A study of the order picking process at PostNord Logistic - improving the picking process by identifying factors that inhibit the productivity

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Upphovsrätt

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Abstract
The goal of this study was to find factors affecting the pickers’ productivity negatively, in the order picking process, and to suggest a change that can increase the pickers’ productivity. By a qualitative approach the initial situation at PostNord was studied. First, observations were concluded to get an understanding of the warehouse design and layout, then interviews with PostNord to get an understanding of strategies used in the initial situation. Afterwards the authors proceeded with interviews and observations with and of the pickers. The obtained results, after analyzing the initial situation, showed various factors that affect the pickers’ productivity negatively. All these contributed to waste, meaning that the picker did not use its time correctly according to Lean theory. These factors were analyzed and categorized into four problem areas, which are quality of tools, standardization of routines and leadership, article placement and jam in the corridors.

Possible suggestions to improve the situation can be done with smaller or bigger changes. One solution is to improve the work procedures by standardizing the methods, which could be done by cooperating more with PEMA and using the pickers’ knowledge. The solutions that require financial funding are, among others, to invest in a more workable picking technique, maintain current tools and expand the warehouse. The suggestions in this study are not evaluated enough to see how much they will increase the pickers’ productivity. Therefore, some suggestions must be investigated further. Adjacent processes, that are a delimitation for this study, have a direct impact on the pickers’ productivity, which was seen by observations. Therefore, it is important for PostNord to examine how they affect the pickers’ ability to be productive.
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1. Introduction

This report is the result of a Bachelor thesis written at the Institute of Technology at Linköping University and in collaboration with PostNord Logistics, who work with third party logistics and operate the central warehouse of Apotek Hjärtat in Norrköping. This chapter will provide a background of PostNord, the received task and describe the purpose, objective, selected study questions and delimitations of the study.

1.1 Background

PostNord AB is the parent company that works with solutions within communications and logistics. In 2009 Posten AB and Post Denmark merged into one company under the name of PostNord AB, in which ownership is divided by 60% and 40% respectively. In 2013 PostNord had net sales of approximately 40 billion SEK and 39,000 employees (PostNord, 2016a). The concern consists of PostNord Sweden, PostNord Denmark, PostNord Finland, PostNord Norway and PostNord Strålfors. All companies, except PostNord Strålfors, work together to enhance and develop the organization within the various business areas. All country units work individually with services, e-commerce and logistics and operate across borders. PostNord Strålfors works with focus on different service offerings. (PostNord, 2016b)

1.1.1 PostNord Logistics

PostNord Logistics is a company in the business area logistics and they work with, among other, third-party logistics (TPL). A company that works with third party logistics is a company to which other companies can outsource their logistic activities. (Aronsson, Ekdahl & Oskarsson 2012: Storhagen, 2003) In this case, Apotek Hjärtat has outsourced the operation of the warehouse to PostNord Logistics. PostNord Logistics has annual sales of 1.4 billion SEK per year, a warehouse space of 320,000 square meters and employs 1400 people per year (PostNord, 2016c). PostNord Logistics has a central approach and is divided into four regions with different areas of focus, which are, Region Central (Norrköping), Region East (Stockholm), Region West (Gothenburg) and Region South (Helsingborg). The focus area in Region Central is drugs & health and construction & garden. (PostNord, 2016c)

In total, PostNord Logistics operates 14 warehouses around Sweden and one of these is Händelö 1, which is in Norrköping, where the customers Apotek Hjärtat and Bluefish and Braun store their products. What these companies have in common is that they have drugs in their assortment and because Händelö 1 is a certified facility for the handling of drugs they have been placed here. Being certified means that there are high demands on warehouse operations, including requirements for temperature and safety monitoring. (PostNord, 2016c). Händelö 1 is the central warehouse of Apotek Hjärtat and provides more than 390 pharmacies across the country (Apotek Hjärtat, 2016).

On Händelö 1 there are different types of workers, which is necessary to operate a big and successful warehouse. The people who work with the actual picking, called pickers, are hired by a PEMA, which is a staffing company. PostNord Logistics has hired PEMA to provide them
with necessary staff. They have a foundation of personnel but often need more on a short notice, which PEMA can provide. This also means that the rotation of different people is high.

1.2 The background of the problem
Logistics can be described as a chain consisting of many different components. Inventory is an important component, the main task of which is to decouple the chain parts from each other and has a requirement to provide customers with high quality service. Logistics can thus create competitiveness and increase the profitability of the company, therefore good logistics is a prerequisite for many companies to achieve success. (Aronsson, Ekdahl & Oskarsson, 2013)

Inventory is found in a warehouse which has several ongoing processes and activities. The picking process of a customer order is the activity that drives most costs according to Richards (2011). It is therefore important from an economic perspective to have high productivity in the picking process. Increased productivity means using the same or fewer resources to pick more than before. In addition to reduce costs per order-picked, this means that companies can increase their capacity and better manage fluctuations in demand.

This study will examine the order picking process at Händelö 1 driven by PostNord Logistics, hereinafter referred to as PostNord. The management of PostNord experience that the picking process in one specific area, called EV, is not as efficient as desired. PostNord has a high demand and they have 100 % delivery service, which means that it is very important for them to have enough capacity when the demand peaks. The pharmacies can order articles to a certain time the day before PostNord has to send them, meaning that they have one day to pick all orders. This makes it hard for PostNord to plan the business and workforce when the demand differ every day. When the demand peaks they need more pickers to manage it and unfortunately, the warehouse can only handle a certain number of pickers, otherwise their productivity decreases and leads to a downward spiral. Today many of the workers must work over time, which creates problem with the workforce and is also very expensive.

1.3 Purpose
The purpose of this study is to help PostNord increase the pickers’ productivity, in the picking process.

1.4 Objective
The objective is to identify factors and moments that inhibit the productivity to be able to give recommendations on what PostNord can do to increase the pickers’ productivity.

1.5 Study questions
The questions that will be answered in the study, in order to fulfil the purpose and objective of this study, are presented below.
What is it that inhibit a picker from using its time right?
What recommendations do the authors have that will help PostNord increase the pickers productivity?
1.6 Delimitations
This study will only take PostNords operations on Händelö 1 into account and will not include Apotek Hjärtats part in this partnership. On PostNord’s request, this study will only focus on the picking process itself. This means that adjacent processes that are interlocked with the picking process are not included.

1.7 Outline
The first chapter describes the background, purpose and study questions to get an overview of the project. Chapter 2 describes the method and approach to the study, which presents why and which methods came to be used. Here the decisions of how data is collected, how interviews are executed and how problems are found presented. Chapter 3, the Theoretical Frame of Reference, explains different theories about logistics, warehouses, lean philosophy and other relevant studies. Next, all the collected data about the initial warehouse layout and picking process will be described in The Initial Situation, Chapter 4. The data will result in an identification of factors inhibit the productivity by analysing the initial situation in Chapter 5. In Chapter 6 the authors have given recommendations of what PostNord could do in order to increase the productivity. These will be discussed in Chapter 7 and the result of the study will be compared to what expectations the authors had in the beginning. In Chapter 8, which is the final chapter, is where the conclusion will be presented.
2. Methodology and approach
To achieve the goal of the thesis and to answer the study questions, the authors use different methodologies and follow a schedule. This chapter will explain the methodology, the approach and how different theories and methods came to be used.

2.1. Research approach
A research project can be implemented in different ways, using different research approaches, a qualitative or a quantitative one. An approach can be described as a strategy to tackle a problem and what kind of approach to use depends on what is observed and what kind of data or information is needed to fulfil the purpose and the goal. There are advantages and disadvantages to both strategies and fit differently in different situations. The strategies and its methods can be combined if the investigation requires several types of information. (Bell, 2016)

Richards and Morse (2013) argues that a quantitative approach is suitable when the research question requires a deep understanding of reality and how the process occurs. Its survey method should provide results that are somehow measurable (Bell, 2016). Patton (1987) suggests that a qualitative approach should be used when the knowledge of how something becomes as it is, is the purpose of the research. The focus is on gathering information about situations that are difficult to describe numerically, such as people’s experiences and behaviours. (Patton, 1987)

This study is mainly based on experiences and perceptions and because the defined study questions are formulated with how and what, this study will make use of a qualitative approach. This approach means that in an analytical way to identify and resolve problem areas that are based on the initial situation. To formulate a report, data was collected through a case study, with observations and interviews, which does not lie in a numeric value, rather in how an action is executed.

2.2. Data Collection
The qualitative research approach includes three different data collection methods, which are document studies, observations and interviews (Patton, 1987: Richards & Morse 2013). Richards and Morse (2013) says that the method of data collection depends on the query design of the issues. If a question seeks to find out how something looks or is designed, then different types of observations and interviews might be a good option. In the case of a problem area where a research question is specified, then a case study is the best option, so that specific cases and specific questions can be addressed. Different types of observations and interviews are examples of data collection techniques that can be included in a case study. (Richards & Morse, 2013)

2.2.1. Document studies
Different kinds of documents were studied, such as drawing of the warehouse layout, which were used as a basis of mapping the initial situation. By reviewing this information and discussing with PostNord the authors got an understanding of how the layout was planned and why, for example, why the aisles were as wide as they are. Later, the written procedures for how to pick an order were studied. This was done before the participating observation, to get
the same understanding of the picking process as a new picker would get. This helped the authors to identify areas of improvement.

