Management of Received Goods
Process mapping at LensLogistics AB

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This Master’s Thesis is the final part of our MSc. programme in Industrial Engineering and Management at Luleå University of Technology, Sweden. The work was carried out during autumn 2007 at Lenslogistics AB in Kista, Stockholm.

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Abstract

Successful companies nowadays know that they have to adjust their operations to meet consumer requirements since consumers become more aware of what they want, when they want it and what price they are willing to pay for it. To retain a competitive advantage companies must have an optimized supply chain that includes short lead times and keeping costs low.

LensLogistics is a third party logistical company selling warehouse and inventory management services as well as distribution of contact lenses to mail order companies, eye care practitioners and wholesalers. Since founded in year 2000 LensLogistics has experienced a substantial growth. The growth has placed the company processes and the whole organization in state of constant change. It has thereby made the processes more complex and some areas inefficient which is the main reason for conducting this thesis.

Some products distributed by LensLogistics are ordered when demand arise and cannot be sent to customer until the products are placed in stock shelf. Therefore are short lead times in the early part of the supply chain as important as in later steps to provide fast deliveries. The purpose of this thesis is therefore to map the process of receiving goods. Specifically, the aim is to identify inefficient operations in the process and give suggestions on how to increase efficiency.

The process could be mapped after initial observations and interviews had been conducted. The theory was searched in the supply chain management area as well as warehouse management and process mapping. For theory regarding increased efficiency, improvement and management tools were also investigated. By further data collection and the theoretical research, analysis could be written and lead to the result and suggestions given by the authors. Tools used in this thesis are, beside the theoretical research, benchmarking and time studies.

The main result of this thesis has led to suggestions regarding following improvements:
- Use of Mobile computer
- A stated order priority
- Less operator movement
- Less document handling
- Use of 5S

These suggestions will give the process of receiving goods benefits that will increase efficiency. These benefits are:
- Shorter lead time for important products
- Higher reliability in stock placement
- Reducing the number of activities
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1. Introduction

This chapter gives the background to the reason for conducting this thesis at LensLogistics AB. The problem background leads to the purpose of the thesis and finally the delimitations taken to be able to finish the thesis within given period are described.

1.1 Background issues

“You can get it in any colour you like as long as it is black” Henry Ford

It is almost one hundred years since Henry Ford said these words when he introduced the T-Ford; the first car ever built on a steady stream assembly line. The contrast between these words and the situation on the market today is obvious. The modern customer would just walk out of a car store if they got that offer today. The challenges that companies deal with today are to meet the consumer demands tomorrow. (Qureshi & Christensen, 2007)

The companies that are successful nowadays either if they are suppliers, distributors or wholesalers know that they have to adjust their operations to meet consumer requirements. Consumers become more and more aware of what they want, when they want it and what price they want to pay for it. If a supplier cannot match their demand someone else will get the sale. (ibid)

It is the consumer’s market which puts pressure on the companies that want to be competitive to increase assortment, keep costs as low as possible and shorten lead times from receiving order until it is delivered. An optimised supply chain is decisive for a company to retain its competitive advantages. (ibid)

According to Ellram (2006) one of the most successful companies in supply chain management is the first e-business company, amazon.com. Since the start of amazon.com e-business has grown exponential the last ten years, many online based companies have positioned themselves as the worlds biggest companies and sales are expected to be doubled in a period of five years. E-business companies have a advantage to companies that uses facility stores to sell their product, which are less cost for location and sales personnel (Qureshi & Christensen, 2007). According to Backlund (2006) online consumers are not as loyal to their supplier as consumers who do not purchase over the Internet. Availability, price and service level are keywords that consumers value when shopping online, that is why companies try to be more efficient in their supply chain strategy and work with continuous improvements in their logistical processes.

1.2 Problem background issues

LensLogistics AB, here on referred to as LL is a third-party logistics company that provides services such as logistics, marketing and finance for their customer. They ship orders to private consumers as well as business customers. Since LL was founded it has grown exponentially and developed in a high pace.
Introduction

Compared to the market situation during Henry Ford’s initial business era LL has completely different conditions since companies today have to meet customer requirements on a higher level and especially e-business customers are more demanding and less loyal. Because of the large growth and thereby changed conditions for the supply chain in general LL has improved and developed its operational processes. Managers have identified the process of receiving goods as a part of the supply chain with development potential. The opinion is, according to the Logistics Manager, that this part of the supply chain could be made more efficient since it is distinguished by long lead times, manual operations and inefficient activities. (Interview with the Logistics Manager at LL)

A fundamental condition for implementation of more efficient processes in a company is to have an overview of the present situation. This means having knowledge of how routines and processes are performed and how tasks are organized. When making a process more efficient it is essential to focus on the areas that will have the largest impact on the organization and has the biggest improvement potential in relation to the resource effort needed.

Some products distributed by LL are ordered when demand arise and cannot be sent to the customer until the products are placed in stock shelf. Therefore, short lead times in the early part of the supply chain are as important as in later steps to provide fast deliveries.

1.3 Purpose of the Thesis

The purpose of this thesis is to map the process of receiving goods. Specifically, the aim is to identify inefficient operations in the process and give recommendations on how to increase efficiency.

The following research questions will be used to specify the purpose:

- How can efficiency be measured?
- Where in the process does waste appear?
- Can LL reduce labour cost by increasing efficiency?

1.4 Delimitations

This thesis will consider the part of the supply chain that starts when a package arrives at the loading bay until the product is placed in the stock shelf ready to be picked for delivery. This is due to that the causes of the long lead times, such as sorting of the products and less part deliveries, might be improved by further collaboration with suppliers. As understood during initial interviews with the Purchasing Manager, this already ongoing collaboration process is described as complicated and time demanding. This means that measures that could be done by suppliers and would contribute to the process efficiency will not be further investigated.
2. Company presentation

The company presentation gives a short briefing of LensLogistics AB. The chapter starts by explaining their core competence and thereafter summarising history facts. Further the business concept is presented and finally the organisation is described.

2.1 LensLogistics AB

LL is a third-party logistic company supplying contact lenses and accessories. Their main objective is to provide an efficient distribution chain from the supplier to the end customer. (Interview with the Logistics Manager)

LL was founded in year 2000 and has ever since experienced substantial growth and have today the largest stock of contact lenses in the Nordic region. About 25% of all contact lenses used in the Nordic region have been distributed by LL and every year over 700,000 orders are dispatched all over Europe. LL is located in Kista, in the north of Stockholm, this is where the 3300 square meters warehouse containing 20 000 articles is positioned. LL has four main suppliers that deliver contact lenses to the warehouse. Contact lenses are mostly delivered from Europe by truck or aircraft. (ibid)

Since 2004 LL is included in the Coastal Contacts Group, here on referred to as CC, which is quoted at the Toronto stock exchange in Canada. According to the company website, CC is one of the world leading suppliers of contact lenses to consumer. (www.coastalcontacts.com)

Within the group the market is divided, where LL is responsible for the distribution in Europe and CC is responsible for Northern America and Asia. LL turnover in 2006 was in total 296M SEK. LL largest customers by far are their subsidiaries LensWay, NordicLenses and YourLenses which together correspond to the major part of the total turnover. These customers sell contact lenses over the Internet and are among the leading on the European market. LL ERP-system is automatically updated as soon as a final customer order contact lenses through Lensway, NordicLenses or YourLenses but when the contact lenses arrive to the final customer there is no sign of LL involvement on the products. (Interview with the Finance Assistant)

LL business concept

LL business concept is to be a third-party logistics company responsible for the supply chain from supplier to customer. LL competitive priorities are short lead times and competitive prices. The strategy is to have short lead times from customer order to delivery and thereby in all involved processes.
LL provides retailers, wholesalers and their subsidiaries with contact lenses and belonging equipment. There is in total about 100 000 unique articles available to order. From the distribution centre in Kista, LL is planning the purchases, customer service and invoicing for some of their customers. Figure 2.1 will explain where the different participants in the supply chain are located and illustrate their relations. (Interview with Logistics Manager)

![Diagram](image)

**Figure 2.1 A simplified picture of LL business concept.**

**Organisation**

According to the Finance Project Coordinator, the company has 75 employees and about 30-40 consultants. Most consultants are from the staffing companies, whose main task is to pick orders from the shelves and pack them into packages in which the contact lenses will be delivered. (ibid)

Since LL has experienced a substantial growth since the start, the organization has had to adapt and expand in the same pace. In reality this means that the organization has been changed once or twice every year. The goods receiving department contains a staff of five persons spending all or some of their working time getting the contact lenses on the shelves. In total 102 hours are spent on this activity during a week. (Interview with the Goods Receiving Team Leader)
3. Methodology

The following chapter summarises how the research in this thesis has been performed. This is done by describing the methods used during the course of action. Data collection techniques are discussed and data collection methods are outlined. Finally, issues in terms of validity and reliability as well as measures that have been undertaken in order to strengthen the quality of this study are presented.

3.1 Disposition

Below is a figure of the disposition used to accomplish the research, the figure illustrates in which order the tools were used in the thesis.

![Disposition of accomplished research](image)

3.2 Data collection

There are two different types of data; primary and secondary data. The difference between the two types is dependent on why the data is collected. Primary data is collected...
especially for the purpose of the research and secondary data has already been collected for another purpose. (Kinnear & Taylor, 1996)

Primary data is material collected for the first time and has not been available before. Different methods for gathering primary data are questionnaires, interviews and observations (Dahmström, 2000). The gathering of primary data for this thesis has mostly been done through interviews, observations and time measuring of operations. The main purpose for collecting the primary data was to understand where inefficiency in the process of receiving goods appeared and to involve the ideas of concerned staff into our final suggestions.

Secondary data is collected by others than the researcher for a company or a specific case. The authors used this kind of data to gather an extended knowledge of the company as well as the investigated process of receiving goods. The annual report has been used when presenting the company and another source for secondary data was LL ERP-system Oracle where data about order history was collected. This order history led the authors to analyse the order characteristics that can be connected to the inefficiency in the process.

3.2.1 Observations
During their initial time at LL, the authors conducted observations of the company activities. An effective way to make observations is process practice. To understand the situation in one area of an organization it is also important to understand how other areas work. Therefore the observations started with spending a couple of hours in each area of the organization. These areas were; order picking, packing station, shipping, return handling, packing station service and how to perform the inventory count. Since this thesis focus on the receiving goods department three days were spent on observations in that area. The way of conducting these was to do the same tasks as the Goods Receiving Operators and at the same time ask questions about unclear working methods. The observations were made to gather an understanding and be able to express problems as well as preparing material for data gathering. The process map was mainly based on these early observations that include way of working and order characteristics. When this first week of observations ended, an introduction could be written. Even though the main observations were done in the beginning, more observations were also done in later stages in the thesis.

3.2.2 Interviews
When gathering information from staff working at the company there are two alternative; questionnaire or interviews. Since the number of staff involved in the process of receiving goods are quite few the authors thought that interviews were the best alternative. According to Andersen (1994) more sensitive questions are answered in an interview compared to a questionnaire. There are different degrees of formality for the interviews depending on the information wanted. An interview can be unstructured, focused or structured. Unstructured interviews aim to find interesting information and questions regarding the actual subject. Structured interviews have, opposed to unstructured, predetermined frames of the subject in question. The focused interview, which is a mix of
the choices above, gives the condition to find pertinent information of the process. Since the thesis has specific areas such as the process description and causes of the inefficiency, but does not exclude that other problem areas might be important, focused interviews seemed to be the best choice. There was in total ten interviews performed, interviewees were Logistics Managers, the, Goods Receiving Team Leader, the Finance Assistant, Purchasers, Goods Receiving Operators and the Distribution Manager. These persons were selected due to their relevant knowledge of the receiving goods process and some are especially influenced from the results of this thesis. Official interviews were conducted during two days in the beginning of the research and each lasted about an hour. Shorter informal interviews were carried out during the thesis as opportunities arose. The interview guide, which consisted of open-ended question, were based on observations made in the process of receiving goods and if the answers coincided with the authors views, assumption could be drawn that the conclusions of present situation was correct. Further purpose of the interviews was to get ideas of what works well and what could be improved to ensure better efficiency in this process.

