is decided by the unloader but the number of pallets in the consignment are always counted while sequenced goods deliveries are
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inspected to a minor extent. Volvo struggles to reduce the inspection of the inbound flow as they consider the inspection to be unnecessary for transports that have been without deviations for a longer time. When the goods are unloaded they are placed on either wagons for distribution to consumption place or on a roller conveyor for transport to storage. The pallets placed on the roller conveyor are marked with a unique pallet number that is used in the following material handling. At the same time the goods are registered as stored and then transported to storage with an AGV\textsuperscript{13}-system.

Volvo in Tuve attempts to increase the number of direct deliveries from suppliers, i.e. they try to minimize the goods handling during transports. Today only 10 per cent of the transports to Tuve pass through the goods terminal in Arendal. Though, a large part of the foreign goods are consolidated in any of the goods terminals in Europe to obtain a better transport utilization. For some goods flows, Volvo has assigned the transport optimization to the forwarder to further increase the utilization. Volvo Trucks has together with Volvo Logistics decided threshold values, concerning the weight of the consignment, for when a transport should enter a goods terminal.

The goods terminal in Arendal is one of Europe’s largest and it handles about 200 units\textsuperscript{14} per day. On a yearly basis, nearly 1.3 million pallets arrive to the goods terminal with a relatively steady intensity during the year. To Arendal, goods arrive by both trucks and cargo ships for consolidation and further distribution to customer. The majority of the arriving transports are controlled by fixed time schedules and most of the goods arrive during daytime.

The goods terminal takes up a total area of 20 000 m\textsuperscript{2} which is divided into 33 small areas for loading and unloading. All these areas are located under a roof and on ground level. Some of the areas are dedicated to large customers, for example Volvo Trucks has its own area. The goods terminal has 15 forklifts at disposal that are leased from a nearby company. Close to the goods terminal, Volvo Logistics also operate a logistics centre where

\textsuperscript{13} Automated Guided Vehicle
\textsuperscript{14} With a unit, Volvo Logistics refers to a truck, trailer or a container.
large consignments can be stored and divided into small batches for distribution to customer.

The work procedure, concerning goods arrival, begins with an announcement of arrival made by the driver when the administrative personnel receive the transport documents. The driver is then informed about unloading location and a forklift driver receives an order to unload a specific truck. The communication between the administrative personnel and the forklift driver is performed in real time as they both use the same system. Notable is that all forklifts are equipped with computers. Based on the information in the system the forklift driver performs an inspection of the consignment. When the unloading is completed, it is entered into the system and the forklift is available for new assignments.

5.4.4 Trollhättans Terminal AB
Saab Automobile in Trollhättan has outsourced some parts of their goods receiving and storage function to a third party logistic provider. This company, Trollhättans Terminal AB (TTAB), is a subsidiary within the Belgium group Katoen Natie which provides global logistic solutions.

When Saab in the late nineties was hit by an urgent need for space, a decision was made to implement a goods terminal outside the premises where material could be stored. This would contribute to a more levelled inbound flow to the factories in Trollhättan and more space could be liberated. The new structure was developed in co-operation with TTAB because of the fact that Saab wanted to focus on their core business as well as that outsourcing was of current interest. The goods terminal was initially only handling large and distant consignments that were stored and distributed to Saab in small batches. Today the function has evolved to also embrace activities as cross-docking and storing of some parts. However, some direct deliveries to Saab still remain. The goods terminal in Trollhättan is approximately located five kilometres from the Saab factories and it takes up a total area of about 12 000 m².

The operative personnel at the goods terminal, which today is 47 people, works in three shifts and the goods terminal is opened around the clock. About 110 to 120 transports arrives every 24-hour period and they carry approximately 4 500 pallets for unloading. The arrival of the transports is relatively constant during the opening hours due to fixed arrival times for
almost every transport. One explanation to the relatively constant inbound flow is also that two forwarders collaborate with a local transporter. This cooperation is shaped so that the forwarders place their trailers nearby the goods terminal and it is then the local transporter’s responsibility to deliver the goods to TTAB at the right time. The goods terminal is divided into one temperate zone for storing and one intemperate zone for unloading. Figure 5:16 presents a simplified layout of TTAB’s goods terminal.

![Diagram of TTAB's goods terminal](image)

**Figure 5:16** A simplified layout of TTAB’s goods terminal (Source: Trollhättans Terminal AB)

The arrival registration is performed in Saab’s own information system and approximately 90 per cent of all consignments are pre-adviced from suppliers. When this registration is conducted, goods labels are automatically generated and the structure of these labels varies depending on the following internal handling. The goods terminal has four permanent unloading stations but when needed, an extra station can be used. At the permanent stations, goods are unloaded from the side but the additional station use a dock door and goods have to be unloaded from behind. The initial quantity inspection is conducted by the forklift driver and the goods are thereafter marked by labelling personnel. Every arriving pallet is given a unique number used in the further handling, both at the goods terminal and at Saab. After labelling, the goods are placed either in storage or at the dispatch location for cross-docking. The storage area in the goods terminal is by the information system considered as an internal Saab storage to which orders are placed when a need occurs. The goods are distributed to seven customers at the Saab area based on specific time schedules. The goods terminal is only responsible for loading the goods as the transport is performed by one of Saab’s contracted transporters. The transports to Saab are performed with trailers and at present time around 30 transports...
departure from TTAB every 24 hour period. When the transport departs, the transporter place an empty trailer at the loading station to achieve an effective loading activity and avoid waiting time. When the goods arrive at Saab, the transporter picks-up a trailer with empty packaging for transport to a packaging material storage. From this storage location an empty trailer is transported back to TTAB, which makes a closed flow of loading units.

The most common problems for TTAB are when goods are incorrectly loaded on the transport or when transport documents are missing. TTAB has also a problem with incorrect goods labels. When a pallet is damaged the goods are sent to an inspection area where Saab has personnel to investigate the damages. Most of the urgent deliveries do not go via the goods terminal but when this happens, the personnel are notified by the information system and the transport is handled after certain routines. The administrative personnel at the reception also handle customs registration and they have to enclose custom documents to Saab.

TTAB believes that their business can be made more efficient because of today’s large number of manual work tasks such as inspection and labelling. They consider there to be great potential of efficiency in for example bar code scanning. TTAB argues that one of the larger benefits with an external goods receiving and storage is the space liberation for the customer. To only use a goods terminal, like their own, for consolidation of goods is much more doubtable as less space can be released, which make the benefits vaguer.

At the Saab area, TTAB’s goods receivers are one final assembly workshop as well as one welding workshop. Before the introduction of TTAB’s goods terminal in 1998, these two workshops had their own goods reception. Today, only one of the receptions is operating in order to handle direct deliveries. The work procedure at this reception is similar to the one performed at the external goods terminal. Previous to the structural change, the goods labelling at Saab was not standardized. Due to the change, Saab chose to introduce a standardized goods label to simplify the work at the external goods terminal. There are today seven unloading locations at Saab’s premises which make it possible to unload close to the consumption place. The largest advantages that Saab believes the new structure has contributed to, is that space has been released and the inbound flow to the factories has been levelled out. The disadvantages with the present structure
are the difficulty to integrate an external company in the own business and the relatively far distance between the goods terminal and the Saab area.

5.4.5 Benchmarking sum up

All of the benchmarked companies have chosen their present structure because of different reasons. Their situation can not be directly compared to Scania’s, but some parts can be adapted to the business in Södertälje and therefore facilitate to fulfil the purpose of this thesis.

The visit at Schenker was interesting because of the fact that their business is directly affected by an introduction of a central goods reception at Scania in Södertälje. It was therefore important to obtain their view and opinions concerning this study. The observation at the goods terminal in Lunda was interesting as it contributed to the authors’ knowledge about how a goods terminal was operated. The now concluded project at SKF differed more from this study than we first thought. SKF had focused the change on activities concerning storage of spare parts and non production products. It was however rewarding to take part of the information about especially their distribution system. The meeting at Volvo gave us an opinion about how a company, in the same business as Scania, is reasoning concerning matters of goods receiving and transport patterns. The work procedure at the goods terminal in Arendal was also interesting to observe, despite the fact that the procedure was more extensive than for a possible central goods reception at Scania. In this study, the most rewarding visit was the observation at TTAB, which presented a situation similar to a central goods receiving for Scania. TTAB handles goods volumes comparable to Scania’s inbound flow which result in that work procedure and layout were interesting to study. It was also rewarding to hear TTAB’s opinions and thoughts concerning improvements of the goods receiving process.
6 Analysis

To give the reader a good understanding of the advantages and disadvantages for each structure is an analysis in this chapter presented. The present situation is analysed and a discussion of the consequences with a new goods receiving structure, consisting of a central goods reception and local receiving units, is held. The analysis chapter is concluded with an economical and qualitative comparison between the new structure and the present situation.

6.1 Analysis of the present situation

The present goods receiving structure is working relatively well, but it results in several consequences for Scania which are important to identify in the analysis work. In this section, the present goods receiving structure with connected work procedure are analysed.

6.1.1 Advantages

The present decentralized structure contributes to goods being unloaded near consumption place as well as the fact that Scania late takes over the responsibility from the forwarder. When unloading goods near storage location or production, the internal handling is minimized and the goods are seldom transported longer distances. As every individual PRU only handles goods for the own business, the operative personnel have a high competence level concerning the handled goods. If, for example, goods labels are missing or are incorrect, can the personnel from their experience judge how the goods should be handled. Since the different PRU:s’ goods receptions are located close to the local production, positive effects of synergy can be achieved due to the closeness to other functions within the PRU. Such an effect is the good and rapid information exchange the goods reception and the material planning have today. This communication is considered as vital, since the production is depending of this co-operation to work effective. When there is an urgent need of material in the production, it is important that every function in the supply chain collaborate to avoid unnecessary production stops. Another case of importance of closeness is when goods with damaged packaging material arrive to the goods reception. To be able to make a quick and correct judgement, people with good knowledge about the actual part are needed, for example a quality engineer from the local PRU. The overall effect, which is created by the closeness of
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the goods reception to other functions at the PRU, is Scania having a good control of the goods when they reach the production units.

The present structure is also adapted to the MONA-concept, which makes it possible for every PRU to design their own goods receiving function based on local needs. Today, this is extra obvious regarding the labelling activity that is formed after the different needs of the PRU:s.