2.2.2. Observations

An observation is a method in which data is collected by the observation and recording of an idea. (NE, 2016) Since the data collected is a perception of reality, it is important to prepare for and be clear about which information is important to collect. It can also be good to have more than one person at an observation to discuss later what was perceived in the situation. (Bell, 2016) Observations can be implemented in different ways; unstructured, participatory or non-participatory, but before it is determined what type to use, it is important to establish the purpose of the study.

An unstructured observation is a type that can be used when there is a defined purpose, but the details of it are not clear. It can also be used when the researcher wants to discover a pattern before determining an approach to process data. The structured observation, which is used in this study, implies that the purpose and goals are specified and it should then be easier to register what happens. A participant observation means that the observer is present for some time to gain understanding of a group's actions or behaviour. The researchers’ situation during this type of observation is experienced in a different way to the other types. Here, feelings and experiences are obtained that also may be important for the study. (Bell, 2016) In an observation, the observed can be either aware or unaware that an observation is in progress. The behaviour of a person might differ if he/she knows that it is being observed and that is something that must be considered when selecting what method of observation to use. (Forsberg et al. 2013)

The first observation in this study was an unstructured observation, to become familiar with the facility, see the layout of the warehouse and discover pattern. To see how the picking process worked, an unstructured observation of a picker was made by following the picker around on his route. Notes were written down which later were discussed among the authors and people from PostNord’s strategical apartment, to confirm the collected data from the observations of the layout, tools and strategies in the picking process. By comparing what was seen with the studied written procedures, differences could be found and a mapping of the initial picking process was done.

A third observation was planned and resulted in a structured observation, to fill some gaps in the mapping of the initial situation and one participating observation was also made to get a deeper understanding of how it all worked. When the questions about how the process is executed were answered, the authors conducted interviews with the pickers. The authors started analysing the process with the information retrieved from the pickers and the knowledge of wastes according to Lean philosophy. This lead to more specific questions and occasional structured observations in the warehouse, both to find and determine negative factors and to double check if the estimations were right.
2.2.3. Interviews

An interview is a data collection method that has both advantages and disadvantages. In an interview, it is easier to formulate and develop issues so they are perceived correctly (Bell, 2016). There are different ways to conduct interviews, structured, unstructured or semi-structured. All three are focused on a particular subject or topic. (Forsberg & Wengström, 2013)

When choosing which structure for the interview, it should be kept in mind that the results generated might differ in ability to analyse. The more structured the interview, then the easier it will be to analyse the interview as there are clear expectations of what the outcome will be. (Bell, 2016) No matter how an interview is designed, it is important to use body language and be interested in the interviewee’s answer to encourage the person to develop their answer in as detailed a way as possible. (Forsberg & Wengström, 2013)

After the participating observations, interviews were conducted for different purposes and with persons playing different roles in the company. This was to make the analysis as accurate as possible. Initially, both an unstructured and a structured interview with the external supervisor at PostNord was held to get an idea about the company and its operations. These interviews gave the authors an insight of the warehouse layout, to be able to understand the prerequisites of the picking process. Another semi-structured interview was held with the shift leader, Julia, she is responsible for the workforce that work during daytime and is the link between the operators and the strategic department of PostNord. The authors asked Julia what she thought of the workforces’ work, demands from PostNord and if she had examples of what could be changed for improvement of the picking process. This was to get a deeper understanding of the initial situation and find factors that affect how productive the pickers can be.

Structured interviews with three pickers were held. The pickers were chosen depending on their picking efficiency, which is why they are anonymous. They were picked by PostNord’s strategic department in the categories high, medium and low and the authors did not know which one was in what category. The purposes with these interviews were to identify specific issues in the picking process. These people are a central part of the picking process and therefore have good knowledge of it and the current system. The authors considered this to be of great benefit when identifying negative factors in the picking process. The interviews were by nature semi-structured, which made it easier to have a conversation about how they experience everyday life and problems in the current situation.

The questions asked concerned the different areas in the warehouse, from warehouse layout and IT, to relationship with co-workers and management. The authors formed the questions after the observations, with focus on what was perceived as a possible waste.

Examples of questions asked to the interviewed picker:
- Do you find the cart easy or hard to handle?
- What do you do when a product is placed wrong in the picking aisle?
- Do you find the aisles to be messy and why do you think that is?

The interviews took from 20 to 30 minutes depending on how much information the interviewed gave and how many follow up questions occurred. The authors could identify many different
problems after analysing their answers and comparing with what had been observed. There were problems related to physical resources, the technological system, the experience of the picking process and the preparation to pick correctly. The authors found common factors that affected the pickers negatively even though they had a different level of productivity.

2.3. Reliability and Validity
If quantitative measurements are to be carried out, one must consistently perform them for the measurements to be reliable. By using the same unit for the measurement and performance tests in the same way, the data is consistent and can be compared. In an interview, reliability can be connected to how a question is asked. Different formations of a question can get different answers. It is important to ask questions neutrally, without an ulterior motive to provoke any particular view of the recipient. (Ejvegård, 2013) Validity involves using based facts. By not having a preconceived opinion about the data they intended to measure, researchers get real information. (Ejvegård, 2013)
3. Theoretical frame of reference

This chapter will present theories to provide an understanding about the subject and the basis that the authors will use in the analysis and further results.

3.1. Logistics

Logistics can be described in many ways and Aronsson, Ekdahl and Oskarsson (2013, p.23) describes logistics as the management of efficient material flow “from raw material to final consumer” in other words, the flow of things or people through one or more processes in the supply chain. Lumsden (2012) suggests that logistics also implies doing things right in all courses of events in a chain, which Aronsson, Ekdahl and Oskarsson (2013, p.23) defines as doing things right and doing the right things. Another well used definition of logistic is as follows: “The process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements.” (Council of Supply Chain Management and professionals, 2013, p.117)

These definitions tell us the importance of using resources wisely. Jacobsen and Thorsvik (2014) mean that all companies use limited resources to reach their goals. The goal of every company may differ, but the common strategy is to reach the goal in best possible way, which is by using resources effectively. The term effectivity goes hand in hand with goals and strategy, the definition of it being “degree of goal compliance in relation to resource usage”. (Jacobsen & Thorsvik, 2014, p.43) Close to efficiency is productivity, which is defined as usage of resources to produce a product. The fewer resources used per product the more productive the company is. For the company to be effective it must be productive. (Jacobsen & Thorsvik, 2014)

With the definition of logistics, it becomes clear that customer service is an important part of it. Customer service can be described as a company's ability to meet customer needs and requests considering delivery, before, during and after the actual delivery. (Aronsson, Håkansson & Oskarsson 2013) Storhagen (2003) claims that since the change of focus of logistics has gone from company to customer, the customer has more influence on the supply chain. This means that customer service plays a more centralized role. It does not matter how good a company’s supply chain is if the company fails to deliver according to the customers’ demand. This shows the importance of good customer service in relation to delivery. (Storhagen, 2003)

3.2. Capacity limitation

Capacity can be defined as the ability to produce or create something for a certain period of time, which is considered in the rate at which work can be carried out in and not in how much work can be performed. It is important for a company to know how much capacity is needed for a job for a certain period of time and how much there is to use. (Arnold, Chapman & Clive, 2008). In all processes, there is an activity that does not allow the same level of capacity as remaining activities, a bottleneck. It is important to identify bottlenecks in a system to be able to utilize them to the fullest. (Lumsden, 2012) Theory of Constraints is a theory of how
bottlenecks should be handled. It was developed by Goldratt M. E and introduced 1984 in his book titled The Goal. Goldratt believes that all producing or service companies are linked like a chain where all activities affect each other. All activities have a certain maximum capacity, which means that it is the bottleneck that sets the pacing rate. Activities capacity before and after the bottleneck should be planned along the bottleneck to avoid unnecessary costs. (Arnold, Chapman & Clive, 2008) Aronsson, Ekdahl and Oskarsson (2013) agrees that unnecessary cost can occur and say that it is important to see the flow as a whole logistic chain.

How much capacity is used directly affects the costs, which is why it is essential to evaluate how much of it is required. Depending on market demand it affects the company's revenue. If the market demands are low it increases the availability of products, which leads to that all invested capacity is not used at the company. (Aronsson, Ekdahl & Oskarsson, 2013)

3.3. Effective warehousing

Logistics is, like earlier described, a flow of things or people through one or more processes in the supply chain, according to Aronsson, Ekdahl and Oskarsson (2013, p.23). Warehousing is one process in this chain and it contains many activities and processes itself. The basic activities at a warehouse is to receive the goods, buffering, storing, picking and shipping. To keep all activities together with the other activities and processes in the whole chain it is also necessary to have functions for purchasing, marketing and human resources. (Aronsson, Ekdahl and Oskarsson, 2013).

Inventory and material management build the foundation of the logistics chain with many activities included and several expenses occur when operating and owning stock. To reduce inventory carrying- and warehousing costs, it is important to think strategically in the design of the inventory, which is done by achieving a high degree of filling and low operating costs. (Jonsson & Mattsson, 2011)

The filling rate is a measure of the proportion of the inventory which is filled with goods and the greater the percentage, the better utilized warehouse. 100% fill factor, however, is impossible because it means that the inventory space is totally full and there is no room to handle the goods. (Lumsden, 2012) Operating costs correspond to the costs of the activities in the picking process, thus costs for pickers and warehouse management, handling- and warehouse equipment costs and storage systems. Another thing that is included in operating costs is the cost of transporting during the picking process. (Jonsson & Mattsson, 2011) Richards (2011) believes that the activity that drives most of the cost at a warehouse is the order picking process. It is difficult to automate and thus requires a lot of labour.

