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Improving loading performance at outsourced warehouse

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Opinnäytetyön toimeksiantaja havaitsi, että sille varastointipalveluita tuottavan ulkopuolisen toimijan suorituskyvyssä oli useita alueita, joita voitaisiin parantaa. Vanhat toimintatavat olivat kuluneita ja aikansa eläneitä. Toimintatavat tarvitsivat uudistamista ja parempia ratkaisuja, mittareita ja prosesseja, jotta jatkuvasti kasvavat markkinat eivät kärsisi varaston toimimattomuudesta. Opinnäytetyön tavoite oli löytää ratkaisuja siihen, kuinka lastausten aiheuttamia negatiivisia vaikutuksia voitaisiin vähentää ja kuinka saavutetaan toimeksiantajan asettamat tavoitteet. Tavoitteena oli parantaa lastaustehokkuutta kolmannen osapuolen varastolla.

Opinnäytetyö tehtiin käyttämällä sekä laadullisia että määrällisiä tutkimusmenetelmiä, joista laadulliset menetelmät korostuivat. Informaatiota kerättiin haastattelemalla useita eri henkilöitä monilta eri tasoilta sekä asiakkaan että varaston puolelta. Kirjallisuuskatsaus tehtiin teoriapohjaisen tutkimuksen tueksi.

Varaston ongelmakohdat lastaukseen liittyen löytyivät tutkimuksen yhteydessä. Näille ongelmakohdille esitettiin ratkaisuja, joilla yritys voisi parantaa lastausten suorituskykyä. Näihin ratkaisuihin kuuluivat uuden huolitsija-aikataulun kehittäminen ja varausjärjestelmän esittäminen pääasiassa FCA-huolitsijoille. Ratkaisuihin kuuluivat myös logististen prosessien kehittäminen muilla varaston osa-alueilla ja prosesseissa sekä SAP-reittien päivittäminen uusien huolitsija-aikataulujen pohjalta ja KPI-mittareiden uusiminen tarkan ja todellisen lastaustiedon saamiseksi.

Opinnäytetyön toimeksiantaja otti uudet suunnitelmat mielenkiinnolla vastaan ja aikoo tulevaisuudessa käyttää näitä ehdotuksia hyödykseen joko suoraan tai välillisesti. Tulosten konkreettisten hyötyjen arviointi jää toimeksiantajan tehtäväksi.

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The client of the thesis found out that there were lots of areas where the company could improve its performance in the field of loadings at the outsourced warehouse. Old habits were outdated and required new and improved tactics and measurements so that the warehouse could meet the service level set by the company. Objective of the thesis was to find solutions on how to ease the impact on loadings at the warehouse and how to meet the standards promised to the customers. Clients object was to improve the loading performance in outsourced warehouse.

The thesis was done using both qualitative and quantitative methods from which the qualitative aspects were given more time and consideration. Information was gathered by interviewing multiple employees from different occupations both from the company and from the warehouse. A literature review was written to manage the substantive subjects for thesis.

Problems in the warehouse were discovered during the writing process of thesis. These problems had improvement plans created for them improve the actual loading performance in the warehouse. This included planning new timetable for forwarders and introducing booking system for non-nominated forwarders. Also, improvement plans for developing other warehouse processes were given. KPI measuring and SAP routes were also checked and planned as a result.

The client was interested in implementing the development plans indicated on thesis and intends to use these plans directly or indirectly. However, there were no time to truly evaluate which recommendations worked for the client and which did not.

Keywords/tags (subjects) performance, KPI, loading, timetable, outsourced logistics, spare part, third-party logistics

Miscellaneous (Confidential information)

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1   Introduction

1.1   Objective of thesis

Imagine the following case. A trucker comes to a warehouse to load a cargo that is meant for a customer in Portugal. He arrives to the warehouse premises only to find out that there are 10 trucks before him waiting to be loaded. Wait time is approximately 3 hours. He has two options; wait for his turn to be loaded and risk the loadings from other possible places or skip this loading and go to the other places to get loaded. He will most likely go to the other places and not return to the first place where he should have been loaded. Due to this factor, the cargo stays in the warehouse for yet another day and this will cause delays and possibly huge losses to the customer who is waiting for the goods. This is the problem the thesis provider is facing at the moment in their outsourced warehouse in Netherlands as said by Riihimäki and warehouse coordinators. The planning of cargo loadings is outdated and is only focused on few days of the week. This causes delays, affects negatively on the KPI measuring of loading performance, waiting time fees occur more often and the free space in warehouse is occupied by these pallets and cargo that were not picked up. And these are just few of the problems that this is causing the company to have. The objective of this thesis is to provide new solutions to balance the loading burdens more evenly throughout the week. The final customers will be happier due to on-time deliveries, there is more space in the warehouse and no extra costs will occur with the updated timetable and schedule for the warehouse. Also, the KPI measuring done by thesis provider will be enhanced and can be used in the future to determine bonuses for the employees. The objective of thesis was to find solutions for improving loading performance at the company's outsourced warehouse by investigating possibilities of alternating the loading timetable and introducing a new booking system for forwarders, defining the warehouse processes more thoroughly at the warehouse and re-developing the KPI measuring which is being used for measuring loading performance.

1.2 Structure and limitations of thesis

The thesis is divided into two sections from which the first is a theory-based entirety and the second part is based on the research. The theory-based entirety will create the framework for the research-part of the thesis by introducing facts and figures about sparepart sales and logistics, KPI measurements and quality and the importance of scheduling and timetables. Research part of thesis will present the current status of loadings at warehouse as well as presenting the proposed changes and amendments to improve the performance at warehouse. The last part of thesis is the own reflection with discussions about the thesis and project and what it matters to the thesis provider to have such results.

