CHALMERS
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Identifying Non-Value Adding Activities to Enhance Productivity in Freight Terminals

A Case Study of DB Schenker's Terminal Operations

Master's thesis in Supply Chain Management

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CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2023
www.chalmers.se
Report No. E2023:068

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Abstract

In today's society, with rising inflation and an increasingly globalized market, companies and organizations are facing ever greater challenges. One company facing these challenges is DB Schenker, a logistics provider offering terminal operations. To remain competitive in today's market, DB Schenker's Terminal Department is working on measuring non-value adding activities (referred to as support activities) through its process-oriented time registration in a system called Check In Check Out. The purpose of Check in Check out is to carry out a detailed productivity measurement and gain insight into the amount of time spent on each process in the terminal. Hence, this thesis aims to provide the company with a better insight into its non-value adding activities and to identify potential areas of improvements in order to increase the overall productivity. During the thesis work, observations of terminal operations and interviews with terminal employees have taken place. Together with the literature review conducted, the research questions were answered.

Conclusions of the study revealed that *activities related to the paper waybill* and *support of drivers* should continue to be registered under their current subprocess. While activities related to *leadership*, *meetings* and *add-on services* should no longer be classified as support activities, since these activities are considered value adding. Furthermore, the study also found that there are three main reasons why terminals spend a significant amount of time on non-value adding support activities. Firstly, many of the support activities are related to the handling of the paper waybill. In addition, a non-dynamic way of working and too general central guidelines regarding the registration in Check in Check Out were identified. DB Schenker is recommended to develop and make greater use of existing digital tools, develop the procedures of following up deviations in the coding of waybills, enlarge the font of the sorting codes and eventually completely digitize the information flow. In addition, DB Schenker should utilize a more flexible workforce, facilitate the punching process by adding more punching clocks and educate the terminal employees about the purpose of Check In Check Out. Finally, DB Schenker is recommended to develop clearer central guidelines for how terminal workers should register their activities in Check In Check Out to increase the accuracy of the productivity measurements.

Keywords*: terminal operations, value adding activities, non-value adding activities, productivity measurements, paper waybill, digital transformation.*

Acknowledgements

This master thesis was written during the Spring 2023 and was part of the master's program Supply Chain Management at Chalmers University of Technology. The thesis was conducted in collaboration with the logistic provider DB Schenker, at the Terminal Department.

Firstly, we would like to thank our thesis advisor, Ola Hultkrantz, for his guidance and feedback throughout the thesis writing process. We would also like to express our gratitude to the Terminal Department at DB Schenker, for supporting us and providing us with the necessary resources and information to conduct our research. A special thanks to our supervisor Mats Källström for offering his guidance and support. Lastly, we are ever grateful for all participants of the study – terminal managers, supervisors, team leaders and terminal workers, who volunteered their time and commitment to provide us with invaluable information about the terminals and their operations.

Ida Andersson & Filippa Johnsen, Gothenburg, May 2023

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Glossary

Arriving Terminal, *"Ankommande terminal"* – The second terminal the goods arrive to for a second sorting before they are sent out to the receiver.

Check In Check Out - DB Schenker's internal process-oriented time registration system in which terminal workers records their working time.

Colli, ***"Kolli"*** - A packaging unit that can be transported individually.

Consignment, *"Sändning"* – A shipment that can consist of several colli e.g., several pallets.

Day 0 Notification, *"Dag 0 Avisering"* - An add-on service that allows the end customer to be contacted when its shipment has arrived at the first terminal, which allows faster distribution than the standard notification service.

Departing Terminal, *"Avgående terminal"* – The first terminal the goods arrive to after being picked up at the sender. Here, the first sorting is done before the goods are sent out to a arriving terminal.

Distribution truck, *"Distributionsbil"* – The truck that collects goods from the sender and brings them to the departing terminal, and leaves the arriving terminal and delivers goods to the end customer.

Branch, *"Distrikt"* - Has the economical and administrative responsibility for one or more terminals.

FTL, ***Full truck load*** **-** The transportation of a shipment that do require a full truckload.

Goods, "*Styckegods*" – Used as a collective term for parcels and groupages. Objects of various sizes and types transported in smaller units or unit loads.

Groupage, *"Gods"* – All items that are handled in the terminal that is not considered a parcel. These items are often palletized.

Hauilier, "*Åkeri"* – The company that is responsible to transport the goods.

Intake area, *"Intagsyta"* – The area of the terminal at which incoming goods arrives at.

Linehaul truck, *"Fjärrlastbil"* – The truck that transports goods between the terminals.

LTL, "***Less than truck load"*** – The transportation of a shipment that do not require a full truckload.

Manet Code, *"Manetkod"* – A sorting code consisting of two parts. One for the sorting in the first terminal and one for sorting in the second terminal.

Notification, *"Avisering"* – An add-on service that allows the end customer to be contacted when its shipment has arrived at the second terminal. When contacted, the end customer gets the opportunity to choose way of delivery. Notification can also be carried out without being requested, if e.g., the recipient address is incomplete.

Notification Area, *"Aviseringsyta"* – The physical area in the terminal where goods are stored until the customer requested delivery date/the customer comes and picks it up.

Pallet jack, *"Pallyftare"* – A pallet lift used by drivers to load and unload the trucks. Is completely mechanical and is not powered by electricity or fuel.

Parcel, *"Paket"* – All items under 30 kg and 2 meters.

Parcel Conveyer, *"Paketbana"* – The equipment (mainly conveyors), used to sort the parcels into different contours depending on the parcel's destination.

Shipping line, *"Linjeruta"* – The physical place in the terminal where outbound goods are placed before loaded onto a truck.

Terminal manager, *"Terminalchef*" – A white collar worker that is the Head of the terminal.

Terminal worker, *"Terminalarbetare"* – a blue collar worker that works in the terminal.

Waybill, *"Fraktsedel"* – A paper that is a legal contract of a shipment that contains all information about the shipment.

1. Introduction

This chapter presents the background and the problem statement of the master's thesis, followed by the aim and the research questions.

1.1 Background

DB Schenker Sweden is a logistics provider and is since 2002 government-owned by Deutsche Bahn. DB Schenker Sweden consists of four divisions: Land, Air, Sea freight, and Contract logistics, see *Figure 1*. This master thesis was conducted at the DB Schenker's Headquarter in Gothenburg, Sweden, at the Land department. The land division handles all land services and transport i.e., road and rail transport, and is divided into several functions. One of the functions is Terminal, at which this master thesis was performed. The Terminal department manage all terminal operations and is divided into five areas: South, West, East, Center, and North. The areas are in turn divided into 23 branches which are economically and administratively responsible for one or more terminals, see *Figure 2*. In Sweden, DB Schenker has 29 terminals, covering a total area of 240 000 square meters. Every day, the terminals handle approximately 220 000 parcels/day and 40 000 groupage consignments. In this thesis, DB Schenker Sweden will hereby be referred to as DB Schenker.

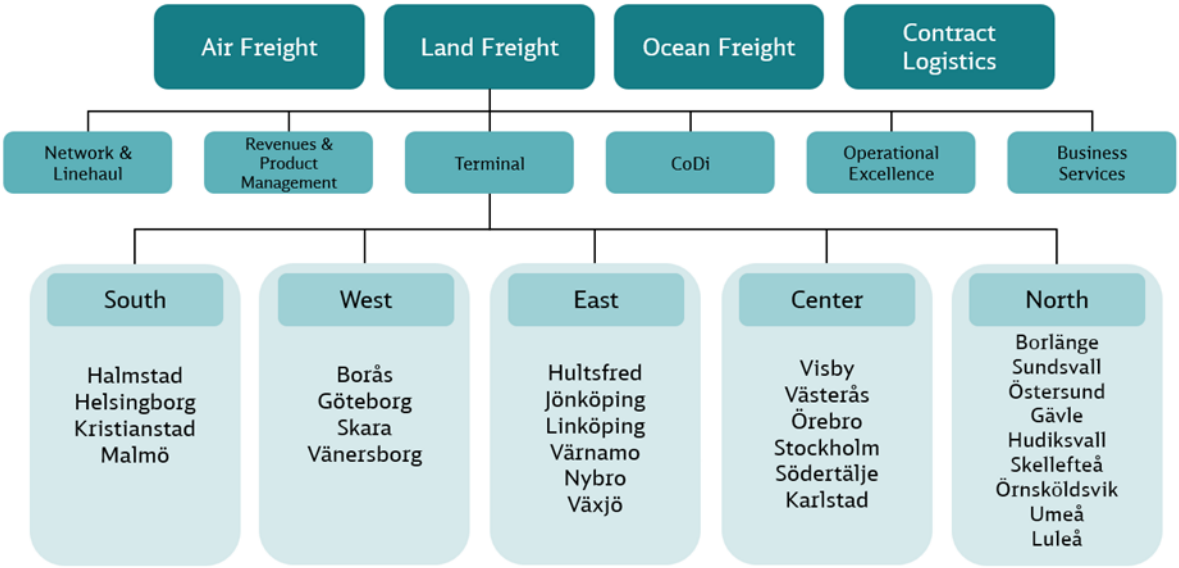

Figure 1: An overview of DB Schenker's organization in Sweden

Figure 2: DB Schenker's branches and terminals in Sweden

The 29 terminals are classified based on their sizes, which in turn are classified based on two parameters: load space and the number of full-time employees (FTEs). The different size categories are extra-large (XL), large (L), medium (M), and small (S). The classification of the terminals is illustrated in *Table 1*. It is important to note that the size classification is not directly related to the volumes being handled in the terminal nor the profitability, although the XL terminals with the largest load spaces and greatest number of FTEs tend to handle larger volumes and therefore generate larger revenues.

Table 1: Classification of DB Schenker's terminals in Sweden

Terminal type	Load space	Number of FTEs
XL	>9000 m²	>40
L	>6000 m²	>30
M	>3000 m²	<30
S	<3000 m²	<17

1.1.1 The Terminal function - 24 hours in a terminal

Each of the 29 terminals is a node in DB Schenker's transportation network and has an inbound flow of goods from the other terminals across Sweden, and an outbound flow of goods from the local area of the terminal. DB Schenker's terminals operate as intermediaries between senders of parcels and groupages and their customer's, the end customers. Thus, DB Schenker's customers are the shippers, while the end customer is DB Schenker's customer's customer. DB Schenker's customers are both businesses and consumers. The core functions of the terminals are to sort and move the incoming goods for further transportation. Sorting goods means that shipments from one area are divided and transported to several other areas, or vice versa, that shipments from several different areas in Sweden are consolidated and delivered to a specific area. The core functions of moving and sorting goods in the terminal is often called DB Schenker's *production*, although nothing is being produced.

During the 24 hours of the day, each terminal operates as both a so-called departing terminal (also called T1 or Terminal 1) and arriving terminal (also called T2 or Terminal 2), see *Figure 3*. During the day, DB Schenker collects departing goods at their customers in the nearby area of the terminal, or at a parcel agent (this collection concerns only parcels). The customers do also have the option to deliver the goods to the terminal themselves. The customers' parcels and groupages are being handled and sorted for future linehaul transportation to other (T2) terminals across Sweden. Thus, during the afternoon and until the evening, the terminal operates as a departing terminal. During the night to the early morning, the terminal handles goods coming from other departing (T1) terminals and sorts them for further distribution to the local area of the terminal, i.e., to the end customers. During these hours, the terminal operates as an arriving terminal.

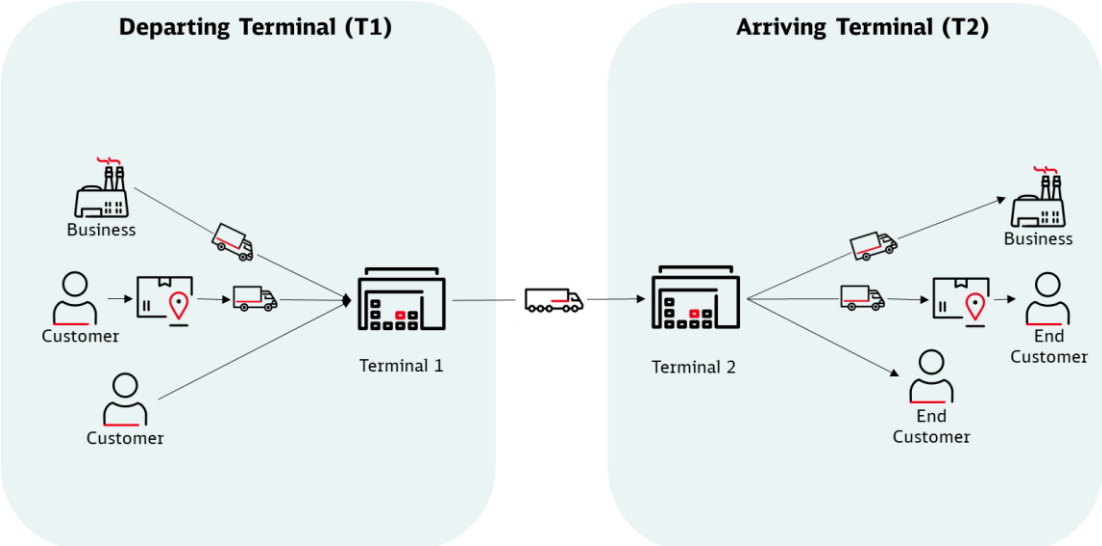

Figure 3: The flow of parcels and groupage from sender (customer) to recipient (end customer).

DB Schenker uses a central application called *Manet code* for sorting goods. The Manet code i.e., the sorting code, consists of two parts, see *Figure 4*. The first part is the code for which second terminal (T2) the shipment is addressed to and is a combination of letters. For example, STO is the code for the terminal in Stockholm and GOT for the terminal in Gothenburg. This part of the manet code is used when sorting goods in the

first departing terminal (T1). The second part of the manet code is a combination of numbers, that corresponds to a specific postal code, which is used for sorting in the second arriving terminal (T2) for distribution to the end customer. This numerical code corresponds to a shipping line inside the T2 terminal. Each terminal decides its own number codes and if a postal code is not linked to a sorting code, 'N/A' is displayed instead of numbers in the second Manet code field. Each shipping line are used both during the departing shift and the arriving shift and does therefore have both parts of a Manet code, see *Figure 4.*

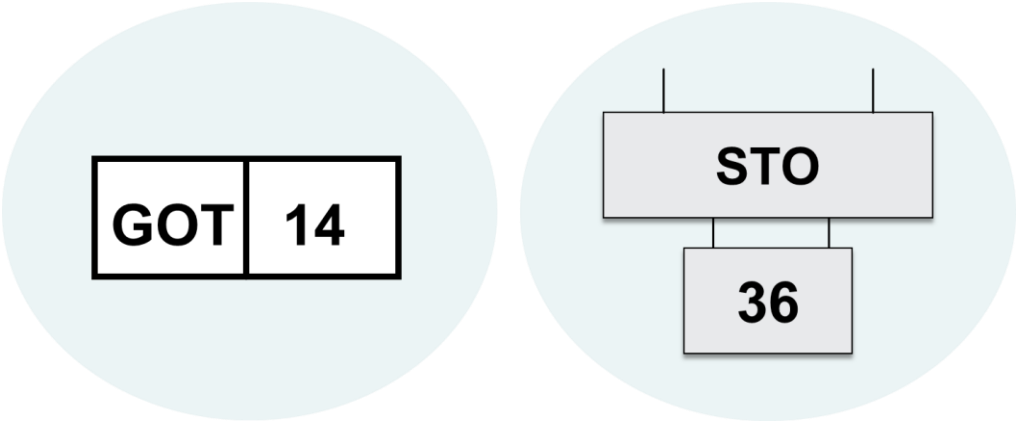

Figure 4: Example of Manet code and example of dual used shipping line.

The 24 hours are divided into three different shifts. Each terminal worker can either work when the terminal operates as a departing terminal, arriving terminal, or during the transformation of the operating state i.e., when the terminal is transformed from an arriving to a departing terminal. The following chapters will present the different shifts in a terminal during a 24-hour cycle.

The Departing shift (in Terminal 1)

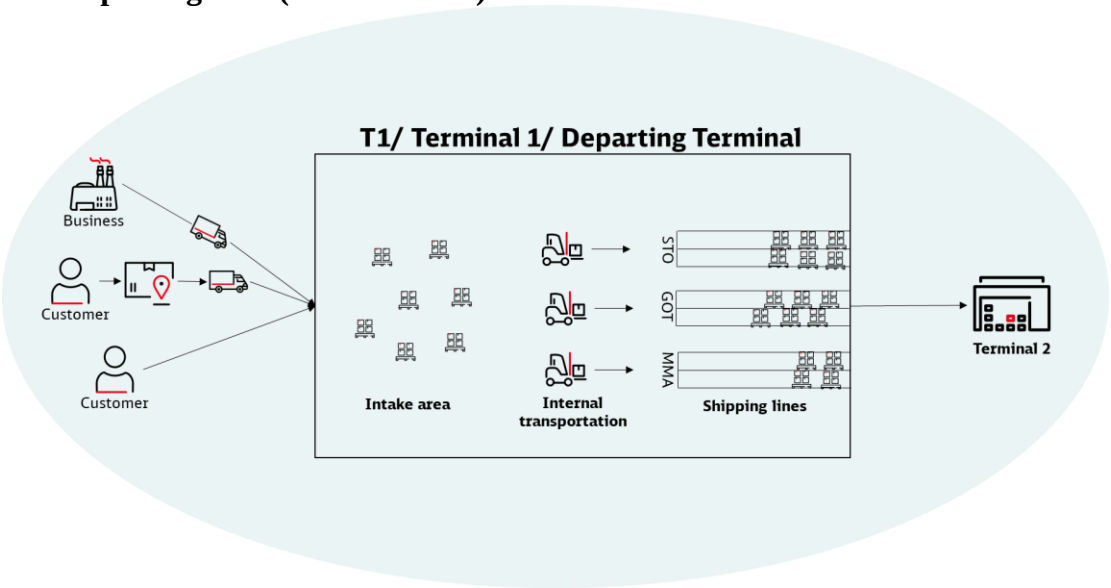

Figure 5: Overview of Terminal 1

The departing shift start approximately at 2 pm and ends at 9 pm. T1 is the first terminal to which parcels, and groupage shipments arrives to after being collected from the local area by delivery trucks. During the departing shift, groupage and parcels are being registered, weighted and measured (volume), and sorted for the first time. Goods are being transported from the intake area to the unloading area, which is divided into shipping lines. Each shipping line consists of two 'strings' that fits approximately 18 EU-pallets and has a sorting code that corresponds to another terminal (i.e., the first part of the Manet code), e.g., STO for the terminal in Stockholm and GOT for the terminal in Gothenburg, see *Figure 5*.

The Arriving shift (in Terminal 2)

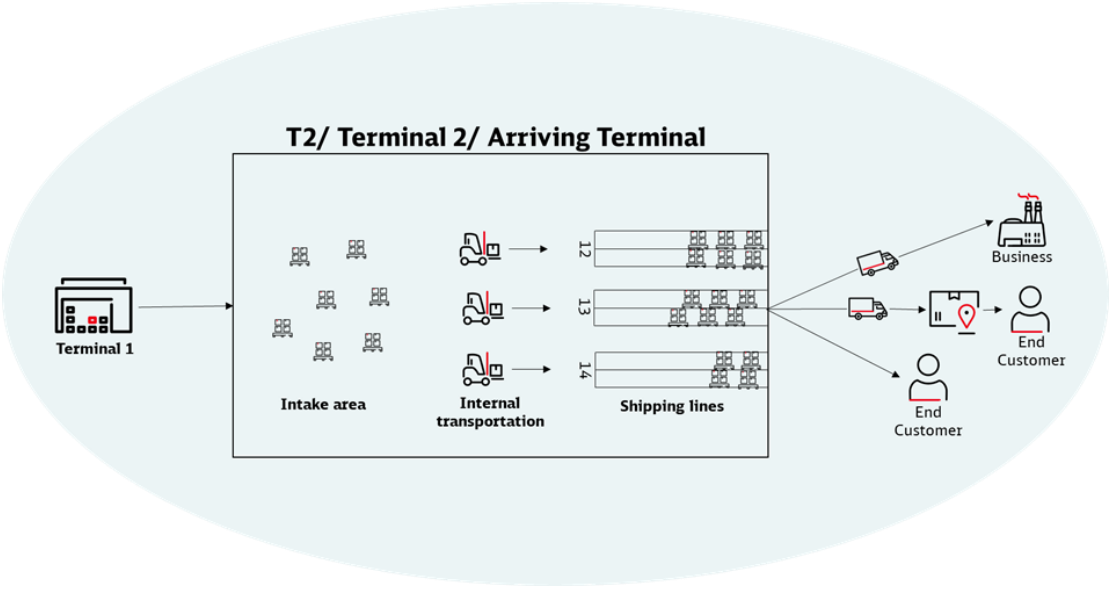

Figure 6: Overview of Terminal 2

The arriving shift is performed during the night and start approximately at 9 pm and ends at 6 am the following day. During this shift, the terminal receives goods from other (departing, T1) terminals across the rest of Sweden. Linehaul trucks, i.e., long-distance trucks, deliver goods that will be sorted and distributed to end customers in the local area. During the arriving shift, groupage and parcels are registered, sorted, and placed on the correct shipping line that corresponds to the recipient address for further distribution. This time, the sorting is done based on the second part of the Manet code, corresponding to a specific postal code. The sorting code is decided by each terminal respectively and is not standardized, see *Figure 6* for examples.

The 'Unloading' shift (in Terminal 2)

Besides the departing and arriving shifts, there is an additional third shift that takes place approximately between 6 am to 2 pm. In this thesis, this shift is referred to as the unloading shift, as it starts when the truck drivers load their trucks and unload the terminal. The terminal workers have three main duties during this shift. First and foremost, the terminal has staff on site to ensure that the loading order of the truck are being followed by the hauliers and drivers so that no prioritized shipments are being left behind, e.g., a premium pallet. Secondly, the terminal workers support the drivers if needed. Lastly, the terminal workers prepare the terminal to become a departing terminal by e.g., cleaning. *Figure 7* illustrates an overview of the three shifts carried out throughout the 24 hours in a terminal.

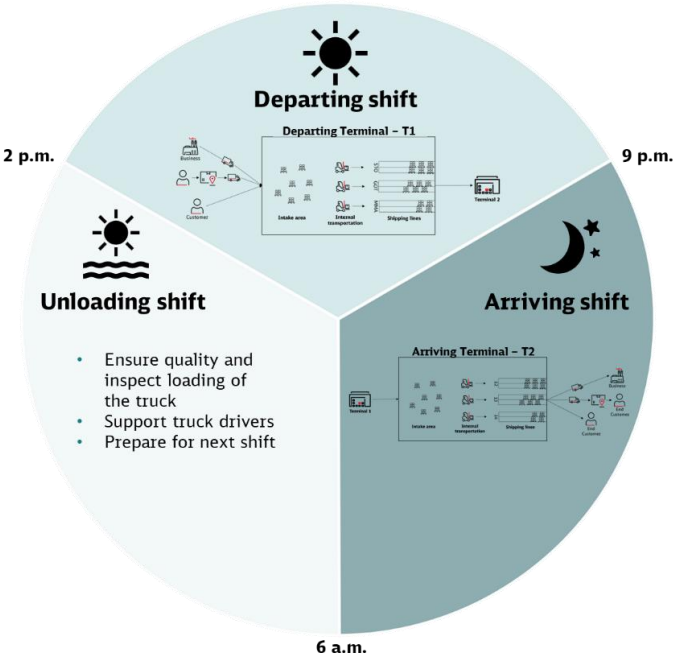

Figure 7: The three shifts during the 24 hours in the terminal.

1.1.2 DB Schenker's Terminal Offerings

DB Schenker offers three different services: *Direct Freight*, *Parcel* and *System Freight*. Direct Freight is the service offered for handling all shipments over 999 kg freight-carrying weight and with dimensions larger than 2,4 x 2,2 meter. These shipments are either LTL or FTL shipments, and do not pass through the terminals and are instead delivered directly to the end customer. Parcel is a service in which DB Schenker offers the handling of the entire parcel flow - from pick up, sorting in the terminals, to distribution to the end customers. System Freight is a service offered by DB Schenker for all other types of shipment that are not considered a parcel, including LTL and groupage shipments, that can be handled inside the terminal. The groupages handled in DB Schenker's terminals are heterogeneous and of different sizes, shapes, and weights. However, the maximum dimensions of the groupages are 2,40 x 1,80 x 2,20 meter and the taxable weight is 2500 kg for international shipment and 999 kg for domestic shipments. One groupage shipment can consist of one or several colli. These shipments can be both palletized and non-palletized, however, all units over 30 kg must be able to be handled by a forklift truck. Since most groupage shipments are palletized, this report will use the word 'pallet' to describe one colli of a groupage shipment. Hereafter, all goods that are not parcels will be referred to as groupage.

Besides the three standard services Direct, System and Parcel¸ DB Schenker offers the premium service of faster delivery. These deliveries are guaranteed, and if DB Schenker does not deliver as promised, DB Schenker is charged a fee. Additionally, DB Schenker's customer i.e., the sender, can buy additional options to the delivery. For instance, the sender can choose a certain delivery date, other than the standard which is the next day. This add-on service is called *Fix Day*. Further, the sender can buy the add-on service called *Notification* which allows the recipient to be contacted when the shipment has arrived at the last terminal (T2). The end customers can then make the option to come and pick up the goods by themselves at the terminal or choose when the goods should be delivered. DB Schenker temporary store the shipment until the end

customer wants it to be delivered. The add-on service *Day 0 Notification* allows the end customer to be notified as soon as the shipment has arrived to T1, which enables faster 'next day' delivery. The faster delivery is made possible since the recipient can select its desired way of delivery earlier than if it would be notified when the shipment arrived at the second terminal, T2.