6.1.2 Disadvantages

The decentralized structure is also contributing to several negative effects for Scania’s business. With the present configuration, a goods transport can be unloaded at several goods reception in Scania’s area, which results in that goods can be unloaded at wrong PRU and then additional work is created for involved parties. Goods being unloaded at wrong PRU are seldom a problem that the goods reception personnel can be blamed for. It can, among other things, have its origin in incorrect labelling from supplier or bad loading by the transporter.

One of the largest disadvantages with performing goods receiving activity on several different places inside the area, is that Scania’s resources are not used in the best way. This is an effect that also Abrahamsson (1992) points out when he states that a decentralized structure results in high costs for personnel and administration. Since the volume of the handled goods quantity varies between the units, resources have been adapted to this but it is still necessary with some resources at all goods receptions. The goods receptions must with present configuration have administrative personnel every opened hour for the function to work correctly. This causes the administrative working burden to vary heavily between the different PRU:s. Today’s transport pattern contributes to many arriving transports being consolidated with goods to several PRU:s. This results in that the goods receptions must adapt their opening hours to each other. The PRU:s that do not have any production in the evenings must have their goods reception open, in order to serve the transports entering the area. Even if most of the receptions would have managed to unload all arriving goods in one shift, they must, with the present structure, tie-up resources at the receptions during evenings.

The work with slot-times has resulted in a more levelled out inbound flow to each PRU, but the arriving intensity is still as largest in the mornings, see
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figure 5:6. This contributes to the working burden being very uneven during the day, and resources for the goods reception must be dimensioned after the maximum intensity. The large number of goods receivers at Scania makes the work to create optimal slot-times complex, which causes the slot-times rarely to be updated. Another problem that comes up due to the present situation with slot-times, is that when a transport is late from one goods reception, all the following receptions are affected. This chain effect, influences the planning of the unloading operation and the problem is often solved by letting the late transport wait for a free time. Waiting time creates a huge dissatisfaction among the concerned transporters, which also causes a poor working environment for the personnel at the goods receptions.

The transporters’ work is, due to the present configuration, very demanding as goods have to be sorted and cargo planned for each receiving PRU. Especially demanding is the work with loading the transports correctly and thereby create a convenient unloading at Scania. Despite the cargo planning, unloading at several PRU:s is very time consuming for the transporters, which in a long-term view is expensive for the transporter and indirect also for Scania. In the daily work, the forwarders are contacted by several different persons at Scania to solve arisen problems. The fact that communication takes place in several channels, contributes to some duplication of work. This can for example occur when material planners from more than one PRU contact the forwarder and requesting the same transport as urgent.

An effect that concerns Scania in general, not the goods receptions in specific, is the large number of external transports inside Scania’s area without any surveillance. Scania is forced to rely on all transporters only to perform the tasks they are instructed to do. The external transports also contribute to a heavy traffic that Scania does not want in their area. Based on a security point of view, the present situation can be seen as relatively problematic.

6.1.3 Work procedure at the goods receptions

Today, the work procedure at the six goods receptions is not standardized which results in every concerned party performing the work tasks in different ways.
With the present configuration, which creates many consolidated goods transports, is unloading from the side the most appropriate. Today, almost all unloading is performed from the side since it is more flexible than unloading from behind. The problem with incorrect loaded transports is also with this unloading method reduced, since it is easier to pick-out specific goods from the side. Though, unloading problems can come up when the goods are too tight loaded on the transport. It is also important to have the goods label visible, to avoid goods being unloaded at wrong reception. Unloading goods under a roof is an advantage, since it protects the goods as well as improves the work environment for the personnel. Today, more than half of the goods receptions have an opportunity to unload under roof which also is appreciated by the operative personnel. In the empirical study, it was stated that almost every arriving goods type can be unloaded from ground level. This results in that a loading platform, which today is used by the goods reception at Engine 1 & 3, is not necessary but it is making unloading of some consignment easier. All large goods receptions have several unloading locations at the own PRU to reduce the handling of some pallets. Most of these places are well located in relation to their customers, which create an effective material handling. The exception is Transmission that, because of their location of heat treatment and storages, is forced to carry out relatively long internal transports before the goods can be stored.

The initial inspection of the consignment performed today at the goods receptions is necessary to carry out. This inspection is conducted so that Scania knows what goods really have arrived. The information from the inspection is required if Scania should make a complaint about the supplier. The inspection should include a check of the consignment note, to make sure that the correct number of pallets has arrived. Performing a more detailed inspection, like Engine 2, is not necessary as the transporter only can be responsible for the right number of pallets from each supplier. A more detailed inspection has though, the positive effect that deviations are early discovered which make them easier to follow-up. A total termination of all inspections is a good thought, since an inspection never is a value-added activity. However, a termination can first be performed when the inspections no longer detects any deviations and thereby played out their role. Scania in Oskarshamn only inspect goods for customs declaration and consignments from some suppliers, because they have realized that a complete inspection was not economically justifiable. This thinking was also found at Volvo Trucks, who did not consider it necessary to inspect
deliveries which had been correct during a long time. These thoughts are also presented in SPS, but it takes a careful risk analysis before a reduced inspection can be implemented in Södertälje. Less inspection is also mentioned in the theoretical framework, when Aronsson et al. (2003) state that many companies can gain benefits from reducing inspection, and instead work to quality secure their suppliers. Today the inspection performed by the PRU:s in Södertälje also has a preventing effect, since it forces the transporters to get more accurate in their loading process.

Today, all PRU:s are registering the consignments with the delivery note number and sometimes also with the customs-id, in either SIMAS or AROS. One thing that differs between the goods receptions is the level of pre-advising with EDI, resulting in the amount of manual registrations to vary between the units. Especially Scania Parts Logistics has a resource demanding registration work, since only half of their arriving consignments are pre-advised. A task that has to proceed is the work with increasing the amount of suppliers with EDI communication. One possibility is, if using bar code scanning, to combine registration and inspection. Since the information about the number of pallets for each consignment already exists in the electronic delivery note, aviexp, this could be used to compare with the scanned data from the goods label. This argument is also strengthened by Lambert et al. (1998) when they point out that increased EDI communication and bar code scanning are of interest for all goods receiving functions. A difficulty is though, the system development necessary to support such a solution. One disadvantage with present work procedure, which was identified in the empirical study, is that pre-advised consignments were entered into the system even if a consignment was not completely delivered. This resulted in a lot of manual work to correct the registered information afterwards. This is a problem that Aronsson et al. (2003) also illustrate in their description of the goods reception’s arrival registration. Webstars is today used parallel with existing systems, which is an obvious disadvantage since registrations have to be entered in several systems. The Webstars registrations are also considered as an unnecessary action by the personnel at the goods receptions. This is a problem that could be avoided if there was some kind of communication between the systems.

The present structure, with sex goods receptions, is well suited for today’s labelling requirements. With this configuration can the information on the goods be adapted to local needs which, in many cases, make the internal
material handling easier. However, labelling do not create an added value for the customer and is therefore no task that Scania should spend time on. If using the labels made by the suppliers, Scania could avoid the labelling activity and resources could be saved. However, this solution can result in some problems if the goods labels are damaged during transport or printed with incorrect information. Starting to use the supplier’s goods labels is a critical changeover and it will initially demand large resource efforts.

The goods reception that today has the largest need of sorting is Chassis, which clearly handles most goods compared to the other PRU:s. Sorting is a work task that is closely connected to the distribution system. This means that every receiver with a large number of long distanced customers must perform some kind of sorting activity. The empirical study shows that only Chassis and Engine 1 & 3 sort the arrived goods. The goods are then simply sorted by customer. For distribution of small and frequent flows, a forklift equipped with a wagon is the most effective alternative while a 2B-system with swapbodies is better for larger flows.

Today, the use of eQuality at the goods receptions is not very frequent, which is a large problem. If faults shall be corrected, the deviations must be reported and followed-up. If eQuality registrations from the goods receptions do not get more frequent, deviations like missed slot-time and incorrect loading never will disappear. Goods receiving personnel often think eQuality to be complicated and extra work. It is therefore important with continuous education in the system to increase the competence level. The customs department at Scania has today relatively large problems with the work procedure at the goods receptions. The most common deviation is missing information when document is sent to the customs department for declaration. Personnel at this department consider the contact with the goods reception today to be complicated, since it often includes several contact persons. Today, there exist well defined routines of how consignments with goods for customs declaration shall be handled, but it is when deviations arise the problems begin. Regarding urgent transports, the communication between the transporter and Scania is today satisfying but large resource efforts are used for contacts with forwarders when shortage of material comes up.
6.1.4 The flow of empty packaging

That all down folding, storing and distribution of packaging material today is done in Hovsjö is not a transport optimal structure. The localisation of this plant contributes to transports between Scania and Hovsjö being conducted through a populated area, which is not a good long-term solution. The flow between the PRU:s and Hovsjö is today poorly balanced since only a few transports returns back to the PRU:s with ordered packaging material. Since most of the transports to the packaging pool are loaded with undownfolded packaging material, the utilization of these transports is low, because a large amount of air is transported. Further, the facilities in Hovsjö are in need of investments to increase the storage capacity and to improve the infrastructure. Before these investments are done, it is vital to investigate if the present configuration of the packaging flow can be improved.

6.1.5 Sum up

To conclude this section we sum up the analysis of the present situation to give the reader a good picture of the advantages and disadvantages.

Figure 6:1 Summary of advantages and disadvantages with the present structure

Figure 6:1 presents a sum up of the consequences the present goods receiving configuration causes Scania. The largest benefit with the present structure is the low internal goods handling caused by the unloading close to consumption. We believe the major disadvantage to be the high need of resources that the present decentralized structure forces Scania to have.

6.2 New goods receiving structure

In the following section a new structure with a central goods reception for Scania in Södertälje is described and analysed. A central goods receiving will contribute to the type of co-ordination of goods transports from supplier
to customer that Tarkowski et al. (1995) describe in figure 4:5. How, and at which function, the different activities in the goods receiving process will be conducted are presented and areas of interest concerning a change in structure are discussed. The new structure has been shaped with the targets to maximize the scale benefits and create one unloading location for the transporters. Further, it has in this analysis been assumed that the packaging pool in Hovsjö is integrated with the central goods reception.