3.2.3 Time studies
Since the studied process was characterized by long lead times the authors decided to conduct a time study on the operations in the process of received goods. Choice of operations is based on the description of present situation and all operations were included in the initial time study. The time study would also give further understanding of the process. A few operations were too short to measure and did not differ in time depending on order therefore they were given a fixed time to perform. A test run of the measuring was conducted which lead to changes of included operations. See appendix E for final document used when measuring the operations. The test run gave the authors understanding of the importance of breaking down the order into four different types which is further explained in chapter five that describes the present situation. The time studies were conducted during two weeks with a goal to include data of 15 orders per order type. During this time study the authors stood beside the operator and measured operations that could contribute to shorter lead times if changed.

3.2.4 Literature review
After the first week of observations, a theoretical framework was determined. This disposition was based upon the observations, problem discussion and the purpose of the thesis which is to map the process of receiving goods, identify inefficient operations and give suggestion on how to increase efficiency. The studied area of theory is supply chain that is narrowed into the main tool, process mapping and the theory of warehouse management. Process mapping is thereafter narrowed into efficiency tool theories while warehouse management is narrowed into theory of management tools. Finally, the theories are summarised in an efficiency theory section.

In the search for literature the authors visited The Royal Institute of Technology, Campus Telge Library and Luleå University of Technology. Examples of words or phrases used in the search were: Supply chain management, process mapping, lead time and receiving goods. Databases were also used for searches on authors and titles from other thesis.
3.3 Benchmarking

As Benchmarking is a well known procedure for process improvement the authors of this thesis visited and studied two well known E-business companies; NetOnNet and Dustin. Björnland et al (2003) state this as a good procedure where information from external actors is used to improve internal processes. The benchmarking was performed after the description of present situation at LL was written and the purpose was to get ideas of possible changes at LL. The selection of companies was made according to following criteria;

- Third-party logistical company
- High product turnover
- Handling of fast moving consumer products

The procedure of the benchmark was to visit the companies, analyse how they work with their receiving goods handling and thereafter compare that to how it is done at LL. This comparison gave ideas on how LL receiving goods process could be done more efficient.

3.4 Validity and reliability

When gathering information it is important to know that what is meant to be measured really is measured and that collected information is reliable. This is called validity and reliability. Low validity and low reliability both depends on measuring faults and lacks in measuring method. (Winter, 1973)

3.4.1 Validity

Good validity is according to Winter (1973) and Eriksson & Wiedersheim (2001) the ability to investigate what is intended to be investigated. Andersen (1998) states that validity can be increased by using triangulation, this means that two different origins are used to determine a third. Lekvall & Wahlin (2001) state the importance of validity to ensure that the outcome is accurately interpreted.

A reason that suggests higher validity in this thesis is that people with knowledge about the problem area have evaluated the thesis continuously. These people were foremost the instructor at the company, who has a degree in Industrial and Management Engineering at Luleå University Of Technology and has experience from process improvement projects, as well as the assigned instructor at the same university.

The interview guide was based on observations, and interviewees were selected due to their relevant knowledge of the receiving goods process. Choice of operations in the time study is based on the description of present situation and a test run of the measuring was done which resulted in changes of included operations.

Another thing that suggests increased validity is that triangulation was used when studying the present situation. Andersen (1998) stated that different origins are used to determine a third. In this thesis observation, data collection and interviews, with more than one person, have been used to determine the process map. If the assumptions drawn
Methodology

by the authors from observations were the same as the answers given by interviewees and strengthened by collected data, another origin, the process map, could be determined.

3.4.2 Reliability

Good reliability implies that the measuring has been done in a reliable way (Björklund & Paulsson, 2003). Winter (1973) gives a description of reliability as; to which degree the results are influenced by circumstances. Lundahl & Skärvad (1999) state that measurements in a study should not be dependent on who performed the measuring.

The reliability was increased by conducting time measuring on the operations in the process of receiving goods numerous times. Data from at least 15 orders per order type was thought as reliable enough. Before starting the measuring, a test run was performed and the method for this was redone. Since no major difference was found in the measure the reliability is thought to be satisfying.

To ensure that nothing important was lost, a tape recorder was used during the interviews. Further, both authors have been present during interviews and observations which decrease the risk of missing out on important information. A copy of the questions was sent to the interviewee before the interview for preparation and their answers were confirmed afterwards for the purpose of increasing the reliability.
4. Theoretical frame of reference

The focus of the theoretical frame of reference is to give the reader an understanding of the subject. Additionally, the frame of reference will lay as a foundation for the analysis in the thesis where a comparison between theories and the description of present situation will be carried out. Therefore, the authors have identified the relevant theoretical areas needed to answer the purpose of the thesis. The chapter starts with a brief disposition of the theoretical framework and thereafter an abridgement of supply chain management. Further are efficiency and management tools reviewed and the chapter is finally summarized in efficiency theory.

4.1 Disposition

Below is a figure of the theoretical framework. The disposition illustrates how the areas are connected. The studied area of theory is supply chain that is narrowed into the main tool, process mapping and the management related theory of warehouse management. Process mapping is thereafter narrowed into two efficiency tools; theories of lead time, which includes time reduction and active/passive time, and 5S. Warehouse management is narrowed into theory of the management tools benchmarking, WMS and KPI. Finally, the theories are connected into efficiency theory that supports the purpose of the thesis.

![Diagram of theoretical framework]

*Figure 4.1 shows the disposition of the theoretical frame of references.*
4.2 Supply chain management

Supply chain is a concept that has increased in importance over the last decade. New factors have made the supply chain very important to consider, the most significant factors are the fast development of IT, the reduced business barriers, lower transportation cost and large-scale production. (Paulsson, Nilsson & Tryggestad, 2000)

A supply chain consists of flows from supplier to the end customer, for example material and information flow. Activities in the flow can be material handling, production planning, stock placement, distribution and delivery. To coordinate all activities in the flow, supply chain management is needed. The idea is to create a system that gives an overview of the complete chain from supplier to customer (Turban, 2003). In a good supply chain the right product is delivered in the right amount at the right time. Secondary objective is to achieve this at the lowest possible cost (Paulsson et al, 2001). According to Ballou (2004) a supply chain can be described as a collection of functional activities ranging over the company and its business network with other companies. These activities convert raw material into finished products and add customer value.

The Council of Supply Chain Management Professionals provides a definition of Supply Chain Management. CSCMP define it as follows: “Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies. Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, and finance and information technology.” (www.cscmp.org)

Today’s market is highly competitive and companies need to constantly redefine their strategies in order to survive on the market. Mentzer (2004) states that an efficient supply chain results in a competitive advantage in today’s global marketplace. Therefore, companies try hard to constantly develop and improve the supply chain in order to achieve competitive advantages. To manage an effective and efficient supply chain, it is necessary to have a strategy and clear goals for the company’s supply chain. (ibid)

Cohen & Roussel (2004) give examples of companies such as Wal-Mart and Dell that use the supply chain as a strategic differentiator against their competitors. They have a strategy to always search for new ways to add value by refining their supply chain and be one step ahead of their competitors. (ibid)

4.3 Warehouse management

“Receiving is a race. The objective is to get inventory into the building and ready for shipment as quickly as possible”. These are the words of Drew Hale, a partner at the
material handling consultants, The Progress Group. Hale also states that there is no better way to restrain a warehouse than to have an inefficient receiving goods process, and that a complicated procedure might offer great flexibility but limit a speedy movement of inventory to its next destination. (Forger, 2005)

In a case study conducted by Gunasekaran, Marri & Menci (1999) the methodology of improving the efficiency of warehouse operations is discussed. They state that inventory control, production control and warehouse management are the underlying methodologies that have an effect on the industrial success of distribution organizations. The word warehousing, often refer to both the physical processes of material handling and stocking as well as the underlying methodologies. Six major activities covering the warehouse operations were identified as:

- Receiving
- Transfer
- Handling
- Storage
- Packing
- Expediting

Gunasekaran et al (1999) also discuss new systems to improve the warehouse operations. They imply that a new system has to be ergonomic, or user friendly, and approved by all staff. An operational analysis underline the removal of all unnecessary workload and aims to bring the information flow in line with the physical flow in order to optimize the overall process time. The material flow follows the information flow and if there is any gap between them, it will lead to inefficiency and poor customer service. The authors also state typical limitations of existing systems; for example, the time spent walking between the work area and goods receiving office to process deliveries, as well as the amount of document handling often involved, which is costly and time consuming. (ibid)

The warehouse and thereby receiving goods is described as a supply operating system. As goods arrive from the supplier, the core function of receiving goods is to update the inventory to make each product available for order picking. The computer system should be regularly updated regarding the received goods. Errors in documents or on the computer screen constitute a query and delay the operation. A mistake in the acquisition of the order on the computer screen, or a misprint on the document, can mean the storekeeper tries to resolve the problem for up to half an hour. Obstacles in a system of a warehouse operation cause problems, and, therefore, increase the number of non-value adding activities. Some measures to improve warehousing efficiency might be to use a shortest path philosophy, avoiding unnecessary waiting time, eliminating received goods inspection to a minimum level and use electronic data interchange. (ibid)

Gunasekaran et al (1999) summarize by presenting recommendations on how to reduce lead time in warehousing operations. They state that the processing of information plays an important role in warehousing activities. It is clear that an efficient and reliable data
handling system is needed to store accurately the extensive amount of information on goods and their movement. In addition, if the warehouse is run competently; the stock for each item is at the correct level, the warehouse capacity fits its purpose and the goods are appropriately stored. This will ensure efficiency in terms of distribution. (ibid)

### 4.3.1 Warehouse Management System

In the article; “Linking warehouse complexity to warehouse planning and control structure” Faber, Koster & Velde (2002) state that warehousing is becoming more and more a critical activity in the supply chain to outperform competitors on customer service, lead times and costs. However, if warehousing is to be a source of competitive advantage, the implementation of a warehouse management information system (WMS) is a necessary. A major practical question discussed is whether a given warehouse should implement a standard or a tailor-made WMS. A standard WMS offers many advantages; it is a proven solution, less costly, the implementation time is shorter and the after sales service is better. On the other hand, a standard WMS remains largely making compromises between the way a warehouse wants to work and the way the system allows the warehouse to work. (ibid)

Faber et al (2002) also declared that warehouse planning and control structures refers to the management functions that plan, direct, coordinate and control the flow of goods through the warehouse, from the time of receiving to the time of shipping. The authors also found that the number of order rows processed per day and the stock keeping units are the two main observable aspects of warehouse complexity, the more complex the warehouse is, the more tailor-made the planning and control structure has to be. A WMS should provide, store and report the information necessary to efficiently manage the flow of products within a warehouse, from time of receiving to the time of shipping. (ibid)

### 4.3.2 Benchmarking

There are many ways to improve warehouse efficiency. Benchmarking is a well known management tool for improving the company processes. Björnland, Persson & Virum (2003) state that when companies start compete with focus on value creating through their processes, a need arise of a more process oriented use of measurements. An effective and important technique used by successful companies today to reach and maintain a strong process capability is known as benchmarking. (ibid)

The idea of benchmarking is to accept that there is always a company somewhere in the world performing the same or similar process more effectively and therefore better than your own process. Benchmarking becomes a manager procedure to systematically follow up and measure a company’s process efficiency compared to the best in the business. They will be given the opportunity to improve the company by implementing the benchmarked processes. It is in other words a manager process where external information is used to improve the internal processes (ibid).
In a study of best practice supply chain companies it was found that those companies that perform at high levels of supply chain capability are much more likely to be involved in benchmarking activity than companies that demonstrate average capability. (ibid)

4.3.3 Key Performance Indicators

The management professional Reh (2007) explains Key Performance Indicators, here on referred to as KPI, as measurements that reflect the critical success factors of an organization or a process. He also states that they will differ depending on organization. A company may have one of its KPI as the percentage of income that comes from returning customers and a school may focus its KPI on graduation rates of its students. Whatever KPI selected, they must reflect the organizations goals, be a key to organizational performance and must be measurable. KPI are usually long term considerations and might change as the organizations goals change, or as they get closer to achieving a goal. (ibid)

If a KPI is going to be of any value, there must be a way to accurately define and measure it. For example; generating more returning customers is useless as a KPI without some way to distinguish between new and returning customers. It is also important to define and stay with the same definition as long as possible. Targets should be set for each indicator in a way that it is clear to all employees, so that they understand and are able to take specific actions to accomplish them. Another important thing is to keep the number of KPI low just to keep everyone’s attention focused on achieving those. That is not to say that a company will have only three or four KPI in total, rather there will be three or four for the company and the units within it will have the same number that support the overall company goals. (ibid)

KPI should be used as a performance management tool, but also as a motivator for the staff. It will give everyone in the organization a clear picture of what is important, of what they need to make it happen. Everything the people do in the organization should be focused on meeting or exceeding those KPI. Show the staff what the target for the KPI is as well as the progress toward the target and people will be motivated to reach them. (ibid)

Björnland et al (2003) present categories to measure efficiency in different logistical activities in a company. These are:

Financial goals: Traditional financial measurements as return on investment, profit margin and logistical measurements such as tied-up capital or cost of transport, stock and handling.