To increase the efficiency of the picking process the handling work must be minimized. Lumsden (2012) means that the time of transferring between the article locations during order picking must be reduced to achieve this, thus the location must be easy to find and the travel distance must be as short as possible. It is also important that the material should be easily accessible to save time. Richards (2011) emphasizes the importance of good planning and preparation for a picking process to be effective.
Petersen and Aase (2004) has done a research about the effect of three process decisions that affect the pickers’ travel distance. The decisions that must be made is about how to pick, how to store storage and how to rout the pickers in the warehouse. Petersen and Aase (2004) state that these are the decisions that most often must be done while planning the warehouse and picking process.

### 3.3.1. Inventory layout

An inventory can be designed in a variety of ways by combining different strategies, methods, techniques and warehouse layouts. The prerequisites for designing a warehouse may differ between companies and it is important to adapt to the activities, needs and requirements one has. (Lumsden, 2012) To minimize operating costs generated in the process of work, it is important that there is enough space for transportation routes to be able to move fast and handle the material on a free space. A reduced time of operating work thus requires more surface area, which then becomes an antithesis to the goal of a high filling rate. According to Jonsson and Mattsson (2011) as a rule of thumb when designing a warehouse, the process efficiency goes before the usage of space.

The layout of the warehouse can be designed in different shapes to create efficient flow. The most common designs are linear and U-shaped. The linear means that the receiving and unloading is done the opposite sides of the room and is a favourable design in a warehouse where large volumes of few articles are dealt with. For an even more efficient handling, the U-shaped layout can be used when receiving and unloading is done on the same side of the premises. This configuration also provides advantages as the ability to adapt article placement more, for example divide the inventory into smaller zones. Jonsson and Mattsson (2011) state that if articles that are similar in the way of handling are placed in the same zone, it will minimize the handling work. This division will only improve the operation work if the warehouse is u-shaped. If the warehouse has a linear layout, the zone division will contribute to longer travel distances. (Jonsson & Mattsson, 2011)

### 3.3.2. Storage methods

Different warehouses require different types of equipment to manage and store their products in a smart way. According Lumsden (2012) and Jonsson and Mattsson (2011) the most common types of storage methods are: deep and free stacking of goods, rack stacking and rack storage. The deep and free stacking of goods is the best-known storage method that utilizes the storage space is deep- and free stacking, see Figure 1. This means that the articles are placed directly on the floor surface and stacked directly on top of each other. It suits best for storing large volumes of the same product and where the durability does not matter.
Rack storage is a method that works well for items that can be characterized as details that are small and lightweight, so that they fit in the smaller compartments on a shelf, see Figure 2. (Lumsden, 2012; Jonsson & Mattsson, 2011) A rack storage system is particularly useful for storing tools or inputs to production, and for storage of a variety of products in small volumes. (Lumsden, 2012; Jonsson & Mattsson, 2011)

Rack stacking also consists of shelves but is used for bigger items and has bigger compartments, the racks create corridors in the warehouse, see Figure 3. This method is the most common in the warehouse industry and goods are usually stored on pallets or in cargo carriers. (Lumsden, 2012) If high racking is utilized, the height of the inventory is well used but it takes a lot of floor space. As previously mentioned this is required for the transport to easily get through the corridors. (Lumsden, 2012; Jonsson & Mattsson, 2011)
3.3.3. System for storage and article placement

In the beginning, it is helpful to determine under which storage system the goods are to be placed. According to Jonsson and Mattsson (2011) and Aronsson, Ekdahl and Oskarsson (2013) there are two different main systems where items should be placed, fixed location storage and floating location storage, or a mixture of these. Fixed location system means that each item has a definite place in the warehouse and is always picked from that spot, meanwhile, the floating location storage means that the article is placed into a free location, that could be anywhere in the warehouse. (Jonsson & Mattsson, 2011; Aronsson, Ekdahl & Oskarsson, 2013)

The fixed location storage requires more storage space overall because there must be capacity for the maximum volume of articles that might occur. In the floating location storage, a placement can be used by one article one day and when it gets empty another article can be placed there instead. The fixed location storage can be more beneficial since the total handling work can be reduced with the possibility to strategically place articles. Placing an article that is frequently picked close to the unloading area can decrease the travel distance. (Jonsson & Mattsson, 2011; Aronsson, Ekdahl & Oskarsson, 2013) According to Jonsson and Mattsson (2011) the floating location storage makes it easier to keep the correct article balance because the article is not refilled at the same spot, from what has been seen this occurs sometimes. Whether one applies fixed or floating location storage one must decide where articles should be placed. There is no general answer to where the optimal placement is. According to Lumsden (2012) the placement should be based on the requirements on the surroundings, size of product, frequency of picking, similarities or family groups.

Like earlier described, one strategy for minimizing the operating work is to divide the warehouse into zones. What articles should be placed in what zone depends on several things. Different methods of finding suitable locations for the items are described below. (Jonsson & Mattsson, 2011)

**Product family principle**

Articles that are equal in size, dimension and require special handling should be placed together. This may involve a special kind of socket handling, leading to a more efficient work. (Lumsden, 2012)

**Principle of equality**

The equality principle means that articles are placed along with other items that often are
purchased together. This means that the buying patterns of customers should be foreseen carefully to know which items often are purchased together. It is important to distinguish between articles that are very similar to one another so no picking errors or wrong replenishment occur. (Lumsden, 2012)

**Height principle**
When one has decided the zone location design it is important to take the height of placement into account. "The golden zone" is an expression used to describe the optimal height from an ergonomic point of view. An article that is heavy or bulky should therefore be placed so that the pickers simply can pick without overstretching themselves. This principle minimizes the pickers’ need to move which benefits the productivity. Therefore, articles that often are picked should be placed in “The golden zone”. (Lumsden, 2012)

**ABC classification**
Another strategy for placement, without taking the articles attributes into account, is ABC classification. An ABC classification means that all articles in the range are classified and divided into, usually, three sections A, B or C. A-articles are the most important products and are the smallest group, B-articles are a little less important and are somewhat a larger group and C-articles are the largest group of products, where the least important products belong. This can help in determining the most optimal placement depending on the warehouse situation.

How important a product is, is determined by a volume value, which is calculated according to the amount of product sold per year multiplied by the value of the product. The value of the product can be determined to be the sales value, capital value or something else, then a ranking according to the volume value and a division of the products A, B or C. A rule of thumb is 80-20 rule, which says that A-products constitute 20% of the articles and they account for 80% of the volume value. (Aronsson, Ekdahl & Oskarsson, 2013) Several other criteria can be considered in an ABC classification, to avoid it being misleading, for example, customer’s importance to the company must be considered even though they might not buy a big quantity of items. Therefore, another critical factor can be added to the analysis to obtain a more accurate idea of the importance of the product. (Aronsson, Ekdahl and Oskarsson, 2013)

3.3.4. Picking process design
There is a main choice when designing the picking process, which is “Good-to-man” and “Man-to-goods”. Depending on which has been chosen, one can form the process further by developing the principles described below.

**“Good-to-man”**
This method means that goods arrive to a special sorting place where the picker is, through a conveyor belt or in some other automated way. (Lumsden, 2012) This reduces the transfer time of the pickers completely because the goods get transported to the stations where the pickers collect them. So, the only thing moving is the goods. (Richards 2011; Lumsden, 2007) There is a steady flow of picking created for the personnel and the stations can be designed ergonomically for that person's benefit. The picking stations can be designed for each individual person which is important for people's health and productivity. (Richards, 2011)
“Man-to-goods”
This is the other principle and means that the goods have a specific place to which the picker goes to pick the item, both vertical and horizontal. (Lumsden, 2012). A warehouse can have low level picking or height level picking, depending on the picked volume of an item and its buffer.