The thesis will not consider the location of the warehouse, it will stay the same. The layout of the warehouse will also stay the same. Thesis is also done from outbound-shipments point of view, no inbound-shipments will be considered. The amount of refunds and customer complaints would have been great to have on the study but unfortunately this data was not available during the time that the thesis was written. Provided the research is done well and thesis provider finds the results useful, future implementation to import-shipments will be possible.

1.3 Company introduction

The study was done for a distribution center unit in a large company that manufactures and designs new machines and solutions for mining and crushing minerals. The company is based in Tampere, Finland and has many other branches globally in every continent. Revenue from year 2018 was 3173 million € and profit was 351 million €. The company employed approximately 13000 people worldwide in year 2018. Year 2018 was a record year for the company and forecasts for the future are looking bright. Mining and infrastructure industries are growing globally and expected result for year 2019 will be even higher than in 2018.

The operative and managing staff of distribution center is located in Tampere but the main distribution center is located in the Netherlands. Operative areas consist of purchasing, order desk, logistics, warehousing and parts support teams. Distribution center has its own operational and managing staff who handle the daily business in

the warehouse premises. DC handles the exports and imports of spare- and wear parts globally through a net of multiple forwarders and transport companies.

The company has customer in almost every country in the world who are either who contact the DC straight or through other branches globally. The customers operate in the fields of mining, infrastructure, rock crushing or breaking and in recycling just to give few examples. The core focus of the company is to offer a complete service for customer's needs, whether it needs new solutions or innovations, the company is willing to invest on those factors to be a leader in its field. This includes problem solving, researching and developing new and improved methods and machines, maintenance, handling the transportations and many more things to enable that the customer is satisfied with the service and products that the company offers them.

1.4   Research methods

Research methods for thesis can be roughly separated into two different methods; quantitative research and qualitative research. These methods are very different from each other they help to define the purpose and objective of the thesis. These methods can be compared as Table 1 shows:

Table 1. Comparing quantitative and qualitative methods

Viewpoint to study	Quantitative	Qualitative
Relationship between researcher and object of study	remote	intimate
research strategy	well structured	un-structured
character of research material	hard and reliable	rich and deep
relationship between study and theory	verifying theory	creating theory

These strict divisions between research methods do not help in the final production of thesis, they are creating several boundaries in which to work during the thesis process and are completing each other in the process. Most of studies and thesis works are done using both quantitative and qualitative methods.

Study or a thesis always has an objective or a meaning. This objective guides in the selection of core research method on which to rely more. Next chapter will go through the differences between these methods and in what kind of studies they can be used.

1.4.1   Qualitative method

Researching using qualitative methods relies on defining the aspects of the objectives and interpreting the results. The study materials are gathered in live situations and they represent the current status well. Method favors a humane person as the main source of data rather than simulations and hypotheses. These data sources are selected according to the usefulness of them, not by random. The research plan is defined alongside with the study, not before it. A qualitative study aims to discover unprecedented aspects, that is why the starting point is not testing out theories or hypotheses, it is about examining the material thoroughly and with great detail. Using qualitative methods in research will also let the aspects and own ideas of the people come through more fluently and with better trustworthiness. (Hirsjärvi, Remes & Sajavaara 2001, 155).

Qualitative method is used in situations in which numeric or other kinds of data is not available or in situations where the human aspects are more important than theories. Qualitative methods work well in studies about people, behavior and in other areas where there is a lot of human interactions. It also works well alongside with quantitative methods when all the data about research is not available and when employees and workforce have some aspects about the case and study.

1.4.2   Quantitative method

Using quantitative methods is all about numbers, theories and using previous studies and hypotheses during the research process. Test subjects are picked randomly from a group and using statistical analyzing when going through the data.

Quantitative methods work well in mathematical researches where data is available as numerical, and it is easy to put in graphs and tables to compare and to process it. (Hirsjärvi ym. 2001, 129).

As said before, most studies and thesis works do not rely on one single method, it is a combination of qualitative and quantitative methods. Methods used in this thesis will be presented in chapter five thoroughly.

2 Importance of sparepart warehousing in manufacturing business

As with every company that makes goods or machines, the sales and logistics of spare parts have to be seen as individually important as the sales and logistics of the main product. The main product can be as good as it gets but if there are problems in the distribution of spare parts, the impact it has on the company can be very significant, for example, in losing customers to another supplier or just having a bad image in the market. The following chapter will go through the manufacturing business and its details in more thorough way.

2.1 Manufacturing business

Manufacturing any types of goods, whether they are components or main products, refers to a situation where a company uses a selection of materials, products or components and using them to build a finished product. These items can then be used in multiple ways depending on the type of customer these will be sold to. Manufacturing these goods employ a selection of tools and human workforce to efficiently make the items. A typical manufacturing business operates on an assembly line or other type of linear method in the manufacturing process where a product is built step-by-step. (Markus, 2019).

Manufacturing types can be divided into three main sections which will be gone through in the next chapters.

2.1.1 MTS (make to stock)

MTS is a model which is highly dependent on the past data and sales figures to match the inventory with anticipated customer demands. Company using MTS model tries to estimate the needs of customers when planning a stock for a specific item. If the company can estimate the volumes accurately, MTS model is the most efficient way, especially when stocking goods which have a high rate of cycle times and demands. (Segal, 2019).

Make to stock model works well with the company with most of its spare parts as it is important for the company to keep these items in the warehouse. These parts have high warehouse cycles, they are easily stored in racking and have a steady flow of volumes.