6.2.1 Activities at the central goods reception

Unloading
A central goods reception will in average serve 78 arriving trucks that unload 2,500 pallets every day. For this to be efficient, the unloading function must be well dimensioned and have a well defined work procedure. When deviations occur, they shall be handled alike every time they are detected to reduce their negative affect and facilitate the goods receiving work. It is important that the number of unloading locations is adapted to the used slot-times and to have one forklift available for each location. All unloading should be performed outdoors but under roof and from ground level, which is the most common way today. At Volvo’s goods terminal in Arendal, all unloading was performed in the above stated way which indicates that this kind of arrangement is functional. From an investment point of view, it is obviously more advantageous with this kind of layout compared to a goods terminal with docking stations. Because of the central goods reception, the problem with incorrect loaded transport will be reduced due to the fact that every Scania pallet is unloaded at one place.

Lumsden (1998) argues that co-ordination based on time tables is necessary for an effective goods terminal. Scania must continue to develop the slot-times and we believe that this development could be conducted more easily with a central goods reception. It is easier to level out the inbound flow since the slot-times only have to be adjusted to one unloading place. At present, the PRU:s have time windows of 15 minutes for the main part of the arriving transports and we believe it appropriate to extend the slot-times at a central goods reception since a larger number of pallets are unloaded from every truck. Extending the slot-times for the arriving transport is on the other hand not beneficial as it increases the uncertainty. We however recommend Scania to introduce slot-times of 30 minutes for a central goods reception. With today’s transport pattern, it is also not reasonable to have
the same time windows for the whole 24-hour period and a work with adapting these windows to the arrival intensity must be initiated. For example is a shorter slot-time in the morning, relatively the evening, needed to increase the unloading capacity. It is vital that the slot-times are followed by the transporters and every deviation must therefore be reported so that follow-ups can be made. Most of the arriving transports should have a slot-time but certain flexibility must be left to handle express deliveries.

**Inspection**

As Aronsson et al. (2003) mention, it is vital to have a discussion about the extent of the inspection activity. At a central goods reception, it is important to check if the consignments are correct before the consignment note is signed. If this inspection would be held manually, a quantity inspection is the most suitable alternative. To manually inspect all consignments on a part number level is not realistic due to the time which then is needed. This is also a fact that Aronsson et al. mention. However, if the inspection could be made with bar code scanning, the examination could be improved and errors caused by the human factor eliminated. Though, a thorough investigation of risks and possibilities must be conducted before an investment in required equipment is made. One large problem with bar code scanning is that the goods labels from the supplier always must be correct, which at present time not is the case. Today, only 60 per cent of the goods labels can be used directly and huge resources would be demanded to attend deviations, if bar code scanning was introduced. This number can however be raised if Scania continuously works together with the supplier and always reports deviations. A correct goods label from supplier would also simplify the internal material handling at some of the PRU:s, where bar code scanning today is used for storage registration. When a goods label is missing or damaged during transport, a central goods reception must have the ability to create new goods labels. If there is a large share of incorrect goods labels, it will cause a lot of manual work and the waiting time for the transporter increases. We however argue that the inspection at a central reception should be performed with scanning equipment, as it contributes to a smooth and detailed inspection of the goods. This is also an opinion that Tarkowski et al. (1995) share, when they mention bar code scanning as an alternative with great potential.

The scanned information should be compared with the aviexp from the supplier, so that deviations can be detected automatically. To achieve an
efficient inspection, it is important that the amount of pre-adviced goods is as large as possible. Today, some of the PRU:s have a too low share of pre-adviced goods and a work to increase this share must be initiated. To manually compare the scanned information with the delivery note is time consuming and not a suitable long-term solution. If all consignments were to be pre-adviced from supplier, the physical delivery note could be terminated since it would only contribute to unnecessary paper work. When Webstars is fully introduced at all of Scania’s suppliers and transporters, exact information about consignments transported on one truck will be available for Scania’s personnel. A connection between the scanned information and Webstars is, what we believe, the best suited system for goods inspection. The inspection, with bar code scanning, will also create a great opportunity for follow-ups and it could also function as arrival and storage registration.

Registration

The bar code scanning should also function as an arrival registration of the goods. With this procedure, only the goods that really arrive to Scania will be registered, oppose to the present situation when the whole pre-adviced consignment is registered. We argue that goods registration should be performed in Webstars but information has also to be sent to the locally installed systems at the PRU:s for arrival registration. This communication is a problem because of today’s MONA-concept, but a solution must be found to enable registration at a central goods reception.

At which point in the inbound flow the goods should be registered as stored in the system, is a question for every receiving PRU. The biggest problem with a storage registration at a central unit is the following distribution lead time. When a material planner gets indications of a part being stored, the part must be available for the production and not temporarily stored in a central goods reception. This consequence will only have a minor affect if the lead time, from goods arrival at the central unit to delivery at goods orderer, is held as constant as possible. We believe the best solution to be that some parts are registered as stored locally while other are registered as stored at the central reception. For example is Chassis already today using bar code scanning when registering some goods, which makes it unnecessary to perform a storage registration centrally. Also Engine 2 and Parts Logistics should have a fair possibility for a local storage registration, since their internal material handling already today includes bar code
scanning. We do not see a large problem in a central storage registration, if the distribution to customer is well functional. Then, each PRU could have a relatively constant lead time from the central goods reception which would improve the control of the goods flow. Which parts that should be registered as stored at the central unit must be decided by the system. For example can all parts with a specific storage location be registered as stored centrally. There is of course great benefits in reducing the administrative work at the PRU:s and if all storage registrations were performed at a central unit resources could be saved.

**Labelling**

Based on the arrival registration, goods labels for each pallet should be generated at the central goods reception. The information on the labels must be collected from the PRU:s’ locally installed systems. It is for example important that Transmission’s goods for heat treatment are clearly labelled so that no mistakes are made in the following sorting activity. The information on the goods label from supplier is enough for some PRU:s, but some goods receivers demand labels containing information about storage position. This specific information can not be generated by the supplier while the storage position changes over time. The goods terminal in Trollhättan performed a goods labelling of every arriving pallet and therefore we consider this to be achievable also at a central goods reception in Södertälje. TTAB used a system with different goods label colours, depending of the destination. That system, or a similar kind, would be suitable for Scania, since the central goods reception will handle a large amount of customers. We believe the goods labels today used by Chassis and Engine 2 as an appropriate choice for a future central goods reception. Since a certain number of pallets have to be labelled, we consider it suitable to label every arriving pallet as it simplifies the following sorting activity.

**Sorting**

The sorting activity that should be performed is a so-called destination sorting, where all pallets to the same customer is placed in one unit. If all pallets were correct and clearly labelled, the sorting of the goods would be relatively easy to carry out. The number of goods receivers at the PRU:s is something that is hard to optimize in a initial state, and the number has to be adapted over time. We propose that the number of goods receivers remain about the same that it is today, but certain modifications have to be made to avoid unnecessary internal transports for the PRU:s. Based on the empirical
study of the internal transports from each PRU, a number of appropriate receivers at every PRU along with other goods receivers have been identified, see figure 6:2.

<table>
<thead>
<tr>
<th>Number of goods receivers</th>
<th>230</th>
<th>003</th>
<th>150</th>
<th>210</th>
<th>075</th>
<th>062</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

**Figure 6:2 Number of customers for the central goods reception**

Chassis has today four large customers, of which two are located nearby the goods reception. The two other are side storages, to which goods today are distributed with wagons from the goods reception. We therefore argue that the arriving goods to Chassis are to be sorted by the goods reception and the two side storages, which makes three goods receivers. Engine 1 & 3 has today three unloading locations, but two of these are only used for direct deliveries. It is therefore enough that the sorting at the central goods reception simply is performed by one customer. Engine 2 has today two unloading location but one is rarely used since it only handles direct deliveries. For that reason, Engine 2 is seen as only one customer for the central goods reception. We also believe that Parts Logistics does not need a more specified sorting, and it is therefore appropriate with only one goods receiver at this PRU. Regarding Transmission, the number of unloading locations should be extended with one location, 064 in figure 6:4, in order to reduce internal transport to heat treatment. Furthermore, no extra sorting of the goods to Industrial & Marine Engines will be required. Besides the goods to the PRU:s, additional deliveries to other customers at the Scania area must be conducted. We have in the empirical study identified three further destinations, by which goods have to be sorted; exparts, goods to material inspection and parcels for example to head office. We consider a sorting by the destinations presented in figure 6:3 as a suitable system for the central goods reception.
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Figure 6:3  Suggestion of sorting destinations

Each sorting destination in figure 6:3 has been given a certain digit to simplify the description of the distribution system, presented in a latter section.

One question that must be investigated is if the sorting also should mean goods being placed directly on a loading unit or if they should be placed on a put-up area close to goods dispatch. If the goods are loaded at once, a handling operation is avoided but planning problems concerning the loading activity occurs. For example can the goods weight be hard to allocate on the loading unit. We therefore recommend that the goods are placed on a specific area before they are loaded, due to the more efficient loading planning.

Distribution

The aim with the distribution to the goods receivers is to level out the inbound flow over the working shifts as much as possible. Both SKF and TTAB used predetermined time schedules in their goods distribution, which contributed to the fact that the receiver always knows when the goods will arrive. The distribution could also be focusing on weight utilization and hold the transport until it is fully loaded. The weakness with that kind of solution is the PRU:s not exactly knowing when the goods will arrive, which complicates the work for especially the material planners. We therefore argue, that the distribution to the local goods receivers should be based on a time schedule so the PRU:s exactly know when the goods will arrive. In figure 6:4 it is shown which flows we believe should take place between the central goods reception and the goods receivers at Scania.
Based on the forwarders’ statistics, see appendix C, and data from the empirical study, the size of the different flows has been calculated. Notice has also been made to the direct deliveries included in the statistics. In figure 6:5, the size in tonnes per day for each suggested flow is presented. Notable is that the size of flow 7 only includes goods to material inspection and exparts. The other goods included in this flow could not be gathered from the statistics. However, we estimate this amount of goods to be relatively small and this simplification will therefore not affect the distribution system.

<table>
<thead>
<tr>
<th>Goods flow</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>142</td>
<td>97</td>
<td>115</td>
<td>136</td>
<td>83</td>
<td>296</td>
<td>17</td>
<td>-</td>
</tr>
<tr>
<td>- Direct flow</td>
<td>48</td>
<td>24</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>48</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Amount to handle</td>
<td>94</td>
<td>73</td>
<td>103</td>
<td>136</td>
<td>83</td>
<td>248</td>
<td>17</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 6:5 Size of the different flows in tonnes

Which type of loading unit that is the most appropriate for each goods flow depends on parameters like weight, volume, frequency and transported distance. Further is a discussion concerning level of weight utilization in the
6 - Analysis

distribution to the PRU:s interesting. Figure 6:6 presents the transport need of each flow with consideration into weight and volume, due to the unit pay weight, as well as average level of utilization in per cent.