Turnover rate: An important measurement from a logistical point of view that specifies how many times capital or stock is renewed in average during a year. Higher rates give better capital and stock capacity utilization.

Volume measurements: Material flow measurements such as delivered packages, number of order rows and order frequency.
**Theoretical frame of reference**

*Time goals:* This category usually consists of lead times from different aspects, in the company’s processes but also from supplier and to customer.

*Quality goals:* The most common quality goal is to have a certain service level, another could be variation in received goods.

Finally Björnland et al (2003) state that there is in general no way to say which measurements units are the best or suggest a method, since it all depends on the type of company, product and purpose of measuring. The intention of measuring is however always the same; follow up and control. (ibid)

### 4.4 Process mapping

A company can effectively improve its operations by first identifying its critical operations that effect production, quality and delivery capabilities of the organization. After identifying such operations, each of them can be individually examined in terms of developing a process map to understand the important characteristics of an operation and generating useful analytical data for carrying out data analysis. Managing processes associated with critical operations are the most effective way for an organization to eventually support its overall goals. By improving processes, a company can improve its internal efficiency, adaptability and customer service levels. Documenting processes can lead to insights and changes that can help improve operations. (Kumar & Phrommathed, 2005)

Process mapping is often used to visualise parts in a process. By mapping the processes in a flow it is easier to describe how the different parts of the organisation are connected and how they cooperate to create value for the customer. Process mapping does not achieve any improvement of the process or ways of working, it is just a help when analysing and measuring the processes to identify improvement areas. (Ljungberg & Larsson, 2001)

Rentzhog (1998) sees process mapping as a tool to visualize how the processes works. A large process is broken down into parts to see the details in the process. This is done to generate a picture over the whole process and to see how the pieces in the organisation are related to each other on different levels. A dilemma is if the process mapping gets to detailed, then the whole picture gets lost and the information becomes irrelevant. (ibid)

Process mapping often includes the creation of a flow chart. Rentzhog (1998) believes that a flow chart makes it easier to show the logical relations between activities. The chart illustrates in which order the activities takes place in the flow and can be a good tool to identify bottlenecks and other problem areas. (ibid)
4.4.1 Lead time

Since process mapping can be seen as a tool to visualize how the process works it can also be used to examine which activities that have the biggest impact on the total lead time. Mattsson (1997) defines lead time as the time it takes from order placement until delivery, but within this step every department has their own lead time on the order. More specifically the calendar time that it takes to carry through an activity, from when the need arise until it is fulfilled. (ibid)

Short lead time is an important factor for companies in general. For a third-party logistics company it is especially important since it is often one of their core competences. A short lead time is a great competitive advantage and can be the difference between making a sale and watching a competitor make the sale. A company that can promise the customer a shorter lead time than its competitors will often have an advantage and stand a better chance of receiving future orders. However a shorter lead time is not a guarantee for overall quality because it is difficult to reduce lead time and maintain quality control (Pollick, 2006). The length of the lead time is often used as a measure of a company’s competitiveness and it is therefore very important for companies to shorten their lead times as a competitive advantage (Sheu & Wacker, 1997).

The lead time for a product or an order depends on a number of factors such as set up time for the machinery and the speed of the delivery system. The lead time often changes depending on season and overall demand. That is because a production system most often has a certain capacity and if the demand increases the system cannot keep up, which leads to an increased lead time. (Pollick, 2006)

Time reduction

When trying to decrease total lead time, the theory of time reduction can be an essential tool. According to Aronsson et al (2004) it is difficult to exactly describe what should be done to reduce lead time by general advice. It all depends on the specific situation. Instead Aronsson et al (2004) describe some structural way to work with time reduction through six principal measures. The first four should be done in the sequence they are described.

1. **Eliminate** activities that do not increase value to the product, neither for the company nor for the customer. For example, doing similar controls twice or repacking a product in many steps.
2. **Simplify** the operations by making them less complex. One way to do that would be to redesign the product to simplify assembly or use a bar code reader instead of manually writing the order- and article numbers.
3. **Integrate** activities that are done separately without adding any value is a way to reduce lead time. For example, let the operator do the quality control of products instead of having a separate quality control department after the operation.
4. **Synchronize** the flow so that one activity can start right after another without any waiting time, in reality this means to reduce the passive time between two activities.
In addition to these steps, Aronsson et al (2004) give examples of measures that do not have to come in a specific order in the flow.

**Prepare**
By coordinating material in a standardized way, it will be easier for the operator to fulfil its objectives and render in a better flow. For example; all the right tools should be placed at the work station before the products arrive.

**Communicate**
It is possible to get a faster and more efficient communication by giving substantial and correct information. For example giving the next department in the flow information about when the products will be delivered. In that way preparation will be easier.

**Reorder**
Persson (1991) adds another way of reducing time by reordering the sequence so that the lead time for important products will be reduced at the cost of less important.

These ways of reducing time is helpful to have in mind when a lead time analysis is going to be carried out. The most suitable technique is based on the situation.

**Active/passive time**
When studying the lead time in a process, a lead time analysis can be of use. To describe the flow, lead time is split in to active and passive time. Active time is the period when any type of activity is performed on the product, for example: assembly, transport or registration. The rest of the time spent in the flow is passive time. Activities that are passive can for example be:

- Products are received but not unpacked.
- Products are on stock shelves.
- Products are waiting to be registered.

The passive time is generally longer than the active time. It is not unusual that the passive time is about 99% of the total lead time and this is the reason why it is more important to reduce passive time than active time (Aronsson et al, 2004). Persson & Virum (1998) believe that it is as important to eliminate activities that do not create any value for the customer as it is to have a good efficiency in the activities that add value. Therefore can it be essential to eliminate non-value activities.

Figure 4.2 shows an example of a lead time analysis diagram of an order from received until it is delivered to the customer. The time when an order is processed and value is added to the product is represented by the gray fields and is called active time. The rest of the time spent in the flow is passive and symbolize non-value creating time such as waiting time. (Aronsson et al, 2004)
4.4.2 5S

5S is a method to improve the work area, through creating order and reduce waste of time in looking for tools and material. By keeping the work area neat and clean as a routine and give all tools a position where it should be unless it is used will create more efficient activities in the line with less defect products according to Hirano (1996).

Sort
Any work area should only have the items needed to perform the intended operation (www.qualitytrainingportal.com). According to Hirano (1996) people tend to collect tools and materials that can be useful in other projects but are in that way interrupting the daily routines. Operators should clear these from the work area and focus on their main objectives.

Set in Order
Everything in the work area should have a place and be in its place. This is so that it will be easy to find and no time is wasted in the search for the right tools (www.qualitytraningportal.com). Hirano (1996) gives an example that a pair of scissors can be painted on the desk to illustrate where it should be if it is not in use.

Shine
Not only should the work area be clear, it should also be clean. Cleanliness involves improving the appearance of the work area and even more importantly keeping the work area from getting dirty rather than just cleaning up after it became dirty. (Hirano, 1996)

Standardize
Everyone in the work area and the organization must be involved in the 5S effort, creating the best practices and then getting everyone to copy those best practices in the same way, everywhere, and every time. Work area layouts and storage techniques should be standardized wherever possible (www.qualitytrainingportal.com). Hirano (1996) sees this step as a method of maintaining the first three steps and it should be seen as a receipt on how well these steps are completed.

**Sustain**

It is tough to keep a 5S effort, or any improvement effort for that matter, going. The 5S involves a culture change in the company. To achieve a culture change, it has to be ingrained into the organization by everyone at all levels. (www.qualitytrainingportal.com)

### 4.5 Efficiency

This section of the theoretical framework summarises the theories above that are used to support the purpose of the thesis. Apart from that, definitions of efficiency from different sources are given to strengthen the literature review for efficiency increasing measures. Supply chain management, warehouse management and benchmarking are all management related issues that can be used when reaching for efficiency improvements. By using correct KPI, efficiency can be measured in different ways. Process mapping can help identifying critical operations and is therefore an advantage when trying to improve operations. Since lead time always is in focus for third-party logistical companies the efficiency in this thesis is focused on time aspects. The theory of lead time is therefore vital in the search for measures rendering in efficiency increase.

Lumsden (1998) defines efficiency as degree of goal fulfilment which can be seen as the benefit of the performed task. Efficiency is about doing the right things and can be split into inner and outer efficiency. The inner efficiency is about how well the company performs the inner processes and can for example be improved by well organized material handling and administration. Outer efficiency is the adaptation of the company in comparison to surrounding environment and can for example be improved by well adjusted delivery service. It is important to realize the effects of these measurements when reaching for the goals of the company. (ibid)

Jonsson & Mattsson (2005) state that the purpose of logistics is to improve company efficiency and that efficiency can be expressed by a few variables that effect the company’s revenue, costs, tie-up off assets and the environment. Time is a variable of that kind. Without a time efficient logistic system it is hard to create an overall efficient system. Short and accurate time to customer is of great importance and to enable fast deliveries, short lead times are required in internal processes. Without this for the processes conducted between arrival and delivery there is a risk that time to customer is longer than accepted. (ibid)

Inner and outer efficiency can be used to describe most types of processes no matter what function it is concerning. However one important condition is that the processes should be standardized (ibid).
Theoretical frame of reference

Measurement of inner efficiency is according to Peterson & Jackson (2000) easily done as long as routines are followed and the workflow is predetermined. Outer efficiency is regarding development and change of the already determined standardized process. To be able to increase the outer efficiency it requires inventive and new ways of thinking, which is important to development and survival of a company. (ibid)
5. Description of present situation

The purpose of this chapter is to give an understanding of how the process of receiving goods is performed at LL.

5.1 Product range

Below is a description of the different contact lenses distributed by LL. In each type section is a description of how consumers use the different contact lenses. This product range is meant to give an understanding of why products should be treated differently depending on type. Some products are ordered from supplier when a customer order is placed while the majority is picked from stock. Service level data is from October and November 2007. Number of available products presented is from data collected at the end of December, 2007. The service level is classified into A, B and C. Class A has the highest service level and class C the lowest.

Daily disposables

Daily disposables are only used once and thrown away in the evening. A new pair of contact lenses is used the next day. These contact lenses are in most cases delivered in packages of 30 or 90. The three most frequently sold products are included in this category. During October and November the service level was class A and there are about 1500 available contact lenses of different brand or power. Examples: Softlens OneDay from Bausch&Lomb, Focus Dailies from CIBA Vision and 1-Day Acuvue from Johnson&Johnson.