1.1.3 DB Schenker's productivity measurements

Today, DB Schenker measures its productivity based on how much volume (number of groupage shipments or parcels) the terminal handles per hour and uses process-oriented time registration in the terminals. In order to measure the time spent on each activity, the terminal worker registers when he or she is working on a specific task and when switching from one task to another. The terminal worker must not switch process if the task requires less than 15 minutes. The registration is carried out through a system called *Check in Check out* (CiCo), in which the terminal worker 'checks in' by scanning a card and selecting the activity to be carried out on a touch screen. The purpose of CiCo is to provide detailed productivity measurements and insight into how much time is spent on each process in the terminal, as well as providing data for cost allocation and cost measurement. In addition, the system also provides DB Schenker. This, in turn, enables DB Schenker to achieve a more even workload, as the system provides information on how to optimize employees' working time, which generates both social and economic benefits. From an ergonomic point of view, a working environment with varied tasks provides better working conditions for the employees. This means that if the system shows that terminal workers spend much time on the same activity, it is a sign that the schedule needs to be redesigned. In addition, the system provides DB Schenker with indications on whether to increase or decrease staffing levels depending on the amount of time spent on support activities

Figure 8: The CiCo Punching clock (touch screen) that is mounted in the terminals.

CiCo is structured hierarchically, containing three different process categories: Groupage, Parcels, and Terminal administration, see *Figure 9*. In contrast to Groupage, and Parcels, Terminal administration is not related to the volume of goods. Instead, Terminal administration is regulated by respective branch and include services that are carried out in the terminal but are not part of DB Schenker's terminal production, e.g., warehousing for customers in the local branch. Furthermore, each process category consists of a number of processes and the terminal worker registers which process he or she is working with. For instance, if the terminal worker performs an activity involving the handling of goods that have arrived at the T2 (arriving terminal), the worker will be punched in on the Arriving process. Furthermore, the processes in turn consist of subprocesses that are classified as either core activities, value adding activities, and non-value adding activities. These subprocesses are represented by

different colors as seen in *Figure 9*. The red subprocesses represent DB Schenker's core terminal activities, such as internal transportation i.e., transporting pallets from one point to another with a forklift. The time spent at these activities is directly correlated to the volume of shipments or parcels. These core activities are considered value adding. The green subprocesses are value adding services such as performing a specific sorting procedure for (sending) customers with specific sorting standards or weighing and measuring the groupages to ensure correct pricing of the transport. Although the green subprocesses do not handle "new" incoming volumes, they still generate revenues and value for the customers or DB Schenker themself. The purple subprocess, referred to as the umbrella term *Support*, includes those activities that are related to volume, however, do not handle "new" incoming volumes. Furthermore, support activities are not value adding such as handling of damaged goods, cleaning and searching for lost goods. The CiCo structure illustrated in *Figure 9* is the only assistance that terminal employees currently have in order to know how to punch different activities. This image is displayed at the CiCo punching clocks in the terminals.

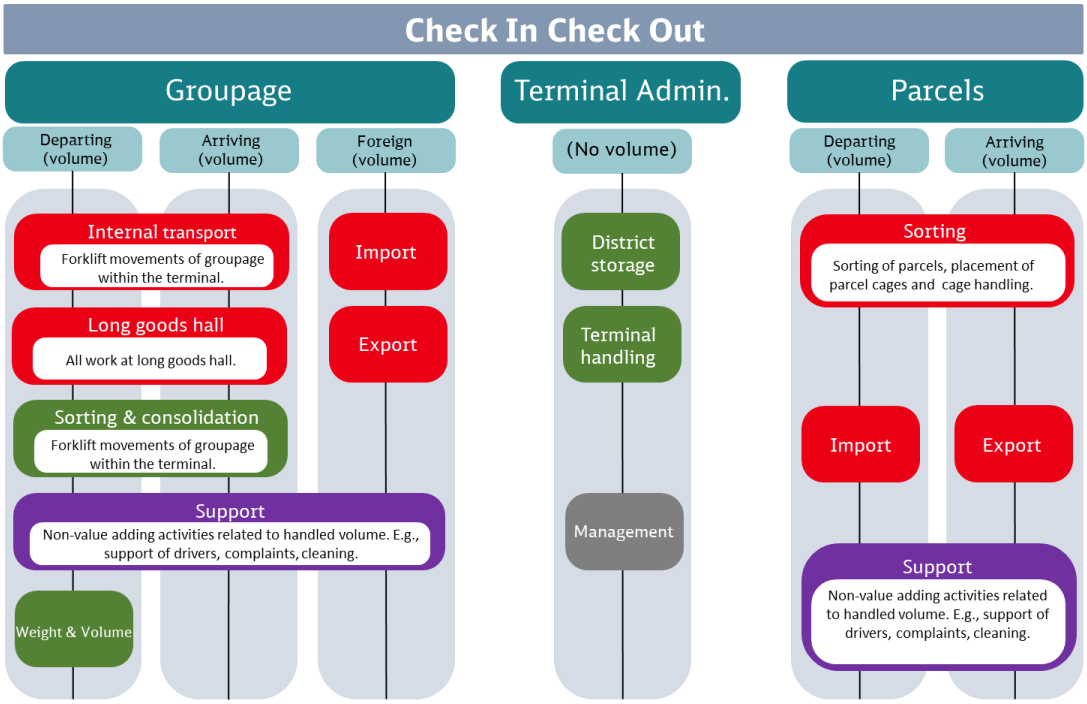

Figure 9: The structure of the CiCo system.

1.1.4 Case Description

With inflation rate rising dramatically over the past year, consumers have increasingly started to review their purchases. The decrease in demand has resulted in lower volumes being transported in the goods flows. The declining volumes are threatening DB Schenker's productivity figures, pressuring the company to revise the time spent in its terminals to avoid the risk of declining productivity. At the same time, inflation is also increasing the costs, for example in terms of rent of facilities and fuel. These circumstances require DB Schenker to become more efficient to achieve profitability despite the impact of external factors on the business. To achieve greater efficiency, the company therefore strives to gain greater insight into its terminal operations to reduce costly and non-value adding activities.

Hence, in this master thesis the activities registered under the subprocess *Support* will be examined, as support activities do not add value to the customer. Furthermore, this subprocess is particularly interesting to study as it accounts for a large proportion of the total time spent in the terminals, see *Figure 10*. In 2022, the *Support* subprocess consumed, on average, 40 % of the total time spent in the terminals, see *Appendix A*. Additionally, the subprocess *Support* encompasses more activities than the other subprocesses registered in Check in Check out, which makes it more complex and more difficult to get an insight into.

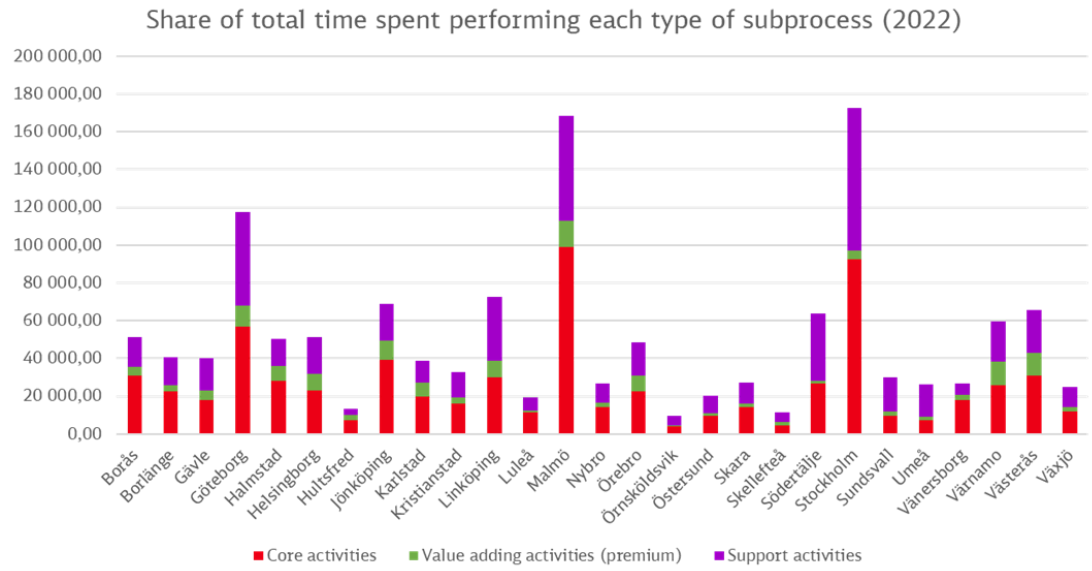

Figure 10: Distribution of the total time spent among the different subprocesses, in respectively terminal year 2022.

Furthermore, by analyzing and mapping the activities included in the *Support* subprocess, potential waste and losses can be identified such as unnecessary movements. Unnecessary transports may involve driving with empty forklifts. Hence, by analyzing and mapping support activities, measures can be developed to minimize losses in the system, which in turn can contribute to improving the sustainability of the terminal.

Selection of Process category and Process based on the CiCo structure

The scope of the study is limited to only examine support activities related to the groupage flow during the arriving shift, i.e., support activities registered in CiCo under the process category Groupage and the process Arriving shift, see *Figure 11*.

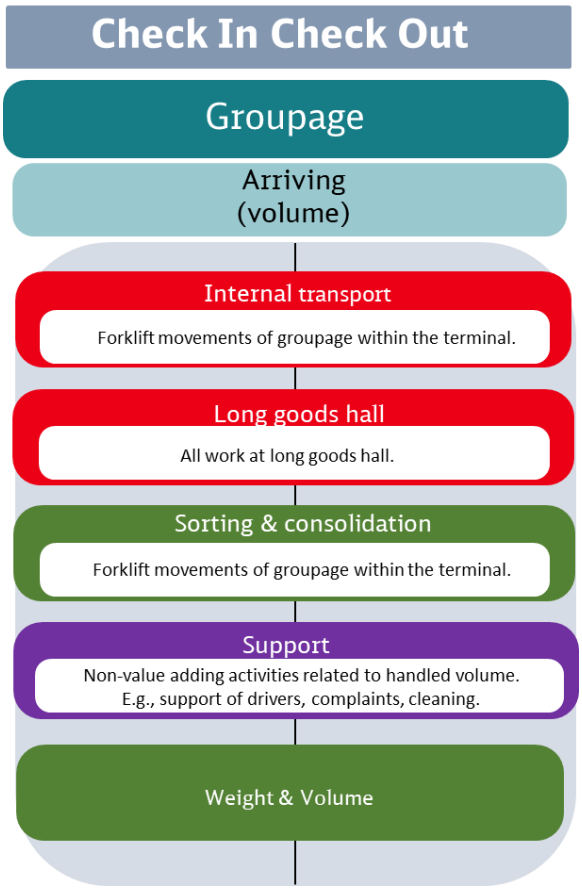

Figure 11: Selected process category and process.

The process *Arriving shift* encompasses all support activities performed during the night (i.e., the actual arriving shift), and all support activities during the unloading shift that are performed on groupages from the arriving shift. *Figure 12* illustrates the activities performed over a 24-hour period in an arriving (T2) terminal. As seen on the red and green bars, the actual arriving shift in which pallets of groupage shipments are received, sorted and placed on the correct shipping line by the terminal workers, takes place between approximately 9 pm and 6 am. It can also be seen that after an arriving shift has ended at 6 am until the next arriving shift begins at 9 pm, support activities are being carried out, represented as purple bars in the figure. Since these activities are carried out to support handling of groupages from the arriving shift, the support activities are registered under the process Arriving in CiCo. Thus, hereafter when mentioning support activities during the arriving shift, activities during the unloading shift is also included.

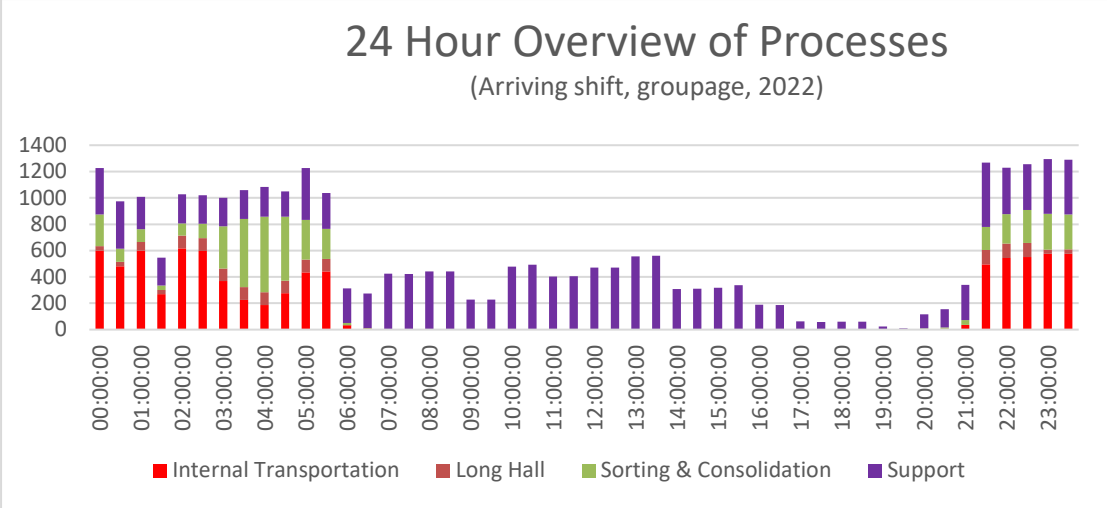

Figure 12: An overview of the terminal processes.

Selection of Process Category - Groupage

In 2022, on average, nearly 70% more hours were spent on support activities related to the groupage flow than on the parcel flow (339,907 versus 200,773 hours), which is the main reason why this study is limited to only examine the groupage flow. Additionally, the service System Freight, i.e., groupage shipments, account for the largest part of DB Schenker's profitability in the terminals. Furthermore, the service of handling groupage shipments is a standard offering and is part of DB Schenker's original business. While parcels, on the other hand, is a much later addition to DB Schenker's service offerings. Further, the parcel flow differs from the groupage flow in the way it was designed, due to different customer requirements causing different conditions. For instance, the process of handling parcels is completely electronic, compared to the groupage flow in which the paper waybill still pays an important role. Furthermore, all parcels are handled via a parcel conveyor where parcels are automatically measured and weighed, while being sorted and transported to the correct sorting outline. The groupage flow on the other hand, does not have any automated pre-sorting and the groupages must be manually transported by forklifts to a separate machine to weigh and measure the shipment. Further, parcels have much smaller margins, which makes it more important to reduce costs, as an extra administration cost can be detrimental as the price increases significantly. Thus, when designing the package flow, there was also a requirement to keep administration at a minimum level. On the other hand, groupage shipments account for larger amount of revenues and therefore additional admin costs do not have the same impact. Hence, DB Schenker sees future potential to cut costs further by streamlining the groupage flow.

Selection of Process - Arriving

In 2022, on average, nearly twice as many hours were spent on support activities related to the groupage flow during the arriving shift compared to during the departing shift (221 347 versus 118 560 hours). Additionally, the arriving shift is specifically interesting to examine since a larger number and more complex activities are being performed. For instance, the sorting of the goods is based on the receivers' post codes, while the sorting during the departing shift is based on the branch of the arriving terminal and therefore limited to less sorting concepts (maximum 29, the same number as number of terminals). Further, during the arriving shift, the terminal workers must consider the additional delivery options customers have chosen and

separately handle those specific shipments. For instance, the terminal workers must notify the customer when the goods have arrived at the terminal, temporary store them in a specific area in the terminal and manage the pick-up point. The more complex nature of the arriving shift makes it more vulnerable for additional time spent performing supporting activities, making it an interesting area of study.

Selection of Case Terminals

Out of DB Schenker's 29 terminals in Sweden, the scope of the study is limited to only examine the terminals located in Stockholm (STO) and Gothenburg (GOT). The selection was made since these terminals, together with the terminal in Malmö (MMA), are DB Schenker's largest terminals, in terms of volume being handled, in Sweden. The three terminals account for almost 30 % of DB Schenker's total number of groupage shipments, see *Figure 13*. The terminal in Stockholm handled approximately 540 000 shipments during the arrival shifts in 2022, and Gothenburg handled approximately 400 000 shipments, see *Figure 14*. Although Malmö handles larger volumes than Gothenburg, approximately 510 000 shipments, the terminal in Gothenburg was selected as a case terminal. The greater proximity to the terminal from the head office that's also located in Gothenburg made it more convenient and less time-consuming to visit the terminal to conduct observations. Thus, more time was available to visit the terminal in Stockholm and to carry out the analysis of the thesis.

An additional reason behind the selection of case terminals, besides volume, is that both the terminals in Stockholm and Gothenburg are classified as XL terminals. XL terminal's operations require the greatest number of hours (> 40 FTEs) and therefore examine their terminal processes becomes essential when aiming to increase the total productivity results of DB Schenker's terminals.

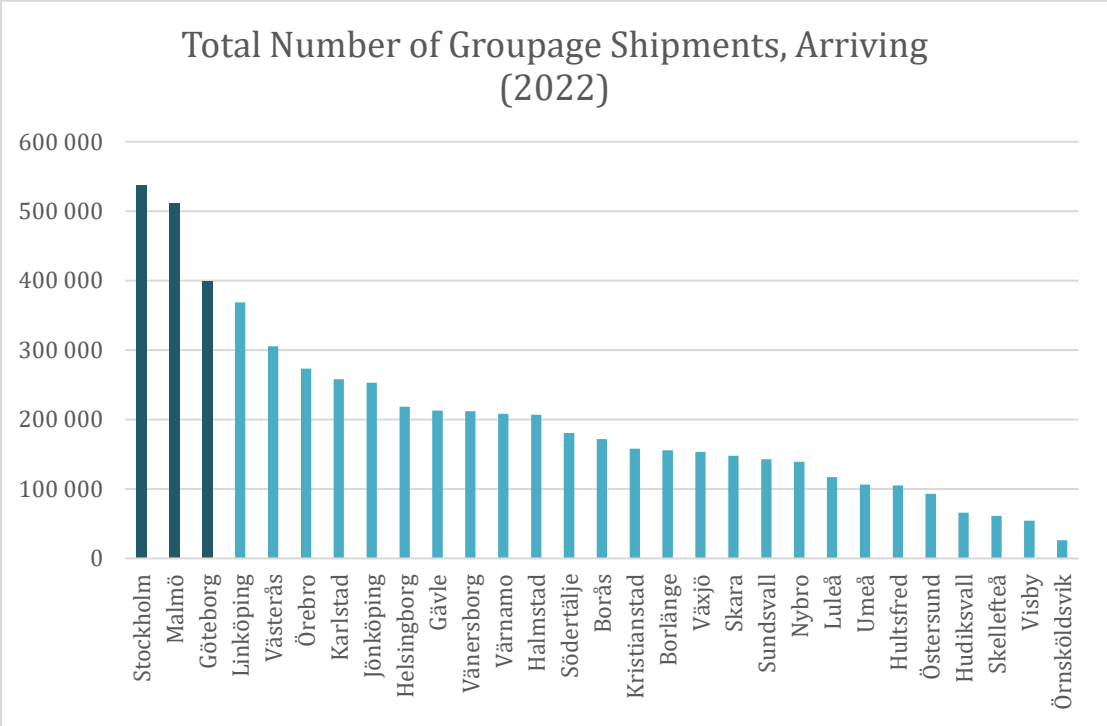

Figure 13: Total number of groupage shipments handled during arrival shift in each terminal in Sweden 2022.

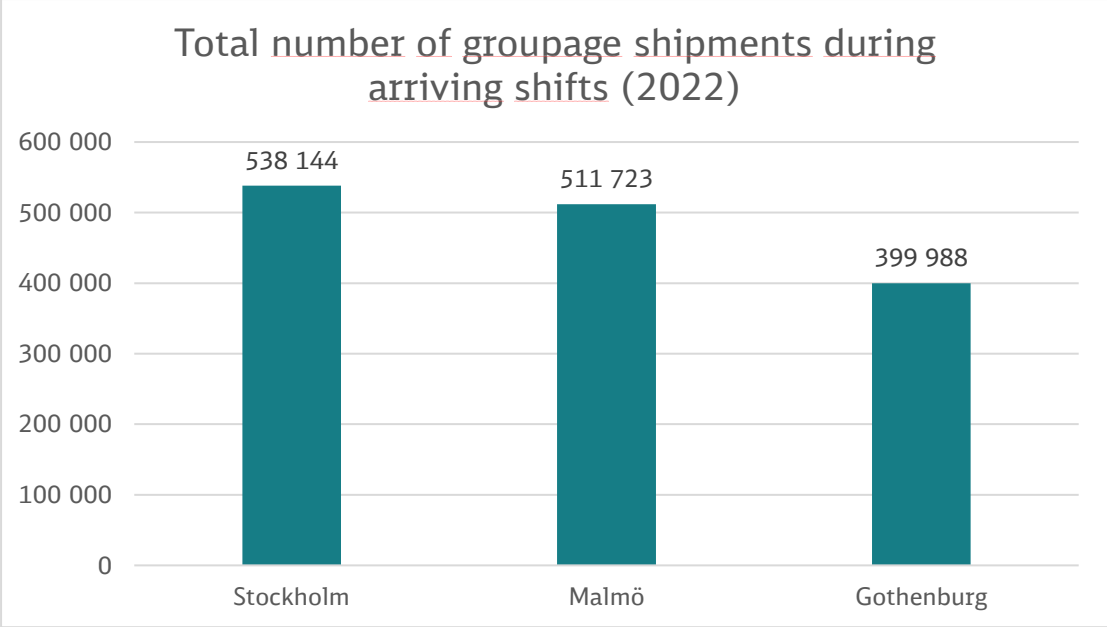

Figure 14: Total number of groupage shipments during arrival shifts in 2022 at the terminals in Stockholm, Malmö and Gothenburg

An analysis of how large share the subprocess *Support* accounted for of the terminal's total time spent showed that more than 40 % of the total time spent, in both Gothenburg and Stockholm, was spent on performing supporting activities. In the two terminals, support time related to the flow of groupage shipments during the arriving shift, accounted for the largest share, see *Figure 15*. In Gothenburg, support activities related to the flow of groupage shipments consumed 51 % of the total time spend during the arriving shift, compared to Stockholm's 56 %. Given that the greatest percentage of support time was spent during the arriving shifts when handling groupage shipments, further supports the chosen limitations and scope of the thesis.

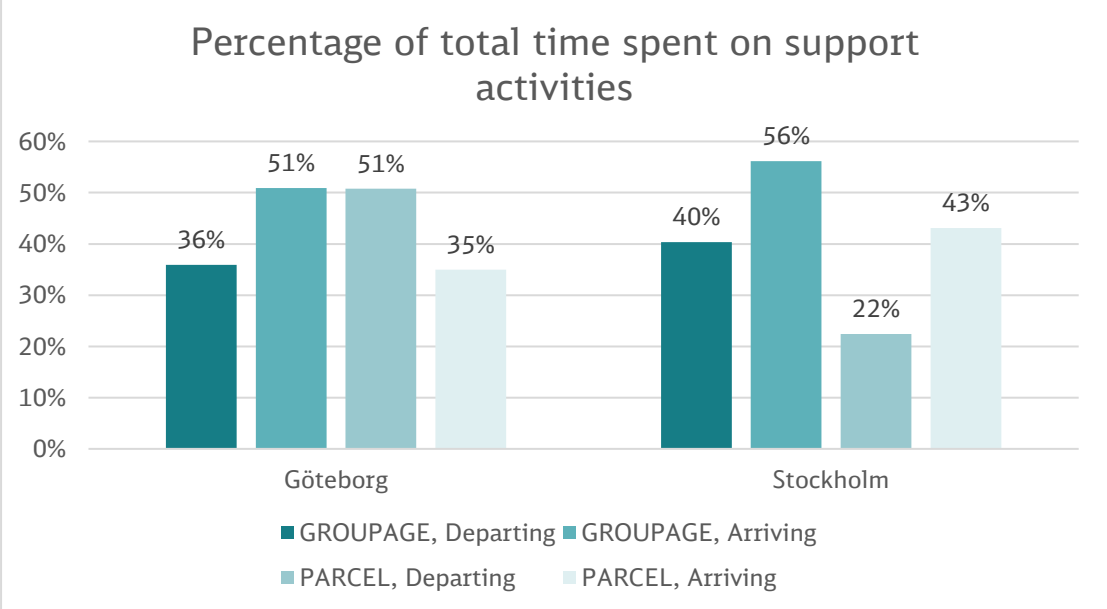

Figure 15: Time spent in the subprocess Support in relation to groupage of shipments during each shift in the Gothenburg and Stockholm terminals.

1.2 Problem Statement

In the current state, DB Schenker's terminal workers spend a significant part of their working time on the *Support* subprocess, which are not value adding activities. Even though *Support* accounts for a large part of the total working time in the terminals, there are challenges in identifying which activities are included in the *Support* subprocess in each terminal and what proportion of time each activity represents of the total number of hours spent on this subprocess. Furthermore, there is a limited insight into how the execution of the activities in the subprocess *Support* varies between terminals. Hence, DB Schenker has a need to gain better insight into this subprocess, especially in the current time of rising inflation which requires each actor to review its costs. The thesis work will be conducted at the XL terminals in Gothenburg and Stockholm since these terminals' accounts for greatest number of working hours and accounts for large volumes in Sweden. Furthermore, the study is limited to the process category *Groupage* and the process *Arriving* since the largest share of total support time is spent during the arriving shift and in connection to the flow of groupage shipments.

1.3 Purpose

The aim of the thesis is to provide DB Schenker's Terminal Department with a greater insight into their subprocess *Support* and find potential areas of improvements of the terminal's support operations to increase the overall productivity.

1.3.1 Research Questions

RQ 1: Which of the activities performed during the arriving shift should be registered under the subprocess *Support* at each terminal?

RQ2: What are the main reasons for spending a significant amount of time on support activities and how can the terminals work to reduce their total time spend on support activities?