Low- and high level picking
Articles that the picker can reach from ground level is called low level picking. The material is accessible from ground level and do not requires high-lift trucks or stacker cranes. The picker usually use a picking cart or pallet truck to bring the orders. Pallet trucks are used for a whole pallet, which is placed closest to the floor, if needed. (Lumsden, 2012) High level picking is suitable when the number of items is large in relation to how much buffer you have for each article. The efficiency decreases at high level picking because the picker cannot move quickly between locations in the warehouse. (Lumsden, 2012). To decide how to pick to minimize the transfer time, one must consider how many order lines each order has and how many articles each order line includes (Jonsson & Mattsson, 2011). There are various methods of order picking and below the most common ones are presented below:

Picking of individual orders
The picker picks one order at the time and moves through the entire inventory if required. This is not a good method if one wants to increase the productivity due to the much time spent on moving in the warehouse. On the other hand, there is less risk of picking errors if the same person picks an entire order. (Lumsden, 2012 Richards, 2011)

Cluster picking
To be more time-efficient but still pick individual orders the picker can bring several orders at the same time and pick the same goods from where the goods is located. There are carts that allow several different compartments for different orders. In this way, you can pick items from different orders in the same area at the same time, causing the pickers to reduce their time in moving around in the warehouse. It contributes to less travel time per order compared to if they would pick individual orders. (Lumsden 2012; Richards, 2011)

Batch picking
This method means that an order is broken down to each item and the same items are consolidated which forms an order. A picker will then either bring a whole container from the inventory or the exact number of articles to a packing station. At the packing station the articles get distributed for all specific orders and redundant products are taken back to its place in the warehouse. There will be less travel time per order and an increase in accuracy for each order. Orders requiring fast handling are negatively influenced when they must wait for the remaining articles to be put together to a full order. (Richards, 2011) Petersen and Aase (2004) made a statement in their article about how different decisions about methods in the picking process affect the travel distance. They reach the conclusion that batch picking was beneficial to use when smaller order sizes are common.
Zone picking
Zone picking means that each person gets a certain zone and they only pick in that one. The order is processed from zone to zone and will be picked by different people depending on how many zones it must pass to be completed. This method can easily create bottlenecks when all pickers are interdependent and must wait for the order to arrive. (Lumsden, 2012) This method is good for warehouses that have a lot of different items, many orders and a few to a moderate number of articles per order. (Richards, 2011)

3.3.5. Picking Techniques
To handle orders and to register picked articles there are various techniques, some more technological than others. Two common high-tech techniques are presented below.

Pick by voice
The pickers use a headset and a microphone for picking orders. Through a small handheld device that receives radio frequency they receive picker messages. These are converted into audio message which the picker then hears and responds to in the microphone. This method allows the worker to have both hands free for work leading to productivity and fewer errors in data when employees are working in real time. (Richards, 2011)

Picking with barcode
There are two types of barcodes, one- and two-dimensional. These are placed in locations that you want to provide information of, for example, on the products. Information is obtained by scanning the code with a scanner. Scanners are available in various forms, for example it can be worn in your hand, put the arm or finger like a ring or put on clothes. A handheld computer is often linked to the scanner where the information can be read on the scanned item, and it can also store orders. The handheld computer stores the information about what has been scanned and can then be connected to a computer where the information can be transferred. (Richards, 2011)

3.4. Lean philosophy
In the earlier chapters, one can read about the importance of using resources wisely to increase the efficiency. This leads us to Lean philosophy which is a way of thinking and the purpose is to create value for all activities and preventing activities that do not. (Lumsden, 2012) Lean philosophy therefore means doing things right and doing the right things. In Lean philosophy, the goal is to develop flow and creating value for the customer. This is done by liberating time from activities that add no value and using the time to make a higher customer benefit. (Sörquist, 2013) Lean is not a specific activity, it is more of an approach or strategy of how to conduct the business and there are different methods to use to find problems and waste. Operations always have some kind of waste. To be able to eliminate redundant activities, one must first identify all activities in an operation and then step by step eliminate wastes, which leads to a productive activity that is competitive. (Petersson, Johansson, Broman, Blucher & Alsterman, 2009)

An important part of pursuing productive work is to have an even flow which is why planning is important. By planning beforehand, the work can hold an even flow regarding working tempo and resource needs. Personnel can feel confident and safe with a known tempo which affects
the quality of work directly. (Petersson et al. 2009)

3.4.1. Waste
To create an effective organization, one must have explicit activities and understand which and if they add value. The rest, that do not add any value, is wasteful and should by a change in operations be eliminated or at least reduced. By making the wastes visible and being aware of their existence one can more easily steer deviations in the process. A prerequisite for improvement of the process is awareness of what addition of value is and what waste is. Waste is divided into several categories of activities which are listed below. (Petersson et al. 2009)

Overproduction
Production of more products, or faster or earlier production than what is demanded by customers is a waste. Wrong timing is also overproduction, for example producing products a long time before the delivering generates a need for storage and increase the inventory carrying costs, which is unnecessary. (Petersson et al. 2009)

Wait Time
It is a waste if a product cannot be handled directly, meaning that equipment, personnel and tools are not available when needed. This creates time that is not used for production but instead doing nothing. (Petersson et al. 2009)

Transport
Only movements which are necessary should be done. Transport between stations within the business suggest that the layout is wrong. This creates more transport than the customer is willing to pay for. Creating the flow right will create minimum need for transportation, both of products and people. Forklifts, conveyors etc. are not seen as these kinds of transports. (Petersson et al. 2009)

Overwork
Overwork refers to production of more products or of better quality than the customer desires or that several workers perform the same operation because of lack of communication. If the customer is not paying for it, it is unnecessary work and a cost for the company. That a task is performed several times, for example parallel documentation, is a clear waste. (Petersson et al. 2009)

Warehouse
Only the most necessary products should be stocked to be able to meet the customer requirements. Stocked products cost money, in the form of tied up capital and the need for storage space. It is important to see the total cost before ordering big batches of products, because companies often sell a bigger quantity for a lesser price which can be misleading. (Petersson et al. 2009)

Movement
Unnecessary movements for the pickers could be having to move from their working position to retrieve a tool or having to bend or stretch over to retrieve it, which should be reduced. A
good design of the workplace affects the productivity of the worker. (Petersson et al. 2009)

**Defects**
Errors in manufacturing, in the instructions and delivery should be eliminated. If something is done wrong by one person it means someone else must redo it. This implies the term “doing right from me” with the meaning that everybody has a responsibility to perform correctly and be taught correctly. If an error occurs, then the root cause should be found immediately and be corrected so it does not happen again. (Petersson et al. 2009)

**Unused skills**
Unused skills of workers lead to untapped business improvement. This means missing out on improvement to all the above-mentioned wastes. To not miss out on improvements and ideas of employees, an activity can be integrated into the work. (Petersson et al. 2009)

### 3.4.2. How to identify waste in a process

There are many different ways one can identify waste in a process. One way to do that is to use Value stream mapping (VSM), which is a tool in the Lean philosophy. This is used to identify all activities that add value in a process, both material value and information value. When mapping, the most common strategy is to choose one product and map all activities from order to deliver to the customer. Then one creates a new map over a desired target state, which becomes the start in the strategy to eliminate the no-adding value activities, waste. (Peterson et al. 2009) In a study about identifying wastes, by Gross and Kindman (2015), VSM was used as a tool. By mapping one product of the industrial company and creating a desired state map with this tool, the authors could easily find the wastes and further on analyse how to eliminate these, to free space in the facility which was their goal.

### 3.4.3. The approach “5s”

5S is a Lean approach which is about creating a standard in the business. It is a good start for businesses who want to invest in Lean thinking since it is a basic requirement for well-organized activities and a requirement before being able to identify waste.

- **Sort**: Sorting items, where the frequently used tools should be placed where they are used and those who are not used should be removed.
- **Set (in order)**: All items should have their own permanent place to facilitate for all employees, both tools and documents.
- **Systematic cleaning**: Maintaining the structure and keeping it clean, to make condition for performing work, and to ensure that it is followed. If something differs, identify the source immediately.
- **Standardize**
- By an agreement for how the operations should be designed, the first three points should be made standard.
- **Self-discipline**: It is hard to change people’s attitude from the conversion of habits. It is important to allow this to take time and constantly demand that the new approach to work is followed. (Petersson et al. 2009)


3.4.4. Jidoka

Jidoka is one of the main principles of Lean, which focus on built-in quality and stopping the process when something is deviant. To be able to reach high quality in the work process there must be built in quality meaning that every worker must have competence and perform tasks according to the rules. If the workers have the competence necessary, they can imply it from the start and quality is automatically built in in the work-process. If something still goes wrong it is important to stop the production and examine why the deviation has occurred and how to rectify it, so that the same mistakes do not occur twice. (Petersson, et al. 2009)

3.4.5. Continuous improvement

Improvement work is a central term in Lean. It means always trying to reach perfection. To reach Lean, the state without waste, evaluation and solutions should constantly be maintained. It is a state hard to reach. Contributors must participate in identifying problems during the working process, even though it is hard because they reside in the environment all the time. (Petersson et al. 2009)

3.4.6. Standardization of method

A method standard is a standardized way of how to perform manual work. The standard describes how to work with the product and not the product itself. Three main reasons why this is important in a business is ergonomics and safety, quality and efficiency. The first thing that must be prioritized in any company is the ergonomic factor. This is important for every human being. By standardizing the workplace methods according to what is best from an ergonomic point of view, then this aspect will be covered in all moments of the work. (Petersson et al. 2009)

Standardization creates conditions for an effective organization but also sets a standard for effective leadership. By finding and following the best-found work method to date, the leadership can focus on making sure that the method standard is being followed. Deviation can be followed up with the method standard as a basis to have a constructive dialogue with the individuals, either for improving the method or evaluating how the method is being followed. Leaders must be convinced that the methods used are the right ones and that they have a deeper understanding of them for the employees to have trust in the leader and want to follow their steps. (Petersson et al., 2012)

Standardization of methods creates an environment where every person performs work in the same way which is an important reason for creating less variation in the process. Efficiency in the process is dependent on method standard. By making a method standard one uses the best possible way to perform a specific activity. Why this is important, is because one does not waste time doing an activity in a way, which takes longer time than needed. This also creates a known time for the performance of an activity and can therefore be used for seeing deviations over both longer and shorter times. Deviations in time is a great way of making difference visible. (Petersson et al. 2009)