2.1.2 MTO (make to order)

Make to order is a model where goods or products are made after a customer places an order for the product. This strategy allows the end customer to be in the process of designing and customizing the final product to their specifications. MTO products should be done only when the market has a demand for such items. Keeping these highly engineered products in stock would be a waste of space and they would increase the working capital of the warehouse. (Hayes, 2019).

Some of the company's spare parts are made using MTO model. These products are usually expensive and must follow a demand set by customer. Also, the cycle rate is much slower for these items so it would be a waste of space which the warehouse is lacking at the moment.

2.1.3 MTA (make to assemble)

Make to assemble is a model where a company keeps ready components stocked at its warehouse and the uses these components in making the final product for customer when the customer places an order for a final product. These components can be, for example, engine units, crusher assemblies and so on. MTA is a hybrid between the two previous models, MTS and MTO. (Kenton, 2019).

Company builds its main products using MTA model. Components used for making these final products are stocked at the manufacturing plant. MTO and MTS are the main models in manufacturing items known as spares.

2.2 Logistics of spare parts

As said by Huiskonen in his paper about spare part logistics, the planning of spare part logistics differentiates quite a lot from the logistics of other items. The service requirements are higher and effects of shortage of items can cause serious, negative effects in the financial status of a company. Sometimes the volumes and demand can be very difficult to forecast, or the prices of uncommon spare parts can go through the roof. But on the other hand, buffer times in supply chains are decreasing so items should be available in stock all the time. This creates difficulties and pressure to the developing spare part industry or a branch from a company.

Spare part logistics have been focusing mainly on inventory modelling. Several theories and models have been created to ease the effects on fluctuations in spare part logistics. These models include the likes of ABC- model, EOQ- model and MRP. These models have been implemented into use in logistics companies but can be found quite heavy to operate and they offer little to none in the ways of developing them. Very strict assumptions and models are being used in planning the logistics of spare parts. (Huiskonen 2001, 125-126). And as said by Huiskonen (2001, 132-133), it is not easy to implement new models even though it would be statistically possible, since the management can not entirely trust on the computer-generated models to create the best possible scenarios when it comes to planning logistics.

2.3 Customer satisfaction

Mining business is very dependent on the products and equipment needed for processing rocks and minerals, so it is very critical to keep the flow of spare parts and other valuable goods stable globally. In case of a breakdown at site, the needed parts must be available immediately and send to the site as fast as possible to keep the customer satisfied with the service. No matter how good the final product, in this case, the rock-crushing machine is, the result is always dependent of the spare parts and the process behind them.

In order to keep the flow and availability of the spare- and wear parts good globally, the company has to invest in the warehouses and their level of availability. When availability for A-class products is 98%, the company can answer to the requirements from customers very well. Trying to get a 100% availability for A-class goods and parts would be so costly that trying to reach the target would almost certainly be more expensive than keeping with 98% and occasionally paying fines to the customers regarding late deliveries or unavailability of goods. The company is using ABC-model to define the importance of an item. A-class products are the main items with best markets, bigger volumes and faster turnarounds than classes B and C.

In 2018, global market for spare parts logistics was 42 900 million US dollars and that amount is expected to rise during the up-coming years as the business model is using more and more technology and robots in the processes. These new technological advancements help to speed up the processes and make them as efficient as possible. (Spare Parts Logistics Market 2019 Global Share, Trend, Segmentation and Forecast to 2025, 2019).

3   Quality and measuring of warehouse performance

Quality as a concept is not a new one. Different types of qualities have been measured for ages and will be measured also in the future. One can measure quality without knowing about it, in everyday circumstances, like in the grocery shop or in their garden, for example. Measuring quality does not have to be set to some industry or business, quality can and will be measured in everyday life in ordinary situations. These measurements are not usually reported and that is what differentiates it from business life. Measuring quality on business will usually lead to changes, plans and ideas on how to improve the quality of a measured action. These next chapters will go through quality and how it can be measured in warehouse processes.

3.1   History of quality and measurements

As said in the previous chapter, quality has been measured for ages. According to Ofori-Boateng, measuring performance was first done in 3rd century by measuring how the royal members of the family were performing. But as for when KPIs and

measurements were used in industries, one will have to travel to the early 19th century to Scotland. However, this method of measuring was very crude and primitive. Methods were quite critically changed during the 20th century as many militaries and industries needed more effective ways of measuring performance. Until 1990s, KPIs were measured individually which in today's world would be out of question. Individual persons were required to meet their goals without any questions. Nowadays, performance is measured as units or as a team performance, so the bigger picture is more well presented. (Ofori-Boateng, 2017).

3.2   Quality and performance in warehouse processes

"If you can't measure it, you can't manage it", a phrase from Peter Drucker which greatly expresses the importance of quality measurements in warehouse processes. Warehouse management is a very complex task with multiple variables and dozens if technologies to use. These tasks and technologies are designed to make the work and leading in warehouse as good as it can be. However, these tasks can be found to be insufficient or ignorable if the performance they bring to the company are not measured. As said by Sunol in his article, round the clock measurements are needed to make sure that essential, consistent and predictable productivity levels are achieved. Tracking performance is needed for improving and correcting the warehouse performances and re-utilizing assets if needed.

Performance can be measured in all the warehouse processes which are receiving, put-away, picking, packing and shipping. Storage performance and return logistics can also measurable. Sunol has presented 24 different KPI meters which should be used in cooperation with each other to present the bigger picture. These 24 different meters can be found in appendix 3 (Sunol, 2018).

3.2.1   Bonus system linked to performance measurement

As KPI measurements provide a good and comprehensive view of the current state of the company and its performance in their field of work, they can be used in the possible bonus system used by a company.