2. Methodology

The following chapter presents the methodology for the thesis work. Initially, the research approach applied in the study is presented, followed by the phases of the study and the data collection methods. Finally, the quality of the selected methodology is discussed.

2.1 Research Approach

To answer the research questions, a case study of two case terminals has been conducted. According to Kumar (2011), a case study can provide an insight into the events and situations that occur in a particular case. Thus, in this thesis, the focus is on the situations of each of the individual case terminals, and not on DB Schenker's overall terminal operations. The aim of the thesis is not primarily to produce quantitative data on how much more productive DB Schenker can be, but to give Schenker an insight and understanding of the current situation. Thus, a case study is a good choice of approach as this method, according to Kumar (2011), is relevant when a study's main focus is on exploring and understanding rather than confirming and quantifying. Further, Kumar (2011) explain that case studies are generally flexible and uses open-ended techniques when collecting and analyzing data, which was essential as the study has been conducted through communication with terminal employees and of visits.

The choice of the case terminals, Stockholm and Gothenburg, was based on historical data of the volumes each terminal handled in 2022. According to Kumar (2011), information-oriented selection methods are commonly used when deciding what case objects to examine. Ericsson-Zetterqvist (2022) describes so-called mixed methods and explains that quantitative studies can be initially used as a starting point for a study and in a later stage the study can have a more qualitative orientation. Kumars (2011) stresses that the results of a case study should not lead to generalization and be applied on cases that are not similar to those studied. Thus, the results of the case study will primarily be relevant for similar (XL) terminals with equivalent volumes and limited conclusions can be drawn about DB Schenker's other (smaller) terminals in Sweden. The terminals in Stockholm and Gothenburg are similar in size, which leads to a fairer comparison than if an extra-large terminal was compared to a smaller one. The terminals would, in such case, be different regarding a number of parameters, such as the loading area, distances inside the terminal, the size of the volume handled, the number of employees, the number of hours worked, the number of customers, etc. However, although the terminal in Stockholm and Gothenburg are similar in size, there may still be differences in their performance and way of working, hence a comparison could potentially lead to the identification of best practices.

In order to collect data about each case-terminal, multiple methods have been used i.e., interviews and observations, which according to Kumar (2011), is an important aspect of a case study. Furthermore, the master thesis has been divided and conducted into four main phases: *Current state analysis*, *Classification of support activities*, *Identification of the main reasons to the time spend on Support* and *Suggestions*, which will be further explained in following subsection.

2.1.1 The Four Phases

The Current state analysis was conducted in order to create a comprehensive insight into the activities and flows of goods and information at the terminals. In addition, this phase aimed to create an understanding of the work situation of terminal employees. Furthermore, to start the data collection process, interviews were carried out with terminal managers, supervisors and team leaders during the arriving and unloading shift, followed by observations. Once all activities were identified and mapped, the second phase *Classification of support activities* was carried out. During the classification process, a framework was developed based on the literature on value added and non-value added (necessary or unnecessary) activities and DB Schenker's internal definitions of support activities. The framework's classification enabled the first research question to be answered: "Which of the activities performed during the arriving shift should be registered under the subprocess *Support* at each terminal?".

When the flow of activities and information in the terminals were mapped, and the support activities were classified, the next phase *Identification of the main reasons to the time spend on Support*, was initiated. In order to collect complementary data from the Phase 1 interviewees, email was used as a methodological tool. By analyzing the data from the previous phases along with the additional data, it was possible to identify the main reasons of support time. Thus, allowed the second research question to be answered: "What are the main reasons for spending a significant amount of time spent on support activities and how can the terminals work to reduce their total time spend on support activities?". In the final step, *Suggestions*, the findings from each step were summarized and enabled the formulation of suggestions and recommendations for the thesis work. *Figure 16* summarizes the four phases of the workflow.

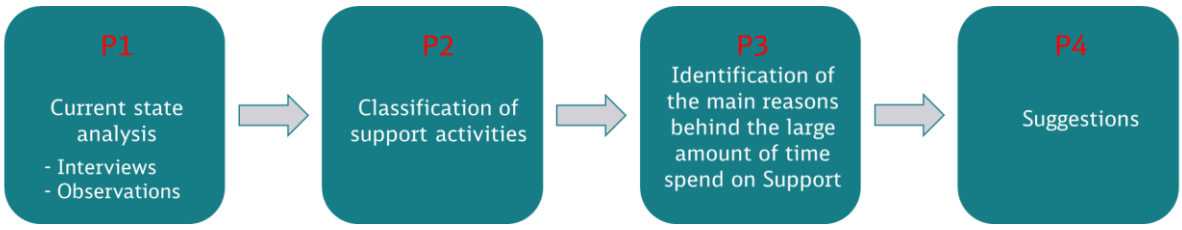

Figure 16: Illustration of the thesis work's four phases.

2.2 Data Collection

The following section presents the methods used to collect data during the different phases of the thesis work. Firstly, the interviews and their design are presented, followed by the approach to the observations and the literature review. Finally, the quality of the research is discussed.

2.2.1 The Conduct of the Interviews

During the first phase of the thesis work, interviews were conducted with terminal managers, supervisors and team leaders from the two case terminals. The interviews carried out in the first phase were of a broader nature and aimed at providing an overview of each terminal's support activities and understanding how these were linked to the flow of groupages. The information gathered from the interviews provided an initial understanding of how the support activities were carried out and the reason behind its execution.

Selection of Interviewees

The interviewees phase was selected based on snowball sampling (Arhne & Svensson, 2022), which means that the initial interviews were conducted with terminal workers recommended by the thesis work's supervisor at the land department's headquarter. Furthermore, these interviewees in turn provided recommendations on additional, appropriate questioners for the study. Hence, the number of participants in the interview process growing like a snowball (Hennink et al., 2011). According to Hennink et al. (2011), this selection method of interviewees is beneficial in terms of increased participation, since the new interviewees are usually linked to the previous ones, who can explain the process. In the third phase, additional data was collected via email through dialog with terminal workers interviewed in the first phase.

Interview Template

The interviews were conducted virtually through Teams due to the distance to the terminals. Although one of the terminals is located in Gothenburg, the head office is not adjacent to the terminal, making a virtual interview format advantageous in terms of time and flexibility. According to Zadkowska et al. (2022), virtual interview formats are beneficial in terms of time savings for both parties, and it also increase the personal space since it allows the meeting participants to adapt the presentation view. On other hand, according to Curasi (2001), a virtual interview format may result in lower motivation for both parties and there is a risk that important signals that cannot be expressed verbally are excluded.

The interview templates for the virtually interviews were designed in a semi-structured way, which according to Mann (2016) is an interview guide rather than a script. Furthermore, semi-structured interviews consist of both open and closed questions and using this methodology facilitates the comparison process when several interviews on the same topic are conducted (Lantz, 2007). This in turn allowed the interviews with the terminal workers to deviate from the guide when the interviews turned to an interesting topic, although it was still important to cover most of the topics in the guide (Mann, 2016). Furthermore, the interview template was categorized into five different categories: *General questions about the interviewee's job role and its shift, Support activities, The Check In Check Out punching system, Structure of the terminal* and

Other questions. During *Other questions*, the interviewee was given the opportunity to share their own thoughts and ideas on the topics covered in the interview.

2.2.2 The Conduct of the Observations

Observations of the case terminal's support activities were carried out in the first phase of the thesis work. According to Kumar (2011), when studying functions performed by a worker, observations are the most appropriate method to use for collecting data. Furthermore, Hennink et al. (2011) emphasize that observations are an appropriate method to use for describing and understanding people's actions in a specific context.

The observations were conducted after the interviews had taken place. The aim of these observations was therefore to ensure that activities were carried out in the way described in the interviews and to gain a greater overall insight of the terminal's operations. In each terminal, two observations were conducted, one during the arrival (night) shift, and one during the unloading shift. In total, four observations were carried out. All observations conducted in the terminals were so-called non-participant observations, which means that the researcher takes a passive role and is not involved in the activities of the terminal workers (Kumar, 2011). Furthermore, the observations were all carried out under the guidance of the shift's supervisor, thus providing the opportunity to ask questions on spot to both the supervisors, group leaders and other terminal workers. These questions followed no particular structure and aimed to gain a deeper understanding of different individuals' work activities and work situation, which according to Lantz (2007) is referred to as an open interview format.

To ensure that all support activities mentioned in the interviews would be observed and to be able to make a fair comparison between the two terminals, an observation template was designed to provide guidance. According to Hennink et al. (2011), it is important to keep clear and detailed notes continuously during the observation as these can be of great importance for the analysis of the work. Furthermore, Hennink et al. (2011) describe that it is advantageous to write notes in a discreet way to avoid disturbing the environment, preferably with a notepad. Hence, before all observation sessions, the observation template was therefore printed out on physical paper and notebooks were also brought for the visits.

The observation template was based on the interviews conducted and had a structure that followed the activities in the flow of goods in chronological order. For each activity in the observation template, there was an associated box containing related questions to the activity that had emerged after the interview and one additional associated empty box for other comments, see *Table 2*.

Table 2: The structure of the observation template.

Activity	Focal Area	Notes
Coding waybills	How many waybills are missing codes? When to double-check codes?	A terminal worker spends eight hours coding waybills.

2.2.3 Literature Review

Information from literature have been collected throughout the thesis work for guidance and to increase the understanding in the field of work. Books and articles from different data bases such as Google Scholar and Chalmers Library have been used as the main source of data collection. In addition, to retrieving literature from databases, printed books have been an essential part of the literature. The printed books were borrowed from Chalmers Library where the selection was based on the available assortment. Furthermore, course literature from courses on the master program Supply Chain Management has been used, as this literature has been selected by experts in the field and thus increases the validity of the study. In addition, in order to find relevant and accurate literature in the databases, a variety of keywords have been used. The most frequently used keywords are summarized in *Table 3*.

Table 3: Collection of the most frequently used keywords in the literature review.

Keywords		
Terminal operations	*Value – adding activities*	*EDI*
Freight terminals	*Leadership*	*Lean philosophy*
Change management	*Waste activities*	*Digitalization*

2.3 Research quality

According to Ahrne & Svensson (2022), there are several different approaches to establishing credibility in qualitative studies. One way is to work with generalizability. A cautious way to start talking about generalizability in qualitative research is to study more than one setting and then compare the results between the different cases (Ahrne & Svensson, 2022). In this study, two different terminals were examined, each during the arrival and departure shift, to ensure generalizability. However, generalizability could have been increased by examining more terminals, which was not possible in this study due to time constraints. Furthermore, according to Ahrne & Svensson (2022), a common way to increase the reliability of a study is to use triangulation. Triangulation means combining different methods, which generate more accurate results of the study than if only one method was used. The study conducted at DB Schenker has not only been based on theoretical frameworks, but also included interviews and observations. In this way, several methods were combined, which in turn increases the reliability of the study.

Before the interviews and observations were carried out, a semi-structured interview template and an observation template were designed to increase the validity of the study. This minimized the risk that the data collected would not meet the purpose of the study. In addition, the decision was made to interview terminal operations staff representing different positions and hierarchical levels in the company. By interviewing terminal managers, supervisors, team leaders and terminal workers, this provided a clearer and more comprehensive picture of the business, which in turn increased the reliability of the study. However, the selection of interview participants was done by snowball sampling. According to Hennink et al. (2011), the snowball sampling is based on social networks and shared knowledges between individuals. This suggests that snowball sampling as a method of selecting respondents may have disadvantages when

it comes to recommending new respondents, as there is a risk that respondents may be biased in their recommendation.
Furthermore, all observations were conducted by two people, which increased the credibility of the study by providing two different perspectives on the data collection. In addition, each interview was attended by two representatives, one responsible for asking the respondent questions and the other taking notes and observing body language and facial expressions. In this way, the data collection becomes more objective and representative of the reality and therefore increases the reliability of the study. All interviews were also recorded, in order to be able to check the notes afterwards and to have more focus on the interviewee during the interview. According to Lantz (2007), it is advisable to record an interview while taking notes in order to be able to listen to all the material and complete notes afterwards. This in turn contributes to a more qualitative data collection.

In order to increase the credibility of the study, the data collection process was also verified on an ongoing basis with the contact persons at DB Schenker. Firstly, the interpretations of the data collection were continuously confirmed by e-mail contact with the terminal staff. In addition, a mid-way review was made at DB Schenker's head office to obtain feedback on the data collection.

3. Theoretical Framework

The theoretical chapter presents theories on freight terminals, lean philosophy, and leadership. Finally, the theory of change management is introduced with a focus on digital transformation.

3.1 Freight Terminal and its Operations

According to Storhagen (2018), the fundamental motive for using terminals is to transport a product from one point to another, in the cheapest way. Further, Storhagen (2018) explains that the shortest path between two points is a straight line but that the cheapest way is not always to follow that line. According to Lumsden et al. (2007), the most ideal transportation is a door-to-door delivery directly from the sender to the recipient. However, in reality, this is not always efficient. Firstly, consignments might be heterogenous and differ in size, weight, and shape. Additionally, it is common for senders to only ship shipments smaller than a full truckload, so-called LTL (Less than truck load) shipments. Thus, transporting one consignment at a time would result in low utilization of the truck and many transports (Lumsden et al., 2007). In order to gain economies, shipments from different senders but with similar destinations are consolidated, or large shipments are broken up into smaller deliveries to several customers (Bartholdi & Gue, 2000). Such operations, among others, are carried out in terminals. According to Rodrigue (2020), a terminal is an intermediate location where freight or passengers are either originated, terminated, or handled. Lumsden et al., (2007, p. 450) describe the terminals as "…a point in a material flow system where material flows are joined together and divided.". Storhagen (2018) describe a terminal as a geographically located function for the storage and/or transshipment of components, finished products or spare parts. Its purpose is partly to be close to the market through its location to ensure customer service and partly to reduce the total cost of transport through combinations of different flows and different means of transport. The terminal can act as a coordinating intermediary, covering goods reception, internal handling and storage, and delivery. But the terminal can also provide other services such as final assembly of products, service, and packaging (Storhagen, 2018).

A terminal act as a breakpoint where its task is to ensure that the flows out of the terminal are different from the flows in (Storhagen, 2018). According to Bartholdi & Gue (2000), all terminals perform both outbound and inbound operations, named after the type of goods which are being handled. Outbound freight are all goods to be shipped out of the terminal outside the geographical area for which the terminal is responsible. While inbound freight are shipments to the terminal arriving from outside the area of responsibility. The outbound and inbound operations can be separated and performed during different hours of the day. During the day, pickup-and-delivery drivers pick up freight from the area close to the terminal. This freight is being handled and moved during the evening in the terminal. The inbound freight arrives from other terminals and are being handled in the early morning. During the rest of the day, the terminal is inactive (Bartholdi & Gue, 2000).

The terminal function of cross-docking is described by Storhagen (2018). In its purest form, cross-docking involves unloading a product from an inbound shipment, identifying who it is going to, and loading it onto an outbound shipment that is appropriate for the destination. Cross-docking means quickly ensuring, without storage, that the flow of goods after the cross-docking point better meets the receiving customer's requirements in terms of content, volume, and packaging form than before. Information systems are essential to make cross-docking work. Access to information is essentially what makes the concept possible. Information on the overall coordination along the chain, but also, of course, on inbound, internal and outbound flows (Storhagen, 2018). Furthermore, Lumsden et al., (2007) presents additional operations that are being performed in a terminal:

- **Consolidation**: In the terminal, goods from different senders in a relatively small nearby area are consolidated and often unified into larger units, which are transported to other terminals.
- **Transshipment**: Goods are transferred from one transportation mode to another, for instance from a linehaul truck to a distribution vehicle.
- **Sorting**: In the terminal, goods are being sorted based on several criteria.
- **Sequencing**: There is an increasing demand of adapt the sequence of the outgoing deliveries by sorting the goods according to customer's wishes.
- **Storing**: A terminal can perform both short-time and long-time storing. Goods are being stored for a short time in the terminals to allow some margins between the arrival and departure times. Long-storing is carried out in order to allow customers to request the delivery time.

3.2 Lean Philosophy

The entire Lean philosophy is based on the concept of value recognition and eliminating waste (Shou et al., 2020). The focus on value has changed from removing waste and reducing costs to creating improved customer value by either removing wasteful activities and/or adding more features for both products and services. In recent years, there has been an increasing focus on the customer, and it has thus become more important to identify what is value-creating for the customer along the entire value chain (Storhagen, 2018). As a result, the customer increasingly controlling business flows and have become one of the key drivers. Hence, it has become more critical for companies to focus on their core business. In simple terms, core business can be described as a company focusing on the activities in which it considers itself superior or focusing on the parts of a product that the company considers to be of greatest strategic importance (Storhagen, 2018). The increasing focus on companies' core business has therefore led to organizational collaboration along flows becoming a strong logistical development trend (Storhagen, 2018).

Furthermore, Shou et al. (2020), identify the term value as a company's ability to deliver exactly the products and services the customer demands at an appropriate price with minimal time. According to Gibbons (2010), based on the concept of customer value, there are three categories into which value can be divided, which are essential to understand in order to improve a process. The three categories are: *Value adding* (VA), *Non-value adding* (NVA) and *Necessary but non-value adding* (NNVA). VA refers to those activities for which the customer expects to pay for while NVA refers to activities that could be classified as pure waste, i.e., those for which the customer would not expect to pay for. Furthermore, NNVA activities refers to existing practices that must be performed to complete the process, but which possess an inherent waste. These are also activities that the customer does not expect to pay for (Gibbons, 2010). An example of a NNVA activity is quality inspections (Shou et al., 2020).

Additionally, waste could be defined as any activity which does not create customer value but consumes resources. In the philosophy of Lean, all types of waste can be divided into three different types of main classifications: *Muda, Mura* and *Muri* (Pieńkowski, 2014). These three M's are strongly linked to each other and together form Lean's understanding of waste.

3.2.1 Muda, Muri & Mura

Waste is often referred to as a Muda activity and refers to all activities a company performs that do not bring value to the product (Pieńkowski, 2014). Important to add is that these wastes are not only applicable in a production line, these are also appropriate for a variety of processes and departments (Liker, 2004). According to Liker (2004), seven types of wastes can be identified in a business, which are:

1. **Overproduction**: refers to produced items which are not orders. This type of waste is the worst form because overproduction leads to the other six wastes (Pieńkowski, 2014).
2. **Waiting**: refers to workers who are idle and need to wait, for example, for a processing step, or idleness due to delays or bottlenecks in capacity.
3. **Unnecessary transport**: refers to inefficient transport, long transport distances and movement of goods and materials between processes and storages.
4. **Overprocessing or incorrect processing**: refers to wasteful processing of the product in a more extensive manner than necessary, which can be described as inefficient processing due to poorly designed products and tools. This in turn generates defects and unnecessary movements.
5. **Excess inventory**: refers to longer lead times, increased costs and delays due to surplus goods and raw materials. Excess inventories mean that companies have problems such as defective products, late deliveries from suppliers and imbalances in production.
6. **Unnecessary movements**: refers to all unnecessary movements that a worker must make during work. Types of unnecessary movements can be looking for specific parts but also just walking.
7. **Defects**: refers to the production and correction required of defective parts, i.e., processes such as repair, inspection and replacement production. These processes are wasteful in terms of time, labor and resources.

Furthermore, Liker (2004) states that an additional eight waste can be identified which is **unused employee creativity**. This final waste refers to companies that do not listen to and take advantage of employee knowledge, resulting in ideas, improvement opportunities, time, skills and learning opportunities are lost.

The second type of waste category is Muri which is associated with overburden of both people and processes (Smith, 2014). Putting both machines and people under unnecessary stress reduces their ability to do the work correctly (Pieńkowski, 2014). One way to overcome the problem of overload is to standardize tasks, as an overburdened worker is more likely to contribute to waste (Smith, 2014). This means by reducing Muri greatly reduces Muda. Furthermore, Mura refers to waste of unevenness or variation in production volume and usually takes two different forms: variation in scheduling and/or uneven production workload and pace of work (Pieńkowski, 2014). Moreover, according to Pieńkowski (2014), Mura is strongly linked to the worst form of Mura, overproduction, as companies produce more than necessary when their scheduling fluctuates, which in turn generates high levels of inventory. In order to deal with all three types of waste and to achieve the best results, you need to deal with Muri and Mura first and then Muda in order to deliver perfection to the customer (Smith, 2014).

Cleaning

Cleaning and keeping the workplace neat can reduce the number of defects (Hassan, 2013), which is one of the 7 wastes in the Lean philosophy, according to Liker (2004). Furthermore, Li et al. (2022) explains that industrial production generates dust which can be harmful for the industrial workers as dust pollutes the air.

3.3 Leadership

Dombrowski & Wullbrandt (2019) emphasize the importance of coordinating human, organizational and technical aspects in a production system, in order to create value. Dombrowski & Wullbrandt (2019) further presents Lean Leadership as an important leadership style when aiming for a customer orientated, value adding and self-developing organization. Lean leadership consists of five principles:

- *Culture of improvement*: the leadership should focus on continuous improvement and according to this leadership philosophy, problems are seen as sources for improvement.
- *Gemba*: Leaders should show respect for the employees and make fact-based decisions after showing their own presence on the shopfloor. Liker et al (2012) explains that Gemba means “where the work is” in Japanese. The philosophy is that the leader should lead from below, compared to the traditional leading from above approach, in order to understand the actual situation. Furthermore, a leader should coach others to take responsibility for solving problems and continuously improve.
- *Coaching/qualification*: The leader should coach the employees and encourage them to independently solve problems and continuously learn through practical work.

- *Participation*: As mentioned above, according to the lean leadership philosophy, the leader should involve the employee in problem-solving and increase adoption of development initiatives.
- *Self-development*: The leader serves as a role-model and should aim to continuously develop his/her leadership skills (Dombrowski & Wullbrandt, 2019).

Liker et al. (2012) explain that traditional leadership is seen as a single responsibility for someone with the right characteristics who stands out from the crowd and can therefore lead the crowd. According to the Toyota Way and lean philosophy, leadership is perceived as both an individual and an institutional issue, where leadership is expected from both the team leader on the shop floor to the CEO of the company. Furthermore, great leadership is obtained if clear goals and expectations are set for the employees, which is done through visual management (Liker et al., 2012).
Internal communication is a crucial factor in a company's performance (Kitchen & Daly, 2002). According to Kitchen & Daly (2002), organizations need to adapt their approach to internal communication according to factors such as the type and size of the company, financial resources, organizational culture, and staff. Internal communication reflects how well leaders communicate with their employees, such as perception of expected performance, the strategic direction of the organization and organizational goals (Jacobsen & Salomonsen, 2021). One important aspect related to this topic is also the use of feedback by management, which Jansson & Ljung (2017) states is crucial to employee motivation, which in turn affects the performance of the entire organization. Furthermore, a common perception is that it is up to the supervisors to inform their teams (Bridges & Bridges, 2017). However, according to Bridges & Bridges (2017), it is likely that in many cases supervisors themselves do not understand the information provided well enough to be able to communicate it properly to their employees.

3.3.1 Meetings

According to Stray et al. (2016), a daily start-up meeting usually lasts about 15 minutes and aims to share relevant information for the team's work and development. To keep the meeting short, it is often conducted standing up in order to prevent long discussions (Stray et al., 2017). A crucial factor for a meeting to take place is that it has a purpose (Bagire et al., 2015). The authors emphasize that if there is no purpose, a meeting should not be convened. Furthermore, meetings allow for the exchange of information, coordination, planning and decision-making, among other things, which are important elements linked to team performance (Stray et al., 2016). In this way, the meetings provide team members with an overview of the work of the other team member and are thus an essential factor in increasing team awareness and information exchange (Stray et al., 2017). Hence, meetings are necessary for successful teamwork (Stray et al., 2016). According to Bagire et al. (2015), meetings bring several benefits to an organization such as facilitating decision-making, building teams, generating new ideas, and improving socialization in the organization. However, the success of the meeting is influenced by how it is conducted, and time management is a key factor in this context (Bagire et al., 2015). Hence, if the time spent in meetings is not taken into account, this affects its effectiveness. In order to achieve successful meetings, Bagire et al. (2015) emphasize high participation, clear agenda, clearly defined action plan and goods focus as some important practices.

3.4 Change Management

The extent of a change is influenced by the implementation, management, and operation of the change process, which in turn depend on the scope of the change (Bruzelius & Skärvad, 2017). Jacobsen & Thorsvik (2008) emphasize that a change can involve different aspects depending on which area it affects. For example, it can involve change in an organization's culture, which concerns values or norms, or changes in behavioral processes, i.e., how communication and decision-making takes place in an organization. Furthermore, a change may involve finding new ways to carry out existing tasks, such as introducing new technology in order to automate a task that was previously done manually (Jacobsen & Thorsvik, 2008).

Bruzelius & Skärvad (2017) distinguish between two different types of changes: *incremental* and *structural changes*. An incremental change can be described as any change activity in an organization that aims to improve products, processes and procedures that already exist in an organization. Furthermore, an incremental change takes place step by step through order from management (Jacobsen & Thorsvik, 2008). Clear characteristics of these changes are smaller scale, lower risk, lower potential and new skills among employees can be developed over a longer period of time (Bruzelius & Skärvad, 2017). Despite their small scale, these changes can face strong opposition from individuals and groups within the organization (Jacobsen & Thorsvik, 2008). On the other hand, structural changes occurs when organizations have to implement more radical changes in a relatively short time frame (Jacobsen & Thorsvik, 2008). These changes aim to structurally reshape the organization by, for example, changing its strategic direction or business model (Bruzelius & Skärvad, 2017). Unlike incremental changes, structural changes are of larger, radical scale and are characterized by higher risk but also greater potential. In addition, when introducing a structural change, the new skills of employees are usually needed immediately (Bruzelius & Skärvad, 2017).