If every person performs activities according to that standard, the efficiency should be improved. To create an even workflow, individuals must work in the same pace. The problem
that arises is if there is a big difference in the time taken for different persons to perform the same activity in the same way. This means that the efficiency of the work gets bound to individuals, which is to be avoided. This does not imply that all individuals can perform work equally fast, due to the human factor, but standardized methods create less of a variation. (Petersson et al., 2009) A problem that occurs with standardization often must do with misunderstanding and not enough knowledge of the operation. When implementing new routines or standards it is important to involve the employees. A common mistake in the developing of a standard is that it is a small group of people, often the management team, develop these and present them for the employees. In these cases, the routines seem like heavy demands rather than as a practical solution of how to implement a process in the best possible way. (Sörqvist, 2013) The procedures should be constantly questioned and should take advantage of employee’s skills, so that the processes can be developed by people who perform the task. In this way, better methods can be found and new standards updated. (Petersson et al., 2009; Sörqvist 2013)

Grosse and Glock (2014) believe that the human factor in warehouse operations are not considered when planning picking processes. They say that learning is a factor that affects the efficiency in companies the most but is still neglected. Therefore, they have researched and created an analytical model that to be able to study how knowledge affects the efficiency, which is applicable for every individual. Grosse and Glock (2004) conclude that learning has a significant effect on picking efficiency and should therefore be considered when managing order picking. Furthermore, they emphasize the importance of treating everyone for their own efficiency and to strategically place them at a position that suits them. By taking this into consideration a company can, for example, predict lead times and use their workforce fully.

3.5. Human resource management

Just like Richards (2011) described, the picking of a customer order is what drives the most costs. One can reduce the cost by a strategically designed warehouse, different strategies and effective tools. But it is equally important to handle the workforce in the organisation right. Humans are resources as well as machines, trucks, tools and money, which is something that often is overlooked during planning of the warehouse. Grosse, Glock and Neumann (2015) describes this in their study about Human factors in order picking system design. Many of the system designs that exists have focused on cost efficiency, considering layout, routes and article assignment. They mean that important human factors have been ignored in the order picking system designs. Jacobsen and Thorsvik (2014) describes that to reach the goal of the company it is important to work with the human capital. This is called human resource management, HRM, and means strategical work with the goals of the organisation by using human capital to reach them. HRM is used in a company to acknowledge how the company should act to develop, motivate and keep their employees. (Jacobsen & Thorsvik, 2014)

Companies who operate in the service industry, like PostNord, are more bound to have employees with skills as a human capital for creating results, because they perform task bound directly to the result. Therefor systematic HRM is an important part in attracting new and developing current staff. People with a skill are important to the company and should be motivated to stay at the company. As important as it is to keep and develop employees it is
equally important to motivate them, by doing so the employees might help the company in various ways uncompeled. Companies that motivate their workforce can expect both operative and economic advantages, as well as developing a long term competitive advantage. The company will be favoured by employees that try their best and do more than what is necessary. Meaning that they try to solve problems if they arise or try to find better ways of carrying out work on their own initiative, contributing to an innovative and productive organisation. This, directly and indirectly, affects the economic result of the company. (Jacobsen & Thorsvik, 2014)
4. Initial situation

The initial situation at Händelö 1 will be described by the collected data from the observations, interviews and document studies that have been done. This chapter will start with a description of the products and the assortment in EV-area followed by the warehouse layout and later a description of the used tools and picking process.

4.1. Assortment

The products that are picked in the EV-area are called self-care products. These products are over-the-counter products that one can buy in the store without having to show identification. Apotek Hjärtat includes products in several categories, such as products for allergy, skin and hair care, wounds, bites and stings, eye and ear, facial care and beauty products. In total, there are 5000 different items in the assortment. These products are generally small and lightweight but there are some big and bulky products as well.

4.2. Warehouse layout

In the warehouse layout, at Händelö 1, the entire surface for EV goes up to 12 000 square meters. The receipt and shipping area is located on the same side and there is a separate zone for the picking. In Figure 4 the layout of the warehouse is shown with the departments and one can see that the warehouse layout is U-shaped.

![Figure 4 Layout of the warehouse](image)

The picking zone is divided into three smaller zones, apiece zone, ka-zone and big package zone, see Figure 5. The apiece zone is where individual articles get picked, in the ka-zone goods in whole cartons get picked and in the big package zone are goods with a different shape, which often is too big to fit in the container that is used to pack orders in.
4.3. Storage methods

The storage method used is rack stacking and the picking area is divided into twelve corridors. Eight corridors are for picking and four for buffering, which are 1.8 m and 3 m wide, respectively. The step height of the racking is twelve meters high. The racks consist of shelves with slides and buffering empty picking locations is done from behind, which means that the article is pushed forward so it can be picked from the picking corridor and the principal of storing is automatically be FIFO. Except in the KA-zone, where picking and buffering occur from the same corridor.

The corridors are divided in the middle so that one easily can pass through vertically. In some of these passages, there are garbage stations located, which is marked with an x in Figure 5, the warehouse has a low-level picking inventory and buffer locations are located above the picking locations. In the racking, there are several shelves and together they form compartments. Each compartment is either a buffer location or a picking location and in every compartment stores only one kind of article. In total, there are 2500 picking locations in the area.
Some compartments consist of shelves with slides, called pallet flow, other compartments only consist of a pallet. All three zones are both pallet picking and pallet flow picking, these are located on levels 1 to 5, see Figure 6. Level 1 is equivalent to ground level and level 5 is the highest level of the low-level picking, which is approximately 2 m high. The racks have a built-in flexibility which makes it possible to add or remove shelves. This is used in some sections where pallet picking is combined with pallet flow picking.

Each compartment has an address in the form of numbers in a logical sequence. The number of the corridor, what part of the corridor and then the level number. The addresses that starts with even numbers are on the left side and uneven on the right side. The address is set on a sticker together with a barcode by the compartment. The stickers come in two colours, yellow patches are pallet flow locations and white patches are pallet locations. All the corridors have large signs showing the corridor name and part of the corridor.

4.4. Article placement

Floating location storage is applied at the warehouse, which means that goods are put where an empty compartment emerges. To find the best placement for the article they use an IT-system automatically optimize the placement. The system takes the size of the article, if it is an A, B or C article by an ABC analysis and the high principle and the ergonomic into account. This has resulted in that the most frequent articles are placed in the golden zone. The A-articles are also divided equally between the numbers of corridors. The rack with only flow shelves, A- and B-articles placed on levels 2-4 and C articles placed on level 1 and 5, see Figure 8. In the racks with the combination of pallet flow racks and pallet location, the first two levels are replaced with one pallet location. Articles with a high picking frequency are placed on these pallet locations, which benefits the refilling because pallets contain more products than the flow shelves.

After the interviews with PostNord it was retrieved that the optimized placement was not working in reality, for example some A-classified articles were placed at level 5. This is something that happens regularly.

4.5. The picking strategy and picking techniques

As it appears in the earlier paragraphs PostNord uses the strategy “man-to-goods”, low level picking and they use the picking principal cluster picking. The picking technique used is picking
with barcode and they use a scanner combined with a handheld computer with a touch screen.

4.5.1. The Picking cart
A picking cart, see Figure 7, is used to be able to bring a multiple order at the same time. 14 containers can be placed on the cart and each container is one order. These containers are the ones being shipped to the customer later on. Each container is assigned an identity in the form of a bar code, making each one traceable. Read more about how the orders are put together in 4.5.3 System for creating routes. The cart is equipped with a small ladder which intends for the picker to step up on to be able to reach the highest picking locations, level 4 and 5.

The case study showed that the ladder is unstable, it broke down and is not maintained very often. This is a problem which makes the pickers unwilling to use it because they are afraid to fall and drop the item. Some pickers are tall enough to reach the highest level without having to step up on the ladder. Another thing that the picking cart is equipped with is a small trash can, which the pickers are meant to use when they are cleaning up empty cartons or plastic from the picking locations. It showed that these trash cans were not used as much because the empty cartons often are too big to fit in it. Some pickers did carry the cartons on top of the containers to the garbage stations, which did not always go as planned and the cartons fell off. Other pickers just left the cartons and garbage at the picking location. All of this contributed to that the corridors were messy.

4.5.2. The handheld computer
Another important tool is the handheld computer, see Figure 8, with the build in scanner. The purpose of having a handheld computer is that the pickers can find all the information they need directly, regardless where they are located at the time. There are two different designs of the handheld computer, both have a wristband that is supposed to facilitate the work and they are of the same size. The one thing that differ between these are that one requires more clicks during
the picking.

Some of the pickers found the computers heavy-handed because of their size and some lack a wristband. This contributes to that the picker must put the computer down to be able to use both hands, instead of hanging it on their wrist. Another thing that slows down the work is that the handheld computer sometimes gets disconnected to the network, which stops the whole picking process. Read more about the picking process and how the pickers work with the handheld computer in chapter 4.5 the picking strategy and picking technique.

![Figure 8 The handheld computer (Barcode Inc (n.d))](image)

4.5.3. System for creating the routes
The goal of the route is to have a high filling rate of the containers and a short travel distance. The IT-system knows the size of all the articles in the warehouse and optimizes each container for the highest fill rate, which is the first step. To get the shortest route the second step is to decide what orders are to be picked in the same route, by taking the placement of the article in consideration.