There are multiple ways to use KPI as the meter to reward an employee about their performance. But the question is, should a company use KPIs to reward them. The

basic principle of the rewarding system is, that an employee should be rewarded for his/hers work which is measured by a specific meter or meters. This reward should, in theory, motivate them to do that in the future as well. Using this rewarding system might cause problems in company as they should treat every employee as equals. As the company has to measure performance as a unit, for example, in receiving or out-away, there is a possibility that some employees carry the responsibility of the others as well. In order to prevent this, a company should put the rewarding system into their strategy which every employee has to follow. As the rewarding system is linked to the strategic goal of the company, using the rewarding system is also bringing profit to the company.

Rewarding employees can be done in multiple ways. If you ask an employee, how they would like to be compensated, they will usually respond that money would be the best way to compensate from great work. But a company should avoid using this as they have already paid the employee about that labor so they should invest in other things to be used as a reward. Company can help in education, giving discounts about products or guiding employees in correct ways when it comes to investing in stocks or other markets.

All in all, rewarding using KPI measurements in industries can be used but only in cases where they serve a purpose to the company as well. A company should investigate rewarding system before implementing it to find out, what is best way of operating for them. (Savkin, 2013).

4 Warehousing and warehouse processes

4.1 Warehousing

There are multiple reasons why a company would keep a warehouse and have operations in the field of warehousing. The reason for storing goods is highly linked to strategy of the company and mostly to the production and transport strategy. Having warehouses or stocks in warehouse might be considered to be nothing more than additional costs for the supply chain. However, when done properly, having warehousing will prove to be a value adding service to the company in its relationship with its customers as the customers are willing to pay for more services if the quality

is guaranteed. As said by O'Byrne in his blog, in a perfect supply chain, warehouses would have no place, but often the warehousing of the goods and items as a necessity as the field in which the company operates might, for example, need the spare parts quickly and efficiently (O'Byrne. 2017). Other reasons for storing items could be unreliable suppliers, fluctuation in the economic states of the buyers, some raw materials might be available only at a certain time of the year and ordering bigger batches might be more cost-efficient. A company should still bear in mind that having too high stocks will increase the capital of the warehouse which will be an issue in insuring the goods. Also, every item that is standing in the warehouse, a company is not receiving any profit from it. (Storage/Warehousing. n.d).

4.2 Warehouse processes

Warehouse processes can be divided into five different sections; receiving, put-away, picking, packing and shipping. These are done either by man or by machine in the warehouse. The next chapters will go through the processes and their characteristics briefly.

4.2.1 Receiving

Receiving is the first step in the logistic chain at the warehouse. During receiving, the items and shipments will be checked for damages and other irregularities such as wrong quantities or wrong items. After this inspection, they will be put on line and wait for next process. (Kukkonen, 2019).

Receiving can be considered to be the most important part of the process chain in the warehouse processes. Errors made during the receiving will cumulate through the upcoming processes and the possibility of a claim to reclamation from customer will rise. (Seppälä, 2019).

4.2.2 Put-away

Put-away is the next step in the chain. Put-away can be defined as the movement between the receiving area and the items dedicated storage area in the warehouse. These areas are racks, floor storage or automated storage systems. Put-away should be done considering the ABC-class of the items so that the items which have the

highest turnovers, the A items, are placed in strategic location to ease the next process. These strategic locations are usually in the below sections of the racking or in other easily reachable areas to hasten the process of picking the goods as they have higher volumes. (Vitasek, 2007).

4.2.3   Picking

The next process in the warehouse is picking of the goods. Picking means the process in which the items are gathered from the warehouse locations or destination bins and moved to the packing area. Since the picking process involves significant cost, it can affect the customer satisfaction levels quite a lot. Due to that fact, companies should invest a lot in the picking process and how to improve it. (Murray, 2019).

The same strategic locations that work for put-away, also work for picking. As the items in the a-areas have higher turnovers and cycle times, the picking process will be much faster as they are in best areas possible in the warehouse.

4.2.4   Packing

Next in the line is packing the goods. Packing is the process where the items gathered in the picking process will be put on boxes, pallets or other packing solutions. During packing process the items are packed in the most efficient way but not forgetting about the safe transportation of the goods. Packing process can take a lot of time, depending on the items which are being packed. (Seppälä, 2019).

From all of the warehouse processes, packing takes the most of time at the company's warehouse as the parts are usually odd shaped and heavy. This requires good expertise from the packers and equipment which can handle the items such as magnets and chains.

4.2.5   Shipping

The last step in the process is the shipping of the packed orders. Ready orders will be put to specific areas in the warehouse where they wait to be booked and eventually loaded to carriers sent by forwarders. During the shipping process, the items are moved from the specific areas into trailers and containers and scanned out from the warehouse. (Riihimäki, 2019)

An example case could be the following; a purchaser orders a hydraulic pump from a supplier which will then be delivered to the warehouse. It will be received and put to wait in the warehouse racks. Eventually an order comes for the item and it will get picked and delivered to the packing place. There it will be packed in the most efficient way possible. After that it will be put to shipping lanes where it will eventually be picked up and transported to the end customer.