It is widely recognized that change is often met with opposition (Jacobsen & Thorsvik, 2008). Furthermore, Jacobsen & Thorsvik (2008), describes a number of basic reasons why opposition often arises in an organization in connection with a change. Firstly, there is a fear of the unknown among employees. The workers move from a secure position to a position of uncertainty. Secondly, it is common for many employees to link their identity to their work and thus feel that part of their identity is lost when an organizational change occurs. Finally, organizational changes can lead to new demands on employees' knowledge and skills, which means that the knowledge they have built up is no longer as useful.

In terms of routines and standard operating procedures within an organization and how it changes over time, this is a topic that has been widely studied in organizational theory (Jacobsen & Thorsvik, 2008). The purpose of standardizing tasks is to ensure that tasks are performed in the same way. This creates predictability in the work and minimizes decision – and production cost. On the other hand, such an approach can lead to more inactivity and maladaptive behavior among employees. Furthermore, according to Jacobsen & Thorsvik (2008), it is most often the case that procedures are not perfectly designed, giving rise to personal interpretations. This means that a new person in the organization may not interpret a procedure in the same way as a previous colleague. As a result, the procedure will change over time (Jacobsen & Thorsvik, 2008).

3.4.1 Digital transformation

According to Bruzelius & Skärvad (2017), digitalization is about adding digital technology to existing activities. Digital transformation is today a necessity for companies and organizations to ensure customer satisfaction and competitiveness, and to reinforce good profitability in an increasingly global market. Furthermore, according to Cijan et al. (2019), digitalization brings many challenges as well as opportunities to organizations. One of the great opportunities of digitalization and the use of Information and Communication Technologies (ICT) is that information within an organization has become increasingly transparent and easily accessible, allowing organizations to share larger amounts of information with all employees at all levels (Cijan et al., 2019). In addition, according to Lindvall (2011), there are opportunities for companies to access immediate, rapid, vertical, and horizontal integration of information in a way that was not possible before. The use of ICT thus generates increased productivity and efficiency within the company (Cijan et al., 2019).

According to Larger et al. (2021), digital technology has become increasingly prevalent in the logistics industry. Storhagen (2018) states that ICT has become a driver and enabler of logistics, as company today are able to develop logistical solutions with the help of ICT. Furthermore, while companies used to rely on self-developed in-house system, which were costly and time-consuming, companies can now rely on standardized systems (Lindvall, 2011). This development has created many benefits for companies in terms of money, time and quality, and in addition, also alleviated many constraints. With the help of ICT, workers can also focus more on complex tasks that require human knowledge, as more repetitive tasks can be performed by automated computers (Cijan et al., 2019). Furthermore, by applying automated systems, organizations can perform function more efficiently, reliably, accurately and safety compared to a human operator (Haight, 2007). According to Haight (2007), it is also cheaper to use these kinds of systems instead of a human operator. However, the human operator still plays a crucial role because of the qualities that humans possess in terms of flexibility, creativity, and adaptability. Hence, it is important that the humans are properly integrated into the systems. Additionally, the improvement of working conditions is closely linked to digitalization and, according to Lager et al. (2021), can be achieved in two different areas. The first area is associated with a greater degree of autonomy, leading to a more satisfying workplace for employees, while the second is associated with the ergonomic improvements offered to employees by replacing physically demanding and repetitive work with various digital tools.

In creation of customer value through digital service capabilities, the human factor is a crucial part of the process (Saunila et al., 2018). Both human competence factors, such as knowledge and skills, as well as behavioral factors, such as motivation and attitude, affect how customer value is created through the use of digital services. Hence, in order to support and improve the use of new technologies by workers, Cijan et al. (2019), considers it necessary to reorganize training, programs and reward systems.

Waybill & Electronic Data Interchange (EDI)
In the transport and logistic industry, waybills have several important functions such as proving the existence of a transport contract between two parties and confirming that the consignment have been received for transportation and delivery (Cane et al., 2012). According to (Riksdagen, 2023), the waybill must contain the name and address of the sender, carrier, and consignee as well as the location and date of receipt of the goods by the carrier. In addition, the waybill must also provide information on the characteristic of the goods, such as the number of colli, whether the goods are of dangerous nature and whether special precautionary principles should be applied when handling the goods.

Although we live in a world today that makes extensive use of electronic information exchange via Internet, paper-based forms of interaction are still prevalent in the transport and logistics industry (Cane et al., 2012). According to Beecher (2006), problems related to the use of paper are growing every year and one of the main shortcomings is that the paper waybill, unlike a digital waybill, has to be physically transported with the goods. In addition to this shortcoming, according to Cane et al. (2012), it is common that sophisticated information systems are used in areas such as transportation planning, but the problem is that the entire system must wait for a signed paper waybill to be physically delivered to the node before it can be completed.

In the current state, there is a growing trend to replace paper documents with a system of computer-to-computer messaging (Schmitz, 2011). One application of this information technology is Electronic Data Interchange (EDI) which allows business partners to both send and receive commercial documents electronically instead of using paper documents (Bergeron & Raymond, 1992). According to Schmitz (2011), the aim with EDI is to provide a multi-user system that enables shipper, carrier, and other parties to achieve a completely integrated electronic commerce process in one single network. Bergeron & Raymond (1992) emphasize three main types of benefits that EDI can bring to an organization. Firstly, EDI allows organizations to save both money and time as it reduced processing time and thus operational costs. Secondly, this information technology allows organizations to offer improved service to their customers as EDI reduces both the number of errors and the transmission time of transactions. Finally, EDI enables firms to strengthen their competitive position as this information technology creates closer links between the company and its customers and suppliers. In addition, Gostic & Jereb (2015) emphasize that electronic documentation provides a range of benefits in terms of cost savings; speed; quality and reliability; visibility; simplicity; regulatory and environmental benefits. These benefits are described in more detail below:

- **Cost savings**: reduced transport and document management costs (which in turn reduce other costs, e.g., staff costs).
- **Speed**: enables transmission of information about the shipment in advance of its arrival at the destination.
- **Environmental**: the climate impact is improved by reducing paper consumption by several tons.
- **Quality & Reliability**: shipments are not delayed due to missing documents because electronic documents can not be stored, resulting in higher quality. Electronic data entry is also more reliable.

- **Simplicity**: as more and more actors in the supply chain use the same standards and processes, the flow of goods becomes more consistent, and execution is simplified.
- **Visibility**: electronic documentation allows for tracking and tracing shipments.

Despite the many benefits that EDI can provide to an organization, Schmitz (2011) states that replacing paper waybills with an EDI system is a transformation that faces many challenges in terms of legality. However, Schmitz (2011) further states that since EDI can provide a firm with so many benefits such as increased efficiency and reduced costs, it is worth accepting a certain degree of legal uncertainty until new laws are established and adapted to the new technology. In particular, traditions and commercial customs are no longer sufficient arguments to refrain from using EDI (Schmitz, 2011).

4. Empirical Findings

The following chapter presents the empirical findings from the interviews and observations at the Gothenburg and Stockholm terminals. The current state of each terminal is described in the respective sub-chapters, starting with a general description of the terminal. Thereafter, the flow of goods and all activities that are carried out from the moment the goods arrive at the terminal until they are loaded onto trucks. Each sub-chapter concludes with a summary of all support activities and the support roles on each shift. Finally, the information flows within the terminals are presented.

4.1 The Gothenburg Terminal

The Gothenburg terminal is part of the Gothenburg branch and transports goods to and from customers in the Gothenburg area. Gothenburg is the second largest city in Sweden with approximately 600 000 inhabitants (Göteborgs Stad, 2023). In 2022, the Gothenburg terminal handled approximately 892 000 domestic groupage shipments in total, of which the arriving shift handled 400 000. The terminal is of size XL and the groupage part of the terminal covers 9800 square meters. A total of 12 respectively 8 employees work during the arrival respectively unloading shift with the groupage flow. The permanent working force consists of full-time employees, except for one part time worker who works 80 %. In addition, the terminal has the possibility to contract temporary personnel on an hourly basis if needed (but must be offered at least 4 hours according to the contract).

The terminal building in Gothenburg encompasses both the handling of parcels and groupages. However, the terminal workers work either with groupages or the parcels and do not switch between the different flows. The parcel area and the groupage area are separated into different parts of the terminal. A simplified illustration of the groupage part of the terminal can be seen in *Figure 17*. Between the groupage area and the parcel area of the terminal is the notification area. In the notification area, parcels and groupages are temporary stored while the end customer is being notified that its shipment is at the terminal. The storage consists of both floor storage that is divided into different zones, marked with letters, and racking storage. The racking system has dedicated slots for parcels and groupages and each slot is marked with a letter and a number, e.g., E11. These placement codes facilitate the retrieving of goods as the forklift driver knows where the specific parcel or pallet is stored.

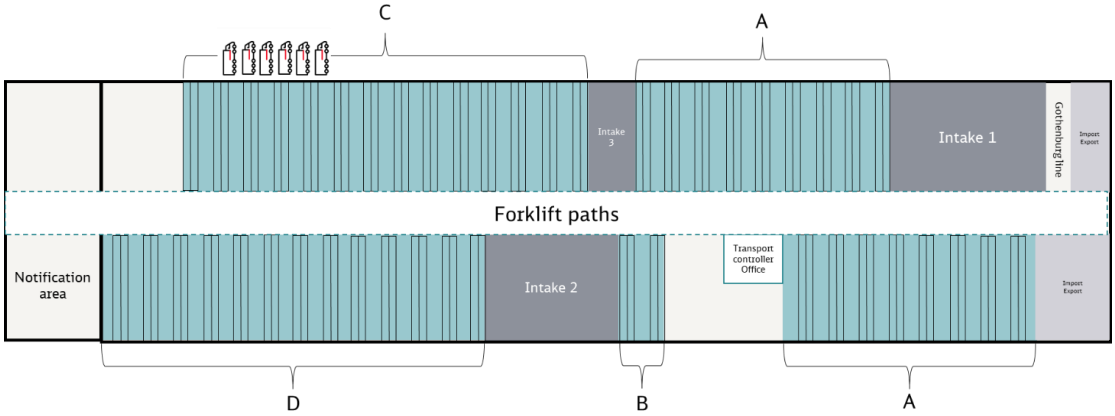

Figure 17: Layout of the Gothenburg terminal.

Along the long sides of the terminal building there are gates for incoming and outgoing trucks. There are three intake areas for arriving shipments, marked with gray in *Figure 17*, each dedicated to a specific set of trucks. The terminal is structured with so-called shipping lines, which are rows where goods are lined up for departure from the terminal. All shipping lines together forms the unloading areas, marked with blue in *Figure 17*. Each shipping line has a specific number which is used as a 'sorting code' when sorting incoming goods. A shipping line can either consist of one or two 'strings' that holds approximately 18 pallets each. In Gothenburg, most shipping lines has a unique sorting code for each string, see *Figure 18*.

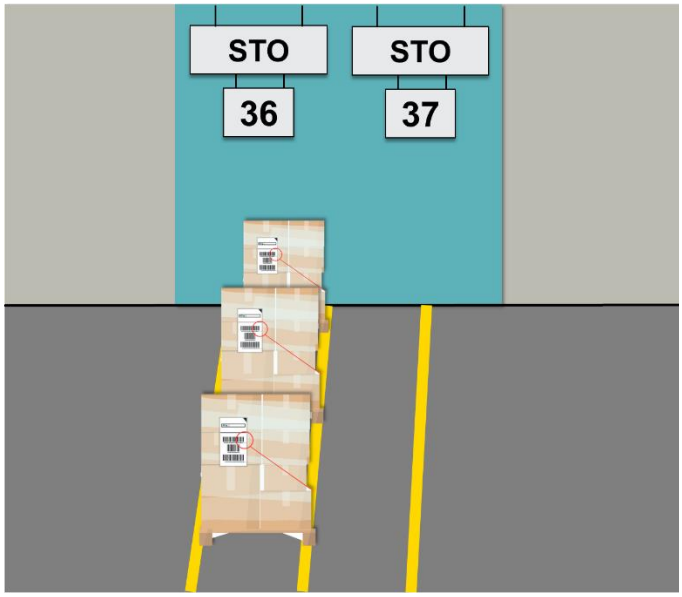

Figure 18: Illustration of a shipping line in the Gothenburg terminal.

The terminal is divided into the blocks A, B, C, and D, which are marked with signs hanging from the ceiling. This type of block allocation is used to facilitate the internal transportation, since it is easier to initially find the correct block rather than a specific number of a shipping line, when moving goods from the intake areas. The terminal also uses the different blocks to separate the area of responsibility of the hauliers. There are two main hauliers that share the responsibility of transporting goods to and from the terminal. TGM is responsible for all shipping lines in zone A, while BÅAB accounts for the shipping lines in zone C and D. A smaller haulier is responsible for one shipping line in zone B. As a result of numerous changes throughout the years, the order of the shipping lines numbers is not chronological. This non chronological order is presented in *Table 4* which shows which numbers the hauliers are responsible for.

Table 4: The division of shipping lines between the hauliers in Gothenburg.

TGM	BÅAB
A14, A65-A73	C15-C63, C76, C78 D41 – D63

In the middle of the terminal is the so-called transport controller office and outside the office the hauliers keep their compartment systems for organizing waybills. Activities such as coding waybills and planning the driving routes take place here. The compartments are labeled with a number corresponding to a specific shipping line in the terminal. As the order of the shipping lines are not chronologically, the organization of the waybills is neither. *Figure 19* is a replica of a picture of the actual order of part of the compartments.

Figure 19: The actual order for a number of the compartments.

In the Gothenburg terminal, three Check in Check out punching clocks are mounted for the terminals to punch in on. Besides the standard processes in CiCo (i.e., *Internal transportation*, *Long goods hall*, *Sorting and Consolidation*, and *Support*), the terminal uses an additional process, called *Other Services*. Other services are a new subprocess that have recently, approximately six months ago, been implemented in CiCo and have so far only been used by the unloading shift. This subprocess includes activities that support parts of the business that are not directly linked to the production in the terminal such as contacting customer regarding damaged goods or local damage prevention.

4.1.1 The flow of Groupages at Gothenburg terminal – from intake to unloading

This chapter describes how a groupage, often palatalized, travels within the terminal during the arriving and unloading shifts, and all operations occurring to move the groupage from the intake to the loading of a distribution truck. Arriving groupages are being handled during the night (the arriving shift) and early in the morning (the unloading shift). In the following subchapters, each step of the groupage flow is being described in more detail.

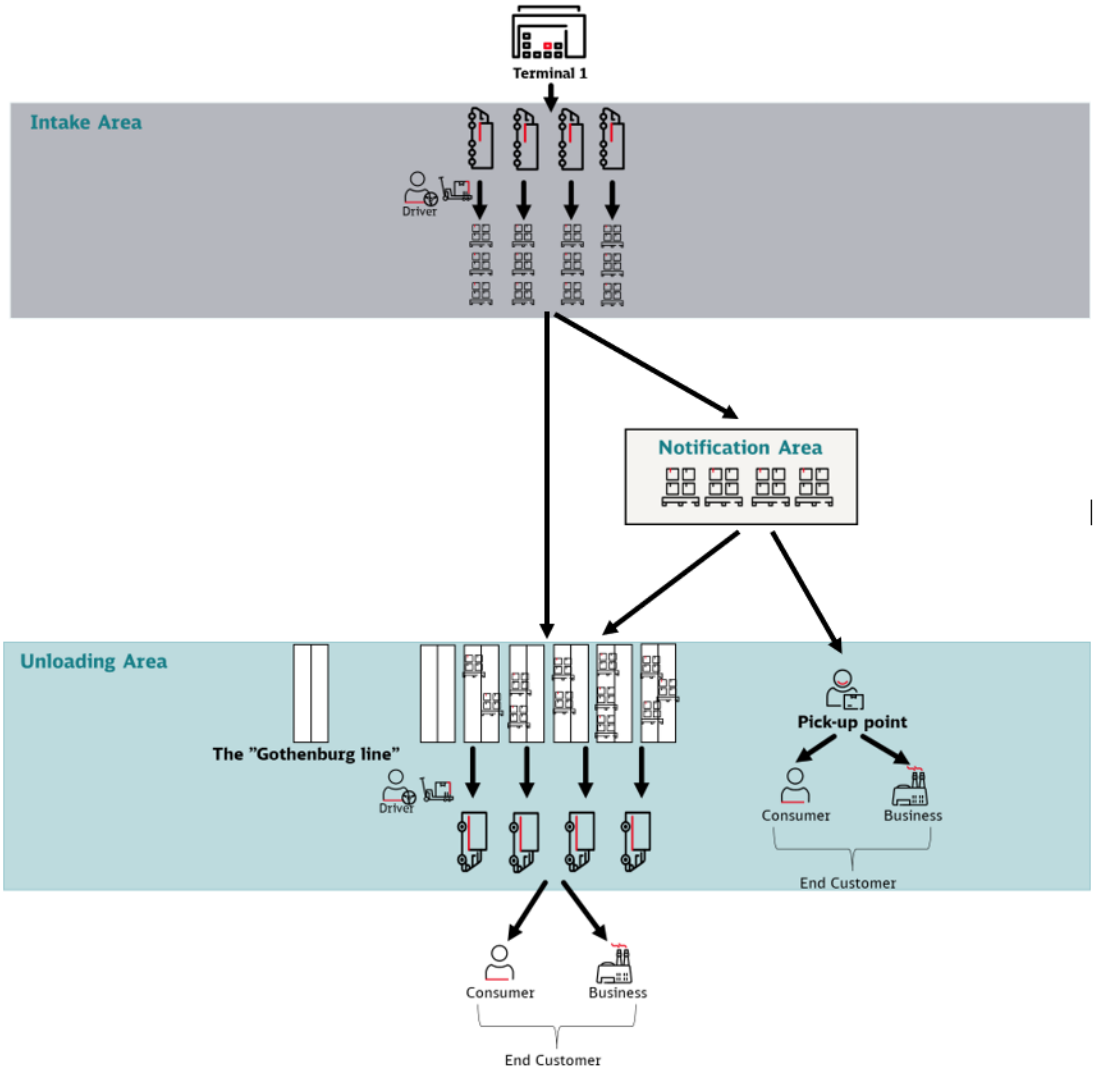

Figure 20: The possible paths by which a groupage can be moved within the terminal.

Figure 20 illustrates the possible paths in which a groupage can be moved within the terminal. In the most efficient and simplest case, the groupage is transported from the intake area directly to a shipping line at the unloading area. The groupage can also be transported to the notification area, waiting for the end customer (the recipient) to be contacted. From the notification area, the groupage can be transported to a shipping line for further distribution, or to the pick-up point in the terminal, where the end customer will come and collect the groupage itself. In *Figure 20*, the arrow between the notification area and the unloading area is double ended, this is because sometimes pallets are moved from the shipping line to the notification area, since the customer

(sender) must be contacted. The main reason for this is incomplete address to the end customer (recipient). In Gothenburg, one shipping line called "The Gothenburg line" is dedicated to pallets that cannot be delivered that day, but the recipient does not have to be contacted.

The Arriving Shift

Unloading of the linehaul trucks

The arriving shift normally starts around 9 pm, when the first linehaul truck arrives at the terminal. Linehaul trucks with goods from DB Schenker's other (departing, T1) terminals in Sweden arrive continuously throughout the night. The trucks are parked at the gates of the intake areas in the terminal and the driver walks to the transport control office to hand over all waybills for coding. While the waybills are being coded, the truck driver unloads the goods using a pallet jack and places them on the intake area in no particular order. Hence, colli belonging to the same consignment may not necessarily be placed together on the intake area. The driver registers that the goods have arrived at T2 using his/her handheld computer.

Coding the waybill and the pallet

Coding is carried out by a specific terminal worker i.e., 'Coder of waybills' who manually codes all waybills with a marker. This takes place in the transport controller office in front of a stationary computer. The waybills are pre-coded with the Manet code, however, according to the transport controllers, these are often wrong and must be checked. If the pre-printed code is correct, the terminal controller circles the correct code for clarification. Some waybills with a Manet code, lacks the second part of the code i.e., the digit part corresponding to a shipping line in the terminal. In these cases, N/A or some other letters chosen by the terminal are often used instead of numbers. The terminal, in agreement with the hauliers, has decided to leave these code fields free of shipping line numbers for two reasons:

1. *Two hauliers delivering to the same postcodes*:
   Firstly, since the two hauliers TGM and BÅAB share the delivery of goods to end customers in Gothenburg, it occurs that their areas of responsibility share the same postal code. Since the Manet code application is limited to sorting only by postal code, the manet code will assign the pallets to the same shipping line. This is despite the fact that the hauliers are responsible for different parts of the terminal and want the pallets addressed to the same postal code to be transported to different shipping lines. To avoid this problem, 'the coder of waybills' manually codes the waybills to makes sure the goods are being separated to their dedicated shipping lines.

2. *Large customers – Storkunder*:
   Secondly, the terminal in Gothenburg has 21 so-called *Storkunder* (translated to 'large customers' in English) who receive large deliveries that alone occupies entire shipping lines. Hence, the terminal wants to handle these pallets separately on their own line slots. However, since these large customers can be located at addresses with the same postal code as, for example, ten other smaller customers, the Manet code will assign all pallets to the same shipping line. To

avoid this problem, ‘the coder of waybills’ manually codes the waybills to makes sure the goods are being separated.

To assist this coding procedure, the terminal has developed its own Excel file in which it is possible to search the address or customer name and obtain the correct, dedicated shipping line code. When a waybill lacks a manet code completely or when a postal code is not connected to a manet code, ‘the coder of waybills’ searches for the correct line location. Currently, the terminal does not employ consistent preventative routines for following up which postal codes are not connected to a code. However, ‘the coder of waybills’ has worked for several years with coding of waybills and thus know several of the codes by heart. In addition, to searching for and writing the correct shipping line code, ‘the coder of waybills’ checks the waybill for any additional information about the shipment, such as premium, fix day, or that the customer must be notified.

When the coding of the waybill is done the truck driver places the corresponding paper waybill on top of the consignment. If a consignment consists of serval colli, the waybill is placed on top of one of them. In addition to the coding of the waybill, the corresponding groupage is also manually coded with the same sorting code on the side of the pallet.

”Coding” when the Manet code is correct.

Coding when the Manet code is replaced.

Coding the side of the pallet.

Figure 21: Different types of coding.

Control of incoming shipments

A transport controller inspects the incoming shipments and verifies that the consignments are complete i.e., the number of pallets corresponds to the number indicated on the waybill. If a discrepancy is detected, it is recorded in a handheld computer. If shipping documents are missing completely, a new waybill must be printed, and this is done by scanning the barcode on the freight label with the handheld computer. If the goods or packaging are damaged, the transport controller makes a complaint by scanning the pallet, taking a picture of the damage, writing the reason for the complaint, and signing the complaint in his/her handheld computer. The transport controller must also stamp the associated waybill with a physical stamp, tick the reason for the complaint (e.g., damaged packaging) and sign the paper waybill before handing it over to the driver, see *Figure 22*.

Figure 22: Replica of the complaint stamp and signature.

If the goods condition is too bad and cannot be loaded onto a distribution truck, they are transferred to the complaints department for further assessment. Sometimes it is sufficient to reload the goods onto a new pallet if, for example, the packaging is broken, but sometimes the claims department decides that the groupage cannot leave the terminal. In such case, the end customer must be contacted.

Internal transportation - Movement of goods with forklifts

Simultaneously as goods are being inspected and controlled, forklift drivers collect the inspected pallets and transports them to the shipping line whose number corresponds to the one on the waybill. If the shipment is to be delivered later than the following morning, it is not placed at the shipping line, but is instead delivered to the notification area. If the end customer has chosen the option to be notified when the goods has arrived at the terminal, or the customer has bought a fix day add-on service, the goods are being temporary stored in the notification area. When a pallet is placed here, the storage location (either a shelve slot or a floor zone) is written manually onto the waybill. The placement in the notification area is also registered in the handheld computer. The waybills are collected and handed over to Operation Center Land (OCL), the department responsible for contacting the end customer.

Placement of groupages at the shipping lines

The pallets are placed at the shipping line in the order in which the forklift driver arrives at the shipping line. Hence, the pallets are placed randomly. Until now the waybill has accompanied the consignments and at this stage all waybills are being collected as they are used by the haulier for route planning. The terminal workers place the bundle of waybills in a designated compartment, marked with the same number as the shipping line from which the waybills were collected. The organization of the trays is determined by the haulier and follows the order of the line locations, which is not in numerical order. According to the terminal workers, it can be time-consuming to find the right compartment to put the bundle of waybills in. However, since this procedure requires less than 15 minutes, the terminal workers, that are registered under the subprocess *Internal transportation* do not shift process to *Support*.

Support Activities and Roles during the Arriving Shift

In the previous section, some roles were mentioned that perform various support activities during the arriving shift. This section describes the responsibilities and tasks of these roles in more detail. The arriving shift consist of eleven terminal workers with one supervisor. The supervisor is a white-collar worker who reports directly to the Head of Department at the terminal. Important to note is that this supervisor is not registered under any subprocess in CiCo during this shift. Furthermore, the arriving shift has several predetermined roles that perform support activities. For these roles, it has been more or less decided in advance how each role should punch in during its shift.

- *Team leader:* there is one team leader during the arriving shift who is, just as the other terminal workers, a blue-collar worker. Compared to the supervisor, the team leader has no direct staff responsibilities. The team leader punch four hours on the subprocess Support in CiCo of his/her eight-hour shift. During these four hours, the team leader is located at the terminal's three different intakes to support the drivers' work.
- *Transport controller:* during the arriving shift, one terminal worker operates as a transport controller. The transport controller is registered on *Support* during their entire work shift corresponding to eight hours. The main responsibility of the transport controller is to inspect incoming shipments, coding goods and support drivers.

- *Coder of waybills:* one person is responsible for the coding all the waybills that are carried out in the office of the transport controller. The coder spends the entire work shift, corresponding to eight hours, registered under the subprocess *Support* in CiCo. In addition to this activity, this person also ensures that waybills are placed in the correct sorting compartment and carries out complaints.