Monthly disposables

Monthly disposables are used for a month and cleaned in a lens solution every night. In most cases these kinds of contact lenses come in packages of six lenses per package. The service level for this category was class A and there are about 28000 available contact lenses of different brand or power. Examples: Purevision from Bausch&Lomb, Air Optix from CIBA Vision, and Frequency 55 from CooperVision.

Extended wear contacts

The extended wear contacts are normally worn for a full month but the difference from monthly disposables is that this lens can be worn 24 hours a day. These contact lenses are also delivered in packages of six. Examples: Purevision from Bausch&Lomb and Air Optix Night & Day from CIBA Vision.

Coloured contacts

Coloured contacts cover or add an effect to a natural eye colour. These contact lenses are in most cases delivered in packages of two or six. There is one brand available as daily contacts and 13 brands of monthly disposables. These 14 brands make a total about 2200 available contact lenses of different colours and powers. The service level for this category was class A. The coloured daily disposables represented a service level of class A and the monthly coloured a service level of class B. Examples: FreshLook Colors from CIBA Vision, and Acuvue 2 Colours Enhancers from Johnson&Johnson.
Description of present situation

**Progressive contacts**
Progressive, bifocal and multifocal contacts help the eye to focus at both short and long distances. This category includes few brands but many choices of powers. Most brands are monthly disposables but they are also available as daily disposables. There are about 780 different contact lenses available. The service level was class B during October and November. Since all products have due date and some have low demand not all available powers can be kept in stock. This is the reason for the low service level for these products. Since not all powers can be kept in stock, some are ordered from supplier when a customer order is placed. Examples: *Softlens Multifocal* from Bausch&Lomb, *Focus Progressives* from CIBA Vision and *Acuvue Bifocal* from Johnson&Johnson.

**Toric contacts**
The toric contacts adjust blurred vision due to irregular curvature of the cornea. These contact lenses come in packages of three, six or thirty contact lenses. This category has the biggest variation for each brand and there are about 25 000 different contact lenses available. Of these are about 23 200 monthly disposables. As the progressive contact lenses, some types are rarely ordered and cannot be kept in stock. If they are kept in stock there might only be one or two boxes. The service level was therefore class B Of this was the service level for daily disposable torics class A and monthly disposable torics class C. Even though there are less available choices of the daily disposable torics these stand for about the same amount of sold boxes as the monthly disposable torics. Examples: *Softlens Toric* from Bausch&Lomb, *Focus Dailies Toric* from CIBA Vision and *Frequency Xcel Toric* from CooperVision.
5.2 Order types
At LL received goods can be separated into four types of orders;

- Large case lots.
- Small case lots.
- Orders containing few order rows.
- Orders containing many order rows.

These types are handled in different ways during the process of receiving goods:

*Large case lots* arrive on pallets, the case top is removed, lens power is identified and the case is manually labelled with power and arrival month. A large case lot contains boxes of 30 or 90 contact lenses.

![Figure 5.1 A pallet of large case lots.](image1.png)

![Figure 5.2 A large case lot.](image2.png)

*Small case lots* that arrive in larger packages are placed on unpacking tables and labelled in the same way as the large ones. While the large case lots are brought to a bulk shelf by a forklift the small case lots are brought to the stock shelf on a trolley. The small case lots contain boxes of 6, 30 or 90 contact lenses.

![Figure 5.3 Small case lots on a trolley.](image3.png)

![Figure 5.4 Three kinds of small case lots.](image4.png)
Description of present situation

An order containing many order rows which is not in case lots, takes the longest time to process since it has to be sorted and sometimes repacked into cases suitable for the stock shelves.

*Figure 5.5 An order containing many order rows.*

*Figure 5.6 An order containing many order rows.*

Orders containing few order rows are in most cases delayed or remaining order rows from previously arrived orders. This kind of order is common but also fast to process. They often arrive in small packages packed together in a large one.

*Figure 5.7 Orders containing few order rows.*

*Figure 5.8 Orders containing few order rows.*
5.3 Order priority

In the interview with the Goods Receiving Team Leader and the Goods Receiving Operator, a question regarding the order priority was asked. The answers could indicate that the operators know in which sequence received orders should be handled but do not always follow this or bring less important parameters into priority decisions. Today a clear order priority of which orders that should be processed first does not exist at LL. In an interview, the Goods Receiving Team Leader states that the priority is that the daily orders from the largest supplier should be processed first but that they often start with the order which will take the longest time. This will indicate how they are doing time wise in a better way. He also pointed out that large case lot orders, which will be placed in bulk, has lowest priority unless he needs to clear out space. The Goods Receiving Operator states that his opinion regarding order priority is that they finish as many orders as possible in as short time as possible. He starts with daily orders because they take the shortest time to place in the shelves. He also gives bulk products lowest priority and believes that customer ordered products should have top priority.
5.4 Flow chart of receiving goods process

Below is an illustration of the order flow in receiving goods. It illustrates the flow starting when goods are received and ending when they have been placed in shelves and registered as pickable in Oracle. The flow is based upon the different approaches depending on order type. The flow chart should give an extended understanding of the process map and can be compared to the detailed list of operations in the end of this chapter.

Figure 5.9 Flow chart of receiving goods process.
5.5 Process mapping
Each activity in the process of receiving goods is described in detail below.

Goods arrives
The mapped process starts when goods arrive at the loading bay. Trucks from suppliers arrive Monday to Friday, usually between 10 am and 2 pm. The amount of goods might differ from full EU sized pallets to a single package depending on product and order. Arriving goods always have to be signed by authorized staff who also count the number of packages before signing the carrier note. When arrived, goods are placed in an area intended for received goods.

Open packages
The second step in the process is when the operators open the packages and allocate the consignment, which contains:

- LL order number
- The suppliers order number
- Shipping date
- Order date
- Delivered products
- Undelivered products

This step includes removing wrapping from the full pallets, opening a big box to retrieve small packages inside or removing the case tops.

Placement on unpacking table
When the package has been opened it is brought to the unpacking table. In this work area, there are three tables for unpacking packages. Large case lots remain on the pallets but other order types are placed on the tables. At the unpacking table there is equipment used in the receiving goods process. This equipment is for example; scissors, knifes, pens and stapling machine. The equipment does not have a specific location at the unpacking table and is mostly located where the operator last used it.
Description of present situation

Printing expected receipts documents
Before labelling or sorting an order, the operator moves to the office desk and allocates LL order number on the consignment. After typing the number on the computer, expected receipts documents can be printed. These documents have a list of products that are ordered on the specific order number. The documents have to be collected from the printer.

Labelling Case
If an order contains large or small case lots the cases are manually labelled with a marker pen. The lens power and arrival month are written on the side of the case.

Repacking and sorting
For orders that are not received in case lots and consist of more than one order row the next step in the process is sorting and repacking. This means that the lens boxes are sorted by their parameters and repacked into suitable cases that are stored underneath the unpacking tables.
Description of present situation

Identification of articles
The next step is to identify received articles. The lens boxes are matched with the expected receipts list to check which products in the order have arrived. Since an order sometimes is split into different delivery dates this step is important to keep track of what has been received and what will be delivered later. Received products are also matched with the consignment.

Receipt of received order rows and printing locator list
When the order has been controlled, it is due to be registered in the ERP-system Oracle. This is done on the computer at the office desk by marking the products as received and saving it in the system. If an order contains undelivered products, the order will still have undelivered status containing only the remaining order rows. Each product is connected to a specific locator number, which is also a number on a shelf where the product should be placed. After the order has been registered a document is printed, containing the product specifications and its individual locator number. This document is collected at the printer.
Description of present situation

Placement on trolley
This step can sometimes be performed before the previous step but it is generally carried out after the order has been registered as received. Large case lots remain on the pallets while other order types are placed on a trolley together with expected receipts and locator list.

Figure 5.18 Order is queuing on trolley.
Figure 5.19 Products placed on forklift.

Placement on warehouse shelves
An operator collects the trolley and places the products on the shelves which are marked with locator numbers, by using the locator list printed in an earlier step. When all products in the order are in the shelves the operator brings the trolley back to its position and takes the documents to the office desk. Pallets with large case lots are collected by forklift and placed in bulk shelves. Each order row is marked on the locator list when it is placed in the shelf.

Figure 5.20 Bulk shelf.
Figure 5.21 Warehouse shelves.

Confirmation in Oracle
The order is now ready to be registered in Oracle again as a confirmation that the products have been placed at their correct locations in the storage. This confirmation is performed on the computer at the office desk. After this step, the product level is increased in the ERP-system and products are ready to be picked.
Placing documents in folder

The final step is taken to complete the process of received goods by placing consignment, expected receipts document and a front cover, which have been fastened together, in a folder. The front cover, see appendix A that is used contains lines for writing receiving date, order number and supplier. It also contains a space where information regarding for example damaged products should be written. Finally it contains four squares, each one representing an activity in the handling of the product. These are marked when each activity is finished. In the folder, documents are sorted by receiving date but partly delivered orders are placed next to the first received order with the same order number. This sorting is, according to the Goods Receiving Team Leader, done two times a week and takes about one hour each time. Each folder contains about 30 orders and they require about five folders each week to be able to save all order documents.
5.5.1 Detailed list of the activities

The table below is a summary of the activities explained above. For an easier understanding, this table is more detailed and some of the activities have been split up. The handling of large case lots differ from the list below since these are brought to the shelves by a forklift instead of a trolley. The table columns consist of activity number, type of activity and the description of each activity. Type of activity explains if the goods are being moved, an operation is carried out, the goods are queuing or if the activity only consists of operator movement.

Table 5:1. Detailed list of the activities.

<table>
<thead>
<tr>
<th>No</th>
<th>Activity type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Move</td>
<td>Goods arrive from supplier</td>
</tr>
<tr>
<td>2</td>
<td>Operation</td>
<td>Number of packages is controlled and carrier note is signed</td>
</tr>
<tr>
<td>3</td>
<td>Waiting</td>
<td>Package queue before unpacking</td>
</tr>
<tr>
<td>4</td>
<td>Operation</td>
<td>Open package</td>
</tr>
<tr>
<td>5</td>
<td>Operation</td>
<td>Consignment is located</td>
</tr>
<tr>
<td>6</td>
<td>Move</td>
<td>Package is placed on unpacking table</td>
</tr>
<tr>
<td>7</td>
<td>Operation</td>
<td>Order number is typed in Oracle and expected receipts are printed</td>
</tr>
<tr>
<td>8</td>
<td>Operator movement</td>
<td>Expected receipts documents are collected from printer</td>
</tr>
<tr>
<td>9</td>
<td>Operation</td>
<td>Front cover, expected receipts and consignment are stamped together</td>
</tr>
<tr>
<td>10</td>
<td>Operation</td>
<td>Repacking, sorting or labelling of order</td>
</tr>
<tr>
<td>11</td>
<td>Operation</td>
<td>Identification of articles received</td>
</tr>
<tr>
<td>12</td>
<td>Operation</td>
<td>Checking that received goods match sent goods on consignment</td>
</tr>
<tr>
<td>13</td>
<td>Operation</td>
<td>Received order rows are marked as received in Oracle</td>
</tr>
<tr>
<td>14</td>
<td>Operator movement</td>
<td>Locator list is printed and collected from printer</td>
</tr>
<tr>
<td>15</td>
<td>Move</td>
<td>Products, locator list and order document are placed on trolley</td>
</tr>
<tr>
<td>16</td>
<td>Waiting</td>
<td>Trolley queue before collected</td>
</tr>
<tr>
<td>17</td>
<td>Move</td>
<td>Trolley is collected and products are placed in shelves</td>
</tr>
<tr>
<td>18</td>
<td>Operator movement</td>
<td>Trolley is brought back to origin</td>
</tr>
<tr>
<td>19</td>
<td>Operator movement</td>
<td>Documents placed on desk in office</td>
</tr>
<tr>
<td>20</td>
<td>Waiting</td>
<td>Documents queue before received confirmation</td>
</tr>
<tr>
<td>21</td>
<td>Operation</td>
<td>Confirmation in Oracle that products have been placed in shelf</td>
</tr>
<tr>
<td>22</td>
<td>Operation</td>
<td>Placing documents in folder</td>
</tr>
</tbody>
</table>
5.6 Order characteristics

To give the reader an understanding of the variation in received orders, processed at LL each day, the authors have collected data showing:

- Number of received orders per day.
- Average number of order rows per order each day during the same time period.