<table>
<thead>
<tr>
<th>Goods flow</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need (tonnes)</td>
<td>94</td>
<td>73</td>
<td>103</td>
<td>136</td>
<td>83</td>
<td>248</td>
<td>17</td>
<td>-</td>
</tr>
<tr>
<td>Swapbody</td>
<td>Loading capacity 16 tonnes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95%</td>
<td>6.2</td>
<td>4.8</td>
<td>6.8</td>
<td>8.9</td>
<td>5.5</td>
<td>16.3</td>
<td>1.1</td>
<td>-</td>
</tr>
<tr>
<td>85%</td>
<td>6.9</td>
<td>5.3</td>
<td>7.6</td>
<td>10.0</td>
<td>6.1</td>
<td>18.2</td>
<td>1.3</td>
<td>-</td>
</tr>
<tr>
<td>75%</td>
<td>7.8</td>
<td>6.1</td>
<td>8.6</td>
<td>11.3</td>
<td>6.9</td>
<td>20.7</td>
<td>1.4</td>
<td>-</td>
</tr>
<tr>
<td>2*Swapbody</td>
<td>Loading capacity 32 tonnes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95%</td>
<td>3.1</td>
<td>2.4</td>
<td>3.4</td>
<td>4.5</td>
<td>2.7</td>
<td>8.2</td>
<td>0.6</td>
<td>-</td>
</tr>
<tr>
<td>85%</td>
<td>3.5</td>
<td>2.7</td>
<td>3.8</td>
<td>5.0</td>
<td>3.1</td>
<td>9.1</td>
<td>0.6</td>
<td>-</td>
</tr>
<tr>
<td>75%</td>
<td>3.9</td>
<td>3.0</td>
<td>4.3</td>
<td>5.7</td>
<td>3.5</td>
<td>10.3</td>
<td>0.7</td>
<td>-</td>
</tr>
<tr>
<td>Trailer</td>
<td>Loading capacity 24 tonnes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95%</td>
<td>4.1</td>
<td>3.2</td>
<td>4.5</td>
<td>6.0</td>
<td>3.6</td>
<td>10.9</td>
<td>0.7</td>
<td>-</td>
</tr>
<tr>
<td>85%</td>
<td>4.6</td>
<td>3.6</td>
<td>5.0</td>
<td>6.7</td>
<td>4.1</td>
<td>12.2</td>
<td>0.8</td>
<td>-</td>
</tr>
<tr>
<td>75%</td>
<td>5.2</td>
<td>4.0</td>
<td>5.7</td>
<td>7.8</td>
<td>4.6</td>
<td>13.8</td>
<td>0.9</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 6:6 Number of transports depending on loading unit

The loading units included in the calculation are the once that DynaMate today use for internal transports. We however argue that swapbodies are the most suitable loading unit for the distribution, since trailers are less time efficient. Which average weight utilization that should be used in the calculation is difficult to estimate, but we believe a weight utilization of 85 per cent to be reasonable since the goods usually arrive in Scania’s own packaging material. This assumption has also been verified by DynaMate when the distribution system was presented. With basis in the calculation, we have chosen to equip flow 1 to 6 with two swapbodies. For the remaining flows we consider only one swapbody to be enough. The flow of urgent goods, number 8, has not been dimensioned, but we believe that the capacity of one swapbody is sufficient for this flow.

Generally, it can be stated that larger flows should be equipped with a 2B-system to make loading and unloading more efficient, both centrally and locally. For other flows is a circulating distribution more appropriate. The transport will then circulate between a pre-determined number of customers, and the truck has to wait while the goods are unloaded. The transport with urgent goods will also be circulating but the goods receivers are then not pre-determined. The distribution system must be adapted to the fact that 88 per cent of the goods transports arrive during daytime. We therefore consider it suitable to vary the distribution configuration between daytime
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and evening. On daytime it is suitable with a combination of a 2B and loop distribution, while it in the evening is sufficient with a circulation distribution to reduce the need of resources. The calculated distribution system is based on two shifts, each consisting of eight hours work. Figure 6:7 presents the distribution system that we propose.

<table>
<thead>
<tr>
<th>Goods flow</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of transports</td>
<td>Need</td>
<td>3.5</td>
<td>2.7</td>
<td>3.8</td>
<td>5.0</td>
<td>3.1</td>
<td>9.1</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Round up</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Departure interval (h)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Unloading system</td>
<td>-</td>
<td>-</td>
<td>loop</td>
<td>-</td>
<td>-</td>
<td>loop</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Daytime</td>
<td>2B</td>
<td>loop</td>
<td>2B</td>
<td>2B</td>
<td>loop</td>
<td>2B</td>
<td>loop</td>
</tr>
<tr>
<td></td>
<td>Evening</td>
<td>-</td>
<td>-</td>
<td>loop</td>
<td>-</td>
<td>-</td>
<td>loop</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 6:7 Distribution design of each goods flow

Both 2B and loop distribution have their own strengths and weaknesses. With 2B distribution, no recourses are tied-up during loading and unloading which makes the work with goods pick-up and receiving more flexible. The weakness with this kind of system is the large number of needed loading units. Loop distribution results in that recourses must be available when a transport arrives, and the personnel therefore become more locked-up at their work stations. This is valid for both receiving and distributing personnel. The strength with this system is that goods to several customers can be loaded on one transport which contributes to fewer transports compared to 2B. This advantage is however only valid if the total amount of goods to all receivers can be loaded on the chosen loading unit. Furthermore, an advantage with loop distribution is the lower number of necessary loading units relatively 2B distribution. We have in our distribution system chosen to use loop distribution for flow 2, 5 and 7 due to the relatively small size and large number of goods receivers of these flows. The same criteria were the basis when we choose to use loop distribution for the evening distribution to Engine 2 and Parts Logistics, flow 3 and 4.

The departure intervals in figure 6:7 have been estimated based on the need of transports together with if the distribution should take place only in daytime or also in evenings. It is assumed that eight departures can be made during one working shift. When goods are distributed only during one work shift, resources can be saved in both distribution and goods receiving. In figure 6:7 it is seen that flow 6 needs ten departures during daytime, which is not possible with the described distribution system where the maximum
number of departures is eight. One solution to this problem is that Chassis’ personnel and the personnel in charge of distribution extend their working time to increase the capacity. Another solution is to decrease the departure interval and then improve the capacity of the distribution. The latter alternative is more beneficial for Scania since no additional resources are needed. This is however only possible if the transport lead time, backwards and forwards between the central goods reception and the local receptions, can be performed on a time less than the departure interval and this requests a close localisation to the customers.

In order to secure the capacity of the distribution some simple calculations have been conducted. The need, in pay weight, for the different goods flows is an average value based on the collected statistics, and it is therefore necessary with an over-capacity to manage maximum volumes. A calculation of the distribution capacity is presented in figure 6:8 from which it is seen that flow 1 and 6 have the lowest over-capacity in spite of the fact that flow 6 has received two additional departures. The capacity of these flows can be increased with an extra evening work shift but then supplementary resources are needed.

<table>
<thead>
<tr>
<th>Good flow</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need (tonnes)</td>
<td>94</td>
<td>73</td>
<td>103</td>
<td>136</td>
<td>83</td>
<td>248</td>
<td>17</td>
<td>-</td>
</tr>
<tr>
<td>Number of transports</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>10</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Capacity (tonnes)</td>
<td>108,8</td>
<td>108,8</td>
<td>163,2</td>
<td>163,2</td>
<td>108,8</td>
<td>272</td>
<td>54,4</td>
<td>-</td>
</tr>
<tr>
<td>Over-capacity</td>
<td>16%</td>
<td>50%</td>
<td>58%</td>
<td>20%</td>
<td>31%</td>
<td>10%</td>
<td>219%</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 6:8 Over-capacity of the distribution system

Notable is that the exact value of the over-capacity is not of any specific interest, it is a flow’s capacity in relation to other flows that is interesting.

When transports arrive to customer, a loading unit with empty packaging should be picked-up with the intention to balance the flow backwards and forwards between the central goods reception and the local units. This is the type of co-ordination of flows in opposite direction that Tarkowski et al. (1995) mention to level out unbalances. Whit the proposed distribution system, empty packaging will be picked-up by transports for goods flow 1, 3, 6 and 7. The trucks operating flow 2, 4 and 5 will not pick-up any packaging material due to different loading unit configurations or insufficient capacity. If a comparison is made with today’s number of pick-ups, illustrated in figure 5:14, it is seen that the proposed distribution system
can fulfil the needs of empty packaging pick-ups. Figure 6:9 sums up the handling of packaging material for the different flows and notable is that the need of flow 3 and 6 is calculated by merging the needs of each collecting area at the PRU.

<table>
<thead>
<tr>
<th>Goods flow</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading unit</td>
<td>● ●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Swapbody</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>2×Swapbody</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Need of pick-ups</td>
<td>0,9</td>
<td>2,2</td>
<td>8,0</td>
<td>1,6</td>
<td>-</td>
<td>8,0</td>
<td>1,0</td>
<td>-</td>
</tr>
<tr>
<td>Pick-up</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>New need</td>
<td>0,9</td>
<td>-</td>
<td>8,0</td>
<td>-</td>
<td>-</td>
<td>8,0</td>
<td>4,8</td>
<td>-</td>
</tr>
<tr>
<td>Number of pick-ups</td>
<td>4</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

**Figure 6:9** Pick-ups of empty packaging material for each flow

The proposed distribution system causes no change in the number of collecting areas for empty packaging, but we recommend the location 230V to be moved so that the goods reception at Chassis takes over the responsibility for this handling, see figure 5:13. The swap of loading units can then be made more time efficient and resources can be better utilized. The collecting area at Engine 1 & 3 will be equipped with an extra loading unit, relatively the present situation, since the size of this flow will increase when Engine 1 & 3 starts to transport undownfolded packaging material. One further reason for the additional loading unit is that the goods distribution then is made with the same transport type. Concerning flow 3 and 6, two different types of loading unit configurations will be used which results in some complications. To solve this problem we suggest that flow 8 serves these collecting areas when time is given. All other collecting areas will be served by the truck operating flow 7, which then will pick-up empty packaging five times a day. To relieve this resource we argue that flow 8 should be used for one pick-up.