- *Support for intake areas and writing complaints:* an additional terminal worker helps to support the three intake areas, coding goods and to write complaints, corresponding to eight hours *Support*. It is important to note that this employee only works four days a week, therefore corresponding to 32 support hour per week.

- *Notification operator:* one terminal worker is working on the handling and driving of notification goods to the notification area. As this worker has a lot of work to do, he or she is punched under *Support* for most of the night, corresponding to about eight hours.

In addition to the time these support roles spend on various support activities, all terminal workers on the arriving shift punch in to *Support* during the daily start-up meeting and monthly meetings. The daily start-up meeting takes approximately ten minutes while the monthly meeting last about one and a half hours.

The Unloading Shift

Route planning
A route planner from each haulier looks through the waybills compartments and manually sorts each bundle according to a recommended driving order based on the recipient's address.

Loading of the distribution trucks and supporting the drivers

The distribution trucks that will distribute the shipments to the end customers in the Gothenburg area arrive early in the morning, approximately at 6 am. The truck driver is responsible for loading the pallets into the truck by using a pallet jack. The driver loads the pallets according to the planned route i.e., the order of the waybills in the bundle (the consignments to be delivered last are loaded first). If a premium pallet is part of the string, it is prioritized. The transport controller checks that no premium groupage shipment or other groupage shipments with time requirements are being left behind. Transport controllers also support the drivers if problems arise. Examples of such problems are:

- *The driver cannot find the pallet corresponding to a waybill*. In such case, the transport controller helps the driver to search for the groupage. If the groupages are not found before the truck must leave, it can either be loaded onto another truck, or in worst case be left at the terminal. The transport controller is responsible for recording the abandoned groupages in the handheld computer. Common reasons why the driver cannot find a pallet are:
    - The forklift driver has, during the night, misplaced the pallet in the wrong shipping line, although the codes on the waybill and the pallet are correct.
    - The truck driver has put the wrong waybill on top of the pallet, resulting in misplacement by the forklift driver.
    - The pallet is placed at the correct spot but due to the human factor, the truck driver cannot find it.

  When searching for groupages in Gothenburg, the terminal uses pictures taken weight and volume machine, which is used during the departing shift and photographs the measured pallets i.e., 40 % of all incoming groupage shipments. The consignment number is entered in the weight and volume system in a stationary computer and a photograph of the lost pallet is displayed, facilitating the search as it is easier to find a pallet when knowing what it looks like.

- *The driver discovers a damage*. The transport controller then makes a reclamation in the handheld computer and stamp the associated waybill with a physical stamp, tick the reason for the complaint (e.g., damaged packaging) and sign the paper waybill before handing it over to the driver, see *Figure 22*. If the damage is too critical and the pallet cannot be loaded onto the truck, the pallet is transported to the reclamation department, as mentioned in the Control of incoming shipments section.

- *The driver needs help to stack two pallets on top of each other*. The drivers are only equipped with pallet jacks and must therefore ask the transport controller for help since they are equipped with counterweighted trucks.

- *The driver cannot load the pallet.* There are several reasons why a pallet cannot be loaded onto the truck:
    - The driver has information about the customer, such as the recipient's opening days, which allows him/her to know that the shipment cannot be delivered that day. Or the pallet is addressed to a small area to which the distribution trucks are not delivering to each day, and instead e.g., every other day. In these cases, the transport controller helps the driver to remove those pallets and places them on a separate shipping line called the "Gothenburg line", in anticipation of them being sent.
    - The recipient's address is incomplete. In such case, the recipient must be contacted, hence the transport controller helps the truck driver with moving the pallet to the notification area.

Support roles and activities during the unloading shift

In the previous section, some roles were mentioned that perform various support activities during the unloading shift. This section describes the responsibilities and tasks of these roles in more detail. Unique for the terminal in Gothenburg is that it uses an additional subprocess in CiCo called *Other Services*, besides the central ones i.e., *Internal transportation*, *Long goods hall*, *Sorting and consolidation*, and *Support*. During the unloading shift in Gothenburg, almost all terminal workers punch most of their activities under *Support* or *Other Services*. As the majority of the activities performed during the unloading shift are support activities, it is challenging for the unloading shift at the terminal in Gothenburg to have pre-determined roles and to map how much time each person spend on support as the time varies greatly from day to day. Furthermore, the unloading shift consists of a supervisor, but this person is not registered under any process during this shift. The supervisor is a white-collar worker who reports directly to the Head of Department at the terminal. Except for the supervisor, other roles in the terminal during this shift perform support activities. These roles are presented below:

- *Team leader*: The unloading shift consist of one team leader who each day check in for four hours of *Support.* These four hours include activities related to complaints, supporting drivers and customer service at the pick-up point as some end customers choose to collect their goods directly from the terminal. Unlike the supervisors, team leaders are blue-collar workers and are more involved in the production where they are responsible for distributing work and providing support when needed.

- *Complaints*: During the unloading shift, two terminal workers are responsible for handling complaints at the terminal and spends their working shifts registered under the subprocess *Support*. However, one of them is also

responsible for local damage prevention and is therefore registered under *Other Services* for two hours of the workday. Local damage prevention involves contacting and educating customers about loading pallets in a safe and correct way, in order to prevent future damages and accidents. To summarize, these roles together account for 14 hours of *Support* during each shift and two hours of *Other Services*. Furthermore, their common tasks include determining whether groupages with any type of discrepancy can be delivered to the customer. If the assessment is that the groupages cannot be delivered, they contact the end customer in order to find a joint solution. In addition to these activities, these workers can also support the production by, for example, conducting inspections to ensure that drivers have the correct waybills or ensure that the pallets are properly packed. Furthermore, searching for groupages are also under the responsibility of the terminal workers responsible for the complaints. Searching involves looking for missing goods in the terminal and it is carried out when a consignee has not received their goods or if the driver has a waybill where he/she cannot find the associated groupage.

- *Pick-up point*: The pick-up point is managed by a terminal worker (sometimes the team leader) who is punched in for eight hours under *Support*. The pick-up point's support activities include customer management and the collection and scanning of goods and parcels. There is no need for one person to be permanently located at the pick-up point due to the infrequent arrival of customers. Hence, this terminal worker carries a tablet that receives a notification when a customer is at the pick-up point and can thus perform support activities related to complaints while overseeing the pick-up point.

- *Transport controllers:* Four transport controllers perform support activities during the unloading shift, corresponding to four hours/worker in CiCo. The main duty of the transport controllers is to ensure that the loading of the trucks is properly prioritized, with premium shipments having the highest priority. Further, the transport controllers' task is to support the truck drivers when loading the trucks. For example, one of the support activities they perform is to register minor complaints in the handheld computer, such as for groupages whose packaging is broken but can still be sent to the end customer. Furthermore, this role's tasks also include the transportation of groupages to and from the notification area. Since movements of pallets to and from the notification area is a second handling of the pallet, this is not considered as Internal transportation, instead these transportations are registered as a support activity.

More general cleaning activities such as running a scrubbing machine are carried out during the departing shift at the Gothenburg terminal. Furthermore, in addition to the support activities mentioned above, waiting/idling time is also registered as *Support* because the terminal does not want it to affect its internal productivity of handling groupages. In order to avoid this scenario, the *Support* subprocess acts as a punching process for activities that do not belong elsewhere.

4.1.2 Summary of Support Roles, Support Activities, and their duration

In the following tables, the support activities performed by each role in the terminal in Gothenburg during the arriving and unloading shift are presented. Furthermore, the duration per shift and per week has been calculated and is displayed in two outermost columns of the tables.

Table 5: The support activities performed by each role during the arriving shift at Gothenburg's terminal and its duration.

Responsible role	Support Activities	Duration per shift	Duration per week
Team leader	Support drivers at intake areas	4 hours	20 hours
Transport controller	Inspect incoming groupages Coding groupages Printing waybills Searching	8 hours	40 hours
Coder of waybills	Coding waybills Sorting waybills Complaints	8 hours	40 hours
Support for intake areas and writing complaints	Support drivers at intake areas Coding groupages Writing complaints	8 hours	32 hours
Notification operator	Transportation of notification groupages Loading groupages Unloading groupages	8 hours	40 hours
All terminal workers	Daily start-up meetings (DM) Monthly meetings (MM)	DM: 10 min x 11 = 110 min (approx. 2 hours)	DM: 550 min (approx. 9 hours) MM: 15 min x 11 = 165 min (approx. 3 hours)
Total		**38 hours**	**184 hours**

Table 6: The support activities performed by each role during the unloading shift at Gothenburg's terminal and its duration.

Responsible role	Support Activities	Duration per shift	Duration per week
Team leader	Management of complaints Supporting drivers Customer service at the customer gate	4 hours	20 hours
Complaints	Evaluation of goods with discrepancies Contacting customers Checking waybills Inspecting packages Searching	14 hours	70 hours
Customer gate	Customer management Collection and scanning of goods and parcels Complaints	8 hours	40 hours
Transport controllers	Supporting drivers e.g., stacking pallets on top of each other with counterweighted forklift Complaints Printing waybills Searching Handling of abounded groupages Collect empty pallets Transportation of notification groupages Ensure prioritized groupages are loaded and not left behind	16 hours	64 hours
Total		**42 hours**	**194 hours**

4.2 The Stockholm Terminal

The Stockholm terminal is part of the Stockholm branch and transports goods to and from customers in the Stockholm area. Stockholm is the largest city in Sweden with approximately 985 000 inhabitants (Stockholms Stad, 2023). In 2022, the Stockholm terminal handled approximately 834 000 domestic groupage shipments in total, and 538 000 during the arriving shift. The terminal is of size XL and has a 15 000 square meters large groupage terminal building. A total of 23 respectively 9 permanent employees work during the arrival respectively unloading shift with the groupage flow. All employees are full-time employees working eight hours five days a week. In addition, the terminal has the possibility to contract temporary personnel on an hourly basis if needed (but must be offered at least 4 hours according to the contract).

The terminal is divided into several buildings and the groupage flow is handled in a separate building. The groupage terminal is divided into two blocks – North and South which handles volumes to the north and the south of the Stockholm area. A simplified illustration of the groupage terminal can be seen in *Figure 24*.

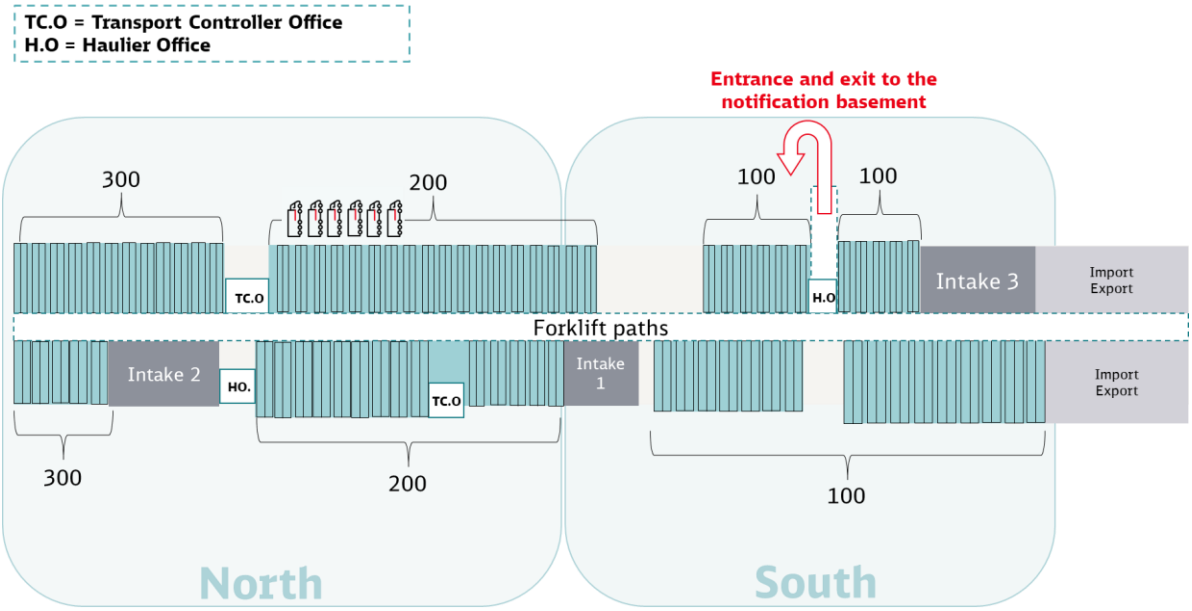

Figure 23: Layout of the Stockholm terminal.

Along the long sides of the terminal building there are gates for incoming and outgoing trucks. There are 3 intake areas, marked with gray in *Figure 24*, which are each divided into three zones: 100, 200, and 300. In zone 100, all pallets with a sorting code within the interval 100-199 are placed. While all groupages with a sorting code between 200-299 are placed in the 200 zone, and all groupages with a sorting code between 300-399 are placed in the 300 zone. This pre-sorting done by the truck drivers makes it easier for the forklift driver to plan their internal transport between the intake areas and the shipping lines at the unloading area, marked with blue in *Figure 24*.

A shipping line consists of two "strings" that hold approximately 18 pallets each. Furthermore, each shipping line has a specific number which is used as a ‘sorting code’ when sorting incoming goods. The shipping lines are in numerical order and the

terminal has three different zones with the interval of sorting codes of 100-199, 200-299, and 300-399. In Stockholm, most shipping lines uses both its strings due to large volumes, and the sorting code therefore corresponds to both strings. To separate the two strings with the same sorting code, each string is marked with a letter. E.g., shipping line 100 has two strings, 100A and 100B, as seen in *Figure 25*.

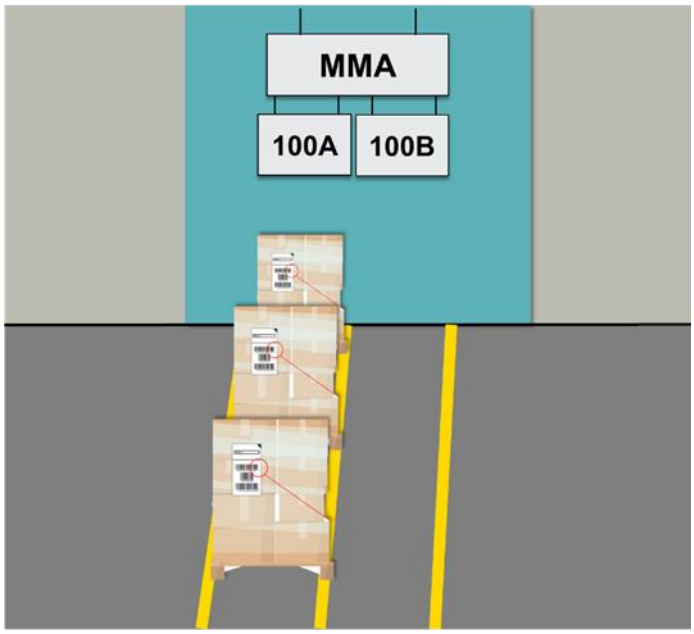

Figure 24: Illustration of a shipping line in the Stockholm terminal with two strings with the same sorting code, separated with the letters A and B.

The notification area is located in the basement of the terminal and can only be reached from the outside. Hence, when moving groupage to and from the basement, the forklift driver must leave the main terminal building on ground floor, and travel outdoors, regardless of season and weather conditions. It takes approximately 4-5 minutes to travel by forklift to the basement, one-way. Groupages that arrive at the terminal during the night and are not to be delivered the following morning are placed in the basement. This includes Fix Day and notification shipments. Furthermore, the notification basement is also operated as a pick-up point for customers to come and pick up their groupages by themselves. The storage space in the notification basement consist of shelving racks and each shelf slot has a specific location code that is a letter-number combination, e.g., E11.

There are two transport controller offices in the terminal in which the transport controllers code waybills. In addition, there are two haulier offices containing numerous compartments for waybills. DB Schenker's haulage company Schenker Åkeri is responsible for the smaller offices and for sorting the waybills into the correct compartments. Schenker Åkeri is the only haulier that operates during the arriving shift and is responsible for all transportations from T2 to end customer.

In the Stockholm terminal, a total of five Check in Check out punching clocks are mounted for the terminal workers to punch in on. Three of the punching clocks are located inside the main terminal area, one is located in the notification basement, and one is in the long goods hall. Besides the standard subprocesses in CiCo (i.e., *Internal*

transportation, *Long goods hall*, *Sorting and Consolidation*, and *Support*), the terminal uses an additional process, called *Arriving Notification*. Since Stockholm has its notification area in the basement, the terminal has been given its own subprocess in CiCo. The reason for this is due to the large amount of time spent on notification and the Stockholm terminal therefore wants to be able to distinguish those hours from other support hours.

4.2.1 The flow of Groupages in the Stockholm terminal – from intake to unloading

This chapter will describe how a groupage, often palatalized, travels within the terminal during the arriving and unloading shifts, and all operations occurring to move the groupage from the intake to the loading of a distribution truck. In the following subchapters, each step of the groupage flow is being described in more detail.

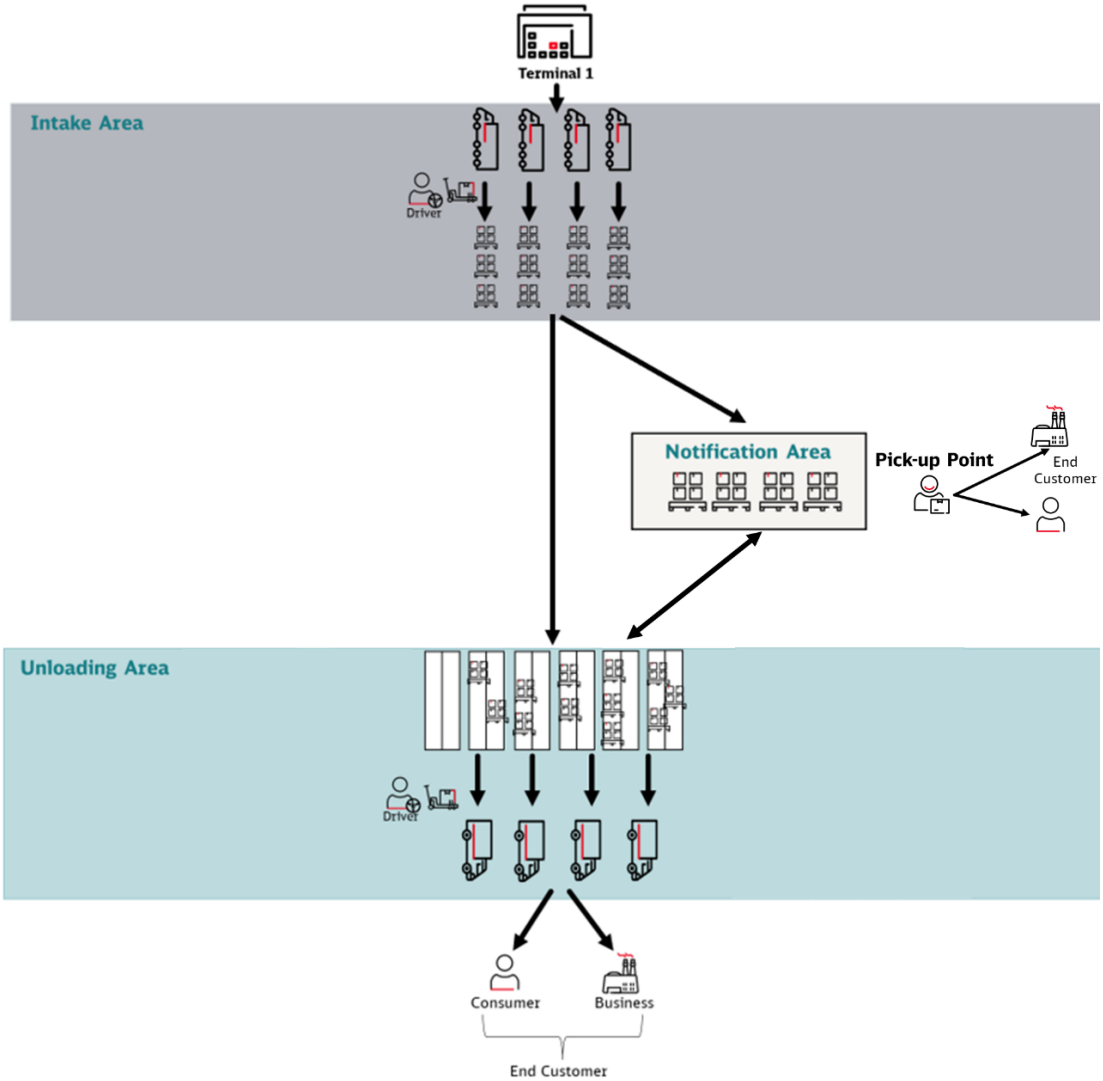

Figure 25: The possible paths by which a groupage can be moved within the terminal.

Figure 25 illustrates the possible paths in which a groupage can be moved within the terminal. In the most efficient and simplest case, the groupage is transported from the intake area directly to a shipping line at the unloading area. The groupage can also be transported to the notification area, waiting for the end customer (the recipient) to be

contacted. From the notification area, the groupage can be transported to a shipping line for further distribution, or to the pick-up point area in the terminal, where the end customer will come and collect the groupage itself. In *Figure 26*, the arrow between the notification area and the unloading area is double ended, this is because sometimes pallets are moved from the shipping line to the notification area, since the customer (sender) must be contacted. The main reason for this is incomplete address to the end customer (recipient).

The arriving shift

Unloading of the linehaul trucks

The arriving shift normally start around 9 pm, when the first linehaul truck arrives at the terminal. Linehaul trucks with goods from DB Schenker's other (departing, T1) terminals in Sweden arrive continuously throughout the night. The trucks are parked at the gates of the intake areas in the terminals and the driver walks to the transport controller office to hand over all the waybills to the two transport controllers for coding. When the waybills have been coded, the truck driver unloads the goods using a pallet jack and places them on one of the zones of the intake area. The driver registers that the goods have arrived at T2 using a handheld computer.

Coding the waybill and the pallet

Coding is carried out by the transport controllers which manually codes all waybills with a marker. Although the Manet code is printed onto the waybill, the transport controllers code all waybills manually since the font of the code is too small to read from a forklift, forcing the forklift driver to get off the truck to read the code. Stockholm has two *Storkunder* (large customers) who receive large deliveries that alone occupies entire shipping lines. Hence, the terminal wants to handle these pallets separately on their own shipping lines. However, since these large customers can be located at addresses with the same postal code as, for example, ten other smaller customers, the Manet code will assign all pallets to the same shipping line. To avoid this problem, transport controllers manually code the waybills to makes sure the goods are being separated. Some waybills with a Manet code, lacks the second part of the code i.e., the digit part corresponding to a shipping line in the terminal. Currently, the terminal does not employ consistent preventative routines for following up which postal codes are not connected to a code. For frequently recurring codes that lack a shipping line code, it happens that the terminal manager is contacted, in the absence of another person responsible for the task. To assist the coding procedure, the transport controllers use the Manet code application on the computer, in which they scan the waybill and the correct manet code appears on the screen. However, the terminal's current transport controllers have worked for several years with coding of waybills and thus know several of the codes by heart.

In addition to searching for and writing the correct shipping line codes, the transport controllers check the waybill for any additional information about the shipment, such as premium, fix day, or that the customer must be notified. When the coding of the waybill is done the truck driver places the corresponding paper waybill on top of the consignment. If a consignment consists of several pallets, the waybill is placed on top of one of them. In addition to the coding of the waybill, the corresponding pallet must also be coded with the same sorting code.

"Coding" when the Manet code is correct.

Coding when the Manet code is replaced.

Coding the side of the pallet.

Figure 26: Different types of coding.

Control of incoming shipments

The transport controllers inspect the incoming shipments and verify that the consignments are complete i.e., the number of pallets corresponds to the number indicated on the waybill. If a discrepancy is detected, it is recorded in a handheld computer. If shipping documents are missing completely, a new waybill must be printed, and this is done by scanning the barcode on the freight label with the handheld computer. If the goods or packaging are damaged, the transport controller makes a complaint by scanning the pallet, taking a picture of the damage, writing the reason for the complaint, and signing the complaint in his/her handheld computer. The transport controller must also stamp the associated waybill with a physical stamp, tick the reason for the complaint (e.g., damaged packaging) and sign the paper waybill before handing it over to the driver, see *Figure 27.*

Figure 27: Replica of the complaint stamp and signature.

If the groupages condition is too bad and cannot be loaded onto a distribution truck, they are transferred to the complaints department for further assessment. Sometimes it is sufficient to reload the goods onto a new pallet if, for example, the packaging is broken, but sometimes the claims department decides that the groupage cannot leave the terminal. In such case, the end customer must be contacted.

Internal transportation – Movement of goods with forklifts
Simultaneously as the transport controllers are inspecting and controlling the goods, forklift drivers collect the checked pallets and transports them to the shipping line whose number corresponds to the one on the waybill. If the shipment is to be delivered later than the following morning, it is not placed at the shipping line, but is delivered to the basement which operates as the notification area and stores fix day shipments and shipments waiting for the receiving customer to answer how and when they want the shipment to be distributed. The basement operator is responsible for receiving the pallets that are transported down to the basement and placing them in the shelves. Each slot has a code, and this is written on the waybill which is kept in the basement awaiting a response from the customer. The placement in the notification area is also registered in the handheld computer. The waybill is handed over to the office of Operation Center Land (OCL) which contacts the customer.

Placement of groupages at the shipping lines
Pallets are placed at the shipping line in the order in which the forklift driver arrives at the shipping line. Hence, the pallets are placed randomly. Until now the waybill has accompanied the consignments and at this stage all waybills are being collected by the block leader as they are used by the haulier for route planning. The majority of the shipping lines consist of more than one string and are therefore marked with letters. When collecting the waybills, the block leader writes the letter of the string in which the pallet is placed. This facilitates the searching of groupages in the shipping line for the truck driver, since he/she knows which string to search in. The block leaders place the bundle of waybills in one single tray for the haulier to collect later. The haulier is responsible for the organization and arrangement of the waybills into different trays that represents each shipping line.