4.3   Outsourced warehouse

There can be a lot of reasons why a company would outsource a warehouse, or at least some parts of the warehouse processes. Usually a company decides to outsource warehousing, so it can cut its costs and direct the costs towards its own know-how and products. It can be a wise investment to invest in outsourcing due to the professionalism a company gets from the warehouse provider. The warehouse provider usually works only in the field of warehousing and has strong knowledge and better premises to operate as a warehouse and service provider. The location of the outsourced warehouse will also play a significant role when deciding whether to outsource or not. For example, if the manufacturing company is based in Finland and has its production in the Finland but has a global market, it would be wise to invest to a warehouse which is located near the biggest hubs of Europe. These could be, for example; Netherlands, northern Germany and coastal France. These areas have quick and easy access to massive harbors and airports which are quick and easy ways to send goods to worldwide locations. Basing the warehouse in Finland might not be cost effective due to the remote location. The costs to move goods from here worldwide are much more expensive than in Central Europe. Also, depending on the company, most of the suppliers are located in Central Europe region (Ritvanen, Inkiläinen, Von Bell Santala. 2011, 143).

However, outsourcing will be always considered as a risk. It can be that the chosen service provider proves out to be incompetent or unable to work with the company that is sourcing the service. There can also be security breaches and the loss of expertise within the company if they decide to outsource the process to an outside-business. When outsourcing services, the company should find out at least the following aspects from the service provider:

1. ability to cooperate and communication
2. expertise
3. experience
4. reliability
5. quality
6. quickness
7. flexibility
8. capacity
9. cost and price
10. reputation

By assessing the above-mentioned factors, company can then decide which provider is the best for the company. It is also important for the company to regularly inspect the quality and costs which the outsourced service provider provides in order to keep the cooperation healthy and constantly developing (Ritvanen 2011, 143-144).

5   The study

As the introduction of the thesis shows, not all is well at the warehouse when it comes to loading and its performance. This chapter goes through the current status of it and its pros and cons.

5.1   Research methods

The study was done using both quantitative and qualitative methods. Defining one method to do this thesis was impossible so the final product is a mix of both research methods. However, more time was given to the qualitative aspect through interviews and observations.

5.1.1   Qualitative method

As said above, more time and more efforts were made when using the qualitative method in this thesis. Qualitative research is typical when: (Hirsjärvi ym. 2001, 155)

- Character of thesis is to gather comprehensive data and it is gathered in natural, real situations
- Using people as the main way of gathering information
- Using inductive analysis where the research has an aspiration of showing unexpected aspects by comprehensively examining data

- Using qualitative methods in gathering the data. This includes etc. different types of interviews and empirical examining.

The above-mentioned aspects define that the research is based on the qualitative method. Most of the data was gathered by interviewing warehouse- and logistics co-ordinators and locally investigating and examining the loading process and other fac-tors which are related to the process. Interviews happened in the distribution center offices and in the warehouse premises to get the comprehensive viewpoint from both operating parties. The managing staff of distribution center was also inter-viewed to have a more comprehensive data from interviews. Ten people were inter-viewed, three of which were managers and other were either warehouse- or logistics coordinators. Warehouse coordinators were from outsourced warehouse in Nether-lands and are employed by the service provider. Meeting with warehouse managers and coordinators took place in week 13. Additional information and some interviews were done by using Skype-meetings.

Interviews regarding the forwarders and their coordinators was done during a meet-ing which happened at the warehouse in Netherlands. This meeting had participants from almost all the company's logistics service providers and from all of the transport form. This meeting took place in week 16. Additional information and interviews were done by e-mails and Skype-meetings.

Interviews followed a same structure regardless of the position of the interviewee. As there is a theme of loading performance, the interview followed a theme-based interview model. According to Hirsjärvi (2001,195), this method works well in qualita-tive research. The theme-interview followed the below mentioned base:

Subject: Loadings at the warehouse

1. Current situation, how would you see the loadings are performed now?
2. Positives about the current situation, negatives about the current situation
3. Why are things like that at the moment?
   a. outside factors
   b. self-made factors

This interview was done for coordinators and managers to have comprehensive re-sults with as much content as possible.

Other interviews were done a quite freely to see what the current situation at any given moment is and to get the correct sensation about loadings. These were done during the rush hours at warehouse to get the best and most honest response from the warehouse coordinators. These interviews did not follow a basis but were in-stead products of the moment.

Interviews give the best view on what a person feels, thinks and experiences. They tell how the person observes the space around him/her. But interviews do not tell what is actually happening around them (Hirsjärvi ym. 2001, 199). Therefore, in addi-tion to interviews, a well based and comprehensive qualitative research needs obser-vations from the researcher. These observations happened at the warehouse on two different occasions. The blue-collar workforce was not told what the observation concerned to get the best possible result from the observation. Observation tend to have corrupted results if the reason of observation is presented to the workforce prior to the observation. The observation was done so that the researcher took part in the loading actions in the warehouse and loaders/warehouse employees were not told what specifically was researched. This gave a totally new viewpoint to the study since in the end, the operating actions are done during the loadings.

5.1.2 Quantitative method

As said above, the research had also some quantitative methods and aspects, but the research does not follow the respective steps of a quantitative research. The re-search did not for example contain any hypothesis or does not draw back to prior studies. (Hirsjärvi ym. 2001, 129). Data for research was submitted by the warehouse and by the forwarding agents. This data contained information about on-time deliv-eries, waiting times at warehouse and loaded collis per day. This data was used to create graphs and simulate the current situation at the warehouse regarding the loading process. This data was also used to present the company's KPI measure-ments related to on-time delivery and loading performance.

The research contained both methods and using both methods the thesis was able to present a full and comprehensive status of the warehouse's current operations.