There is despite the balancing of the distribution flow, still a large overcapacity in the transports back to the central unit. The most balanced flows are 3 and 6 which will pick-up empty packaging at every distribution transport. There will also be a minor flow of packaging material to the PRU:s, but we believe that no additional resources will be needed for this handling.
6.2.2 Activities at the local goods receivers

One of the targets with a centralized goods receiving structure is to obtain as many scale benefits as possible which, according to Lambert et al. (1998), can contribute to large cost savings. It is also important that the activities at the PRU:s are easy to perform and as few as achievable. The best solution would be the local goods receivers only to handle and move the goods in a minimum extent. Since some storage registrations will remain even with a central goods receiving, it is important to point out that this activity already today is performed by a number of PRU:s, and sometimes by a function other than the goods reception. This is for example the case, for goods to Chassis’ and Parts Logistics’ warehouse as well as for some goods to Engine 1 & 3. While resources for storing registrations already exist at these locations, no additional resources will be needed at the goods receptions, even if unregistered goods were to arrive. If Engine 2 chooses to locally register the arrived goods as stored, extra resources are needed. Though, bar code scanning is today already used at this PRU, which should mean that this registration could be conducted with only a small amount of additional resources.

When every pallet is labelled at the central goods reception no further labelling activity will be needed locally. There is however one situation where local labelling is necessary. A large amount of the goods to Transmission is heat treated before storing, and the goods have to be repacked after the treatment. While then not the same packaging material is used, an extra labelling operation is required. We therefore suggest that no storage registration of this goods is made centrally, which forces the local personnel to also perform this activity.

Most of the PRU:s will, despite an introduction of a central goods reception, handle internal goods flows demanding administrative activities. If Scania chooses to keep this registration of internal flows, the PRU:s would still need to have a small administrative function, even after a central goods reception was implemented.

6.2.3 Other activities

Webstars

We suggest Webstars to be used as an overall information system for the goods receiving process. Based on the information in Webstars,
consignments should be arrival registered, deviations generated and urgent deliveries visualised. Tarkowski et al. (1995) illustrate in figure 4:4 the large number of information transfers needed in goods transports and they argue that a well functional system is required to fulfil the needs of every involved party. We believe that Webstars has the capacity to achieve efficient goods transports to Scania.

**eQuality**

To deal with problems and improve situations it is highly important to always report deviations. eQuality is the overall tool that Scania wants to use and it is therefore this system that we suggest should be used at a central goods reception. For efficient reporting, it is important that deviations always are registered in real time. It is also vital that the function affected by the deviations is the one responsible for writing the deviation report. We think that the personnel at the central reception should report all deviations affecting the goods receiving work and some examples of deviations are presented in figure 6:10.

![Figure 6:10 Examples of deviations together with receiver of the deviation report](image)

At the central goods reception, we think it to be appropriate for the administrative personnel to handle the deviation reporting in eQuality. Since the reporting frequency will be high, a good competence concerning the design and usage of the system can be built-up.

**Handling of goods for customs**

All customs documents should be handled by the administrative personnel at the central goods reception. When registering goods for customs declaration, a connection to the PRU:s locally installed systems is needed to obtain the cargo-id which is necessary for the following declaration. This handling could be improved, relative today, at a central goods reception due to a more frequent handling. A central reception will also simplify the
performed assignments at the customs department, as the number of contact persons will be reduced.

A future possibility is all customs information being transferred directly to the customs department without passing via the goods reception. The forwarder could for example enter the customs-id in Webstars and the cargo-id could be electronically transferred to the customs department when the goods are registered as arrived.

**Urgent deliveries**
Well stated and clear routines are vital when urgent goods are handled. When urgent parts arrive to Scania, all handling must be as smooth as possible in order to minimize the waiting time for the customer. We suggest that as large share as possible of urgent goods should be handled in the central goods reception, but a case to case decision must be taken. If the increased transport lead time could cause a production stop, the goods must be unloaded as close to consumption place as achievable. However, if a large number of urgent deliveries are to be unloaded locally, it creates many exceptions from the standardized working method and extra work is required.

Information about urgent deliveries should be available in Webstars so an overall picture can be obtained together with an easier planning of the daily work. Urgent deliveries is something that already today is entered in Webstars and therefore is no further system development necessary. The present information must almost certainly be complemented with additional information about for example level of priority. The goods reception at Engine 2 is today using a web page where responsible material planners notify the operating personnel about urgent goods transports. We believe this solution also to be an alternative for a central goods reception. An extra notification on urgent goods is also necessary to avoid misunderstandings and forgotten goods.

**6.2.4 Opening hours**
If a central goods reception handles almost every arriving pallet, there is a possibility to adapt the opening hours to the forwarders wishes and thereby level out the inbound flow. According to DHL and Schenker, there is no need for unloading in the night, but both believe extended opening hours in the morning to be valuable for the transporters. We therefore argue that
goods unloading should be possible at the central reception between 05:00 to 23:00, which makes the reception opened for 18 hours every 24-hour period. By extending the opening hours in the mornings, a possibility is given to level out the huge flow of goods in the mornings. We have not recognised a need for the goods reception to be opened around the clock, but longer opening hours is an easy way to increase the capacity. With a new goods receiving structure, the opening hours at the local receptions can be more adapted to the production’s opening hours. An identified problem is urgent goods deliveries to a closed local reception. For this not to cause any serious problems, it is vital that clear routines are created for this matter.

6.2.5 Localisation and layout

During the empirical study we realised that a central goods reception should be located as close to its customers as possible, especially with focus on the largest one. Saab considers the goods terminal in Trollhättan to be located at a too far distance from the own premises. We therefore recommend Scania not to locate a central goods reception in Södertälje further than five kilometres from the main area. The distance to the customers is a critical parameter that must be deeply investigated before a decision can be made. One obvious effect of a location decision is the lead time for the internal distribution. The aim must be to achieve a relatively short and constant lead time that could be included in the arrival time calculation made by the PRU:s’ material planning function. One further aspect that must be well thought-out before a location discussion, is the delivery intensity to the customers. If a customer demands a certain delivery intensity, it must be possible for the transport to travel backwards and forwards between the goods reception and the customer, without the need of additional resources to maintain the demanded intensity.

The physical closeness existing today between the goods reception and the other functions at the PRU, will be lost if introducing a central goods reception. In order to minimize the negative consequences of a lost closeness, it is vital to maintain a well functional communication between the central unit and the local receptions. To achieve an efficient goods receiving process, it is also important to have well stated responsibilities for involved parties. It is crucial, the goods reception not becoming a black hole for the PRU:s, but we have identified a risk of lost control if the goods were unloaded at a central unit. In order to reduce this risk, an adequate system is needed together with well defined routines.
When discussing possible locations of a central goods reception, we also
like to mention areas as infrastructure and available space that have to be
taken into consideration. As the traffic to the chosen location will be very
intensive, it is essential with a well functional infrastructure to avoid
unnecessary waiting time. It is also important that the heavy traffic to the
central goods reception does not pass through a residential area which could
cause unsatisfactory. This is a problem that already exists today due to the
traffic to the packaging pool in Hovsjö. It is also favourable, in a security
point of view, to locate a central reception outside the Scania area since it
would heavily reduce the number of external trucks on the premises.

The central goods reception will function as a goods terminal with a cross-
docking function, where goods are unloaded, sorted and distributed. With
this design, no permanent storing of the goods will be made, only a
temporary storing during waiting time for dispatch. We propose that the
layout of the new goods reception will be of a flowing type. Lumsden
(1998) points out that this kind of layout often contributes to many crossing
internal flows in large goods terminals. We however, think the central
reception at Scania to be relatively small and therefore we see no risk of
crossing flows. This opinion is also shared by logistic managers at
DynaMate. A simple layout is shown in figure 6:11.

![Proposed layout of a central goods reception](image_url)
The proposed layout will only have fixed departure stations since the arrival locations for external transports will vary from time to time. The layout can also be compared to a goods terminal of circulating type, but without a circulating sorting flow. We consider an investment in a circulating conveyor system to be unnecessary since it would not contribute to any larger improvements in the goods receiving process.

For the central goods reception to be dimensioned by the arriving peaks presented in figure 5:8, we found it necessary with three unloading stations. With an opening time of 18 hours and a slot-time of 30 minutes, it is calculated that the maximum number of unloaded trucks is 108 per day. Three unloading stations are enough since the average number of arriving trucks was 78 and the peak 100 during March 2003. If a comparison is made to TTAB’s goods terminal, which handles approximately 120 arriving transports per 24-hour period with four unloading stations, the suggested amount of stations at the central goods reception is reasonable. Lumsden (1998) points out that varying arrival intensity is a large problem when dimensioning which often results in goods terminals being heavily over-dimensioned. We have also in the study identified this kind of problem and it is therefore vital to work towards a more levelled inbound flow.

With the described layout presented in figure 6:11, a wide of 100 metres is necessary to accomplish the unloading of three maximum length transports. Further, a depth of 60 metres is required to handle all goods receiving activities before distribution to customer. This results in a total need of approximately 6 000 m² for the goods receiving function. This area can be compared to Chassis’ goods reception that today takes up about 2 000 m² and handles approximately half the number of pallets which will be unloaded at the central goods reception. The fact that the recommended area is three times as big as Chassis’, depends partly on the suggested area also including offices for administration as well as the distribution activity being much more extensive. Close to the goods reception is also a parking lot for waiting trucks necessary. This area is today located outside Chassiporten which takes up about 6 000 m² and the same size of area is needed close to the central unit. When presenting our study for DynaMate, it came up that the packaging pool in Södertälje requires approximately 8 000 m². This sums up to the total need of 20 000 m², which today is not available within Scania’s premises.
The layout of a central goods reception is closely linked to the available space and therefore are many different alternatives possible. The layout presented in this section is however our choice based on the conducted study.