4.6. Conveyor to the shipping area
Finished containers are unloaded on a conveyor that transport them to the shipping area. Here each container gets labelled with information, strapped and transferred to the shipping area. The conveyor has sensors to secure that it is closed before it gets strapped, which react to slightest wrong and stop the process.

The conveyor also stops because of overloading. When there is a high demand of products, the frequency of containers increases, which creates a higher pressure on the conveyer. The conveyer is in these times turning into a bottleneck because it does not have enough capacity to work as fast as desirable. When the conveyor stops, it has to be manually handled by a technician. The picker himself must go and find a technician, because of the lack of an automatic notification when an error occurs. When the process is standing, the other pickers must stand in line and wait until the process is restarted to unload their containers on the conveyor. Most often the pickers unload the containers at a different spot and continue their picking. When the conveyor restarts, a picker gets assigned to load the conveyor with these containers.

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4.7. The picking process step-by-step

Every day the pickers are given a zone to pick in. In Figure 9, all the moments during one picking round is seen. The first thing that the pickers do is to sign in to the handheld computer with their personnel ID and then, the picker can see all orders in their zone for the day. The orders are listed in the order they are being shipped, the earlier shipping deadline the higher in the list the order are. The case study showed that some pickers choose orders which benefit their own productivity, thus as many order lines as possible in a short route. This is because PostNord has a minimum requirement of 89 picked order line per hours, to reach the demand from the customers. By the interviews the authors got the interpretation that the pickers’ feel that this contributes to injustice and create less of a team work feeling.

![Figure 9 Activities in the picking process](image)

When the picker has chosen what order to pick the next step is to take a free cart that is standing next to the unloading area and loads the cart with 14 containers. In Figure 10 the moments that take place in the handheld computer during the picking of an order line can be seen. An order line is one of the products included in a sales order, regardless of quantity.

![Figure 10 Moments in the scanner](image)

When arriving at the right picking location, the picker scans the barcode on the address sticker, or write it in manually, and the picker approves. Then the barcode on an article gets scanned to see how many items are to be picked into which container, the picker approves. Articles are put
in its container in the right quantity and the picker confirms this by scanning the barcode on the container, which finishes an order line. The next order line is shown and the process is repeated until all order lines are picked and the picker closes the containers at a lid station and finally unloads them on the conveyor.

4.7.1. Adjacent activities at the warehouse

PostNord has several activities ongoing at the warehouse. This study is delimited to everything outside of the picking process, but there are still some adjacent activities that have an impact on the efficiency of the picking process, see list below.

- Shipping
- Purchasing
- Buffering
- Items care

Shipping and purchasing are processes that control how much items there are stored at the warehouse at the moment and affects the article placement. The buffering has a direct impact on the picking, since if there is no buffered items there is nothing to pick. If a deviation, such as no articles at picking station, the picker must report to items care. From the case study, it was clear that the most common wrong was when the article at a picking location was out. The shift leader, Julia, indicated that this occurs because of the pickers sometimes pick the wrong number of the article, the article breaks or are placed at the wrong location. The case study showed that interruptions happened up to 10 times a day and every time a picker had to go to items care it often became a long period of waiting, up to 20 minutes when there was a waiting line. Julia pointed out that problems like these were not always reported and therefore it contributed to uncertainty in the article balance.

4.8. PostNord’s management of human resources

PostNord has their own personnel, which are the strategic planners. The pickers are the ones performing the task of picking orders and are hired from PEMA, the staffing company. This workforce constitutes of pickers, replenishers and shift leaders. It is PEMA who are responsible to teach their new staff how to perform tasks and the routines. The shift leaders are a link between PostNord’s strategic department and the operative workforce. PostNord informs the shift leaders about how many orders there are to pick the next day and it is their job to provide with enough pickers to handle that amount of work. This means that the number of pickers vary from day to day depending on the number of orders that day. There is also a difference in the need of pickers in the forenoon and afternoon, which depends on the shipping deadlines. PostNord has a short delivery circle, one day to pick the orders and 100 percent delivery service. Because of this there is more shipping deadlines in the forenoon, so the customers get their order on time.

PostNord keeps track of the pickers’ productivity by collecting data from the pickers’ personnel accounts. If the picker does not reach the requirement of 89 lines per hour, three days in a row, PostNord alerts the shift boss, who has the responsibility to inform the concerned picker. During the case study, it was shown that there is a great range in how many order lines every picker
picks. Some pickers never have a problem of reaching the requirement and even pick more than this while others get an admonishment every week.

When talking about this in an interview it came clear that there was a lack of teaching, both of new and current staff. The pickers also told the authors that there are some people who voluntarily pass on their own tricks to their companions to make the picking process easier. What also appears in the interviews with the pickers is that some are stressed and other are not. However, this does not seem to have a connection with how much they can pick. Another time when the pickers feel stressed is when it is crowded in the corridors, which was retrieved from the interviews. The observations showed that the corridors often were jammed because of the pickers and their carts and like earlier described, the cartons and garbage left in the corridors.
5. Analysis of the initial situation

To find what inhibits a picker from using its time right the initial situation will be analysed and compared to the theories about how a warehouse and a picking process should be designed to reach productivity. First, the warehouse layout will be analysed and afterwards the picking process, with a focus on factors that the authors found contributing to some kind of waste.

5.1. Analysis of PostNord’s warehouse design

The analysis in this section will have a focus on the factors that affect productivity related to travel distance, article placement and picking method. PostNord has divided the warehouse in three different zones using the family principal and they have a u-shaped layout. Dividing into zones when having a u-shaped warehouse is according to Jonsson & Mattson (2011) a benefit for the travel distance.

The picking process design in the warehouse is “man-to-goods” combined with low-level- and cluster picking. PostNord has done right using low level picking considering the amount of space needed if using high level picking. It is also good since they have a high amount of orders per day, meaning that they need the most productive way of handling orders. It is clear that the EV-area filling rate is high and not all products can be placed on picking-places always. But, if PostNord used high-level picking they would need more space for more trucks, which neither exist today. The use of trucks would also decrease the productivity according to Lumsden (2012). Since they have such a high amount of orders each day this would not be productive in their case. They solve the matter with articles not being place at a picking location by a picker requesting an article which a buffering-truck then retrieves.

The pickers bring 14 orders and places the articles directly into the containers, that later is shipped to the customers. This method contributes to shorter travel distance according to Lumsden (2012) and therefore better for PostNord. When comparing cluster picking, which PostNord uses, with batch picking, it is hard to tell which one that would be the best for the productivity in this case. Today’s strategy of using the same containers during shipping saves time in the big picture, because they do not have to sort or re-pack the orders in other containers. However, according to Richards (2011) the travel time per order will decrease and the accuracy will increase when using batch picking, because there are two pickers that works with the same order. Petersen and Aase (2004) tells us that batch picking is beneficial to use when the customer order contains a small number of order lines. However, the customer orders, in PostNord’s case, often contain many different articles, which is not beneficial when batching. Batching also requires a station for sorting and packing, like earlier described, would be hard to find room for in this area because it is filled with goods. To sort and pack will also add one or two extra activities and the time saved in the transfer will be used in these extra activities. How much time these activities will take is hard to say because it depends on how many order lines there are in one order and how the organisation will develop this activity. In the initial situation PostNord has a problem with corridors being crowded and affecting the productivity negatively, which batch picking might facilitate. More examination is needed to know if this method would be the
most time efficient in PostNord’s case.

PostNord has according to Lumsden (2012) the right strategy of placing the articles. The idea is to use ABC-classification and place the most frequently picked articles in “the golden zone”. They also take height of shelves into account and place the heaviest articles on the lower shelves to benefit the ergonomic and therefore improve the productivity. What the authors could see is that this is not working in reality and this contributes to waste, which decreases the productivity. Read more about how the placement of the articles affect the productivity in chapter 5.2.3 Article placement.

PostNord has applied floating location storage, which according to Jonsson and Mattsson (2011) suits their situation well since they have both a big variety and number of articles are in the assortment. This makes the utilizing of the surface better compared to if fixed location storage was applied. Like Jonsson and Mattsson (2011) claims, the floating system will prevent interruptions during picking because it is easier to keep the correct article balance. Despite of using floating location, PostNord still has problems with the balance. This indicates that other reasons for the incorrect balance exists. The interview with the shift leader indicated that the problem was that the pickers did not report if items were broken, put aside or other occurrences. Why they did not report the problem to items-care is unsure, but the authors think it depends on that the pickers want to use their time right, trying to reach the requirement of picked order line per hour. Another thing that it could depend on is that the pickers do not feel motivated enough to do their best. The authors state this based on how PostNord work with PEMA, such as many of the pickers get asked to work in a very short notice, they do not feel like they get the instruction that they need and get thrown into different workflows every time.

5.2. Wastes in the picking process
To find what prevents the pickers from using their time right, the picking process will be analysed in this section and is based on the Lean theory, about how wastes affects the productivity. Petersson et al. (2009) describes that operations always have waste and redundant tasks and if these are eliminated the productivity will increase.

There are different ways to identify waste, one of them is the VSM method as Gross and Kindman (2015) described. They used this method and mapped all value adding moments in the process of an article, to later find and eliminate unnecessary moments, considered waste. In this research, there are no products to be followed, but pickers in the picking process. The pickers’ time, in this case, is the value and waste is what stop them from using their time right.