In this section statistics of received goods from the first of June until the last of August is documented. The data are collected from Oracle:

![Graph showing received orders per day](image)

*Figure 5.22 Number of received order each day.*

Figure 5.22 shows the number of orders received during a day. It varies between 10 and 70 with an average of 32 orders. Within these, an order contains varying number of order rows. Figure 5.23 shows the average number of order rows each day during the same period of time.
Description of present situation

During the period, the average number of order rows/order varies between 4 and 52. LL goal is to place all goods in the shelves the same day they are received even though the flow is varying and difficult to predict. Despite this, the goal is fulfilled about 98% according to the Goods Receiving Team Leader.

Figure 5.23 Average number of order rows per order.
5.7 Layout planning

The planning of the layout at LL department of receiving goods is shown in figure 5.24. Stations used in the process of receiving goods is marked with a letter from A to F to give the reader a better understanding of the process mapping in chapter 5.5.

![Figure 5.24 shows the layout of LL department of received goods. Scale 1:200](image)

- A = Received goods area
- B = Unpacking table
- C = Printer
- D = Computer desk
- E = Warehouse shelves
- F = Trolley load space

When goods arrive to LL it is placed at point A in figure 5.24. If the received goods are large case lots it will stay there to be unpacked. Small case lots and small packages are moved to the unpacking table at point B. When products have been unpacked the operator walks to the computer desk, at point D, to print the expected receipts. These are
Description of present situation

collected at point C and the operator walks back to the unpacking table to sort and carry out the quality control. When the quality control is done and the locator list is printed the operator moves the products to the trolley at point F. The operator brings the trolley with the contact lenses to point E and places them on the right locations in the shelves. Before the contact lenses are ready to be picked the operator walks back to the computer desk and confirm in Oracle that the contact lenses are pickable.
5.8 Movement

In the process of receiving goods, there are activities that include movement for both the operator and the products. In Table 5:2 the total movements of these are compared to find out if any non-value adding movement is to be found. Figure 5.24, the layout planning, can be used to find out where the stations are placed in the warehouse.

Table 5:2. Movement on the product compared to the movement of the operator.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Movement product (stations)</th>
<th>Movement operator (stations)</th>
<th>Movement product (metres)</th>
<th>Movement operator (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products are received from the supplier and placed at A</td>
<td>Start</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator brings a package to the unpacking table (B) and look for the packing slip</td>
<td>A – B</td>
<td>A – B</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Operator moves from unpacking table to the computer (D) where expected receipt is printed</td>
<td>B - D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator walks to the printer (C) to collect expected receipts</td>
<td>D - C</td>
<td></td>
<td></td>
<td>34</td>
</tr>
<tr>
<td>Operator walks to the unpacking table (B) to sort and do the quality control</td>
<td>C - B</td>
<td></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>The contact lenses are placed on the trolley (F)</td>
<td>B — F</td>
<td>B - F</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Operator walks back to the computer (D), registers the receipts and prints the locator list</td>
<td>F – D</td>
<td></td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Operator walks to the printer (C) to collect the locator list</td>
<td>D - C</td>
<td></td>
<td></td>
<td>34</td>
</tr>
<tr>
<td>The list is placed with the contact lenses on a trolley (F)</td>
<td>C - F</td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Operator brings the trolley with the contact lenses and places them in the shelves (E)</td>
<td>F — E</td>
<td>F - E</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Operator walks back to the computer (D) and confirm the order as pickable</td>
<td>E - D</td>
<td></td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>223</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5:2 shows that the operator movement is 223 metres and the products are moved 38 metres. The average operator movement is about 185 meter more then average movement of an order. As said, in chapter 5:6, there is in average 32 orders received every day which means that operators sometimes walks almost six kilometres (185*32) more then
the contact lenses is moved during a day. The distance to point E is dependent on which shelf the products are placed in. Calculations above are based on an average distance to the shelves.

5.9 Time study

To measure the lead time in the process of receiving goods the authors decided to perform a time study on each operation in the process. In the study the four order types; large case lots (LCL), small case lots (SCL), orders containing many order rows (MOR) and orders containing few order rows (FOR) have been measured in the most suitable way for the specific type. The main study was carried out during two weeks in November with a few compliments during December and January. Because of the short and similar duration for some operations, they were given a fixed time to perform instead of being measured each occasion. These operations are therefore classified as “fixed times” and are for example, walking to the printer and computer, document handling and placing documents in folder.

Table 5:3. Lead time for the four order types.

<table>
<thead>
<tr>
<th>No.</th>
<th>Measured Activities</th>
<th>LCL (min)</th>
<th>SCL (min)</th>
<th>MOR (min)</th>
<th>FOR (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3</td>
<td>Goods arrive → starts open package</td>
<td>77,5</td>
<td>107,5</td>
<td>78</td>
<td>181,5</td>
</tr>
<tr>
<td>10</td>
<td>Sorting/Labelling</td>
<td>20,5</td>
<td>6,5</td>
<td>9,5</td>
<td>-</td>
</tr>
<tr>
<td>11,12</td>
<td>Quality control</td>
<td>5</td>
<td>2</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>Receipt of received order</td>
<td>2</td>
<td>1,5</td>
<td>5,5</td>
<td>1,5</td>
</tr>
<tr>
<td>16</td>
<td>Waiting on trolley/pallets</td>
<td>120</td>
<td>82</td>
<td>140</td>
<td>59</td>
</tr>
<tr>
<td>17</td>
<td>Placement on shelves/bulk</td>
<td>37</td>
<td>16,5</td>
<td>38</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>Waiting to be registered → registered</td>
<td>12</td>
<td>30,5</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Remaining activities</td>
<td>8,5</td>
<td>8,5</td>
<td>8,5</td>
<td>8,5</td>
</tr>
<tr>
<td></td>
<td>Total lead time with movement</td>
<td>282,5</td>
<td>255</td>
<td>312,5</td>
<td>276,5</td>
</tr>
</tbody>
</table>

Goods arrive → starts open package

In table 5:3 it can be seen that orders with longest queue time before processed are orders containing few order rows which is waiting in average 181,5 min. This is because this type is not prioritized and operators choose other order types first. Orders containing large case lots and orders containing many order rows are the ones queuing shortest time in this activity.

Sorting/Labelling

The case lots, both large and small, are labelled with arrival month and lens power. Due to this, the large case lots have the longest process time in this activity. For orders containing few order rows the time to sort is not needed since these only contains between one and three order rows.
Quality control
A quality control is performed on all orders but most time is spent on orders with many order rows because every order row needs to be matched with the expected receipt and matched with consignment.

Receipt of received order
The receipt of received order time is almost the same for all types except for orders containing many order rows. This order type takes more time to type on the computer since each order row has to be confirmed as received and when the order is not delivered complete, there is often some correction that has to be done.

Waiting on trolley/pallets
When the products have been controlled and are ready to be placed on the shelves they are queuing on a trolley. Products can be queuing here several hours before an operator places them in the shelves. The length of this activity depends on workload for those operators that are placing products in shelf.

Placement on shelves/bulk
The time spent placing an order in the shelves is depending on the number of order rows and type of product since the length to shelf is dependent on product type.

Waiting to be registered
When products have been placed in the shelves, the belonging documents are placed on the computer desk waiting for an operator to register the products as pickable in Oracle. This waiting time is dependent on the workload of the operator that often waits until there are a few orders on the desk waiting to be registered.

“Fixed times”
Below is the activities that have been given a fixed time instead of been measured during each order. The reason for the fixed times is that they are short and have the same duration independent processed order type.

Table 5:4. Operations that were given a fixed time.

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity description</th>
<th>Estimated time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Number of packages is controlled and carrier note is signed</td>
<td>0,5</td>
</tr>
<tr>
<td>4,5,6</td>
<td>Open package → package placed on unpacking table</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Order number typed in Oracle and expected receipts are printed</td>
<td>0,5</td>
</tr>
<tr>
<td>8</td>
<td>Expected receipts documents are collected from printer</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Documents are stamped together</td>
<td>0,5</td>
</tr>
<tr>
<td>14</td>
<td>Locator list is printed and collected from printer</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Products and belonging documents are placed on trolley</td>
<td>0,5</td>
</tr>
<tr>
<td>18</td>
<td>Trolley is brought back to origin</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>Documents placed on desk in office</td>
<td>0,5</td>
</tr>
<tr>
<td>21</td>
<td>Confirmation in Oracle that products have been placed in shelf</td>
<td>1</td>
</tr>
<tr>
<td>22</td>
<td>Placing documents in folder</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total “fixed time”</td>
<td>8,5</td>
</tr>
</tbody>
</table>
6. Benchmarking

This chapter presents findings of the performed benchmark study in this thesis. As Björnland et al (2003) state the idea of benchmarking studies is that you have to accept the fact that there are always companies that have a similar process that is more effective than yours. To get a better understanding of the process of receiving goods and see how other companies handle this issue the authors of this thesis visited two companies, Dustin and NetOnNet. The authors studied the process of receiving goods at these companies and compared it with LL.

6.1 Dustin AB

The eight of October 2007 the authors visited Dustin, located in Stockholm. The Logistic Manager gave a guided tour through their process of receiving goods.

General information

Dustin is a logistics company that supplies technological products to companies as well as private consumers. Dustin was founded in 1984, since that has Dustin grown into a brand associated with reliability, good service and fast deliveries. During its 20 years in the business, Dustin has grown to incorporate three companies: Dustin AB, Dustin Partner AB and Dustin Home AB. The Dustin Group's turnover amounted to 2.2 billion SEK from September 2004 to August 2005. (www.dustin.se)

Receiving goods

Dustin’s suppliers deliver goods between 07.00 and 16.00, generally the busiest time are between 11.00 and 15.00. Depending on the workload, between four to eight persons work at this department. Dustin has four main suppliers that stand for 75% of the received goods and deliver three times a day during working hours to smooth out the workload. The other suppliers deliver on a steady flow during the day. The amount of received goods varies from one package up to several EU-pallets.

When goods arrive, it is placed in an intended area separated from the main warehouse where an operator signs the carrier note after counting the number of pallets arrived. As soon as the delivery truck has left, the goods are moved to a registration area and the wrapping is removed.

Registration

To simplify the registration, goods are sorted depending on size. Small packages go to one station where they are unpacked on a desk and bigger packages on other hand go to a station where they remain on the pallet during registration. Operators have a wireless scanner to register the bigger packages and a wired scanner to register the smaller packages. The operator scans the product and the information is transferred to a computer screen. Order number and packing slip number are typed in the same window as the product information appeared. When scanning the next product a new order row will appear below the first and the numbers are still there if it is the same order. When completing the registration of an order row, labels are automatically printed. The label is
placed on the product which is dispatched with a trolley to the shelf. The label contains shelf number, article number, barcode and received date. All products get a label but if an order row contains a large quantity of products a second operator paste the labels so that the operator at the computer desk can continue with the next order row. When an order row is completed the stock status will increase on the website. The company policy is that if the product is on the shelves it should be delivered the same day as the customer placed the order.

6.2 NetOnNet AB
The first of October 2007 the authors visited NetOnNets warehouse shop in Stockholm. During the visit the authors studied how the Goods Receiving Operator worked during three hours.