5.2 Description of current situation

As the below to graphs indicate, the workload when it comes to loading the cargo is not evenly distributed during the week. Peaks are visible in Tuesdays and Thursdays. This fact has been confirmed by representatives at the warehouse. 90% of air shipments and all LCL ocean shipments are picked up on Tuesdays and Thursdays. In addition to those, normal road shipments and FCA carrier pick-ups also happen during these days and that obviously increases the workload during these days.
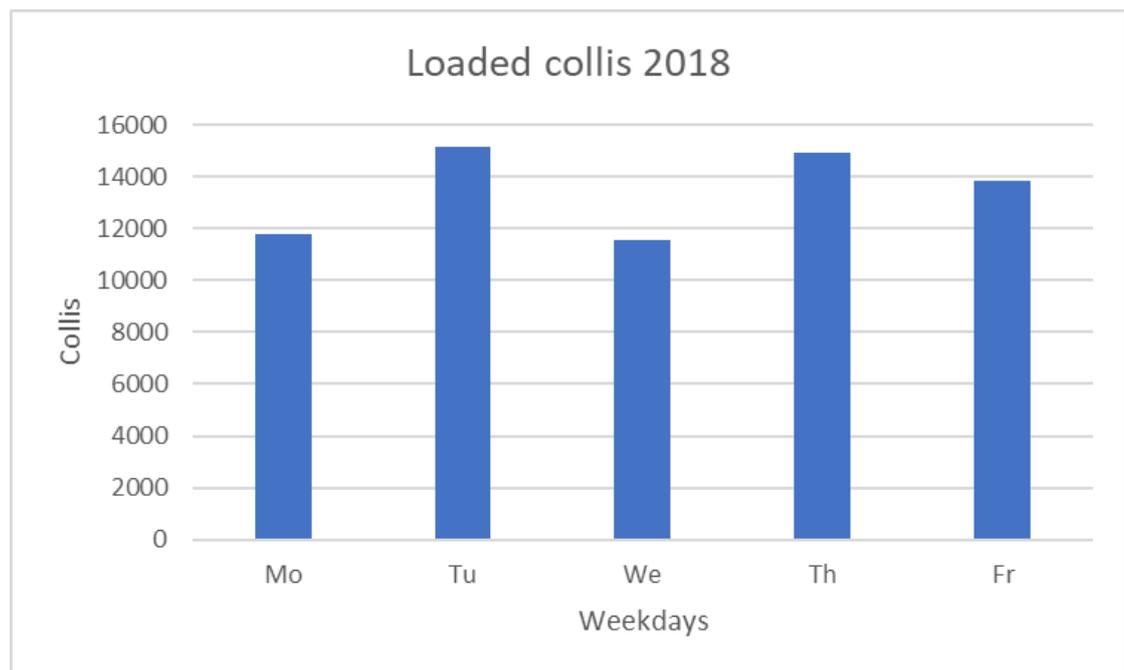
Figure 1. Loaded collis per weekday in 2018

There has been a steady improvement in leveling out the load in loading process as can be seen in Figures 1 and 2. Year 2017 had three very huge volume days what comes to loadings. Especially Fridays have become much easier to handle during year 2018 but still warehouse sees too much movement in certain days and as the volumes are not always that steady, it is very difficult to forecast the real impact on a certain day. The real volumes per week or day are very dependent on the global holidays and global financial state.
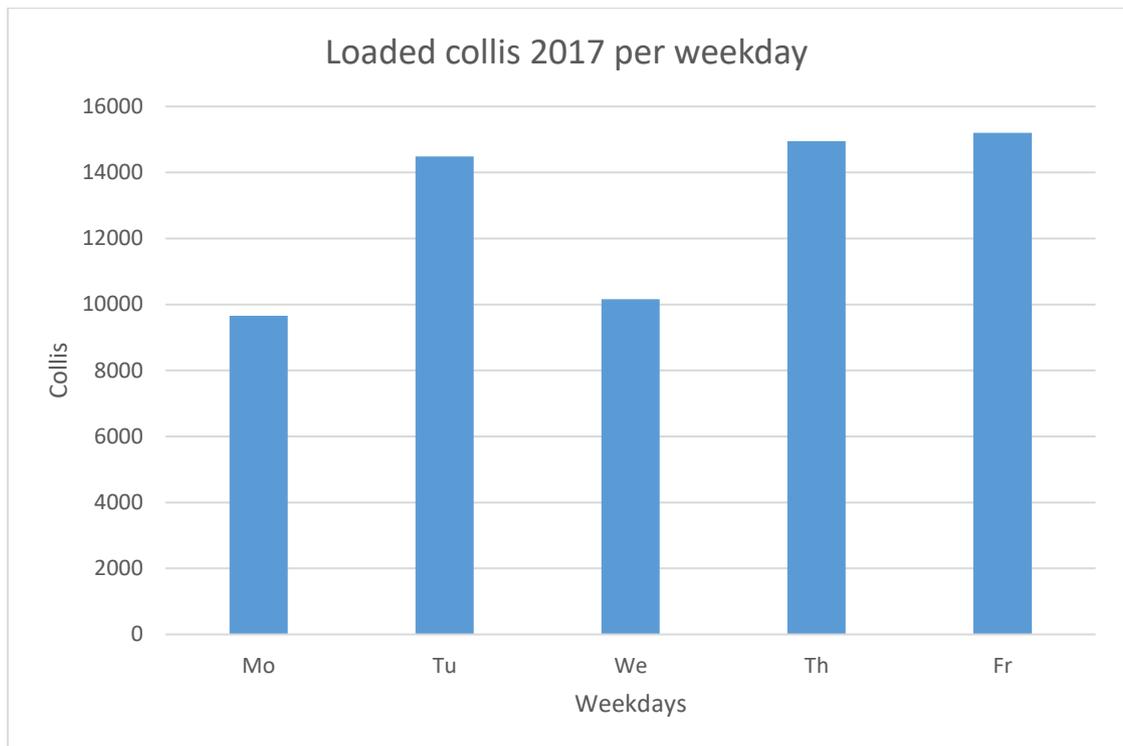
Figure 2. Loaded collis per weekday in 2017

5.3 Loading strategies and processes

Following loading strategies and processes were observed locally at warehouse premises in Netherlands. Warehouse employees and coordinators were interviewed at place and conclusions were drawn from those answers and expressions.