The Support Activities and Roles during the Arriving Shift

- *Supervisors:* the arriving shift consists of two supervisors who each check in for eight hours of *Support*. Their support activities include start-up meetings, monthly meetings, scheduling, and staff responsibilities (e.g., performance appraisals and internal training programs). Furthermore, the supervisor's duties also include personnel responsibility for the staff at the unloading shift. In case of a major crisis in production, supervisors can step in for a few hours, but otherwise the intention is that the entire shift should be recorded as *Support*. The supervisors are white-collar workers who report directly to the Head of Department at the terminal.

- *Team leaders:* the arriving shift consist of two team leaders, who each check in for eight hours of *Support*. Unlike supervisors, team leaders are blue-collar workers and have no direct staff responsibilities. Instead, they are more involved in production where they are responsible for distributing work and providing support when needed. The team leaders carry out a part of the administrative work such as printing loading list and waybills, and correcting salaries. In addition, the team leader is also responsible for the terminal telephone. If it is necessary for team leaders to step into production, for example during periods of high absence, the aim is that this should be registered as

Internal transport. However, this is not always possible as team leaders are constantly interrupted in their work and thus it is not 'effective' *Internal transport*.

- *Transport controllers*: two transport controllers are working during the arriving shift who each register their entire shift (corresponding to eight hours) as *Support*. The main responsibility of the transport controllers is to inspect incoming shipments, coding goods and support drivers.

- *Block leader*: as the Stockholm terminal is divided into two blocks, North and South, the terminal consists of two block leaders performing several support activities in each block. Each block leader register approximately four to five hours *Support* each arriving shift. While the transport controllers are mainly responsible for support activities happening at the intake area, the block leaders perform support activities related to the unloading area. The block leaders collect all waybills from the groupages when they are placed at the shipping lines to hand over to the hauliers for route planning. The block leaders do also correct misplacements of pallets in the shipping lines, collect goods from the notification basement, and supporting drivers (e.g., searching for pallets).

- *Basement operator*: The Stockholm terminal stores all notification goods and valuables in the basement of the terminal. Hence, one lone terminal worker is responsible for handling the goods placed in the basement. The support activities carried out by this worker include scanning goods that are taken out of production to be notified and placing these in different racks as well as scanning out goods to be delivered at the customers expected delivery date. In total, these support activities represent eight hours of *Support*.

- *Transporter of notification goods*: One terminal worker is responsible for transporting notified goods between the terminal and the basement, which represents five hours *Support*.

- *Cleaner*: A terminal worker checks in at *Support* for two working hours each night shift when the scrubber is running to keep the terminal clean and tidy.

The Unloading Shift

Route planning
A route planner from each haulier looks through the paper compartments and sorts each bundle according to a recommended driving order based on the recipient's address.

Loading of the distribution trucks and supporting the drivers
The distribution trucks that will distribute the shipments to end customers in the Stockholm area arrive early in the morning, approximately at 6 am. The truck driver is responsible for loading the pallets into the truck by using a pallet jack. The driver loads the pallets according to the route i.e., the order of the waybills in the bundle (the consignments to be delivered last are loaded first). If a premium pallet is part of the

string, it is prioritized. The transport controller checks that no premium goods or other goods with time requirements are being left behind. Transport controllers also support the drivers if problems arise. These problems are similar to the ones in the Gothenburg terminal, namely:

- *The driver cannot find the pallet corresponding to a waybill.*

- *The driver discovers a damage.*

- *The driver needs help to stack two pallets on top of each other.* The haulier has its own forklifts in the terminal and can often solve this problem by themselves, but it sometimes occurs that the transport controller support with this.

- *The driver cannot load the pallet*. If this occur, the waybill will either be put in a tray marked "second loading" or a tray marked "next day" for the haulier to further look at and replan the route. If the goods can fit onto another truck they can be delivered the same morning. However, if the trucks are full, the goods are left by the shipping line for the next day's delivery. To avoid confusing these pallets with the departing shift's goods, their waybills are collected, and the pallets are marked with orange paper. These papers indicate the day they are to be unloaded. Stockholm follows the rule that no pallets without a waybill may be loaded onto a truck, so that the evening drivers do not take the wrong groupages with them. If the pallet must stay at the terminal for more days, due to e.g., uncomplete address to recipient, the pallet is transported to the notification basement. It is the block leader's responsibility to move the pallets to the new location. The transport controller takes the inventory of all compartments and inform OCL that in turn contacts the customer.

The support activities and roles during the unloading shift

- *Team leader*: the unloading shift consist of one team leader who check in for eight hours of *Support*. Since this shift takes place during the office hours, the team leader receives many phone calls and emails. Furthermore, this team leader also monitors deviations and urgent cases and then informs affected parties and follows up. Examples of such deviations can be high workload or damages. Additional tasks for this role are to reconcile with the previous shift and provide a fair handover to the next shift. In general, many of the work tasks are similar as for the team leader working during the night shift.

- *Transport controllers:* during the unloading shift, two transport controllers register their entire shifts as *Support*, corresponding to 16 hours in total. Contrary to the night shift, the transport controllers during the unloading shift carry out a daily inspection of abandoned groupages, follow up and contact customers in case of damaged groupages and provides new waybills. One additional, important support activity performed by the transport controllers is searching.

- *Block leader*: the unloading shift consist of two block leaders who, like the arriving shift, are responsible for different blocks in the terminal and register their entire shift as *Support*. The block leaders' carriers out a range of support activities such as: supporting drivers, searching goods, writing complaints, picking/printing waybills, driving goods up and down from the basement, emptying containers, collecting empty pallets from the shipping lines after the unloading, calibrating the weight – and volume machine and cleaning the unloading area.

- *Basement operator*: one terminal worker is also responsible for handling the groupages in the basement during the unloading shift. However, the tasks are slightly different from the arriving shift. *Support* activities during the unloading shift in the basement include scanning out notified goods to be put into production, taking inventory and customer support for customers coming to collect groupages that are temporary stored in the basement. These activities correspond to eight hours of support activities.

- *Cleaner*: during the unloading shift, one terminal worker who operates a scrubbing machine is logged on *Support* during the entire shift (eight hours). This worker's duties include scrubbing both the terminal and the basement as well as sweeping surfaces when needed.

In addition to the support activities mentioned above, waiting/idling time is also registered as *Support* because the terminal does not want it to affect its internal productivity of handling groupages. In order to avoid this scenario, the *Support* subprocess acts as a punching process for activities that do not belong elsewhere.

4.2.2 Summary of Support Roles, Support Activities, and its Duration

In the following tables, the support activities performed by each role in the terminal in Stockholm during the arriving and unloading shift are presented. Furthermore, the duration per shift and per week has been calculated and is displayed in the two outermost columns of the tables.

Table 7: The support activities performed by each role during the arriving shift at the Stockholm' s terminal and its duration.

Responsible role	Support Activities	Duration per shift	Duration per week
Supervisor	Meetings Scheduling Staff responsibilities	16 hours	80 hours
Team leader	Printing loading list Printing waybills Manage the terminal telephone Correcting salaries Supporting production in case of high absence CARE	16 hours	80 hours
Transport controllers	Coding waybills Checking waybills Checking groupages Writing complaints Supporting drivers at intake area	16 hours	80 hours
Block leader	Collecting waybills to hauliers Correcting misplacements of groupages in the shipping lines Collecting groupages from the basement Control work at shipping lines	9 hours	45 hours
Basement operator	Scanning in and out groupages from the notification basement	8 hours	40 hours
Transporter of notification goods	Transporting notified groupages between the terminal and the basement	5 hours	25 hours
Cleaner	Running the scrubber machines	2 hours	10 hours
All terminal workers	Daily start – up meetings (DM) Monthly meetings (MM)	DM: 10 min x 22 = 220 min (approx. 3,5 hours)	DM: 1100 min (approx. 18,5 hours) MM: 15 min x 22 = 330 min (5,5 hours)
Total		**75,5 hours**	**384 hours**

Table 8: The support activities performed by each role during the unloading shift at Stockholm's terminal and its duration.

Responsible role	Support Activities	Duration per shift	Duration per week
Team leader	Monitors deviations and contact affected parties Reconcile with previous and next shift Printing waybills Printing unloading lists Managing the terminal phone Phone calls E - mails	8 hours	40 hours
Transport controllers	Daily inspection of abandoned groupages Contacting customers Printing waybills Searching Writing complaints	16 hours	80 hours
Block leader	Searching Writing complaints Picking waybills Printing waybills Transport groupages up and down from the basement Collecting empthy pallets Cleaning the shipping lines	16 hours	80 hours
Basement operator	Scanning out groupages Taking inventory Customer support	8 hours	40 hours
Cleaner	Running the scrubbing machine Sweeping surfaces	8 hours	40 hours
Total		**56 hours**	**280 hours**

4.3 The Flow of Information

In addition to the flow of groupages, there is also a flow of information in the terminal. The information in the terminal is conveyed in two ways; either via the paper waybill and/or via the functions of the handheld computer.

4.3.1 The Paper Waybill

The paper waybill is a legal document and contains information about both the shipper and the recipient as well as information about the characteristics of the consignment, add-ons, consignment number, data and manet code, see *Figure 28*.

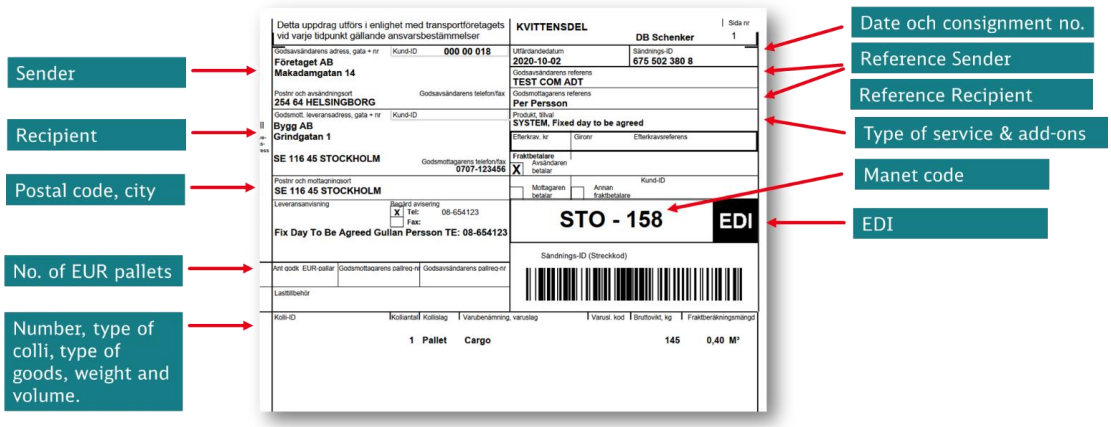

Figure 28: The information and design of a typical paper waybill in DB Schenker's terminal operations.

In addition to the existing information on the waybill, terminal workers add information to the waybill during its journey in the terminal. As mentioned in previous sections, the manet code is a source of information that is being read through the paper waybill. In addition, the waybill also provides information about if the manet code has been double-checked by the coder in the terminal, i.e., the code is circled or replaced by a new code, see *Figur 21 and 26*. Furthermore, if the groupage is placed in the notification area, the placement of the pallet is also coded onto the waybill, to facilitate the retrieving. Currently, the waybill is also used by OCL to contact the recipient if additional information is required for notification. Complaints stamps and signatures are additional important sources of information that the waybill provides. When searching for 'lost' groupages, the waybill is read, as it provides information about the characteristics of the pallet and facilitates the search. Furthermore, the waybill is used for route planning and is the basis for drivers to load the truck. In addition, the paper waybill also provides information about the status of the consignment in the terminal depending on whether it is placed on top of the consignment or not. For example, if the waybill has been collected from the associated pallet at a shipping line in the unloading area, it is an indication that the consignment is ready to be loaded by a driver who has not yet arrived. The prerequisite for route planning is that the waybills have been collected from the associated pallets. Hence, if the waybill is still on top of the pallet, the consignment is not ready to be loaded onto a truck.

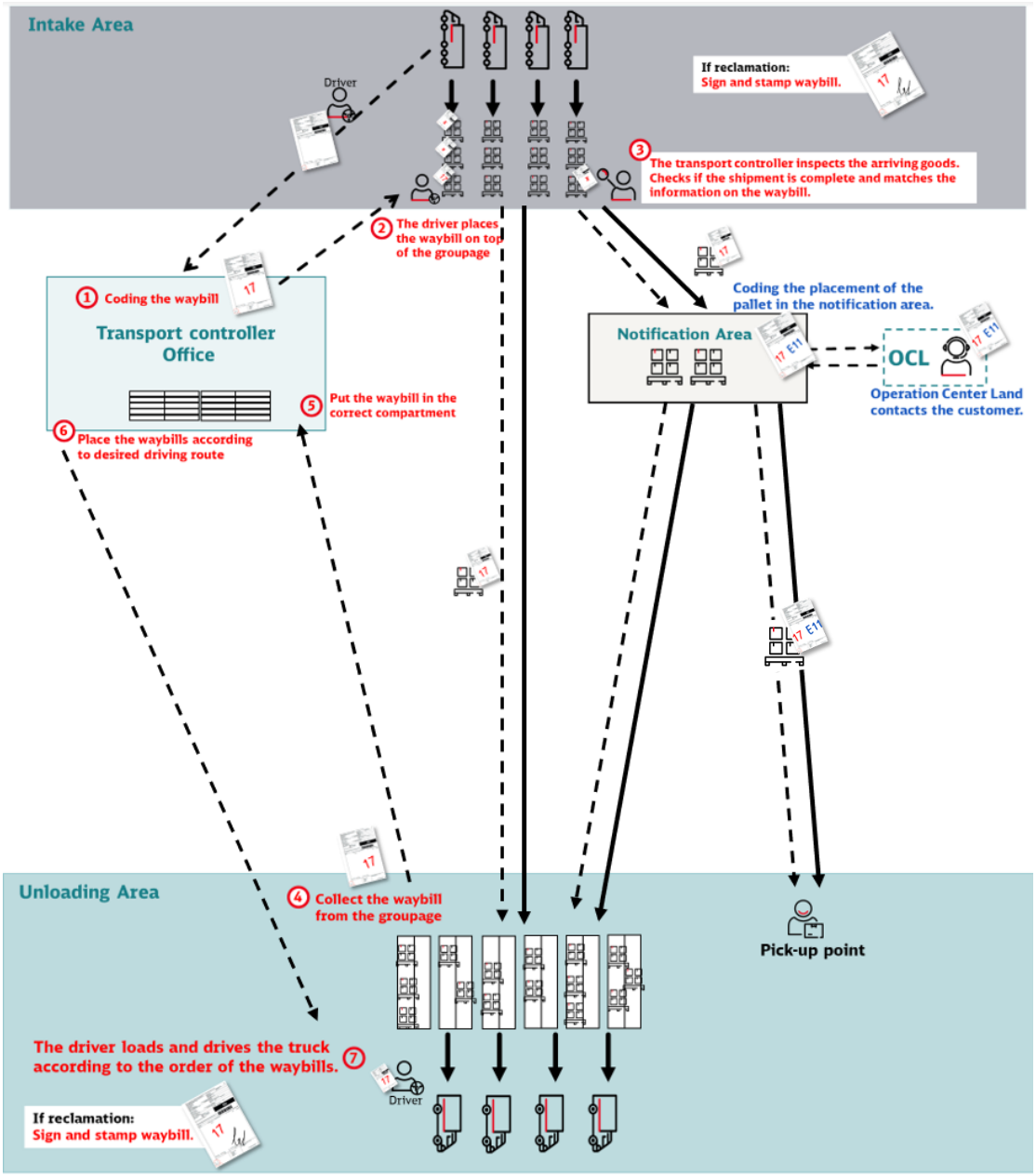

Figure 29: The flow of paper waybill and the groupage (dotted line: movement of waybill, solid line: movement of groupage).

As seen in *Figure 29*, there are several activities carried out in relation to the waybill. Following, each step is explained further:

1. After the driver has left the waybills at the transport controller office, the paper waybills are being manually coded.
2. The driver places each (coded) waybill on top of the corresponding pallet.
3. The transport controller inspects the incoming goods by checking the waybill and manually codes the side of the pallet. As the forklift driver picks up a pallet, the waybill is transported on top of it to the shipping lines.
4. The waybill is collected from the pallets that now are lined up at the shipping line and is brought to the transport controller office.

5. The waybills are put in the correct paper compartment that corresponds to the shipping line from which the waybills were collected (and the sorting code stated on the waybill).
6. The bundle of waybills in each compartment is manually sorted and placed in a desired shipping route by the haulier. When the bundle is sorted, it is re-placed in the compartment for the driver to collect when he/she arrives.
7. The driver collects the bundle of waybills and based on the order of the waybills; he/she loads the truck.

The steps described above represents the happy flow. However, if the pallet is to be temporarily stored in the notification area the flow of the waybill looks a bit different from step number 3 onwards. The information flow of the waybill in each terminal is illustrated in *Figure 30* (Gothenburg) and *Figure 31* (Stockholm).

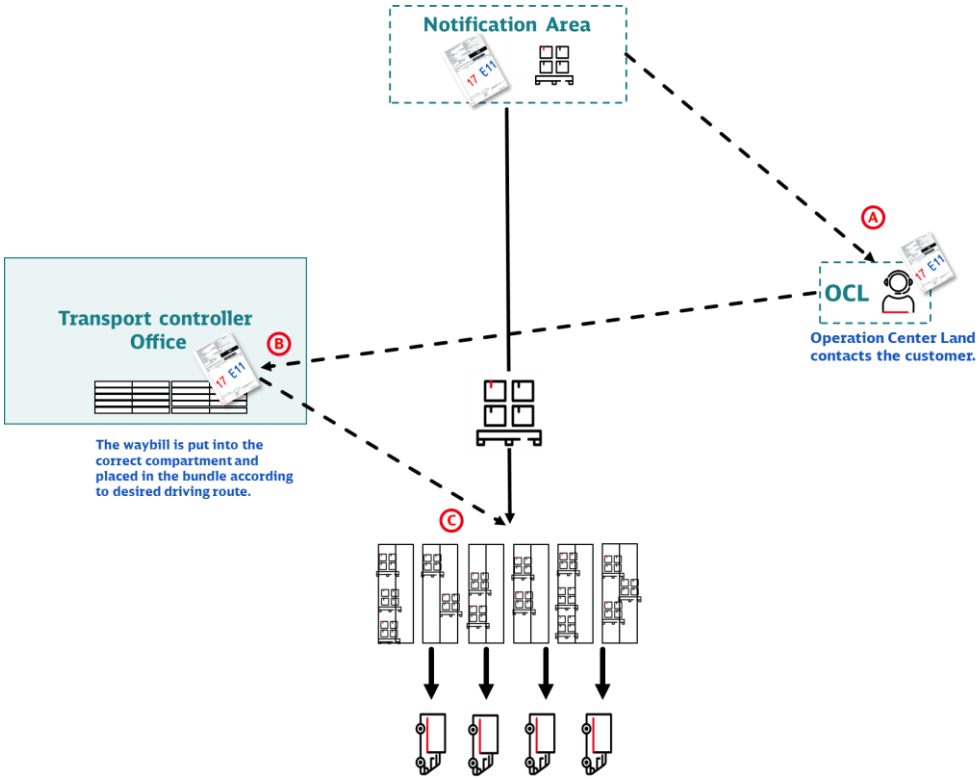

Figure 30: The movement of the paper waybill in Gothenburg (if notification occurs).

- As the forklift driver picks up a pallet, the waybill is transported on top of it to the notification area. The placement in the notification area is manually written onto the waybill.
- (A) The waybill is handed over to the office of Operation Center Land (OCL) which contacts the customer. OCL is dependent of all complementary information on the waybill to contact the customer. If the notification was customer-requested at the time of order placement, OCL does not rely on the waybill to contact the customer, as all information is available electronically.
- (B) When the customer has been contacted and an agreed delivery solution has been found, the OCL leaves the waybills in a compartment in the transport controller office, which is then collected by the terminal staff who in turn sort

them into the hauliers' compartments. The bundle of waybills in each compartment is manually sorted and placed in a desired shipping route by the haulier. When the bundle is sorted, it is re-placed in the compartment.

- (C) The driver collects the bundle of waybills and based on the order of the waybills; he/she loads the truck.

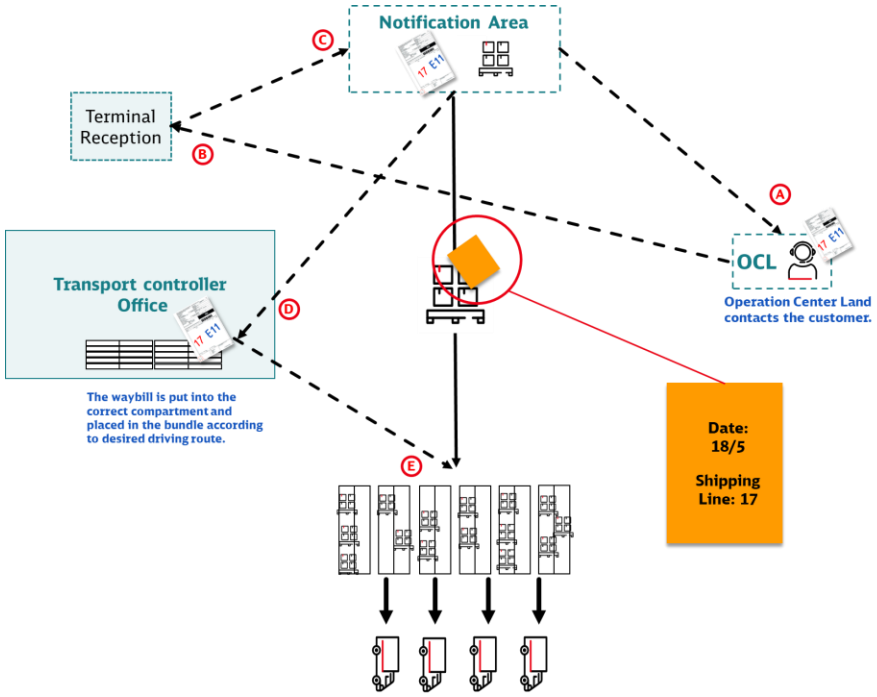

Figure 31: The movement of the paper waybill in Stockholm (if notification occurs).

- As the forklift driver picks up a pallet, the waybill is transported on top of it to the notification basement. The placement in the notification basement is manually written onto the waybill.
- (A) The waybill is handed over to the office of Operation Center Land (OCL) which contacts the customer. OCL is dependent of all complementary information on the waybill to contact the customer. If the notification was customer-requested at the time of order placement, OCL does not rely on the waybill to contact the customer, as all information is available electronically.
- (B) In a designated compartment at the terminal reception, OCL leaves the waybills of the shipments to be collected from the notification basement.
- (C) These waybills are collected during the day and read by the basement operator. The basement operator marks the shipments to be sent to the shipping lines with an orange label (indicating the shipping line code and the delivery date).
- (D) The waybill does not follow the pallet but is collected and placed in the haulier's compartment.
- (E) The driver collects the bundle of waybills and based on the order of the waybills; he/she loads the truck.

4.3.1 The Handheld Computer

Figure 32: The handheld computer

The handheld computer was developed to simplify and improve the efficiency of the terminal operations by digitizing some analogue processes. The handheld computer has been in use for over 20 years since its first edition was introduced, and two years ago (2021) many functions were updated to facilitate and improve terminal operations. The handheld computer is a small tablet that possesses the technical functions of scanning barcodes, taking photos and has a touch display that allows writing with your finger. The handheld computer is equipped with a range of functions that are listed below:

Table 9: List of functions in the handheld computer.

Functions for obtaining information		
Function	**Description**	**Information**
Shipment details	Provides information about the shipment. How: Scanning the barcode i.e., shipment number	-Sender and recipient -Weight, volume & loading meters -Product type (e.g., Premium) -Add-ons (e.g., fix day or notification) -Icon (e.g., dangerous goods icon) -Number of colli - List of all colli numbers
Status request	Provides information and status of the shipment and tells you what events have been recorded. Example of event: "Completed notification".	-Departing terminal -Arriving terminal -Weight, volume & cubic meters -Last event -Time of last event -Terminal for last event
Manet Code Application	Provides a two-parted sorting code that is connected to a postal code. How: Scanning the barcode i.e., shipment number	Part 1: Which T2 terminal the good is addressed to. Part 2: Which shipping line in T2 the groupage is addressed to.
Functions for recording information		
Function	**Description**	**Information**
Abandoned Groupage	Used to record groupages that have been left at the terminal.	- Cause - Placement
Searching	Used to search for groupages that is missing.	- Start searching (requires scan of waybill) -Status request
Notification In	Used to record the entry of groupages to the notification area and register the position.	- Cause - Location - Number of colli
Notification Out	Used to record the withdrawal of groupages from the notification area.	-Cause
Complaints	Used to register complaints if a good or the packaging are damaged.	-Responsible process -Type of goods -Transport number -Image -Comment -Signature
Pick-up/Drop-off	Used to record pick-up or drop-off of goods at the pick-up point.	Scan the barcode i.e., shipping number.

Handheld computers used in terminals are called C2T (Connect to terminal) while the handheld computers used by hauliers and drivers are called C2D (Connect to drive). Currently, these two systems are not connected to each other, resulting in the information recorded by the terminal workers in the C2T handheld computer is not communicated to the drivers. For example, when a terminal worker records a complaint in the handheld computer, the driver is unable to see it the his/her handheld computer.

5. Analysis

The analysis chapter starts by analyzing which of DB Schenker's activities are classified as support activities and should be registered under Support in CiCo. Following, an analysis of the main reasons behind the large amount of time spent on support activities.

5.1 Classification of Support Activities

There are two parameters by which DB Schenker defines a support activitiy. The first parameter is that a support activity is not value adding, which according to Gibbons (2010) means that the customer is not expected to pay for it. The second parameter that determines if an activity is a support activity is whether it is linked to volume i.e., a support activity is performed in relation to the handling of a groupage and/or increases in time if the groupage volume increases.