General information
NetOnNet is Europe’s first and one of the biggest suppliers of electronics online, it was founded in 1999 with the intention to sell quality products at lower price then regular stores. Today there is also an opportunity to buy these products directly at the warehouse at the same prices as online. In the warehouse the products are still in boxes and navigation is done by the customer through computers, where storage status and availability can be controlled. (www.netonnet.se)

Receiving goods
At NetOnNets warehouse in Stockholm is there mostly just one person handling the received goods. The goods arrive to the warehouse between 07.00 and 16.00 in a constant flow. Trucks unload at the loading bay where an operator sign the shipment consignments after counting the number of packages arrived. The order is then registered as received.

An order can contain between 2 and 300 order rows depending on type and size of product and it is not unusual that orders are part delivered. Most of the received goods are sent from the main warehouse in Borås which has about 30-40 suppliers. Only delayed orders are delivered straight from manufacturer to the warehouse in Stockholm. (The Goods Receiving Operator)

Registration
The operator locates consignments and traces the order in the ERP-system using the order number that is found on the packing slip. The ERP-system will show the order rows that belong to the order number. The operator then scans the bar code with a wireless scanner, the product information appears on the screen and is compared to the order. By using the wireless scanners products can remain on the pallets instead of being moved to an unpacking table. The operator registers and saves one order row at the time and that row is removed from the order once registered. A label containing shelf number, article number and order number is printed and placed on package. This is completed to make it easier for the warehouse staff to know where it should be placed in the warehouse. (ibid)
7. Analysis

In this chapter the analysis performed on the present situation will be presented, the analysis is connected with the theoretical aspects. The chapter starts with analysis of the process as a whole. Other areas chosen for analysis is order priority, movement, working station and the document handling which are all identified as inefficient parts of the process. The authors have also analysed the benchmarking study as well as the use of Key Performance Index. Finally, a summary of waste and inefficiency that has been found in the process of receiving goods is presented. The purpose of the analysis has been to illuminate inefficient operations in the process.

7.1 Process mapping

Rentzhog (1998) views process mapping as a tool to analyse how the process is performed. In order to generate a picture over the process and see how the pieces in the organisation are related to each other on different levels, the process is broken down into parts to perceive the details. In the description of present situation in chapter 5, all operations have been identified and explained in detail. The flow chart visualises how the operations are linked together and in which sequence they are done. Even though process mapping visualizes the problem areas, it does not achieve any improvements itself. As Ljungberg & Larsson (2001) states; it is a help when analyzing or measuring any problem areas. Anyone at LL can use the process map if an understanding of the process is required, it could be stored on the company intranet for easy access. It is a good training tool and can be used as a checklist for new employees. Contrast that with the usual training method, where the current employees tells the new employee how something is done, including the mistakes that tends to be made and the shortcuts taken. The process map will also give the company a tool when doing changes in the future and give a hint of how an operation in a later stage is dependent of a change in an operation at an earlier stage.

7.2 Order priority

The process map of receiving goods has given a classification of received order types that were not stated at LL earlier. The four order types are large case lots, small case lots, orders with many order rows and orders with few order rows. By classifying these order types, decision regarding priority can be taken. Short lead time is more important for some products then others. Products that require short lead time is for example contact lenses that are received late and could be sent with an earlier delivery to customer if they are made pickable as soon as possible. Due to the low service level, toric, colour and progressive contact lenses are the type of product that should be prioritized. Another reason for prioritizing the toric contact lenses is since these are mostly ordered by retailers that LL want to keep the highest customer service towards them. Large case lots on the other hand, are always placed in bulk and are thereby less dependent on short lead time. Persson (1991) states that time should be reordered in a way so that the lead time for important products will be reduced in cost of less important products. By defining a priority that is based on the four order types, lead time could be kept as short as possible for products that requires this.
7.3 Working station
Hirano (1996) mentions that by keeping the workstations neat, clean and give all tools a position where they should be unless they are used will create more efficient activities in the line. In LL case this is problematical since the tools do not have a specific position at the station and can thereby be found where the operator last left it. To give all tools a position on the unpacking table where operators can find them, will probably make the process more efficient. Time will not be wasted on finding the right tool when needed, therefore time can be reduced and irritation can be avoided. Hirano (1996) gives an example of this where he believes that a scissor can be painted on the desk to illustrate where it should be if not in use.

7.4 Double control
Aronsson et al (2004) state that activities not increasing the value of the product should if possible be eliminated since they are a waste of time. Doing the same control twice is an example of an activity that should be seen as waste of time. At LL, the receiving goods are receipt controlled when the quality control is performed for the first time and also receipt controlled a second time before placed on the warehouse shelves. At the first quality control the operator is counting the quantity of received products and marks them in expected receipt. At the second control when the products are placed on the shelves the operator is marking products as placed on shelves in the locator list. The authors of this thesis see this as a waste of time that could be done more efficient where the first control could be exchanged to a more efficient solution.

7.5 Document handling
Lumsden (1998) states that a well organized administration is important when a company wants to improve their inner efficiency. The authors of this thesis have the same view as Lumsden regarding document handling. Since computers are regularity in work processes today the administration part should be done on the computer as much as possible. If documents have to be manually archived, for LL case as verification, it should be done as seldom and with as few documents as possible. Today is consignment, expected receipts list and front page stamped together and saved in a folder. When a folder is full it contains about 30 orders including late delivered orders with the same order number as an earlier received one. Since there are in average 32 orders received per day it implies that about five folders are archived each week and about 260 folders in a year. The reasons for saving these documents are that there has to be a verification of receiving an order and that the purchase department sometimes needs to use the documents if something regarding a specific order is incorrect. The authors believe that new routines regarding purchase departments need for these documents should be created since there have to be a simpler way to check for faults in received orders.

The expected receipts list, which is a list of all order rows of an order, is sometimes a problem when controlling received products. For most of the products, the order rows on the list are sorted by product type and thereafter lens power in increasing order. The toric contact lenses however do not have the sorting by lens power and are only from some suppliers listed by product group. Since the orders with toric contact lenses consist of
many order rows this tends to render in an inefficient receipt control. This is also one of the things that the Goods Receiving Operator pointed out as a problem during the interview.

7.6 Movement

Aronsson et al (2004) state that activities that do not increase the value of the product for neither the company nor the customer should be eliminated. The layout planning of LL warehouse can be compared with the operations listed in table 5:2. This shows that the operator is walking a lot more than the product is moved. Operators does not, for example, add any value to the product by walking 11 meters to the computer to print a document and walk 34 meters to pick it up just to walk 26 meter to get back to the unpacking table. Aronsson et al (2004) means that if a company wants to reduce time the flow should be synchronized so that one activity can start right after another without any waiting time. This can partly be achieved at LL by reducing the time that the operators walks just to print the documents and to collect them.

7.7 Time study

Persson & Virum (1998) state that it is as important to eliminate activities that do not increase value for the customer as it is to have a good efficiency in the activities that adds value. At LL products are placed on a trolley after they have been sorted and controlled. Here they can be queuing up to three hours, according to the time study, before they are placed on the warehouse shelves. Another problem is when products have been placed on the shelves and the operator walks back to the computer to register them. There is quite often a delay before the product is confirmed as ready to be picked. This delay is caused due to that the operator is waiting until there are more orders to confirm in Oracle. These factors increases the lead time and might result in delayed customer orders.

Lead time analysis

According to Aronsson et al (2004) the passive time is always longer then the active time. It is not unusual that the passive time is about 99% of the total lead time and this is the reason why it is more important to reduce passive time then active time. When measuring the lead time at LL it was found that the relation between active and passive time differ depending on measured order type. For example when processing orders with few order rows only 3% of the total lead time were active time and remaining time was passive. Aronsson et al (2004) gives three examples on activities that should be seen as passive; products are received but not unpacked, products are on stock shelves or products are waiting to be registered. For all order types most of the passive time is spent waiting in queues, both when products are received but not unpacked as well as when waiting to be registered.
Table 7.1. Operations that should be considered as active or passive; activity 1-6 is classified as receiving goods, 7-15 as control and 16-22 as placement in warehouse shelves.

<table>
<thead>
<tr>
<th>No</th>
<th>Active/passive</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Active</td>
<td>Goods arrive from supplier</td>
</tr>
<tr>
<td>2</td>
<td>Active</td>
<td>Number of packages is controlled and carrier note is signed</td>
</tr>
<tr>
<td>3</td>
<td>Passive</td>
<td>Package queue before unpacking</td>
</tr>
<tr>
<td>4</td>
<td>Active</td>
<td>Open package</td>
</tr>
<tr>
<td>5</td>
<td>Active</td>
<td>Consignment is located</td>
</tr>
<tr>
<td>6</td>
<td>Active</td>
<td>Package is placed on unpacking table</td>
</tr>
<tr>
<td>7</td>
<td>Active</td>
<td>Order number is typed in Oracle and expected receipts are printed</td>
</tr>
<tr>
<td>8</td>
<td>Passive</td>
<td>Expected receipts documents are collected from printer</td>
</tr>
<tr>
<td>9</td>
<td>Active</td>
<td>Front cover, expected receipts and consignment are stamped together</td>
</tr>
<tr>
<td>10</td>
<td>Active</td>
<td>Repacking, sorting or labelling of order</td>
</tr>
<tr>
<td>11</td>
<td>Active</td>
<td>Identification of articles received</td>
</tr>
<tr>
<td>12</td>
<td>Active</td>
<td>Checking that received goods match sent goods on consignment</td>
</tr>
<tr>
<td>13</td>
<td>Active</td>
<td>Received order rows are marked as received in Oracle</td>
</tr>
<tr>
<td>14</td>
<td>Passive</td>
<td>Locator list is printed and collected from printer</td>
</tr>
<tr>
<td>15</td>
<td>Active</td>
<td>Products, locator list and order document are placed on trolley</td>
</tr>
<tr>
<td>16</td>
<td>Passive</td>
<td>Trolley queue before collected</td>
</tr>
<tr>
<td>17</td>
<td>Active</td>
<td>Trolley is collected and products are placed in shelves</td>
</tr>
<tr>
<td>18</td>
<td>Passive</td>
<td>Trolley is brought back to origin</td>
</tr>
<tr>
<td>19</td>
<td>Active</td>
<td>Documents placed on desk in office</td>
</tr>
<tr>
<td>20</td>
<td>Passive</td>
<td>Documents queue before received confirmation</td>
</tr>
<tr>
<td>21</td>
<td>Active</td>
<td>Confirmation in Oracle that products have been placed in shelf</td>
</tr>
<tr>
<td>22</td>
<td>Passive</td>
<td>Placing documents in folder</td>
</tr>
</tbody>
</table>

To illustrate where value is added to the product, Aronsson et al (2004) propose that a lead time analysis diagram should be used. In the diagrams below gray fields represent the active time where value is added. The authors have created a lead time diagram for each of the four order types to show the differences and the similarities. For calculations see appendix D

Active time

Passive time

Receiving goods

Control

Placement in warehouse shelves

Figure 7.1 Orders containing few order rows.
The active time for the FOR order type is only 3% of the total lead time. Most of the lead time is queuing to be unpacked and queuing before placed on the shelves. The total lead time is 276, 5 minutes where 266, 5 minutes is passive time.

The lead time for the MOR order type is 312, 5 minutes and the active time 72, 5 minutes which correspond to 23% of the total lead time.

SCL has the shortest lead time and only 12% of the lead time is value adding time.

The active time in the process of receiving goods is for LCL 69 minutes from the total lead time of 282, 5 minutes. This is equivalent to 24% of the lead time.

7.8 KPI

The only KPI used in the process of receiving goods is stating that all received packages should have been processed at the end of the day. This KPI is similar to what Björnland et al (2003) refers to as volume measurement. The difficulty in creating suitable KPI for the process of receiving goods is to formulate it measurable as well as it should be connected to the company goals (Reh, 2007). Since the business concept of LL is to provide fast deliveries to the customer, a suitable KPI for this should be connected to the department of receiving goods. According to the Logistical Manager, other departments use financial KPI that if possible should be used in this department as well. No matter what KPI identified, the authors believe it is vital that it is easy to measure otherwise it will probably not be measured at all. As Reh (2007) states, a KPI should be a long term consideration and confirm how the progress is going. Since LL is growing and thereby changing, KPI should often be revised and this should be considered when comparing.
earlier data. If possible, KPI should also be used before any changes are done to see how these changes influence the process and it can be a tool for future changes.