Warehouse in Netherlands is divided into two sections, indoor location (number 1 on figure 3) and yard location (number 2 on figure 3). Both have its own set of goods and items, but the main idea is that the yard area is for oversized items which can withstand the weather and other elements well. When a trucker working for a for-warding company comes to load, they usually must load from both areas. This means that they first must be loaded either from inside or from yard. Loadings from indoors are very self-explanatory, usually rather quick and easy to handle. Yard loadings are much harder to manage due to the size of items and the size of the area. The yard loadings can be considered to be the bottleneck of the loading process at this point.

Figure 3. Yard and indoor loading areas

What comes to actual process of loading done by a warehouse employee or opera-
tor, it is very efficient and after research, there is not much to enhance and improve
it. Their professional ability is at a good level both indoors and at yard. Usually for-
warders inform beforehand what they will be loading and when they will be approxi-
mately coming. The warehouse then prepares the shipment by moving the items to a
single loading bay and doing the necessary steps before the actual loading process.
When the cargo unit eventually arrives, the indoor loading is usually done in under
30 minutes as everything is done in advance. This solution does not apply to the yard
area as moving the goods to a designated place waiting to be loaded is impossible
during the current configuration the yard area has. If moved, they would block vital
loading areas and slow down the process even more.

As the current loading schedule suggests (Appendix 1), there is a gap in the loadings
between 16-18 in the warehouse. This is when the warehouse gets ready for eve-
nings courier shipments. The warehouse must label every shipment and attach an in-
voice for every shipment going outside EU. These courier shipments are often the
most crucial ones and they must be ready when the forwarder comes to load. This
ensures that the goods will catch the nights transfer flights and road shipments so
that they can be delivered in the next day. This has led to a problem at warehouse

that they can not load any trucks in that timeslot. This is usually the best time for inside-EU trucks to come load. They have completed the distribution of goods usually in the afternoon or evening and would come to load at that time.

The location of the warehouse is not considered in this thesis, but the area of the warehouse is. The current situation in the warehouse is that there is too much materials and ready pallets waiting to be loaded in it. Warehouse has had to sacrifice one loading dock to accommodate some of the items. This further leads to the fact that there will be more trucks waiting to get to dock.

6 Results

Company for which the thesis was done was very keen on improving the loading performance and due to that, some of the improvement plans indicated in this chapter are already carried out and are being tested at the moment.

The results are visible on table 2 and have a priority marking from 1 to three indicated. The responsible person in the company is also marked on the target.

Table 2. Action plan table

Development targets	Suggestions
1. New timetables for loading (logistics manager, warehouse manager, warehouse process specialist)	• New timetables for mainly ocean forwarders • Booking system for FCA forwardes and carriers
3. Improved warehouse processes (warehouse manager and warehouse specialists)	• Clearing the yard bottleneck • Workforce planning • Improving the storage area
2. Revised KPI measuring (logistics manager and SAP key users)	• SAP routing • Employee training

6.1   New loading timetable

A new timetable for loadings was constructed during the thesis. The new list can be seen in appendix 2. The new list was constructed on the basis of improving the loading performance and helping the warehouse to manage the workflow of loading process more efficiently. The new timetable option was discussed with the company's nominated forwarders and some of them were interested on improving the performance alongside the company. The improvement plan was coordinated mainly with the ocean forwarder and they were also very keen on improving their own performance and trying to keep the level of service in the field which customer has approved.

Other bigger forwarding companies used by the client of this thesis were not so eager to change the current situation, or the company found out that the current timeslot they had worked well enough during the discussions and interviews which were held with them. The opening of the new slot between 16 and 18 helped the loadings tremendously though which was a wonderful aspect for the main road forwarder.

6.1.1   New ocean LCL timetable

As appendix 1 shows, ocean LCL pick-ups were originally planned for Wednesdays and Fridays. The current situation at the warehouse is that ocean LCL shipments are loaded on Tuesdays and Thursdays which are already the busiest days. This has caused delays in the loading process and delays also with trucks coming on the same time or after these loadings. And after the situation becomes critical, some forwarders or trucking companies will find it very hard and un-efficient to stay and wait for their turn to be loaded.

The company has gone through extensive discussions with the current active ocean forwarder during a meeting which took place on 15th of April and found out that the ocean LCL can be distributed to three different weekdays; Monday, Wednesday and Friday as can be seen on figure 4. This would most definitely help decrease the stress on Tuesdays and Thursdays and enable faster processes at the warehouse.

New loading slots for ocean LCL shipments		
Monday	Wednesday	Friday
USA (all ports)	South Africa	Australia (all ports)
India	Ghana	New Zealand
Middle East	Brazil	Far East
Dubai	Peru	Japan
	Chile	
	China	

Figure 4. New ocean LCL timetable

6.1.2 Booking system for forwarders

The company has nominated forwarders which will deliver goods around the world for customers. In some cases, customers will want to use their own forwarders which the company calls "FCA forwarders". Current problem is that they tend to arrive in the warehouse whenever they feel like it, not caring about the rush hours or about the documents being ready for transportation. Usually logistics coordinators ask if the companies could arrive either in the mornings or during days that are not that busy. This works with some of the forwarders but not with all. A discussion was raised with warehouse and logistics managers, whether it would be possible to use a

booking system for FCA forwarders which would then reserve a timeslot from the warehouse using the example templates which can be seen in figures 4 and 5.