6.2.6 Direct deliveries

To avoid unnecessary handling of goods, there are certain flows that should not be unloaded at the central reception. These flows are the direct deliveries that today exist between some suppliers and Scania which are often optimized and handled separately by the PRUs. Lumsden (1998) describes these direct deliveries as ideal transports and we believe an extra handling only would create negative consequences. To avoid a too large administrative burden on the local receptions, we think it is appropriate for all direct deliveries to be administrated at the central unit. At the central unit, the truck driver shall hand over the transport documents and receive an unloading list as well as new goods labels. The administrative personnel then register the pre-adviced goods as arrived and stored. After the goods have been unloaded at the PRU, the unloading personnel are responsible for arrival inspection and deviation reporting to the central unit. The above stated work procedure can however only be performed if a central goods reception is located close to the Scania area.

6.2.7 Resources

A change in Scania’s good receiving structure obviously affects the resource need at different functions. Figure 6:12 shows a summary of the personnel requirements for the two structures and it is illustrated that Scania’s total resource need is reduced with five persons if a change in structure was to be made. The identified reduction in personnel correlates to the centralization theories that Abrahamsson (1992) presents. It should however be mentioned that new requirements arise for the internal distribution which causes the total change only to be minor.
The personnel requirement at each local goods reception, concerning the new structure, is estimated by responsible managers at the PRU:s. The total change in personnel requirement is mainly due to the centralized administration and a levelled out inbound flow. Further, the need of internal transports reduced at Chassis and Transmission since unloading takes place at several locations with the new configuration.

The central need of personnel is estimated from information gathered during the empirical study and mainly with basis in the visits at the benchmarked companies. A more detailed specification for each goods receiving activity is presented in figure 6:13.

The administrative personnel should be responsible for contact with customs department, eQuality reporting and communication with forwarders as well as internal customers. The unloading personnel should be responsible for the own station but we also recommend that they could assist the sorting and loading personnel when help is needed. We consider it necessary with three persons dedicated to the labelling and inspection activity. The inspection activity will include bar code scanning and it is therefore vulnerable for
deviations. For example must all goods labels be correct and a large share of the consignments pre-advised with aviexp. This results in, the need of personnel in this function to be very depending on the quality of the arriving consignments. Both the local and the central personnel requirements are based upon rough estimations and it is therefore important to state that these values only shall be seen as guidelines.

Besides the need of personnel, we consider it important to calculate the forklift requirement. Based on the empirical study it was found that electrical forklifts of larger size are the most appropriate choice for a central goods reception. Some PRU:s estimates their need of forklifts to reduce but since the responsibility differs between PRU:s, no general conclusion can be made. The estimated forklift requirement at the central goods reception is higher than the reduction at the local units, which is visualized in figure 6:14.

<table>
<thead>
<tr>
<th>Present structure - Need of forklifts</th>
<th>230</th>
<th>003</th>
<th>150</th>
<th>210</th>
<th>075</th>
<th>062</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of forklifts</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22</td>
</tr>
</tbody>
</table>

| New structure - Need of forklifts     | 230 | 003 | 150 | 210 | 075 | 062 | Total |
| Local                                |     |     |     |     |     |     |       |
| Number of forklifts                  | 3   | 3   | 4   | 3   | 3   | 3   | 19    |
| Central                              |     |     |     |     |     |     |       |
| Unloading                            | -   | -   | -   | -   | -   | -   | 3     |
| Sorting and loading                  | -   | -   | -   | -   | -   | -   | 2     |
| Total                                |     |     |     |     |     |     | 24    |
| Change - Need of forklifts           | -1  | -1  | 0   | 0   | 0   | -1  | 2     |

Figure 6:14  Comparison of the need of forklifts between the two structures

With a new goods receiving structure resources will be needed for internal distribution. It has in this study been assumed that DynaMate will handle all internal transports. According to the new distribution system, a total amount of eight flows must be operated and our estimation is that this can be done with five resources\(^{15}\) in daytime and two in the evenings. Since many of the transports operating the different flows departure in two-hour interval, resources can be shared between the flows. A summary of which resources are needed for each flow is shown in figure 6:15.

\(^{15}\) For the internal distribution a resource includes truck, driver and loading units.
DynaMate has today, as earlier mentioned, three resources dedicated for transporting empty packaging material which means that a new structure requires four additional resources.

6.2.8 Transport agreements and invoice handling

With the new goods receiving structure, transporters will only unload goods at one location even if the transport contains goods to several PRU:s. This brings certain benefits to the forwarder that could result in lower transport costs for Scania. In a comparison between the present structure and the new presented configuration, it is important with a motivation of why Scania’s transport cost could be reduced when introducing a central goods reception.

In worst case with the present structure, the transporter has to unload goods at six different receptions, which is very time consuming. With just one unloading localisation, the transporter will be able to complete the mission faster and thereby be available for new transport assignments earlier. This is not only a benefit for the transporter but also for the forwarder. The forwarder’s goods terminal handling also has a potential to be more efficient as goods only have to be sorted by one receiver, i.e. Scania. With only one receiver for Scania in Södertälje, the forwarders should be able to rationalize their goods terminal function, which should result in lower goods terminal costs and then generate lower transport prices. Today, DHL loads a maximum number of goods to three PRU:s on each transport to Scania, which contributes to a sometimes lowered utilization. With a central goods reception, DHL would not need this restriction and would be able to better utilize the goods transports to Scania. The new structure could also contribute to the transporters not having to pass by as many goods terminal, as they do today, during the way to Scania. The reason for this is that the breaking point for goods terminal handling more often will be reached, as
goods from one supplier to several PRUs can be considered as one consolidated consignment. All above mentioned parameters should contribute to a better position for Scania in the negotiation with forwarders and lower transport rates is possible to obtain.

That several consignments from one supplier can be counted as one common consignment will be a significant parameter for the reduction of the total transport cost. Storhagen (2003) illustrates in figure 4:11 how a goods terminal reduces the number of consignments in a goods flow, which also would be valid for Scania in Södertälje if introducing a central goods reception. If the pay weight for several consignments could be merged together would less small consignments, which have a high price per kilogram, be transported. Viewed in a total perspective, this will result in a lower price per kilogram for all Scania’s goods transports. The forwarders would however, most likely, change their transport rates because of the changed conditions. This resulting in the overall profit for Scania being difficult to decide. Despite the fact that goods from one supplier to Scania are considered as one consignment, the suppliers and forwarders must continue with their routines for goods dispatch and transport. For example must every individual consignment still be pre-advised with aviexp, to make it possible for Scania to divide the transport cost between each receiving PRU.

Storhagen (2003) points out that great potential exist when making the financial flow between two parties more efficient. We therefore consider it important to analyse Scania’s handling of goods transport invoices. In order to make this handling more efficient, we recommend Scania to use Webstars for invoice checking. Today, Webstars contain information about each consignment’s pay weight and if the invoices from the forwarders could be available for the system, the price for each consignment could automatically be generated. If Scania could receive electronic invoices, a comparison with the calculated price in Webstars would be systematically possible. Volvo Logistics uses, as we earlier mentioned, a similar system and therefore we suggest Scania to introduce such a solution. There are however some complications, especially when the price for several consignments shall be calculated based upon a consolidated one. The price Scania is charged for one consignment is collected from rate schedules, based on weight for a specific consignment. With a consolidation of consignments from one supplier, a total weight for these consignments must be calculated, in order
to collect the right price for Scania. We thereafter suggest the invoiced cost for the consolidated consignment to be distributed between the PRU:s based on pay weight.

An idea with Webstars, we believe is possible to introduce, is that Scania only pays for the transports that actually are performed and therefore is no invoicing by the forwarder necessary. Since all information concerning a consignment’s cost shall be available in Webstars, the paper invoice would only be unnecessary handling for involved parties. Avoiding this handling is beneficial for Scania because the forwarder takes over the responsibility for the invoice inspection.

6.2.9 Risk analysis
We also find it relevant to estimate the risks that can occur with an implementation of a central goods reception. The risk analysis that has been performed is, in many ways, similar to what Nilsson (2003) describes as rough analysis. Figure 6:16 presents the identified risks together with the probability of occurrence. The probability estimation has been conducted based on interviews with involved persons.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem with systems</td>
<td>High</td>
</tr>
<tr>
<td>Incorrect internal transports</td>
<td>Low</td>
</tr>
<tr>
<td>Longer lead time</td>
<td>Low</td>
</tr>
<tr>
<td>Extensive deviation handling</td>
<td>High</td>
</tr>
<tr>
<td>Increased handling damages</td>
<td>Low</td>
</tr>
<tr>
<td>Reduced control</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Figure 6:16 Risks and probability of occurrence

As earlier mentioned, the present structure is shaped by the MONA-concept and with a central goods receiving a communication between the local system and Webstars is needed, which does not exist today. Webstars should also be used as an overall system in a central goods reception and it makes it necessary for some development of the system. How these problems shall be solved have not been analysed in this study, but we believe that some difficulties in the system initially will occur. Opinions about problems with the internal distribution from a central goods reception have emerged during the visits at the goods receptions. Unloading at wrong PRU and not followed time schedules are some mentioned examples. Saab has no complaints regarding the flow from TTAB’s goods terminal and
therefore we believe it to be unlikely that Scania would suffer from the above mentioned problems. The extra handling that a central goods reception will result in, contributes to a longer lead time for some consignments. At maximum will this extra lead time be a couple of hours which, according to our estimation, only will have a minor affect on the PRU:s’ business. A high risk due to a central handling of all administration is that the deviation handling is very extensive, which would initially demand large resource efforts. This risk is estimated as high, because today’s deviation handling constitutes a major part of the work procedure. If an extra terminal handling is introduced in the goods flow to Scania, risk for handling damages increases. We however consider this extra handling only to marginally raise the number of damaged pallets and therefore we estimate the risk as low. Finally, the risk for losing control of the goods flow is estimated as medium, since it is complicated to handle large amounts of goods at the same place. Hopefully could a well working system support create a good control of the flow to the PRU:s.