DB Schenker's customers are companies and private individuals who want to ship products to other companies or consumers, i.e., the end customers. Hence, DB Schenker's customers are expected to pay for the logistics activities needed to ship their products to their customers. In DB Schenker's terminals, these activities are sorting incoming shipments for further transportation, and different types of storing pending delivery (e.g., fix day shipments or notification shipments) which are both common terminal activities, according to Lumsden et al., (2007). Thus, non-value adding activities are all other activities that take place in the terminal that do not directly contribute to DB Schenker's customers shipping their products to the end customer and are hence not expected to be paid for.

Based on the illustration of CiCo in *Figure 9*, a framework has been developed to classify DB Schenker's support activities, see *Figure 29*. If an activity is considered non-value adding and is related to the groupage volume, it should be registered under the subprocess *Support* in CiCo. Activities that are both value adding and relate to the groupage volumes being handled in the terminal, belong to the left-hand side of the illustration with other value adding activities registered under the subprocesses *Internal transportation, Long goods hall* or *Sorting & Consolidation* are in CiCo. Other activities that are not related to the groupage volume should instead be registered under *Terminal Admin*, which is a completely different process category in CiCo and considers time that is not related to neither the handling of groupages nor parcels.

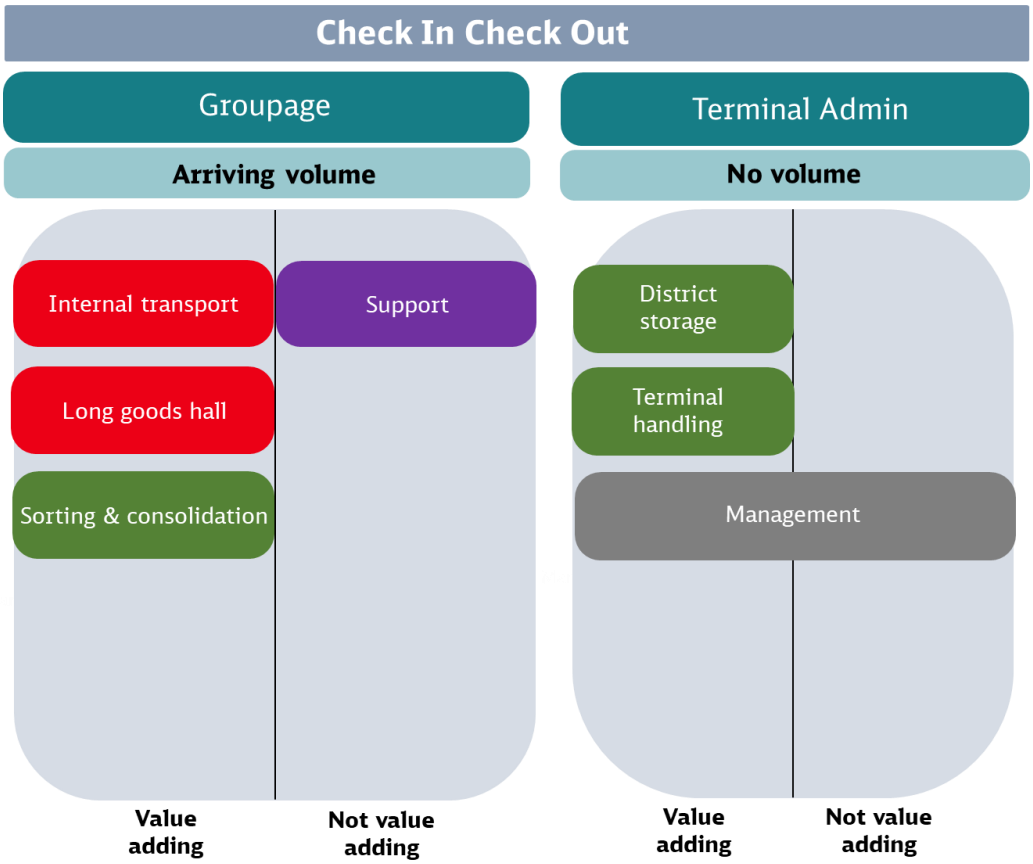

Figure 33: A framework of how an activity should be registered in CiCo.

Based on the summaries of support activities and their time spent at each terminal, see *Tables 5-8*, seven different categories of activities were identified; (1) Activities related to the paper waybill (2) Support of drivers (3) Quality Inspection (4) Leadership activities (5) Meetings (6) Cleaning and facility maintenance (7) activities related to add-on services. *Table 10* illustrates these categories of activities and the associated support activities.

Table 10: Support activity categories.

Activity Category	Support Activity
(1) Activities related to the paper waybill	- Coding of waybills and groupages - Printing waybills - Collecting waybills - Sorting waybills into the paper compartments
(2) Support of drivers	- Searching - Complaints - Stacking pallets on top of each other - Correcting misplacement of groupages in the shipping lines - Handling of abandoned groupages
(3) Quality Inspection	- Inspect incoming groupages - Ensure prioritized groupages are loaded and not left behind
(4) Leadership activities	- Scheduling - Staff responsibilities - Printing loading list - Terminal phone, e-mail - Correcting salaries - Supporting production in case of high absence - CARE - Reconcile with previous and next shift
(5) Meetings	- Start-up meetings Monthly meetings
(6) Cleaning and facility maintenance	- Running the scrubbing machine - Sweeping surfaces - Collecting empty pallets - Cleaning the shipping lines
(7) Activities related to add – on services	- Transportation of notification groupages - Transportation of Fix Day groupages - Scanning in and out groupages from the notification basement

Activities related to the paper waybill & Support of drivers

Activities related to the paper waybill includes the coding of waybills and groupages, printing waybills, collecting waybills from the shipping lines, and sorting waybills into the correct paper compartment for route planning. These activities are related to volume since each waybill corresponds to a groupage shipment. Additionally, the greater the volume handled at the terminal; the more waybills circulate in the information flow. Similarly, activities related to driver support at the intake and unloading areas are also related to the groupages, such as searching for missing pallets, conducting complaints on damaged groupage, correct misplaced pallets, and stack pallets on top of each other. Furthermore, activities related to the paper waybill and driver support are non-value adding, as the customer is not expected to pay for the performance of these (Gibbons, 2010). Hence, *Activities related to the paper waybill* and *Support of drivers* should continue to be registered under the subprocess *Support* in CiCo.

According to Gibbons (2010), there are two types of non-value adding processes; non-value adding (NVA) which are pure waste, and necessary non-value adding (NNVA). Activities such as manually coding waybills that already has a correct manet code is an example of an activity that is considered over processing, which is one type of pure waste, according to Liker (2004). Other activities, such as printing new waybills or searching for missing groupages are necessary non-value adding activities, as without them the process cannot be completed, and the customer will not receive their goods.

Quality inspections

DB Schenker performs several activities related to quality control, such as inspecting incoming groupage shipments and ensuring that the priority order is followed during unloading. Quality inspections are linked to the size of handled volumes as the inspection is conducted on incoming and outgoing groupages. Furthermore, according to Shou et al. (2020), quality inspection is a necessary non-value adding activity. Thus, *Quality inspection* activities are support activities and should continue to be registered under the subprocess *Support* in CiCo.

Leadership activities

Currently, all team leaders in both Gothenburg and Stockholm punches in on *Support* in CiCo. In Stockholm, the supervisors also record their worked time under *Support*, while the supervisors in Gothenburg do not register their time in CiCo at all. Current support activities that are categorized as leadership activities include scheduling, responsibility for the terminal phone, responding to emails, payroll management, and other personnel responsibilities such as appraisal meetings. These activities are not carried out for a groupage and is conducted regardless of the variation of volumes in the terminal. Hence, *Leadership activities* are not related to volume which implies that leadership should not be registered under *Support* in CiCo. Instead, this analysis indicate that leadership activities should be registered under the process category *Terminal Admin*.

Furthermore, according to Dombrowski & Wullbrandt (2019), leadership is a value-creating activity, which further argues that leadership activities should not be classified as support activities. In all DB Schenker's terminals, the team leaders are blue-collar workers and work alongside the terminal workers on the shop floor. The presence of the team leaders is, according to Dombrowski & Wullbrandt (2019), considered value creation within the lean leadership philosophy as the team leader can lead from below. In addition, in DB Schenker's terminals there are several levels of management: terminal managers, terminal department managers, supervisors, and team leaders. This way of organizing the management is aligned with the Toyota Way of leaderships, which according to Liker et al., (2012) focuses on value-creation and explains that leadership is not a personal issue and should therefore be present in all levels of the company.

Meetings

Daily 10 minutes start-up meetings are conducted in the DB Schenker terminals, held by the shift supervisor. The purpose of the start-up meetings is to inform the employees about the expectations and previous days results, and delegate tasks. DB Schenker's daily meetings are carried out every day, regardless of groupage volumes, which indicates that meetings should be recorded under the *Terminal Admin* subprocess. Bagire et al. (2015) stress the importance of time management and keeping a meeting

short and purposeful, in order to obtain efficiency and to be necessary. The short duration and the informative nature of DB Schenker's start-up meetings indicate that they are carried out in an efficient manner. In addition, according to Stray et al. (2016), meetings provide team members with a good overview of the work of other team members and are necessary to create awareness and information exchange, and therefore meetings are necessary for successful collaboration among staff. Hence, daily meetings can be considered necessary. However, DB Schenker's customers are not expected to pay for meeting time, thus meetings can be considered as more or less necessary non-value adding activities.

Cleaning and facility management

The DB Schenker terminals have daily cleaning routines and perform cleaning activities such as running the scrubbing machine and collecting empty pallets that's been left on the shipping lines after the unloading. According to Li et al. (2022), cleaning is necessary to remain a healthy working environment, as industrial production processes generate dust pollution. Furthermore, Hassan (2013) explains that keeping the workspace clean is necessary in order to reduce the number of defects. However, the customer does not expect to pay for cleaning, thus cleaning activities can be seen as necessary but non-value adding activities, according to Gibbons (2010). In addition, higher groupage volumes lead to more activity in the terminal, which could lead to more dust, based on Li et al. (2022) statement that industrial production generates dust. It could therefore be assumed that there is a correlation between the number of groupages handled and the amount of cleaning required. Further, it can also be assumed that the greater volume of groupages the more empty pallets are left at the shipping line. Based on DB Schenker's parameters when defining support activities, cleaning should preferably remain registered under the subprocess Support in CiCo.

Activities related to add-on services

According to Shou et al. (2020), it has become increasingly important for companies to add value to their products and services by offering additional options/features. DB Schenker's customer, the shipper, has the option to pay extra for add-on services, such as predetermine a fix day of delivery, or notifying its end customer when the shipment has arrived at the terminal, to allow the end customer to choose delivery date/time or pick-up at the terminal. According to Gibbons (2010), the fact that Schenker's customer is willing to pay for add-on services indicates that all activities associated with these options are value added. These activities include i.e., moving groupages to and from the notification area, take inventory of the notification area, and customer service at the pick-up point.

In addition, these activities related to add-on services are linked to volume because the add-on services are performed on groupage shipments. Since these activities are both considered value adding and are related to volume, there is an indication that these should not be classified as support activities. Instead, activities related to add-on services should belong to the lefthand side of the framework, where the other value adding activities are. In Stockholm, a separate subprocess called *Arriving notification* has been designed to distinguish the time spent on activities related to the add-on services from other subprocesses in CiCo (i.e., internal transportation, sorting and consolidation, and support), unlike in Gothenburg where these activities are registered as *Support*. Inspired by Stockholm's way of working, there is an alternative for

Gothenburg to separate their time spent on add-on services from the *Support* subprocess and create a new separate subprocess.

In addition to cases where DB Schenker's customer has requested and paid for a notification, groupages can sometimes end up in the notification area for other reasons e.g., insufficient recipient address. Since customer requested and paid notifications represent a majority of all notifications, all activities related to notification are considered value adding.

5.2 Main Reasons to the Large Amount of Time spent on Support

From the empirical findings, it is possible to distinguish three main reasons why DB Schenker spends significant time on *Support*. By analyzing the support activities performed at each terminal, it is clear that the ***management of the paper waybill*** plays a crucial role and represents a large proportion of the activities registered under the *Support* subprocess. *Figure 27* also shows that the number of waybill movements is significantly higher than the number of groupage movements. Further, *Figure 30* and *31* illustrates the complexity of the information flow if notification occurs and OCL must be involved. Hence**,** the management of the paper waybill can be seen as one of the main reasons behind the substantial time spent by the terminals in Gothenburg and Stockholm on support activities. Furthermore, by studying *Tables 5-8*, it is possible to get an instant idea of how many hours each role records under the subprocess *Support*. The predetermined duration indicates that the pre-defined roles have been given instructions on how long they should be registered as *Support* during each shift, which in turn suggests that the punching in CiCo is not done in a dynamic way. Hence, the data from CiCo is not entirely consistent with what happens in the production. Thus, the ***non-dynamic way of working*** could be seen as a second main reasons behind the large amount of time spent on *Support*. In addition, *Tables 5-8* indicate that the activities registered under *Support* differ between Gothenburg and Stockholm, which suggests that there are local interpretations of what should be registered under *Support*. Consequently, ***too general central guidelines*** can be seen as the third main reason behind the substantial time spent on *Support*.

5.2.1 Management of the Paper Waybills

In the current state, DB Schenker uses paper waybills, which according to Beecher (2006) cause increasing problems every year. For example, unlike digital waybills, paper waybills must be physically transported with the goods, which can lead to disruptions in the flow. In addition, Cane et al. (2012) highlight that it is common for an entire system to have to wait for a signed waybill to be physically delivered to a node before it can be completed. These challenges suggest that the paper waybill becomes a bottleneck in DB Schenker’s flow of groupages, causing waiting time, which Liker (2004) states is a form of waste. For instance, in both the Gothenburg and Stockholm terminal, groupages cannot be transported to their shipping lines until their corresponding waybills have been coded manually. In the case of Stockholm, it also means that some drivers cannot start the pre-sorting of pallets at the intake area (in zones 100, 200, and 300) because they depend on all the waybills being coded.

The Waybill's Generation of Redundant Work and Support Hours

As mentioned above, both terminals use manual labor to code the waybills by hand, although both the waybills and the groupages themselves are already marked with a sorting code from DB Schenker's application Manet. As stated in *Tables 5 & 7*, the coding activity requires a significant amount of time in both the Gothenburg and the Stockholm terminal. According to Liker (2004), one type of waste is overprocessing, which the author refers to as processing a product more than necessary. In DB Schenker's case, it can be suggested that the manual coding of already pre-coded waybills is over-processing, especially if the manet code is correct. This is the case in the Stockholm terminal, in which most manet codes are correct but waybills are still re-coded since the forklift drivers find the font of the manet code too small. Hence, if the sorting (manet) code could be more clearly stated on the waybill, the manual coding would be extensive in the Stockholm terminal.

However, one reason for re-coding the waybills is due to incorrect sorting codes, which appeared to be most prevalent in the Gothenburg terminal. In such case, the manual coding is necessary in order to complete the process of moving groupages to the correct shipping line. However, the interviews and observations revealed that the terminals lack consistent preventative routines for tracing and correcting incorrect codes. Thus, incorrect codes will appear over and over, which according to Liker (2004), can be classified as waste as the customer does not expect to pay for the time spent correcting sorting codes. In addition, sometimes the terminals want to make a more detailed sorting of the groupages than sorting based on postal code e.g., based on customer number or street number, which is currently not possible in the manet application. It is therefore worth considering that the application may require more sophisticated functionality and the ability to differentiate shipments in more detail. This could save time and avoid over-processing.

Over-processing is found in several of DB Schenker's operations in the form of redundant work, which contributes to the large amount of time spent on support activities. For instance, both the waybill and the groupage itself is being manually marked with a sorting code. The purpose of coding the pallet is to facilitate the truck driver's ability to read the sorting code without having to get off the forklift. If DB Schenker had a fully electronic information flow with no paper waybills, at least one of the coding activities could be reduced and the manual coding of waybills could have been eliminated.

In addition, it also emerged that the handheld computer, which each terminal worker has access to, contains several functions that can be used to perform support activities related to the paper waybill, which could also be seen as over-processing (Liker, 2004). However, the paper waybills are widely used to carry out support activities and the functionality of the handheld computer is seen more as a complement to the waybills. For instance, when a groupage is moved to the notification area, the terminal worker must register the placement in the handheld computer by entering the cause, the notification placement, and the number of colli. In addition, the placement is coded onto the waybill as well. Furthermore, complaints are being conducted in the handheld computer, as well as on the paper waybill. The fact that DB Schenker's terminals and the hauliers do not have the same handheld computer system that is synchronized with each other leads to redundant of work in the event of a claim. Storhagen (2018) states

that organizational collaboration is a strong logistics development trend. In addition, according to Lindvall (2011), digital communication creates opportunities to integrate systems and communicate faster and easier, suggesting that if DB Schenker integrates a more digitized system instead of using a paper waybill, benefits can be gained. Furthermore, the hauliers are currently using the paper waybill for route planning. If the terminals' system could be integrated and communicate the recipient delivery data with the haulier's system, the route planning process could presumably be improved and more efficient. To conclude, *Figure 34* illustrates when the handheld computer is currently being used and where in the flow of groupages and waybills the usage takes place.

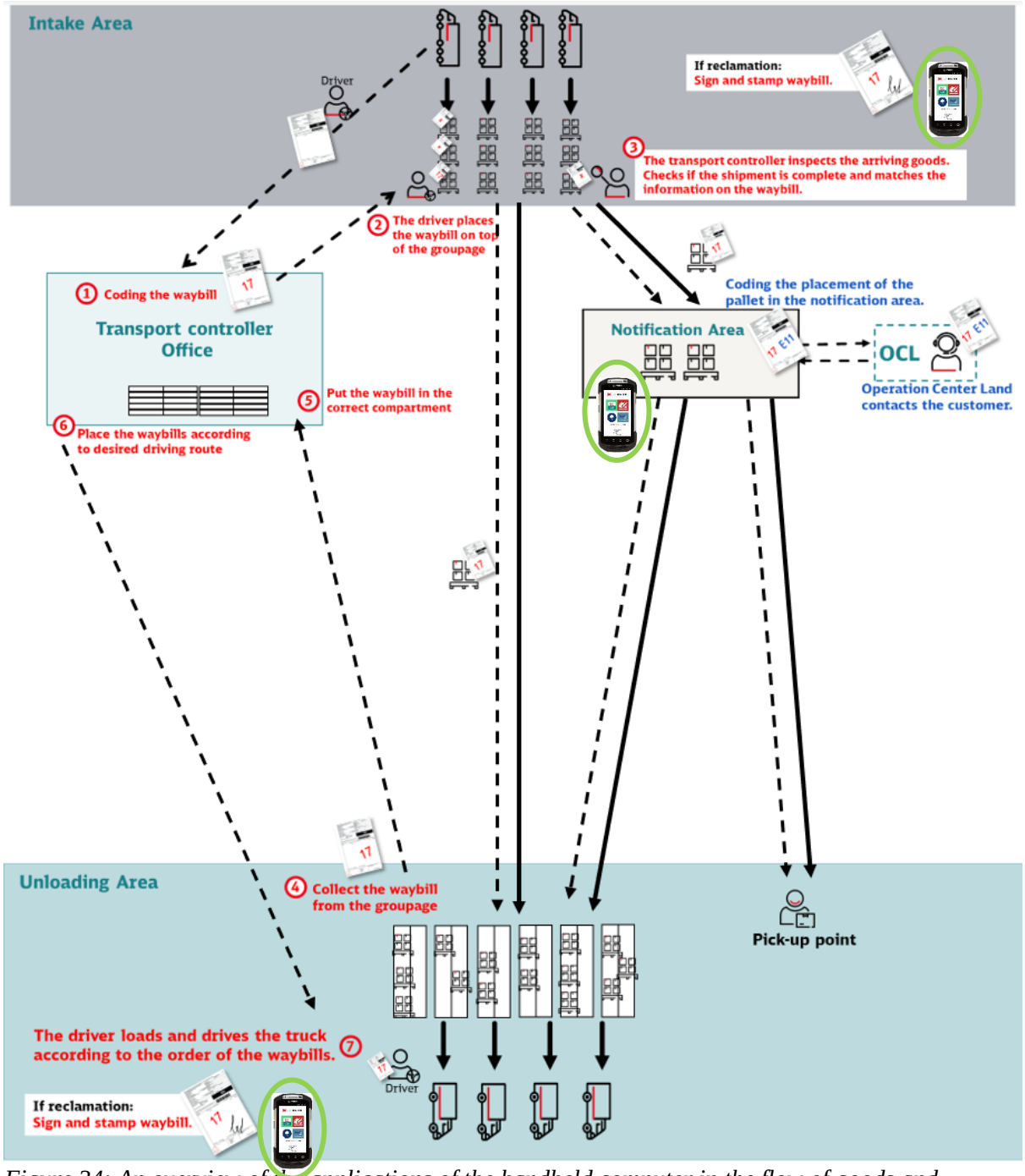

Figure 34: An overview of the applications of the handheld computer in the flow of goods and information.

According to Riksdagen (2023), a waybill must among others include the name and address of the sender and the receiver and provide information about the groupage. This information is available since each shipment has an EDI and can be accessed through the function 'Shipment details' in the handheld computer. 'Shipment details' is only one of DB Schenker's C2T functions that possesses similar or the same functions as the paper waybill. Following *Table 11* was generated from an analysis and comparison between the functions of the paper waybill and the functions available in the handheld computer.

Table 11: The functions of the waybill vs. the function of the handheld computer

The functions of the paper waybill	The functions of the handheld computer
Information about the shipment - Weight, volume, square meters, number of colli - Details of the shipper - Details of the end customer - Options (e.g., notification) - Premium - Other information (e.g., dangerous goods)	Shipment details
Sorting code (code of the correct shipping line)	Manet Code Application (provides the manet code)
Placement in the notification area	Records the placement of groupages in the notification area: - Cause - Location - Number of colli Records that groupages are taken out from the notification area: -Cause
OCL: The waybill includes complementary information of groupages with discrepancies.	No function available.
Complaints: - Stamping - Signing	Complaints: - Responsible process - Type of goods - Transport number - Image - Comment - Signature
Route planning	No function available.
Searching/ goods with discrepancies	Start searching (requires scan of waybill)

As previously mentioned, the handheld computer encompasses functions for recording the placement of a groupage in the notification area, and the function of conducting complaints. In the Manet application, the consignment number of a groupage can be scanned in order to obtain the Manet code, which could potentially be used as the only tool when sorting groupages, thus reducing the manual labor of coding waybills. However, as mentioned earlier in this chapter, currently, the terminals cannot fully rely on the Manet codes, due to the limitations of the application. Further, as seen in *Table 11*, there is currently no functions in the terminal's handheld computer (C2T) for providing the OCL with complementary information regarding notification of groupages, or to conduct route planning. Furthermore, the paper waybill and the information about the groupage e.g., the height of the pallet, are utilized when searching for 'lost' groupages. As previously mentioned, the function 'shipment details' can provide the same information. However, with no access to the pallet nor the waybill, it may become complicated and time consuming to enter the consignment number manually, to obtained the required information. Instead, the solution of utilizing the photographs from the weight and volume machine, as done in Gothenburg, could be beneficial to implement in the handheld computer, as it is easier to find the 'lost' groupage when knowing what it looks like. Currently, the handheld computer offers a function called "searching", however, this function is only used to register that a search is in progress and serves as a communications tool to inform different actors, such as customer service.

In addition to the waybill's functions mentioned in *Table 11* above, according to Cane et al. (2012), the paper waybill also serves as proof that a transport contract exists between two parties and confirms that the shipment has been received for transport and delivery. As the waybill acts as a contract, legality is an important consideration. This is something that Schmitz (2011) highlights in terms of the challenges that companies face during digital transformation. Furthermore, Schmitz argues that digital transformation brings so many benefits to organizations that it is worth accepting a degree of legal uncertainty until new legislation is established.

The Digital Transformation of the Waybill – a way to reduce time spent on Support

Today, according to Bruzelius & Skärvad (2017), digital transformation is a necessity for companies and organizations to ensure customer satisfaction and competitiveness, but also to reinforce a good profitability in an increasing global market. At DB Schenker, many of the activities associated with the paper waybill are still carried out manually, meaning the human factor comes into play. For example, coding waybills and pallets by hand can cause discrepancies in the flow of goods, such as the coder writing the wrong number or the forklift driver misreading the handwritten code, resulting in misplacement in the shipping lines. Furthermore, *Figure 29* illustrates the complexity of the flow of the paper waybill, which can cause discrepancies along the way. For example, paper waybills disappear, and new ones have to be printed, which represent one of the activities registered as *Support*. According to Bergeron & Raymond (1992), by introducing a digitized waybill instead, an organization can save time and money, but also minimize the number of errors, which means that organizations can offer a better service to customers. In addition to this, Gostic & Jereb (2015) explain that organizations can also achieve benefits such as reduced climate impact, simplicity, and visibility.

As the waybill is currently an information tool between several parties in the supply chain and is handled at several different levels, it would be a change of radical character for DB Schenker to introduce a digitized waybill. This type of change can according to Bruzelius & Skärvad (2017) be classified as a structural change. Furthermore, according to Jacobsen & Thorsvik (2008), it is common for employees to resist this type of change. A common underlying cause is that the change places new demands on the knowledge and skills of employees, making the knowledge and skills that employees have built up over a long period of time no longer useful. In the case of DB Schenker, this can be linked to terminal worker who manually code waybills and have learnt the system by heart. However, according to Haight (2007), the human operator still plays a crucial role in a digitized system as humans possess skills in flexibility, creativity, and adaptability that a digitized system cannot provide. These skills are used in DB Schenker's operations, for example, when terminal workers carry out various types of quality inspections or when dealing with customer at the pick-up point. Hence, it is important to keep humans well-integrated when implementing this type of system.