When collecting data, the authors have identified factors and moments contributing to a waste of the pickers’ time. By analysing these factors and moments the authors could find why these moments contributing to waste emerged and divided them into four areas of the root cause.

- Quality of tools
- Standardization of routines and leadership
- Article placement
- Jam in the corridors
5.2.1. Quality of tools

There are some problems related to the handheld computer and its lack of quality, such as the wristband, disconnections to the network, that they are heavy handed and there are too few of the ones without auto-enter. These are contributing to some kind of waste. The lack of wristband and that it is heavy handed creates unnecessary movements for the picker, because the picker must put the computer down during the picking of articles. Otherwise they have a risk of dropping both the computer and the picked item. That the computer loses network is a waste of time because the picker must wait, meaning lost time and not using ones’ resources well. That there are two different computers, where one enables the picker to work faster, is also a waste of time. What was retrieved from the case study, the pickers preferred the handheld computer with auto-enter. According to Lean philosophy all of these wastes affect the pickers’ efficiency.

Just like the handheld computer, the cart is also heavy handed and it takes effort to work with because it is hard to manoeuvre, this creating unnecessary movement. The cart easily breaks and many of the ladders are unstable which makes the pickers cautious and slowing them down more than necessary, which wastes time. Some of the pickers do not use the ladder, which seems positive from one point of view but it contributes to a higher risk of dropping the items. This can lead to that the item breaks and it is also bad for the picker from an ergonomic point of view.

The conveyor, unlike the previously mentioned tools, does not have a problem with quality. The problem is that it has a low capacity and turns into a bottleneck, when the frequency of containers increase. The conveyor will turn into a bottleneck more often if the productivity of the pickers increase. As previously mentioned, this creates waiting time and extra work assignments. So, even if PostNord increases their picking productivity the conveyor will prevent the actual goal, to ship orders to the customer on time.

All the above-mentioned tools are contributing factors to waste and prevention of the flow, which are some of the main principles when it comes to productivity according to Lean philosophy (Petersson et al. 2009). If PostNord could upgrade their equipment and invest in picking techniques-equipment that prevents waste, their productivity would increase.

5.2.2. Standardization of routines and leadership

That the productivity vary among the pickers is something that needs to be considered. It is important to have the human factor in mind, but surely that cannot be the only thing creating the variety. There are pickers that do not have a problem reaching the requirements or even surpassing them, the question is only what they are doing different from their fellow colleagues?

Some pickers choose what orders to pick because they benefit their productivity, thus do not follow the routines of how to perform the work. This results in that the orders with long travel distance are left, which could be one of the reasons why some have a lower productivity than others. The authors do not have any statistics or other proof of the relation and do not know how much the productivity is affected by this matter. Something that was told during the interviews was that the pickers felt irritated and it felt unfair that this could be done. To make sure that this
does not happen, PostNord has a responsibility to make sure that the system does not allow choosing orders.

Another reason for irritation is that some pickers do not clean up after themselves. Instead of reaching straight for an article the picker must move the cartons around to get through at the picking location or move pieces of garbage to get through with their cart. This contributes to a waste of time and prevents them from focusing on their picking. This might depend on that the garbage stations often are overfilled, are too far away to motivate the pickers to carry their garbage with them or that the cartons are too big to fit in their trash can on the cart so the pickers leave it. One reason could also be that the pickers are focusing on their own productivity, to reach the requirement and do not think how leaving the garbage will affect the rest of the pickers or in the end, themselves.

The authors think that all of these problems, related to that the pickers do different and do not follow the routines, is because the routines are not as developed as necessary or cover all situations. There is a lack of introduction and it is unsure what the new pickers get told how to do. That the pickers work differently or do not clean up after themselves could depend on the lack of knowledge and not because they do not care.

If PostNord creates a standardization of the best way to pick and all pickers picked that way, the productivity would improve. The routines created should cover all possible scenarios that might occur in the picking process, so that every task is performed in the most optimal way. This would increase the productivity and diminish the variation of the pickers, if it is implemented in the right way. By creating clear routines about who, what and when nobody would evade the responsibilities, improving the irritation that occurs and it would prerequisites the pickers to pick in the best way. It is important for PostNord to cooperate with PEMA in this work, using the staffs’ knowledge, to find and develop routines. Jacobsen and Thorsvik (2014) tell us how beneficial it is for a company to use the staffs’ knowledge. They highlight that motivation and development of staff members create initiators, which will lead to a productive and competitive company in the long term.

It is important that the new staff get a thoroughgoing introduction where they learn the standard work routine. Due to the lack of teaching new and current staff, the introduction is something that PostNord must improve. It is also important to follow up the work routine to always find and use the best way of performing tasks. To easier maintain improvement one solution could be to have one or a few pickers that helps maintaining the routines and coaching staff the best way to pick.

5.2.3. Article placement
As described in the initial situation, PostNord uses ABC classification and that it does not work fully is an issue. This means that the classification loses its purpose, which is to save time by optimally placing articles. The source of this problem is that the warehouse is overfilled. There are not enough empty picking locations for these number of articles, which leads to that articles must be placed wrong to even be placed. Frequently picked articles should be placed on a location with minimum retrieving effort otherwise it will result in a waste of time, according to
Lumsden (2012). By placing heavy items on the higher racks the risk of dropping increases, breaking it or fall while picking. This is not good for the pickers’ ergonomics or the productivity. Lumsden (2012) means that the location of a product directly contributes to how fast an item can get picked and is also an attribute to good ergonomics, referring to less climbing, bending and lifting. Route optimization is also important to create less travel distance, which cannot work correctly if the articles are not placed right.

A possible solution to get the placement to work in reality, is to use a fixed location storage. This storage method ensures that every product is placed correctly, on the optimal location. This implies that the area of the warehouse must be as big as when all articles are brought home at the same time. This also implies that the travel distance increases, which on the other hand could prevent the pickers productivity. From that point of view, a floating location storage is more beneficial because the area of the warehouse can be smaller. (Aronsson, Ekdahl & Oskarsson, 2013) However, they still have a need of expanding the area to get the ABC placement to work fully and get rid of the waste. Even if the problem with the wrong placed articles would get solved by expansion of the area, it is hard to say if the productivity would increase in total, because the travel distance would most likely increase. Another solution is to switch focus, from expanding the area to lower the number of products in the assortment. If they do not have as many articles they would not need to expand and the article placement would work better because the warehouse would not be overfilled. This would probably increase the productivity but might affect the customer service and the business in another way, which is not beneficial from a bigger perspective.

5.2.4. Jam in the corridors
After the analysis of the layout, it was clear that PostNord has a thought-through layout of the warehouse, but they still got some problems related to the layout and the size of the warehouse. The jam in the corridors occurs for different reasons but is major contributing factor to the emergence of stress and irritation of the pickers. This contributes to that the pickers get less motivated and do not do their best, which decreases the productivity. The first solution that comes to mind is to expand the warehouse. This would ease the pickers’ ability to move around and like Jonsson and Mattsson (2011) says, the rule of thumb when designing a warehouse is that the process efficiency goes before the usage of space. But on the other hand, an expansion of the warehouse will also contribute to longer travel distance and waste might occur since the time of transferring between the article locations will increase. This inhibits the pickers’ productivity and needs a deeper investigation to assure that this solution is profitable for PostNord. The authors thought that the problem with jams depend on other factors as well and started to look for them, to find the root cause and how they could be eliminated.

The corridors become crowded because of people, equipment and garbage, which is causing jams and worsening the ability for the pickers to move around. Moving around the pickers and carts is causing a waste of time. The carts are big and ponderous and when the number of pickers increase, each with a cart, the worse the ability to move around will get and the productivity decreases. But here a consideration must be given to the fact that the carts are used as a tool for increasing picking efficiency, by enabling picking multiple orders at once, decreasing the travel distance. The corridors are often crowded but not always, the number of pickers vary from day
to day depending on the number of orders that day. The more orders indicate that more pickers are needed, which contributes to more jam. This problem mainly occurs in the forenoon, because of the many shipping deadlines at that point of the day.

Another waste is waiting, which occurs when the picking location that one should pick from is busy by another picker, and you must wait for the other picker to finish. This is a common happening and it wastes the pickers’ time. The chance of this situation occurring gets bigger if a picker is detained at the picking location. This could be avoided by creating more locations for the same article, which on the other hand creates a need for a larger warehouse and it would increase the tied-up capital.

5.2.5. Adjacent processes and activities
What this study lacks are the consideration of adjacent processes and activities, due to delimitations. The picking process is not detached from the rest of the processes and activities in the warehouse and they all have an impact on each other. During the case study the authors experienced adjacent processes and activities have an impact on the picking process, these were out of the studied area. The authors recommend PostNord do further investigations about these processes and to see how the pickers productivity would change, because these probably influence the productivity from what has been seen. Down below are three factors that PostNord should have a closer look at.

Delivery cycle
The problem with jam in the corridors is not constant. There is more jam during daytime, which is because the day shift has more shipping deadlines and therefore require more pickers. If PostNord could extend their lead time, the authors think that PostNord could spread the shipping deadlines more even during the day, which would create a more even flow of work which Petersson (et al. 2009) advocate. This would create jams to a lesser extent, which would lead to that pickers can work more productive. This is something PostNord should discuss with Apotek Hjärtat, since this affects the customer service.