6.2.10 Sum up

To conclude this section, we present the identified advantages and disadvantages with a central goods reception, see figure 6:17.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Better utilization of Scania personnel</td>
<td>• Additional handling of the goods</td>
</tr>
<tr>
<td>• A levelled out inbound flow to the PRU:s</td>
<td>• Increased costs for internal distribution</td>
</tr>
<tr>
<td>• Better administrative competence</td>
<td>• System development is needed</td>
</tr>
<tr>
<td>• Possible lower transport cost</td>
<td>• Cost of investment</td>
</tr>
<tr>
<td>• Better security</td>
<td>• Reduced control of the goods flow</td>
</tr>
<tr>
<td>• United front towards the forwarder</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6:17 Summary of advantages and disadvantages with the new structure

The advantages are difficult to rank since some aspects are qualitative and other economical. The greatest economical benefit for Scania can be found in the possible reduction of the external transport cost. The disadvantages we believe are the most crucial are the extra handling as well as the internal distribution that Scania is forced to perform due to the new structure.
6.3 Comparison with the present structure

Finally in the analysis, the new presented structure is compared with the present situation. The comparison is based on the presented analysis of the two different goods receiving configurations. To give the reader an opinion of which structure that is the most appropriate for Scania, both an economical and a qualitative comparison have been performed.

6.3.1 Economical comparison

We believe that a structural change would not affect Scania’s revenues and therefore are only costs and savings analysed in the economical comparison. The created total cost model, see Appendix D, has been designed by the four factors presented by Aronsson et al. (2003). When the model was revised, costs for personnel, forklifts, ground space as well as internal and external transports remained.

Examples of costs that we have ignored in the economical calculation are costs for system developing and equipment, besides forklifts, as well as costs for performing the structural change. We believe that these costs are relevant for Scania but they are not included in the comparison because of the complexity to have them estimated.

In the economical calculation all costs have been transformed to fixed annual costs which is a simplification compared to a model where consideration is taken into, for example depreciation. We think this simplification only has a minor affect on the result of the comparison as the assumption only concerns the cost for ground space.

The cost of personnel has been based on the present collective agreement at Scania. As a consequence of this, it has been assumed that no clerks will work in a central goods reception. Though, this assumption will not affect the result since the salaries for clerks within this working area do not distinguish from the salaries for collective employees. In the calculation of costs of needed forklifts, the present leasing agreement has been used. The monthly cost, which is used in the calculation, is based upon the fee for an electrical forklift of a larger model. To be able to economically compare the internal transport costs of the different configurations, the PRU:s fee to DynaMate has been used. This payment includes costs for a driver and a truck as well as belonging loading units. The cost for ground space has been
collected from the PRU:s and refers to the cost for an asphalted area under roof. This charge is not Scania’s real cost, but the amount the PRU:s pay to the internal premises department. It would have been possible to calculate the real cost, but we estimated the resource efforts were too large. The comparison has only included costs for the actual space of a central goods reception, not for parking area and packaging pool, because Scania already has these two areas at disposal. The external transport cost for Scania in Södertälje has been calculated from collected statistic and the actual amount has been verified by our tutor. This cost is vital for the calculation since a new structure probably would result in a reduction of the transport cost. The economical calculation shows, that the saving, due to the reduction of personnel, is less than the increased cost for forklifts and internal transports. The conclusion is that the external transport cost must be reduced, if a change in structure shall be profitable for Scania.

Since no exact figure on the reduction of the transport cost has been given to us by the forwarders, the economical calculation has been performed with reductions at different percentages. To identify the economical consequences for each PRU, the costs and savings with the new structure have been divided between the units based on number of received pallets. This is the distribution basis that we consider to be the most appropriate, but a further analysis of this basis should be performed to estimate its accuracy. A disadvantage with the used distribution basis is that the larger goods receptions have to carry an unreasonable large part of possible profit or loss. Figure 6:18 shows how Scania would economically be affected by an introduction of a central goods reception at different percentage reductions of the external transport cost. The different percentage figures are chosen based on discussions with our tutor at Scania.

<table>
<thead>
<tr>
<th>Reduction of the external transport cost</th>
<th>Profit / Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>-</td>
</tr>
<tr>
<td>2%</td>
<td>-</td>
</tr>
<tr>
<td>5%</td>
<td>+</td>
</tr>
</tbody>
</table>

**Figure 6:18  Economical consequences for certain transport cost reductions**

The conducted calculation shows that a change in structure results in an economically loss for Scania if the transport cost can not be reduced. A profit is first obtained when the reduction exceeds 2.7 per cent. With chosen distribution basis, it is observed that some PRU:s gain an economic loss at
this reduction level. First at a reduction by 4.6 per cent, all PRU:s profit of a central goods reception.

### 6.3.2 Qualitative comparison

Besides the economical calculation, qualitative aspects have been compared between the two structures. Based on the analysis of both structures, the most important parameters in the qualitative comparison are believed to be the ones mentioned in the study’s purpose surplus control of the goods flow.

The lead time is one of the parameters that we consider to be relevant to compare between the structures, and we define lead time as the time from goods arrival at Scania to when the goods are available for the PRU. With the present structure, the goods are unloaded near consumption location which results in a short lead time. The introduction of a central goods reception will contribute to a longer lead time, but this is believed only to have a minor affect on the PRU:s. The quality aspect can represent both physical quality as well as quality on the delivery. With quality on the delivery we consider “the seven R:s”, which Persson and Virum (2001) mention, as appropriate to describe quality of goods transports. We believe that a goods transport of high quality shall deliver the right goods, in the right time, with right quality and to the right customer. A central goods reception results in an extra handling of the goods, which will risk the goods quality to be reduced but, as earlier mentioned, we believe this risk to be low. We recognise great benefits for the PRU:s, since a central goods reception can level out the inbound flow to the PRU:s and goods can be delivered in the right time and to the right place. One of the problems with the present decentralized structure is the unloading of goods at the wrong reception. We believe the new configuration to be the solution to this problem. The good local competence that today exists, is lost with a central goods reception but instead can a competence of the overall picture be created. We estimate the latter to be more valuable for Scania, since sub optimizations hopefully then could be avoided. We believe that a better administrative competence can be achieved with a central goods reception. This opinion is also shared by Hatch (1997), who points out that it is easier to achieve co-ordination and control in a centralised organisation. The biggest difference between the two structures is in a security point of view, since a new configuration will contribute to less external trucks in the Scania area and therefore be more beneficial. We believe that a structural change will result in some loss of control for Scania regarding the goods
6 - ANALYSIS

flow. This problem can however be solved with a well working system, but initially this problem will most likely arise. The present structure is, concerning loss of control, a better alternative as the goods are handled in physical closeness to the customer. Figure 6:19 shows an estimation of the qualitative parameters for the different structures. The more dots the structure has, the more favourable it is.

<table>
<thead>
<tr>
<th>Qualitative parameter</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
</tr>
<tr>
<td>Lead time</td>
<td>●●●</td>
</tr>
<tr>
<td>Quality</td>
<td>●●</td>
</tr>
<tr>
<td>Competence</td>
<td>●●</td>
</tr>
<tr>
<td>Security</td>
<td>●●</td>
</tr>
<tr>
<td>Control</td>
<td>●●●</td>
</tr>
<tr>
<td>Σ</td>
<td>11</td>
</tr>
</tbody>
</table>

Figure 6:19 Summary of the qualitative comparison

In the sum up it can be seen that the new structure is more beneficial for Scania based on the studied parameters. We have though, not performed any ranking between the different aspects which can cause a misleading result. When a comparison is performed with the priority given by the Scania house, see figure 2:3, it is shown that quality and lead time have high priorities. However, we believe that these areas have a different meaning in SPS, and it is therefore difficult to apply this priority to the qualitative comparison.
7 Conclusions

In this final chapter of the report, the conclusions and the authors’ recommendation to Scania are presented. The recommendation is based on the performed analysis and will answer the question if a central goods reception is an alternative for Scania in Södertälje. Since this is an academic report, a generalization is presented where a discussion is held concerning the transferability of the results to other companies.

7.1 Recommendation to Scania

The study shows that a central goods reception is possible to implement at Scania in Södertälje. The central unit should perform as many administrative activities as possible, in order to create resource scale benefits. This will also result in a higher competence concerning deviation reporting as well as a united front towards the forwarders. Further, a central goods reception will give more focus to the overall process which we consider as beneficial for Scania. A central goods reception shall conduct the same work tasks performed at the present local receptions but the work procedure, regarding inspection and registration, should be made more efficient with an introduction of bar code scanning.

The qualitative comparison between the present structure and the new configuration with a central goods reception shows that the new structure is more advantageous for Scania. The areas that will see major improvements are competence level and security. It is also seen that the logistic quality, in the sense that the PRU:s receive the goods in the right time and to the right place, will change to the better. The present structure is by the authors believed to be relatively well functioning, with unloading close to consumption and good control of the goods flow due to the closeness to the customer. These advantages will be lost if a change in structure was to be made.

According to the study, Scania’s requirements in personnel will be reduced with five persons if a central goods reception was introduced. This due to a more levelled out inbound flow and scale benefits concerning administrative tasks. However, the need of internal transports increases with four resources and the demand for forklifts rises with two units.
A central goods reception means that Scania in Södertälje should be able to lower their costs for goods transports from external suppliers. This, because of larger consignments and lower costs for the forwarder. The study presents, unfortunately not, no exact transport cost reduction and the economical comparison has therefore been based on different reduction alternatives.

The economical calculation has considered costs for personnel, forklifts and ground space. Further, also costs for internal and external transports have been compared between the two alternatives. The comparison shows that a central goods reception is profitable for Scania if the external transport cost could be reduced with more than 2.7 per cent. It also shows that the transport cost must be reduced at least with 4.6 per cent, if a change in structure should be profitable for all PRU:s. For the latter calculation, the costs for a central goods reception is divided between the PRU:s based on number of received pallets.

We recommend Scania in Södertälje to implement a central goods reception if a reduction of the external transport cost with approximately 5 per cent can be ensured. We do not propose a structural change for lesser reduction because of the uncertainty concerning the economical comparison’s validity, since large costs for e.g. restructuring have been neglected in the calculation. The qualitative comparison states that the new structure is more favourable for Scania but it also shows that today’s goods receiving functions relatively well. A conclusion made in this study is that Scania should not carry out a change in structure before a significant economical profit can be guaranteed.

7.2 Generalizing the result

We consider it important to have a discussion regarding how the study and its result can be used by other companies outside Scania’s business in Södertälje. Since the thesis mainly can be characterised as a case study, the result can be difficult to generalize. Ellram (1996) points out that results from case studies can be generalized but complications often occur as they tend to be very specific.

The conducted investigation is of course closely linked to Scania in Södertälje but we believe that some parts of the conclusions can be adapted to other companies, besides Scania’s business. The economical conclusion
that is made can regrettably not be generalized, since it only reflects Scania’s situation. We however believe that the qualitative comparison together with the held discussion can be of use for other companies planning to perform a centralization of a function within the supply chain. The businesses of these companies do not necessary have to be similar to Scania’s but we consider the study to be mainly useful for manufacturing companies. One example of a company that we believe would have had interest in some parts of this report is the benchmarked company SKF.