7.9 Benchmarking

Similarities
When comparing the benchmarked companies with LL noticed similarities were; number of main suppliers, order characteristics, order arrivals and separation of big and small packages.

Receiving goods
At Dustin there are between 4-8 persons working with received goods and at NetOnNet there are 1-2 persons working in the comparable department. LL has between 2-4 persons working at receiving goods department. Dustin have their goods delivered during the entire day to get an even workflow. The authors do not see this as a good solution for LL and would rather see that most of the received goods would come in as early as possible to be able to conduct an order priority.

Registration
Both NetOnNet and Dustin label the received goods. The labels are printed in connection to the registration. The reason for using them is to make the goods easier to scan in a later stage, since the products packing varies in size and design it might be hard to spot the bar code. The label also works in the same way as the locator list at LL since it contains a shelf number. Working with labels seems to be a good solution at the benchmarked companies since they have a wide product range. The authors believe that this is not a needed method for LL since their products are similar to each other and the barcodes are easily spotted.

When products are registered at the benchmarked companies stock increases, at the same time the stock quantity on the webpage is increased which makes the product orderable for the customer. This puts a certain pressure to place the products on stock shelf quickly after registration since they must be pickable for delivery. At both benchmarked companies this is solved by having available staff that can place the products on the shelf immediately after registration. Making the products pickable as soon as possible after being received is something that should be strived for at LL as well since the product might be delivered to final customer sooner. However some products, such as bulk products, are not prioritised and should be used to even out the workload during the day.

During the registration of received products, both Dustin and NetOnNet use wireless scanners. By doing that, products can remain on the pallets instead of moving them to an unpacking table. The authors see the use of wireless scanners at LL as an opportunity to make the process of receiving goods more efficient but not as an optimal solution. This is because the operator must still be close to a computer to be able to register the products as received. The authors would like to able to register products as pickable and at the same time places them on the shelves. As Aronsson et al (2003) state that the flow should be synchronized so one activity can start right after another without any waiting time.
7.10 Summary of waste and inefficiency

Based on the description of present situation the authors have identified following activities as waste or cause to inefficiency in the process of received goods.

*No stated priority of received orders*
Jonsson & Mattsson (2005) state the importance of short lead times to ensure an efficient process. There are products that might be delivered to customer earlier if registered as pickable soon after they are received. Therefore, routines for priority of orders containing these products should be stated.

*Operator movement*
The length of operator movement has been measured for an order and can be seen in table 5:2. Aronsson et al (2004) state that activities not increase value to the product should be eliminated. Therefore some of the operator movements can be seen as waste.

*Unsorted expected receipts*
The expected receipts document is a list of all order rows on the order. First, the order rows are sorted on type of product and thereafter lens power. The toric contact lenses however do not have the sorting on lens power and are listed by product group. Since the orders with toric contact lenses consist of many order rows this tends to render in an inefficient quality control.

*Disorder at the unpacking station*
Since the equipment at the unpacking table does not have allotted places, time is sometimes wasted when searching for them. In his 5S theory, Hirano (1996) mentions how more efficient activities are created when each tool has a specific placement at the working station.

*Double control of received products*
A control of received products are done both at the unpacking table when marking received order rows in expected receipts document as well as when placing the product in the shelf and marking received order rows on the locator list. Aronsson et al (2004) points out that doing same control twice should be seen as waste of time.

*Document handling*
Consignment, expected receipts and a front page are fastened together and saved in a folder. For an order with many order rows expected receipts documents consist of quite a lot of pages. Since the sorting of these documents also are a time demanding task, it is not only a waste of space.

*Slow registration of received orders*
Due to undefined routines, an order document can be waiting at the office desk before it is registered as received. Since the product is pickable in the ERP-system after it has been registered this should be done as soon as the products have been placed in the shelves. By registering orders sooner the total lead time would be shortened.
8. Conclusions

In this chapter, the authors present conclusions on previous analysis as well as recommendations to the company. First, the results and the answers to the research questions are presented. In the rest of the chapter, the suggestions will be further clarified and thereby fulfilling the purpose.

8.1 Disposition

The results and suggestions given by the authors are presented below, in a list and a more visualized figure. The results are based on both long term and short term improvements.

**Short term**
- Less movement
- Less document handling
- 5S
- Expected receipt list
- Order priority
- KPI

**Long term**
- Mobile computer
  - Shorter lead time
  - Higher security
  - Less resources
  - Less movement
- Order priority
- 5S
- Less document handling

![Diagram](Figure 8.1 Suggestions.)

In chapter 1.3 three research questions where asked; *How can efficiency be measured? Where in the process does waste appear? Can LL reduce labour cost by increasing efficiency?* The authors state that the answers to these questions are:

1. Efficiency should be measured by the *total lead time* and the number of *orders registered as pickable before xx.xx am/pm*.
2. As the summary in chapter 7.10 states have waste and inefficiency been found in parts of the receiving goods process. In some of these inefficiency have already been reduced.
3. On the long term, when a mobile computer will be implemented, the efficiency of the process will increase. The authors believe this will turn into more processed orders per operator and thereby reducing labour cost.
8.2 Mobile computer

The suggestion of mobile computer implementation will have the largest impact on the overall efficiency in the long term. By using a mobile computer, the operator will be able to perform the quality control and make a product pickable at the same time as it is placed on the shelf. These activities should be performed as soon as the package arrives to the warehouse, following stated order priority. This way the average lead time will be shortened for important products.

When an order arrives the package should be opened and products be placed on the trolley. After typing the order number on the mobile computer; order rows, quantity and shelf locator is shown in the display and the operator brings the trolley to corresponding shelf. Since an order contains similar products which is placed in stock shelves nearby each other the operator will be performing following activities without a lot of movement. The toric contact lenses arrive in low quantities per order row and each one have to be scanned but despite this, since the stock shelf is closely positioned, there will be no unnecessary movement. The coloured contact lenses however have stock placement dependent on colour but orders might be sorted by lens power. Therefore, these orders must be roughly sorted before placed on the trolley.

This suggestion is mainly based on the fact that some lens types have low service level and should be pickable as soon as possible so they may be sent to customer with an earlier shipment. By implementing the use of mobile computer, lead time will be decreased for the important products. Lead time for bulk products will probably increase but since these types of contact lenses always are pickable this is of less importance. This suggestion is also based on the benchmark study performed in the thesis where visited companies used a wireless scanner for increased efficiency in receipt registration.

Types of mobile computers differ and choice should be further investigated according to the specification in chapter 8:10. In addition, the choice of implementing a tailor made or standard software is dependent on what the system retailers can offer. The system solution should be of an online version and connected to a WLAN that already exists at LL warehouse. This WLAN has not been used since LL moved into the warehouse and how well it works needs to be tested. If it does not meet the requirements, a new WLAN have to be purchased.

This solution is for the receiving goods process but the authors believes that in the future a WMS system for the whole warehouse, including processes such as order picking and counting the inventory, is an option which should be considered when evaluating a suitable system.

8.3 Order priority

As stated in chapter 7.2 an order priority should be used to ensure that important products are placed in the shelf and registered as pickable as soon as possible.
Products or orders that have been identified as important are the following:

*Part delivered orders*, which is orders with few order rows, are prioritised because they are being delivered later than expected and there might be a customer order awaiting these. They are also fast to process compared to the other order types which implies they can be placed in shelf quickly.

*Toric, coloured and progressive contact lenses*, since these have the lowest service level due to that there is few in stock out of total available.

Based on the importance of the products or orders the author will suggest following order priority:

1. Orders with few order rows
2. Toric contact lenses with many order rows
3. Coloured contact lenses with many order rows
4. Progressive contact lenses with many order rows
5. Other orders with many order rows
6. Orders containing small case lots
7. Orders containing large case lots

In addition to this priority, the knowledge behind this list should be used. What the authors tries to mediate is that there might be bulk products that are part delivered as well and those are not considered important and do not have to be prioritized. The basic idea is that all *orders with few order rows* should be handled first and other decision should be based on the idea of the order priority. In the same way there might be an order with many order rows containing one box of toric contact lenses per order row. Even though this order contains many order rows it is a big possibility that one or a few of these boxes are waiting to be sent to customer.

### 8.4 Working station

When analyzing the order at the unpacking table, an improvement potential was found. Problems finding the correct equipment sometimes occurred since it commonly were found where the operators last left it. To prevent this, the authors of this thesis will recommend LL to introduce a shelf between the two connected unpacking tables where the equipments needed, can be found if it is not in use. The authors recommend that the stapling machines will be tied up to the shelf to make it easier for the operator to know where to find it. Operators must be able to release scissors, knives and marker pens when using them but after completing an order the equipment should be placed on its specific location in the shelf again. But as Hirano (1996) states the work area should not only be
Conclusions

cleared and with all equipment in its specific location; it should also be clean. It is important to keep the work area from getting dirty rather than just cleaning it up after becoming dirty. According to Goods Receiving Team Leader about ten minutes are spent every day cleaning the unpacking tables. If the work area would be clean during the day this time should not have to be spent cleaning. By creating order at the unpacking tables less time will be spent on finding the right equipment and a better efficiency will occur.

8.5 Stock placement reliability

The reliability of the correct product being placed on the correct location will be influence by the use of a mobile computer in such a way that the control performed at the unpacking tables today will be replaced with a control when the operator place products on the shelves. This way the problem with double control will disappear and higher reliability of the correct product on the correct shelf will appear since the products are bound to the shelves. When a product is placed on a shelf the bar code must be scanned and matched together with the bar code on the shelf. The risk of placing a product in the wrong shelf should decrease and thereby the reliability of the inventory on hand will increase. The authors believe that a use of mobile computer will not only shorten the lead time for important products but also render in less problems with miscalculations during inventory counts.

8.6 Document handling

This piece of the result considers the document handling and the necessity of it. For the long term suggestion that implies mobile computers to be implemented, most of the document handling will be unnecessary. Since both receipt control and registration is done in the mobile computer, documents that are printed in the present process will not be needed. Still, for the long term suggestion the authors believe that the consignment should be saved since a verification of received order is necessary.

On short term the authors still believes that there is too much documents being archived. Since there has to be some verification of what have been received, the authors suggest only archiving the consignment and the front page. The purpose of the front page are the squares marked for each step the document is going through and the front page will therefore still be useful. However, the faults usually written on the front page should be written in a separate document and be stored elsewhere.

The consignment should be saved in coloured folders, one colour for each of the four main suppliers and a fifth for the rest of the suppliers. Consignments should be sorted on LL order number and to make a folder search easier the order number could for example be written in the upper right corner. All faults in an order, which earlier were written on the front page, should be saved in a specific folder or in a computer. If saved in a folder it should be sorted by supplier. In this way if information or statistics are needed, it will easier be found. If using a computer program to store order faults, sorting on for example date or product will be easier.
The authors also suggest to overlook the possibility to change the expected receipts list concerning the sorting of the toric contact lenses. This sorting should be done in the same way as the other products to make the control of received goods more time efficient. According to the Goods Receiving Operator, sorting by lens power would be the best option. This type of change has to be done by the person at LL in charge of the ERP system Oracle or an Oracle consultant. Since this list is unnecessary when applying a mobile computer, it is a short time suggestion.
8.7 Movement

At LL department of receiving goods there are, as described in the analysis chapter 7.6, unnecessary movements made. To reduce these, the authors give a suggestion, where LL forms a working station that contains a computer and a printer. This station should be located at one of the unpacking tables. This will make it easier to register and print near the unpacking table and in that way minimize the time that the operator spend on walking between stations when receiving goods. To see the consequences of this suggestion, table 8:1 shows the movement in the receiving goods process where the total is reduced. In the present process at LL the operator is walking 223 metres when completing an order, which can be compared to the new suggestion where the operator only walks 82 metres. This will give a result where the operator walks about 150 metres less per order.