Items-care
Items care contains different activities and is a process that the pickers visit multiple times a day. What was seen from the case study is that the picker often must stand in line here to retrieve information of how to continue with their work. This is not time efficient and the picker waste its time which could be used to pick orders. Since many pickers strive to fulfil the picking requirement this might be a process that they avoid, which creates problems like messy corridors. The pickers might rather leave broken and wrongly placed articles somewhere in the warehouse than to lose their time in the items-care process. The items-care process would need a further investigation to develop the process and to make it more time efficient, since it affects the pickers’ time and is a contributing factor to other problems.

Lower the assortment
That articles are not placed correctly, because of the overfilled warehouse, could be solved by lowering the assortment. How much the productivity would increase by enabling articles to be placed right would need further investigation. A lower assortment could affect the business and
customer service negatively, therefore it is important to carefully investigate this solution.
6. Recommendation

By analysing the identified factors and moments that inhibit the productivity and finding what their source of occurrence might be, the authors found different solutions that would help PostNord increase the pickers’ productivity. The authors recommend PostNord to consider the suggestions down below.

6.1. Invest

What was retrieved from the analysis of tools was that there are several issues that occur because there is a lack of quality in tools used. Therefore, the authors suggest that PostNord should invest in the handheld computers and upgrade all of them to the ones that do not require as many clicks as the current hand held computer. Further, they could invest in an even more efficient and workable picking technique, which enables the pickers to use both hands when picking. PostNord should also invest in more durable cart so the pickers are not afraid to use it properly and can manoeuvre it better, to facilitate the picking. The shipping conveyor also needs an upgrade, especially if the productivity increases, otherwise it will become an even bigger problem and bottleneck than it is today. Just as important as it is to invest it is also important to maintain the quality of the tools and fix them permanently if they break.

6.2. Improve the work procedures by standardization of method

PostNord should continuously improve the method of the picking process to get all the pickers on the same level of productivity. Like described earlier, some pickers do not have a problem reaching the requirements or even surpassing them, which is why it is important to PostNord to create a standardization of method and teaching the pickers it. It is also supremely important that the new pickers get a meticulous and thoroughgoing introduction where they learn the standard work routine, which PostNord has a lack of today. If everybody follows the method, the variation of the pickers’ productivity will reduce and it will in total get increased. This implies continuous evaluation of how the method is being followed and continuously working to find the best way of picking, which is best done by involving the pickers.

6.3. Improve the cooperation with PEMA

PostNord should improve their cooperation with PEMA, to make the pickers feel more motivated and to get them to do their best. The team work feeling and responsibility taking would increase, which would prevent, among others, the messy corridors and the stressful environment. If the cooperation with PEMA could improve, the work with finding the best way of picking and improving the work procedures would be easier. In general, it is very important for PostNord to work with human resource management, to increase the productivity.
7. Discussion

The purpose of this study was to help PostNord increase the pickers’ productivity by identifying factors and moments that inhibit the productivity. By doing so, recommendations of what PostNord should focus on was made. In the recommendations, there were different kinds of things PostNord could do and work further with. The authors cannot tell what the most time- or cost effective way of improving the process would be. It is also not said that if PostNord implement these, it will optimize the picking process to its fullest potential. To decide what change PostNord should do, they must consider know how much time and money they are ready to devote, to decide what the best solution would be for them.

When starting the case study the authors did not expected to find factors that were affiliated to HRM- and personnel strategic questions, since theories that the authors had read mostly pointed out the importance of warehouse design, picking methods, article placement. When realizing the change of focus there was not a big selection of theory, scholar research or examples of similar situations, connecting picking process productivity and HRM. Despite this unexpected change of focus, it did not affect the result in any way, because the study questions still could be answered.

To identify the factors and moments that inhibit the productivity both interviews and observations were done. There were three interviews with pickers done and some of the identified factors are based on their answers. If more interviews had been done the authors believe that more negative factors would have been found and it would be easier to find associations that could have helped in the analysis. To increase the reliability of the interviews, the authors followed up by observations to confirm what the pickers had told. The authors found that the three pickers interviewed had similar opinions on what factors affected their productivity, even though they had different productivity. From this, a generalisation was done and the authors considered this to be evidence of that these identified factors were affecting all the pickers.

During this study the authors found additional questions that would be useful in future studies at PostNord. Firstly, the authors found an interesting question about the picking process design. There are jams created because there are pickers in the corridors, which slows down their ability to move around, which could be solved if pickers were not in the corridors as much. The authors think that it would be interesting to see what would happen with the productivity if the picking method batch picking was used instead of joint picking, as it is today. This might improve the jams in the corridors but should be examined carefully since other activities get affected by this kind of change. The second question was about examining what the difference between the pickers that surpass the productivity requirement and those who struggled to reach it is. It would be interesting to see if there are some influenceable factors that are key elements of the difference.

The findings in this study shows that there are many things that affect the productivity in a
pickings process. Some of these are specific to PostNords warehouse at Händelö and some of them the authors think are common in other picking processes as well. Regardless, the findings in this study will be a help for PostNord to see faults in their process and how they could improve them. The negative factors found are a help for PostNord to see what they contribute to, which will make it easier for them to prioritize what recommendations they want to implement directly or if they want to do further investigations. The authors elucidated that there are adjacent activities and processes that affects the picking process, which is something PostNord could keep investigate to find the factor that affects the picking process the most.
8. Conclusion

The purpose of this study was to help PostNord increase the pickers’ productivity, in the picking process. The objective was to identify factors and moments that inhibit the productivity to be able to give recommendations on what PostNord can do to increase the pickers’ productivity.

After the case study the authors compared the initial situation with the theories within this subject. PostNord has a thought-through layout of the warehouse, design of the picking process and a good article placement, according to Aronsson, Ekdahl & Oskarsson (2011), Jonsson and Mattson (2011), Lumsden (2012) and Petersen and Aase (2004). It was confirmed, by the case study, that even if one has a good theoretical plan, it does not mean that the processes in the warehouse reach their optimal state.

This study shows that there are many factors that contribute to wastes, which according to Lean philosophy is a basic requirement for a business to be effective and use its resources wisely. The authors have identified factors that inhibit the pickers from using their time right and have given recommendations that PostNord can carry out right away and suggestions of other areas that they can investigated further. Moreover, this study elucidated that HRM is important to become effective and one should consider these questions as well as layout, transport distance etc. which seems to be the most common things to investigate when solving issues like this.
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Appendix 1 – Interview questions

These questions were asked to the three interviewed pickers at PostNord, the 11 of May 2016.

- How long have you been working here?
- Do you have previous experience working at a warehouse or with similar assignments?
- How is your experience working here at PostNord?

The handheld computer
- Do you find the handheld computer to be heavy handed?
- Do you find any difficulties with it?
- How do you think it is to distinguish the location and what article you are to pick in
  the handheld computer?

The cart
- Do you feel that the cart is difficult or easy to control and manage?
- Can you give an example of when you think that it is hard to manage?
- Do you think there is something you can do with the cart to facilitate your work?

The picking location and aisles
- Do you think that the signs of picking locations and aisles are clear to follow?
  - If no: In what case do you feel it affects your work?
- Do you think any zone is better / easier to pick in than in another?
  - If yes: Why and how does it differ?
- Do you experience that it is messy in the aisles / on the picking location?
  - If yes: How do you handle it? What do you do to prevent it?
  - Do you find that you must clean up after others?
- What do you do if an item is placed wrong?
  - Do you always do so or are there situations where you do otherwise?
- What to do if a defective product is on the site?
  - Do you always do so or are there situations where you do otherwise?
- How do you experience the height of the different picking places?
  - Is there any difference in pallet / pallet flow picking?
- Do you feel that it is difficult to pick from the pick places that are high up? As you cannot see what items are in the box? Why?

- How do you act when someone else is picking from the location you want to pick from?

- How often does that happen that the location is occupied by another picker? 1 or 10 times per day or week?

- How often do you feel that it is empty on a picking location?
  - 1 or 10 times a day or week?

- What do you do if it's empty on a picking location?
  - Do you always do so or are there situations where you do not do so?
  - If yes: Does it affect your work?
  - If yes: Can you give an example of such a situation and what you do then.

- What do you think about the space in aisles?

- Do you experience it crowded? In that case, when? Does it affect your work and how?

- Do you always pick in the order that the handheld computer suggests?
  - If no: Can you give examples of situations in which you do not, and why?

- When you are done picking a route, do you follow the flow to get out or do you go back the same way you came in in the aisle?

Other questions

- Is there any special irritation moment at work?
  - If yes: Explain how and why they occur.
  - Does it affect your work?

- Do you feel that it can be stressful at work?
  - If yes: In what situations, can you get stressed?
  - What is causing you to be stressed?
  - How does stress affect your work?

- What do you think affects how quickly you can pick?

- We have heard that there is a goal that you should pick 89 lines per hour, what do you think about that?
  - Is it hard or easy to reach that goal?
- Do you have other examples of problems that might occur when picking that we have not discussed?

- Is there anything you could do to be more productive?

- Is something PostNord could do so that you could be more productive?

- Is there anything you think that we should get a closer look at and improve in the inventory?