7.3 Further studies
If Scania chooses to implement a central goods reception we consider a deeper analysis in some areas to be necessary. These areas have been neglected or only vaguely described in the study because of lack of resources or simply the fact that they were not included in the assignment directive.

Scania must further investigate the possibility of Webstars communicating with locally installed system as well as if Webstars has the capacity to be the general tool that is proposed in this study. Further, an investigation must be performed to decide if bar code scanning really is profitable for Scania. At Scania in Södertälje many internal transports are executed and the distribution system from the central goods reception has only been integrated with the flow of empty packaging. We suppose that a further optimization of internal transports can be achieved and we therefore recommend Scania to further studies regarding this matter. A future development of a central goods reception can be a transformation into a logistic centre where for example storing, sequencing and pre-assembling can be conducted. We therefore consider this area to be of interest for Scania and we suggest further studies. This thesis has arisen from discussions concerning high transport costs and if Scania does not see a central goods reception as a solution we recommend further studies regarding the material ordering process, in order to achieve lower transport costs.

7.4 Concluding words
This master thesis has had the aim to compare two different structures of Scania’s goods receiving. Based on the performed comparisons, Scania is recommended only to introduce a central goods reception if certain
7 - CONCLUSIONS

economical guarantees can be made. The authors though believe, that there is a great potential for Scania to improve their goods receiving process even if a structural change was not to be made. We believe for example, that Scania’s overall process can be changed to the better if the work procedure at the goods receptions could be standardized which would contribute to continuous improvements. Furthermore, we also like to state that during our conducted literature studies we realized that the goods receiving process is a low prioritized area. We found this rather strange while this process is vital for a company and the area deserves a better reputation.
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Appendix A - Questionnaire

Goods reception Scania

Inbound flow
How many trucks and pallets arrive every day?
How is the arrival distributed over time?
Arrive full truck loads or are arriving transports always consolidated?
Does the goods reception have slot-times for arriving transports?
Is direct deliveries handled by the goods reception, and if yes how often?
How are the direct deliveries handled?

Resources
When is the goods reception opened?
How big is the workforce at the reception?
How many forklifts are used by the goods reception?
Is special equipment necessary for unloading certain consignments?

Work procedure
How is the unloading performed?
What kind of transport documents are handled by the goods reception?
How many transports can be unloaded at the same time?
What kind of packaging material is most common at the goods reception?
How is the arrival inspection performed?
On what level is the inspection performed, number of pallets or part number?
How is the goods registration conducted?
Are all goods registered, or are there exceptions?
In which system is the goods registered and how large share is pre-advised?
Does the arrival registration also function as a storing registration?
How are the goods labelled?
Are all of the arriving goods labelled or is the supplier’s goods label sometimes used?
What additional information is added with the new goods label?
Is some kind of sorting activity performed, if yes based on what?
How is the distribution to the goods reception’s customers performed?
Does the goods reception perform other work tasks besides goods receiving?

Other activities
Is eQuality used for deviation reports?
How often is a deviation report created?
How is the goods reception informed about urgent goods?
How are urgent goods handled?
How is goods for customs declaration registered and how frequently?
For which arriving transports is Webstars used and how often do they arrive?
What is the goods reception’s opinion about Webstars?

Problems
What kind of problems does the goods reception have and how are they handled?
What problem is the most common?
Appendix B - Questionnaire

Benchmarking companies

Background (SKF and TTAB)
How was the goods receiving structure before the change?
When and why was the change performed?
Was the change performed together with a third party, and if yes why?
How, and based on what parameters, was the capacity of the new structure dimensioned?

Present physical flow of goods
How many transports and pallets arrive every day?
How is the arrival of these transports distributed over time?
Are slot-times used for arriving transports?
Is unloading performed at other locations besides the goods reception?
What kinds of flows are not handled in a goods terminal? (Volvo and TTAB)

Present work procedure
What kind of transport documents are handled by the goods reception?
What kind of inspection is performed on the arriving goods?
Are the goods marked with new goods labels?
How is the distribution to customer performed?
How are deviations reported?
How are urgent goods identified and handled?

Present information flow
How are the goods registered and when are they registered as stored?
Is bar code scanning used?
How are transport invoices handled?

Opinions
What kind of advantages and disadvantages does the present structure contribute to?
What kind of process improvements can be made?
What is your opinion concerning Scania’s situation?
Appendix C - Statistics

**Summary of consignment statistics from forwarders**

**March 2003**

<table>
<thead>
<tr>
<th>Pay weight (tonnes)</th>
<th>230</th>
<th>03</th>
<th>150</th>
<th>210</th>
<th>075</th>
<th>062</th>
<th>Total</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewals</td>
<td>203</td>
<td>50</td>
<td>427</td>
<td>162</td>
<td>483</td>
<td>18</td>
<td>1 344</td>
<td>8%</td>
</tr>
<tr>
<td>DHL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic</td>
<td>1 071</td>
<td>571</td>
<td>52</td>
<td>0.2</td>
<td>11</td>
<td>10</td>
<td>4 713</td>
<td>63%</td>
</tr>
<tr>
<td>W. Europe</td>
<td>3 429</td>
<td>1 664</td>
<td>887</td>
<td>1 352</td>
<td>704</td>
<td>60</td>
<td>10 647</td>
<td>100%</td>
</tr>
<tr>
<td>S. Europe</td>
<td>213</td>
<td>134</td>
<td>160</td>
<td>150</td>
<td>169</td>
<td>11</td>
<td>1 344</td>
<td>8%</td>
</tr>
<tr>
<td>Total</td>
<td>4 713</td>
<td>2 369</td>
<td>1 099</td>
<td>1 502</td>
<td>884</td>
<td>80</td>
<td>1 344</td>
<td>8%</td>
</tr>
<tr>
<td>Schenker</td>
<td>2 283</td>
<td>601</td>
<td>657</td>
<td>923</td>
<td>268</td>
<td>103</td>
<td>4 835</td>
<td>29%</td>
</tr>
<tr>
<td>Total</td>
<td>7 199</td>
<td>3 020</td>
<td>2 183</td>
<td>2 588</td>
<td>1 635</td>
<td>202</td>
<td>1 627</td>
<td>100%</td>
</tr>
<tr>
<td>Mean per day</td>
<td>379</td>
<td>159</td>
<td>115</td>
<td>136</td>
<td>86</td>
<td>11</td>
<td>886</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of pallets</th>
<th>230</th>
<th>003</th>
<th>150</th>
<th>210</th>
<th>075</th>
<th>062</th>
<th>Total</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewals</td>
<td>1 161</td>
<td>266</td>
<td>1 462</td>
<td>1 080</td>
<td>528</td>
<td>95</td>
<td>4 592</td>
<td>10%</td>
</tr>
<tr>
<td>DHL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic</td>
<td>2 007</td>
<td>803</td>
<td>362</td>
<td>6</td>
<td>44</td>
<td>116</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W. Europe</td>
<td>8 210</td>
<td>1 392</td>
<td>3 767</td>
<td>4 192</td>
<td>888</td>
<td>332</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. Europe</td>
<td>567</td>
<td>192</td>
<td>718</td>
<td>900</td>
<td>261</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10 784</td>
<td>2 387</td>
<td>4 847</td>
<td>5 098</td>
<td>1 193</td>
<td>518</td>
<td>24 827</td>
<td>54%</td>
</tr>
<tr>
<td>Schenker</td>
<td>6 084</td>
<td>862</td>
<td>2 939</td>
<td>5 533</td>
<td>413</td>
<td>674</td>
<td>16 505</td>
<td>36%</td>
</tr>
<tr>
<td>Total</td>
<td>18 029</td>
<td>3 515</td>
<td>9 248</td>
<td>11 711</td>
<td>2 133</td>
<td>1 287</td>
<td>45 924</td>
<td>100%</td>
</tr>
<tr>
<td>Mean per day</td>
<td>949</td>
<td>185</td>
<td>487</td>
<td>616</td>
<td>112</td>
<td>68</td>
<td>2 417</td>
<td></td>
</tr>
</tbody>
</table>

The mean value per day has been calculated based on the fact that March 2003 contains 21 work days of which four are Fridays with only one work shift. This results in a total amount of 38 work shifts during March. The mean value per day has thereafter been calculated by the total volume divided by 38 times 2. This has been performed to obtain a mean value for every two shift period.

The number of pallets delivered by Schenker and DHL S. Europe has been calculated based on a mean pay weight of pallets from the other forwarders.
Appendix D – Model for the economical calculation

**Costs per year**

<table>
<thead>
<tr>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>Transport cost</td>
</tr>
<tr>
<td>Forklifts</td>
<td>Reduction</td>
</tr>
<tr>
<td>Space (SEK / m²)</td>
<td></td>
</tr>
<tr>
<td>asphalted under roof</td>
<td></td>
</tr>
<tr>
<td>indoor</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td></td>
</tr>
</tbody>
</table>

| Profit / loss with a central goods reception |
| SEK per year |

Number of working days: 220

---

**Economical consequences for Scania**

<table>
<thead>
<tr>
<th>Resource need</th>
<th>Structure</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New</td>
<td>Present</td>
</tr>
<tr>
<td>Personnel</td>
<td>64</td>
<td>49</td>
</tr>
<tr>
<td>Forklifts</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>Internal trp</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Space</td>
<td>6 000</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>
### Costs for a new structure - central goods reception

<table>
<thead>
<tr>
<th>Resource need</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>Personnel</td>
</tr>
<tr>
<td>Forklifts</td>
<td>Forklifts</td>
</tr>
<tr>
<td>Space (m²)</td>
<td>Space</td>
</tr>
<tr>
<td>asphalted under roof</td>
<td>Distribution</td>
</tr>
<tr>
<td>indoor</td>
<td>Total cost</td>
</tr>
<tr>
<td>Distribution</td>
<td>Cost per pallet</td>
</tr>
</tbody>
</table>

### Economical consequences per PRU

<table>
<thead>
<tr>
<th>PRU</th>
<th>230</th>
<th>003</th>
<th>150</th>
<th>210</th>
<th>075</th>
<th>062</th>
<th>Σ</th>
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