Table 8:1. New list of operator movement.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Movement product (stations)</th>
<th>Movement operator (stations)</th>
<th>Movement product (metres)</th>
<th>Movement operator (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products are received from the supplier and placed at A</td>
<td>Start</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator brings a package to the unpacking table (B) and look for the consignments</td>
<td>A – B</td>
<td>A – B</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Operator moves from unpacking table to the computer station (CD) where expected receipt is printed and collected</td>
<td>B - CD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator walks to the unpacking table (B) to sort and perform the quality control</td>
<td>CD - B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The contact lenses are placed on the trolley (F)</td>
<td>B - F</td>
<td>B - F</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Operator walks back to the computer station (CD), registers the receipts, print and collects the locator list</td>
<td>F – CD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The list is placed with the contact lenses on a trolley (F)</td>
<td>CD - F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator brings the trolley with the contact lenses and places them in the shelves (E)</td>
<td>F - E</td>
<td>F - E</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Operator walks back to the computer station (CD) and confirm the order as pickable</td>
<td>E - CD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>82</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

### 8.8 KPI

LL main objective is to provide an efficient distribution chain with competitive priorities such as short lead times and competitive prices. In the process of receiving goods, one or a few KPI should be connected to this objective and the total lead time is suggested by the authors. This time goal should be measured from that the goods arrive until registered as pickable. It should also be measured for each of the stated order types with different goals for each one and ascertain shortest lead time for orders with few order rows. This KPI have been measured in the thesis and can therefore be compared when implementation of new operations have been done. A measurement complication is the time for package arrival that is not measured at present and is important for visualisation of the total lead time. In the time study in this thesis, arrival time was manually noted. If this can be done as a routine at the same time as the carrier note is signed the total lead time could be measured for each order. When an operator starts processing an order, the order number and arrival time will be entered in the mobile computer and thereby can the queuing time before this be measured. This will also display if the operator processes orders according to the order priority and if the process is improving in terms of time efficiency.

The second suitable KPI could be orders registered as pickable before xx.xx am/pm. This time goal should be connected to time of release in the shipping process that means as important release set is closing in started order rows should be registered as pickable. If a product could be sent with an earlier shipment it should be pickable when order picking is about to print the orders and thereby be delivered with that shipment. This would require some communication between receiving goods and order picking or predetermined times when received orders should have been made pickable if possible.

Concerning the already existing KPI, that states all received orders should be handled at the end of the day, the authors do not see any reason for withdrawing this even though it rarely is something else then 100%. It is a KPI known to the staff and increases their effort to handle all received orders before leaving for the day. A financial KPI, that is easily measured, is harder to determine. It would be preferable to connect workload to number of order rows but since the available staffs vary this will be difficult to measure. If the operator signs in to the mobile computer only when processing orders the active time for each operator might be used as a KPI but this has not been further investigated by the authors.
8.9 Flow chart of receiving goods process

Below is an illustration of how the order flow of receiving goods will look like if a mobile computer would be used according to the specifications. It illustrates the flow starting when goods are received and ending when it have been placed in shelf and registered as pickable. The flow is still based upon the different approaches towards an order depending on order type.

![Flow chart of receiving goods process](image)

*Figure 8.2 New flow chart of receiving goods process.*
8.9.1 Detailed list of activities

The list below is a summary of proposed activities if a mobile computer was used. The handling of large case lots would differ from the list below since these are brought to the shelves by a forklift instead of a trolley.

Table 8:2. Detailed list of activities when a mobile computer is in use.

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Move</td>
<td>Goods arrive from supplier</td>
</tr>
<tr>
<td>2</td>
<td>Operation</td>
<td>Number of packages is controlled and carrier note is signed</td>
</tr>
<tr>
<td>3</td>
<td>Waiting</td>
<td>Package queue before unpacking</td>
</tr>
<tr>
<td>4</td>
<td>Operation</td>
<td>Open package</td>
</tr>
<tr>
<td>5</td>
<td>Operation</td>
<td>Consignment is located</td>
</tr>
<tr>
<td>6</td>
<td>Move</td>
<td>Package is placed on unpacking table</td>
</tr>
<tr>
<td>7</td>
<td>Operation</td>
<td>Repacking, sorting or labelling of order</td>
</tr>
<tr>
<td>8</td>
<td>Move</td>
<td>Products are placed on trolley</td>
</tr>
<tr>
<td>9</td>
<td>Move</td>
<td>Trolley is collected and brought to warehouse shelves</td>
</tr>
<tr>
<td>10</td>
<td>Operation</td>
<td>Order number is typed in mobile computer</td>
</tr>
<tr>
<td>11</td>
<td>Operation</td>
<td>Product is scanned and placed in shelf</td>
</tr>
<tr>
<td>12</td>
<td>Operation</td>
<td>Shelf is scanned and the product is registered as pickable</td>
</tr>
<tr>
<td>13</td>
<td>Move</td>
<td>Trolley is brought back to origin</td>
</tr>
<tr>
<td>14</td>
<td>Operation</td>
<td>Consignment is placed in folder</td>
</tr>
</tbody>
</table>

Comparison of the present and proposed process of warehousing operations was carried out to determine the change in the number of active and passive activities. In the proposed process in table 8:2 of warehousing operations, the total number of activities are reduced from 22 to 14. Both the number of active and passive activities would decrease and due to this the ratio of active activities will increase.
8.10 Specification mobile computer

Below are the specifications of the software for the mobile computer listed.

Demands on the mobile computer:
- It should have a maximum weight of less than 0.4 kilogram.
- Big display and easy to manoeuvre.
- The sensitivity in the bar code reader should be low.
- The mobile computer must be able to connect to wireless internet.

Demands on the software:
- It should be compatible with the ERP-system Oracle.
- The display should show a window that contains order number, locator and the order row quantity.

The process:

Step one: The operator will manually type the order number
- Order number will be shown in the upper left corner of the display.
- Supplier will be shown in the upper right corner of the display.
- A list will be shown containing the order rows on the order, sorted by their locator numbers.

Step two: Operator scans a product
- Only the scanned products order row will be shown on the display.
- “Number of articles” will be lightened.
- Depending on the number of products on the order row the operator should have the option to scan all products on an order row or scan one product and type in the order row quantity that is placed on the shelves. This quantity is determined depending on type of product.
- The operator should be able to use a “back button” if something went wrong or if the operator for some reason does not want to place the product on the shelf.

Step three: Scan the shelves
- When the quantity of products has been registered, the software will highlight the shelf number to show where the product should be placed.
- The operator places the product on the shelf and thereafter scans the bar code on the shelf to match it with the locator in the mobile computer.
- If the bar code and locator match “Scan a product” will appear in the mobile computer and the product is registered as pickable. If the bar code on the shelf does not match the product locator, a warning sign will appear and a new product cannot be scanned.
## Conclusions

![Figure 8.3 Mobile computer before step one](image1.png)

Enter order number

![Figure 8.4 Mobile computer after step one](image2.png)

Scan a product

<table>
<thead>
<tr>
<th>Ordernr: 13933</th>
<th>Cooper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prod. Spec</td>
<td>Quantity</td>
</tr>
<tr>
<td>-3.5/8.6/14.4</td>
<td>15</td>
</tr>
</tbody>
</table>

![Figure 8.5 Mobile computer step two](image3.png)

![Figure 8.6 Mobile computer step three](image4.png)

<table>
<thead>
<tr>
<th>Ordernr: 13933</th>
<th>Cooper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prod. Spec</td>
<td>Quantity</td>
</tr>
<tr>
<td>-3.5/8.6/14.4</td>
<td>15</td>
</tr>
</tbody>
</table>
9. Discussion

In this chapter the reflections that came up during the work with this thesis is discussed. First, the reason for the choice of two suggestions is explained. The chapter will also present what the authors have learnt when performing the thesis and what could have been done in a different way. Finally, further research is briefly discussed.

9.1 Reflections

The two different suggestions given by the authors to improve the process of receiving goods were both for short term and long term. The proposal that shows the company how to improve on a short term, does not need a big effort to implement but will still make the process of receiving goods more efficient. To implement the long term proposal some investments have to be made, both in time and in capital. The authors believe that this suggestion will save a lot of capital and make the process much more efficient. The long- and short term structure have been chosen since LL at present time have many ongoing projects costing both time and money implying that the long term suggestion may not be implemented in a close future. Therefore, the authors want to show LL the small things that can be done for a more efficient process during this time. Some of the changes done on short term basis will be useful for the long term basis as well but others will just improve during this initial time and be eliminated after the implementation of the long term suggestion has taken place.

To figure out what could have been done different or with another method is common to do in the end of a project. If the authors of this thesis would start over this project again, some things would have been performed differently. For example some of the benchmarking studies would be done later when a further understanding of the problem area had been reached. The authors would also document the conversations with staff at the start of the project, instead of just having documentation from the structured interviews.

The authors have made some considerations concerning the choices that have been made to fulfil the objectives for this master thesis. One of these considerations is the choice of presenting conclusions and recommendations in both a short and long term suggestions, even though some improvements will be reduced when the long term suggestion will take place. This might be seen as a sub optimization but the authors state that the short term improvements can be done without demanding a big effort but will increase the efficiency. A second consideration is that in the time study some operations were set to a fixed time to even though it was measurable. The authors found that the variations at these operations were depending on factors not included in the process.

As said in chapter 2.1, LL is a company that is growing exponentially, whereby the organisation and conditions are constantly changing. This has been a fact at the department of receiving goods where some of the changes that the authors have suggested has been implemented and other conditions has been changed. This has not been considered in the report where the initial situation has been described and analysed.
Discussions

Based on this, statements regarding reliability can be discussed. Since the conditions have changed, reaching the same results in the study would be impossible. The short term proposal would probably differ more then the long term if the study would be repeated since some of these suggestions are already implemented.

What we have learnt
During this project, the authors have learnt that many problems have a simple solution and can be solved with a small effort. The staffs were not aware of some problems that were found at LL and the authors had to show its existents to them before being able solve it. These daily routines have been performed during a long time and are much easier to be identified by someone not working at the department. This is a conclusion the author will have in mind when performing similar projects in the future.

Further investigations
After performing this project the authors have found some areas that would be interesting for further research, for example investigating if a WMS system for the warehouse would be efficient at LL. This would be a solution for the whole organisation and not only for the receiving goods department.
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This chapter consist of references used to accomplish the thesis.

10.1 Literature


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10.2 Articles


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http://www.dustin.se/dacsaportal/ 071008

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http://cscmp.org/aboutcscmp/definitions/definitions.asp 071014

https://www.lenslogistics.se/lenslogistics_se/index.jsp 070923

10.4 Interviews

At LL:
Blomberg Toralf Distribution Manager
Larsson, Anders Goods Receiving Team Leader
Markström, Per-Olof Purchaser
Mosegaard, Pär Purchaser
Mühlbach, Oskar Logistics Manager
Nilsson, Björn Finance Assistant
Sekiz, Lana Purchaser
Öhlund, Peter Goods Receiving Operator

At NetOnNet AB:
Svensson, Jim Goods Receiving Operator

At Dustin AB:
Carlsson, Fredrik Logistics Manager
Godsmottagningsslista för linser och vätsskor i bokföringen

Fel i sändning:

Datum mottagit: _____________________________
Signatur mottagit: ___________________________
Leverantör: _______________________________
Inköpsordernr: ______________________________

1. Kvalitetskontroll (avräkning)
2. Godkänna anknom (registrering)
3. Upplagning på hyllplats
4. Godkänna mottagel gods
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Appendix D

The tables below describe the calculations that the lead time analysis diagram is based on. Activities 1-22 are the activities that the authors measured in the time study. Active and passive time is represented by white and gray fields in the lead time analysis diagrams. Block time represent the different blocks in the diagrams. All figures are described in minutes.

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