5.2.2 Non-dynamic way of working

Given that a non-dynamic way of working has been identified in both terminals, three factors can be analyzed in order to examine how these are contributing to the empirical findings.

Rigid Labor Force

The first factor is related to the *rigid labor force* at both terminals, as the terminal's permanent workforce in Stockholm consist only of full-time employees, while in Gothenburg all permanent terminal workers are full-time employees except one who works 80 percent. Having only full-time employees as the permanent workforce, the terminal poses challenges in adapting the workforce to decreasing volume, which Pieńkowski (2014) considers to be a form of waste due to uneven volume flow. In addition, he stresses that Mura, in turn, leads to overproduction, which is considered the worst form of waste. In the case of DB Schenker, overproduction is not about handling larger volumes, but rather about oversizing the workforce. This in turn sometimes results in a lot of waiting time, which according to Liker (2004) is another form of waste. Furthermore, the interviews and observations revealed that this waiting time is largely classified under *Support* at both terminals.

Predetermined Distribution of Work

A second factor related to the non-dynamic way of working is the *predetermined distribution of work*. As illustrated in *Tables 5-8,* the supervisors were able to report relatively easily how much time each job role was generally allocated to *Support*. Hence, the empirical findings indicates that it is not possible to draw as clear a connection as to how the variation in volume affects the measurements in CiCo, since it is more or less predetermined how each terminal worker should punch in. According to Jacobsen & Thorsvik (2008), a standardized approach can lead to increased inactivity and maladaptive behavior among employees. In the case of DB Schenker, there is a risk that pre-determined roles can lead terminal workers to adjust their productivity according to the duration of tasks, and thus to work at a pace that allows their assigned tasks to fit perfectly into their shift.

The Long Distance between the Punching Clocks

A final factor associated to the non-dynamic way of working is the *long distance between the punching clocks in the terminals*. In the Stockholm terminal there are four punching clocks in a terminal area of 15 000 m^2, while in Gothenburg there are three punching clocks in a terminal area of 9800 m^2. The few number of punching clocks in relation to the size of the terminals indicate that workers must move long distances to register for a new activity. As unnecessary movement, according to Liker (2004), is something that an organization should strive to minimize because of its waste. For DB Schenker, the long transportations have resulted in a policy regarding CiCO registration that states that any activity with a duration less than 15 minutes must not be re-registrated. Furthermore, how well leaders communicate with employees within an organization is reflected in internal communication (Jacobsen & Salomonsen, 2021). A non-dynamic way of working in the terminal can therefore be an indication that the communication of the purpose of CiCo from management to terminal workers is not sufficiently clear.

5.2.3. Too General *C*entral *G*uidelines

According to Jacobsen & Thorsvik (2008), it is common that procedures are not perfectly designed and leave room for personal interpretations. The authors statement reflects the situation that has arisen in DB Schenker's terminal operations. From *Tables 5-8*, it is clear that there are differences in which activities are registered under *Support* for the terminal in Stockholm and Gothenburg. For example, supervisors in Stockholm register their hours as *Support*, while supervisors in Gothenburg do not. As a consequence of the terminals' own interpretations of *Support* punching, the productivity measurements recorded in CiCo do not provide a representative view of the terminals' productivity, making it difficult to compare the productivity of the terminals. An additional factor contributing to the situation that has arisen may be, in accordance with Bridges & Bridges (2017), that supervisors themselves do not understand information from DB Schenker's top management well enough to be able to communicate it in a pedagogical way to other terminal workers. The fact that there is a risk that clear communication has not taken place is another indication of the need to develop existing centralized visual guidelines in the terminals, which currently consists only of the illustration of CiCo structure.

Furthermore, according to Jansson & Ljung (2017), feedback given by leaders to employees is crucial in motivating employees. Again, as there are differences in which activities are registered as *Support* at each terminal, employees are receiving productivity measurements that are not representative of their work. The current situation suggests that if DB Schenker's management developed clearer, visual centralized guidelines on which activities should be registered as *Support*, allowing terminal productivity to be compared, which presumably would create greater motivation among employees. In turn, this action could potentially improve the overall productivity.

6. Conclusions & Recommendations

The aim of the thesis work was to provide DB Schenker a better insight into their support activities and find potential areas of improvements of the terminals support operations to increase the overall productivity. To achieve this, a current state analysis was conducted, with data collection through interviews and observations, as well as a literature review. Based on the theoretical and empirical findings, an analysis was conducted. Finally, in this chapter, the conclusions are presented together with the associated recommendations to answer the questions posed by the study.

RQ1: Which of the activities performed during the arriving shift should be registered under the subprocess Support at each terminal?

Based on the analysis in section 5.1, *activities related to the paper waybill, support of drivers, quality inspections* and *cleaning and facility management* should continue to be registered as support activities in CiCo, as these activities are related to volume and do not add value to DB Schenker**'**s customer. In contrast, activities related to *leadership* and *meetings* should no longer be registered as support activities. Instead, these activities should be included in *Terminal Administration* as they are not related to volume. Furthermore, *activities related to add-on services* should not be registered as support activities. Although these activities are related to volume, they generate value for DB Schenker**'**s customers, which indicates that these activities should be classified as value added services for customers. For this reason, DB Schenker should develop a new subprocess in CiCo in which all the activities associated with the add- on services can be included. In turn, by separating the activities related to add-on services from other subprocesses, would provide DB Schenker a greater insight into their business. *Figure 35* summarizes where each of DB Schenker's current support activities should be punched

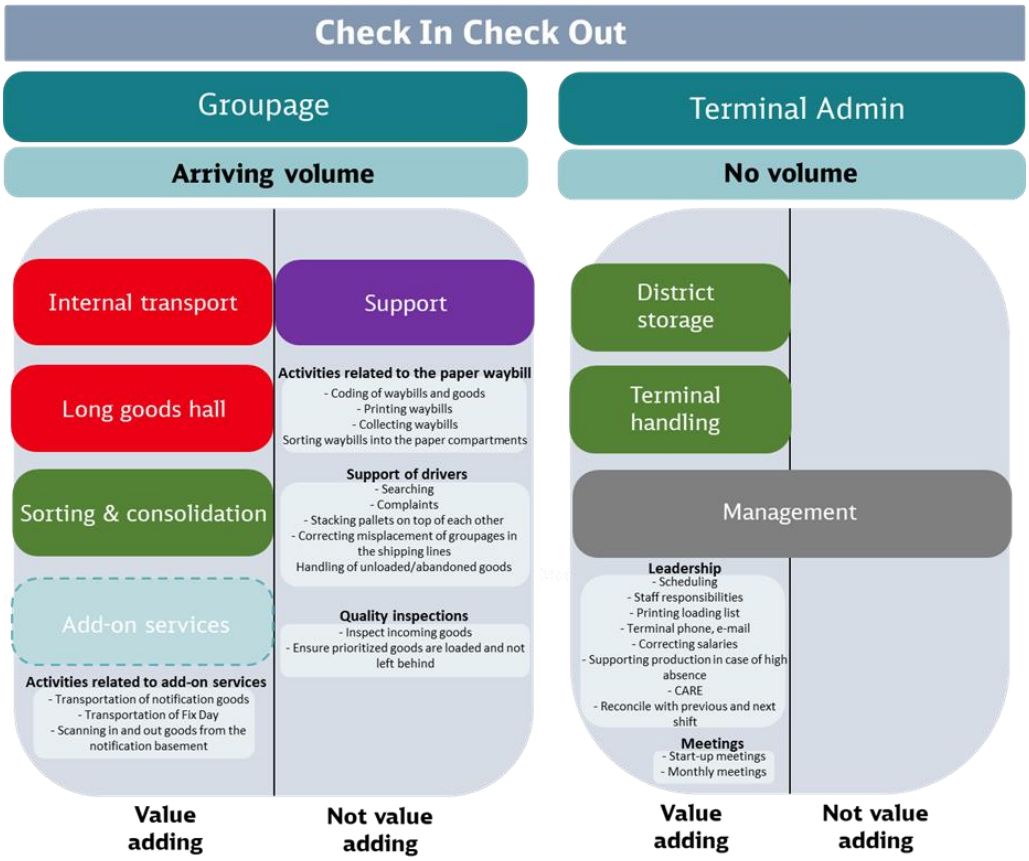

Figure 35: Guidance on where each support activity should be recorded.

RQ2: What are the main reasons for spending a significant amount of time on support activities and how can the terminals work to reduce their total time spend on support activities?

As stated in the section 5.2. in the analysis, there are three main reasons why DB Schenker spend a large proportion of time on support activities today:

1. *The management of the paper waybill.*

The study reveals that the paper waybills play an important and crucial role in the flow of groupages and information. The paper waybill must be handled in significantly more steps in relation to the groupages, resulting in a large number of support activities. Additionally, the paper waybill is in many aspects a bottleneck in the current situation, as it generates redundant work and relies on manual execution. Based on the empirical findings and analysis, the challenges posed by traditional paper waybills may be resolved through two distinct methods: one for short-term implementation and another for long-term transformation.

By having manual operations, the human factor comes into play, causing many discrepancies in the system. In particular, manual coding has a significant impact on the flow of groupages, as it takes a lot of time and generating excess work when incorrect manet codes require manual re-coding of waybills. In the short term, to minimize the support time and reduce duplication of effort, DB Schenker needs to develop clearer follow-up routines to correct incorrect manet codes that are currently missing. In order to improve operational efficiency and reduce redundant manual

coding of waybills, it is suggested that DB Schenker increase the font size of the Manet codes printed on the waybills, thereby facilitating the work of forklift drivers. It is also suggested that the Manet application must be developed to allow sorting at a more detailed level, such as customer number, to avoid manual coding. This development is crucial for ensuring the precision of codes, especially for a future digital transformation.

Furthermore, the study reveals that there is considerable duplication of work in the terminal due to the use of handheld computer functions in addition to manual work. By taking greater advantage of the handheld computer and develop functions for route planning and providing OCL with complementary information regarding notification groupages, manual work can be replaced. In addition, inspired by the Gothenburg terminal, a function should be developed in the handheld computer to display images of groupages from the weight and volume machine to facilitate searching of 'lost' groupages. In turn, DB Schenker can reduce redundant operations and decrease time spent on *Support*. Currently, the low integration between the terminal's and the hauliers' systems is largely responsible for the extensive reliance on paper waybills. In the long term, by eliminating the paper waybill and replacing it with a digital one, this integration can be achieved and generating a more efficient and smoother flow with fewer discrepancies. Thus, replacing the paper waybill would result in fewer hours spent on *Support* and increased productivity.

2. Non-dynamic way of working

Based on the analysis presented in subsection 5.2.2, three factors can be identified in both terminals that contribute to a non-dynamic way of working, which in turn leads to a lot of time spent on support. The first factor is the rigidity of the labor force, which results from having almost only full-time permanent terminal workers. The recommendation to DB Schenker is therefore to reduce the number of full-time employees and, if needed, to use additional temporary staff in order to adapt the workforce to the size of the volume. The second factor is that there is a high degree of pre-determination of how terminal employees will be punched in at CiCo during their shift. As a result, it is not possible to draw correlations to how the variation in volume affect the measurements in the terminal. Moreover, there is also a risk that these pre-determined roles will create inactive behavior among employees, which in turn will affect productivity. This situation highlights the need to inform and educate supervisors, team leaders and terminal workers about the purpose of CiCo and why a dynamic approach is beneficial to the organization. The third and final factor is the cumbersome way of switching subprocess in CiCo punching clocks, as the terminals are equipped with only a few, requiring terminal workers to move long distances. As a result, subprocesses are not always switched if the activity to be performed is not expected to take long enough to make the switch worthwhile. This means that more CiCo punching clocks need to be installed in the terminal to minimize the distance between them. Furthermore, the recommendation in the long term is to make punching in more accessible in the terminal, for example by allowing terminal workers to change their activity using QR codes that can be scanned with a handheld computer in places where they are often located, such as in forklifts.

3. *Too general central guidelines*

The study reveals that the central guidelines on which activities belong to which subprocess in CiCo, are too general. The ambiguity leads to local interpretations, resulting in terminals register different activities as *Support*, which in turn cause misleading measurements of terminal productivity and difficulties in comparing terminal productivity across terminals. Hence, there is a need for the terminal management to develop a clearer central CiCo template that illustrates in a pedagogical way, at a more detailed level, which activities belong to which subprocess. Thus, giving supervisors a better basis for clearer communicating to terminal workers how they should enter CiCo, depending on the activity they are performing.

7. Discussion

This chapter outlines the possible implications of the findings and recommendations and provide a comprehensive discussion of this study's impact on DB Schenker. Finally, the study's limitation is discussed and suggestions for future area of study are stated.

Implications of the Study

As stated in *the Conclusion & Recommendation* chapter, this study has provided both short-term and long-term recommendations which allow DB Schenker to approach the challenge of reducing the amount of non-value adding time in different ways. For example, the development of the handheld computer and its functionality can streamline the flow of information and goods, thus creating better conditions for future digitization. Similarly, the development of the Manet application and its functionality can reduce the amount of manual labor that is currently spent on coding waybills. Hence preparing for the long-term structural change of digitizing the entire information flow. Thus, by implementing the short-term recommendations provided in this master thesis, DB Schenker reduces the risk of digitizing unproductive groupage and information flows in the future, that include wasteful and non-value-adding operations.

Apart from the recommendations being categorized into short-term and long-term suggestions, there is another way of dividing them. Recommendations that emerged from the classification of DB Schenker's current support activities (i.e., the answer to RQ1) are solutions that would provide DB Schenker with greater insight into the *Support* subprocess and how the total time spent is allocated. However, implementation of these recommendation would not reduce the total amount of time spent. Whereas the identification of the main reasons behind the significant amount of time spent on support activities and the following recommendations to reduce it (i.e., the answer to RQ2) would result in a reduction of the total time spent on *Support.* Ultimately, the improved insight gained from answering RQ1 was necessary to identify the main causes and solutions to the high time consumption done when answering RQ2.

However, it is important to also highlight the risks of the recommendations provided by the study. The suggestion of creating a new subprocess in CiCo for activities related to add-on services, entails the risk of employees failing to appreciate the change and are reluctant to undertake another subprocess. Similarly, the recommendation of creating following-up procedures to increase the accuracy and quality of the Manet code may initially be seen as a cumbersome and excessive task as current personnel performing the manual coding does not rely on Manet and manage to perform the job regardless. Further, an improvement of the Manet system will jeopardize the coder's area of responsibility, as manual coding won't be needed. However, to minimize the risk of employees perceiving changes as burdensome and being reluctant to adopt them, the purpose of the new implementations must be clearly communicated.

Additionally, the recommendation of developing an additional functionality in the handheld computer that can show a picture of the groupage, comes with the limitation that only 40 % of all incoming groupages are being photographed in the weight and volume machine. The suggestion of implementing more flexible workforce and limit the current rigid labor force of full-time employees can be discussed as it comes with both opportunities and risks. The drawbacks and risks of relying on temporary

employees is that it might have a negative impact on quality and increase the number of errors. Moreover, finding labor is presumably more challenging if full-time employment cannot be promised, particularly during the night. Additionally, there is a risk DB Schenker's reputation would be negatively affected, if they wouldn't offer full time employment for their workers.

Finally, it is essential to consider the delicate balancing act of avoiding too many centralized guidelines from the top, while at the same time providing clear directives to avoid local interpretations. The recommendation of the study to implement clearer guidelines for punching could thus appear risky as it might possibly result in reduced motivation at the terminals. However, as the study argues, a more uniform punching process results in a fairer comparison between the terminals, which is believed to enhance motivation.

The study overall highlights the need for DB Schenker to undergo a digital transformation in the long term, particularly regarding the digitalization of their information flow. Ultimately, the proposed digital transformation is a major shift that will significantly impact the entire terminal organization and its operations, as well as other actors that are involved, such as hauliers, the OCL, customers etc. However, by implementing these recommendations, DB Schenker's competitiveness will be enhanced.

Limitations of the Study

The study has identified three main reasons, common to both terminals, for DB Schenker spending a significant time on *Support*. Beyond these three common main reasons, there are additional things at a more granular level that differ between the two terminals, that cause them to spend time on *Support*. In the case of the Gothenburg terminal, they have more exceptions to the Manet system i.e., more *Storkunder* (large customers) compared to Stockholm, and a number of external hauliers sharing routes to the same postcodes. These exceptions require them to spend more time on manual coding, which leads to more time spent on *Support*. Furthermore, since the hauliers in Gothenburg are not part of DB Schenker, the assumption is made that it is more difficult to allocate responsibilities between each other, compared to Stockholm terminal that uses DB Schenker's own haulage company. As the terminal and haulier in Stockholm belong to the same organization and share profit, it is assumed to be easier to delegate some of the activities to the hauliers, such as sorting waybills into the paper compartments. Thus, reducing the terminal's time spent on support. On the other hand, in the case of the Stockholm terminal, their support time is affected by the fact that this terminal store all its notification groupages in the basement. The examples above demonstrate that each terminal has its own unique characteristics and circumstances, resulting in more or less time being spent on support.

An additional limitation of the study is that the recommendation to move the leadership activities and meetings to Terminal Admin is given, however, it is not specified under which subprocess. Thus, DB Schenker is left to decide whether a new subprocess under Terminal Admin should be created, or whether these activities should be placed under an existing subprocess. Furthermore, another limitation of the study is that it was carried out in DB Schenker's Land terminal department and, as the study has shown, there are a number of other actors that play a crucial role of DB Schenker's operations. Hence, there is a risk of bias as the data collection was based only on interviewing and

observing DB Schenker's terminal employees and no other stakeholder, such as the hauliers.

Suggestion for Future Areas of Study

As the empirical findings and analysis revealed, the management of the paper waybill is one of the main reasons why DB Schenker spend a significant time on support activities. Additionally, the journey of the paper waybill within the terminal was mapped, illustrating its complexity and the multiple functions it performs within the terminal, both for the terminal employees and for other actors in the supply chain. Due to the crucial role of the paper waybill in the flow and its cause of deviations, this is an area suggested for future research in order to create a better understanding of how to implement a digital waybill in the long term. Furthermore, the sustainability aspect of the paper waybill's impact on the environment was not investigated in the study. As DB Schenker currently uses paper waybills, it can be assumed that a considerably amount of energy and paper are being consumed in the printing process. Thus, this area of study is an additional suggestion for future research.

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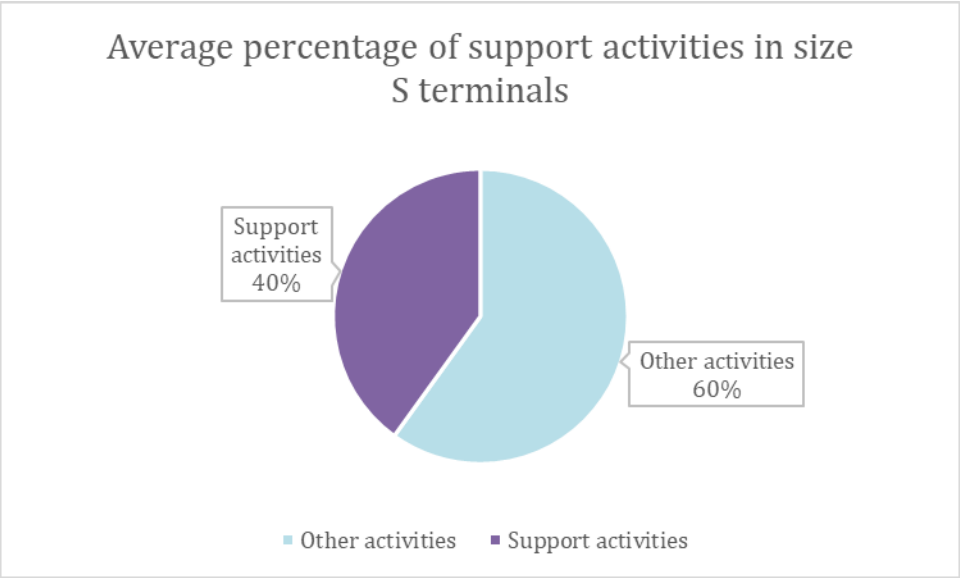
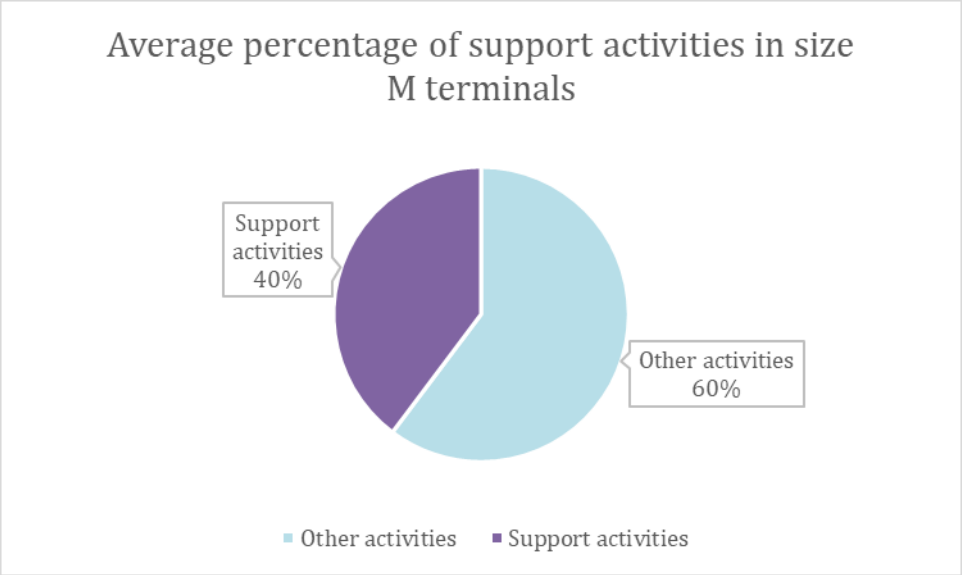
Appendix A


Average percentage of support activities in size S terminals
Support activities 40%
Other activities 60%
Other activities
Support activities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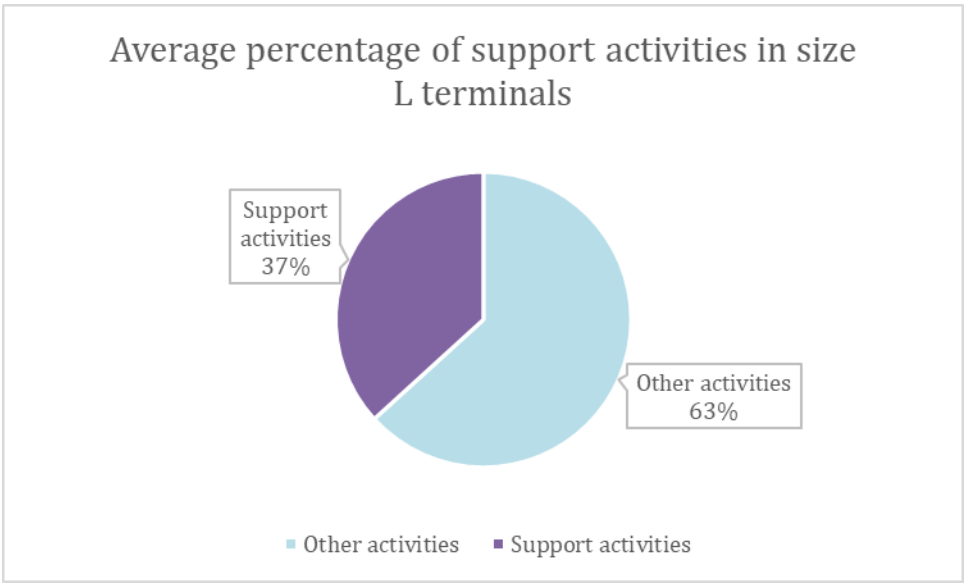
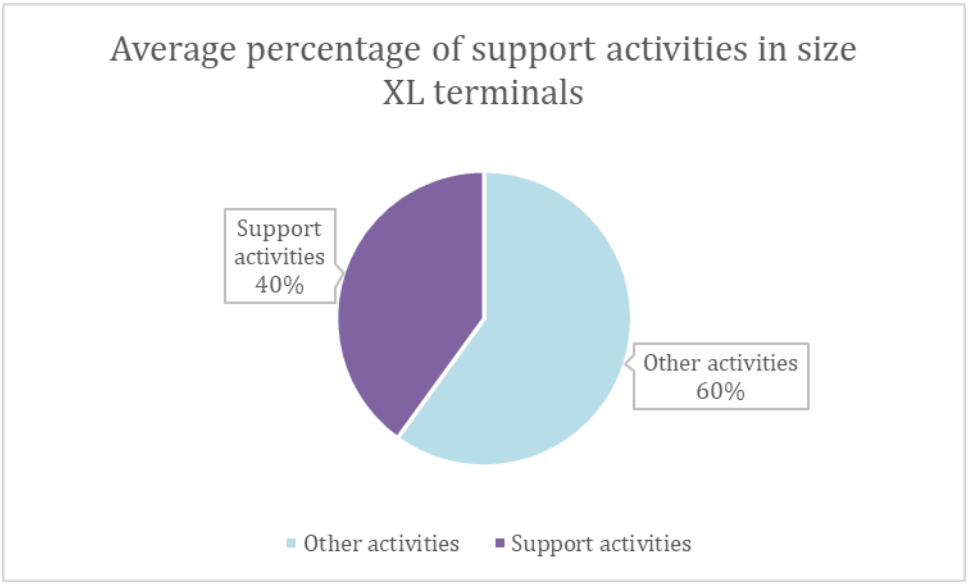
Support activities 40%
Other activities 60%
Other activities
Support activities


Average percentage of support activities in size L terminals
Support activities 37%
Other activities 63%
Other activities
Support activities


Average percentage of support activities in size XL terminals
Support activities 40%
Other activities 60%
Other activities
Support activities

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