Week 15	Monday	Tuesday	Wednesday	Thursday	Friday
8-9	green	green	yellow	green	green
9-10	green	green	green	green	green
10-11	yellow	green	green	yellow	yellow
11-12	red	red	red	red	red
12-13	red	red	red	red	red
13-14	red	red	red	red	red
14-15	red	red	red	red	red
15-16	yellow	yellow	green	green	yellow
16-17	green	green	green	green	green
17-18	green	green	green	yellow	green
All times in CET	Markings and remarks about holidays and other factors				
Green slots are available, red slots are taken and very busy. Yellow ones are slots which already have some loadings but warehouse is able to load small shipments at the same time					

Figure 5. Suggestion for weekly timeslot availability

After selecting the open timeslot, a window seen on figure 5 will open. After filling out the file, information about pick-up will be sent directly to warehouse coordinators at the outsourced warehouse and to a logistics coordinator at the company.

"Booking system for forwarders"	
Delivery numbers	805552211, 805544223, 805544131 etc…
Truck plate and driver name	WE 247 PH + PH 55 JB Lewis Hamilton
Container or trailer	trailer
Company correspondent person	name.somebody@company.com

Figure 6. Suggestion for additional information regarding pick-up

Forwarders would then be available to communicate with the warehouse about the loadings more efficiently. This would help decrease complaints from customers and their forwarders regarding loading not being handled in the best possible way when it comes to loading times at the warehouse. Other forwarders would also see which slots are taken and which are open so they could plan their arrival times more efficiently.

6.2   Improving warehouse processes

During observation and interviews, it was found that there was quite a lot of waste in some of the warehouse processes, many of which have significant effects on the actual loading performance of the goods.

6.2.1   Yard bottleneck

Firstly, warehouse should consider easing the yard bottleneck by moving some pallets from the yard area to indoors. Yard items are quite big and heavy, and they have to be lifted to the trailer as there is just one ramp to load trailers and cargo. This ramp is usually occupied by container which can not be loaded from the side. The loading of the items is a slow process and the workspace in yard area is very limited at the moment. Moving some of the pallets indoors would help in situation where, for example, trucker should load one pallet from the yard area and 10 pallets from the indoors loading area. If the warehouse could move the item from the yard to inside, the driver would not have to go the yard area to get loaded. This would work in situations where the warehouse knows in advance, what the trucker is coming to load and when. They could then move the pallet during the previous day and load it from the indoors area.

Moving the pallets indoors would demand some efforts from the yard team but they could move the pallets at the end of the shift to indoors area. The estimated time of moving would take around 15 minutes a day since the volume and quantity of the items is not that significant. However, there will be a time-saving factor when it comes to loading as the most amount of time is lost in the yard area.

6.2.2   Workforce planning

As described in chapter 5.3 Loading strategies and processes, the original timeslot between 16-18 was taken by the labeling and preparing evenings courier shipments. This timeslot would have worked excellently to forwarders coming to load. During the process of writing this thesis, the timeslot was opened for forwarders and they can no plan to load between 16 and 18 CET from the warehouse. This was made available by increasing the workforce during those hours. As the warehouse is located quite far from the main hub areas such as Rotterdam or Antwerpen, most of the loadings took and will take place during the evenings and afternoons so it was very critical that the warehouse could open the timeslot for use. According to the logistics manager of the company, this was the timeslot which the company's main road trucking company would have wanted to use as it suited it's scheduling the best (Riihimäki, L. 2019).

6.2.3   Storage area improvement

All loading processes and improvement ideas can be improved but will have little or no effect on the final process itself if the storage area and its surroundings are not improved alongside it. At the moment, the warehouse has a quite bad situation when it comes to storage, especially on the yard area. This affects both loading areas, from the inside and from outside. The inside loading docks are not put to full use due to the huge number of large items that are stowed in front of the loading dock, preventing warehouse from using the dock. These items are quite slow moving and will be placed on the same spot for a long time. The same goes with the yard area, there is just too much slow-moving items which have a negative effect on the fluency of loadings.

As a result of that, the company is looking for solutions within the current warehouse premises on how to increase space for slow-moving items. Improvement plans have been drawn and currently the company is increasing racks in the inside area of the warehouse. This frees space from the floor area which can then house the bigger and less important items counted by the rotation rate of the goods. The warehouse will

also have a small, yet efficient, increase on space when another one of their customers will leave the premises. Their current space will be occupied the thesis providing company to stock the larger items from the loading bay area.

6.3 Revised KPI measuring

The current KPI indicator measures the loading performance by calculating the time between order completion and scan-out from the warehouse. The current measurements are negatively affected by the wrong or outdated information in SAP. In order for the company to get correct data from the KPI indicator, it first has to renew its data from SAP.

6.3.1 SAP routing

As the company will change the loading dates for ocean shipments, new SAP routing will be necessary to keep the KPI measurements on order and help stabilize the load on picking and packing per day. Current SAP route for most of ocean shipments states, that all of the orders which will be booked via ocean, have to be ready on Wednesday mornings at 8:00 CET (Central European time). The new routes for ocean shipments would distribute the load more evenly throughout the week. The ocean forwarding company has also agreed that they have to load LCL shipments in the next day from the booking. For example, if a booking is made on Monday, the pick-up day has to be on Wednesday, otherwise their KPI measuring will look bad and the company will lose time in the supply chain.

The SAP routes for the other existing transport methods and forwarders should also be checked to see that they correspond with the current situation and service level agreement. The company should discuss whether they should use to types of measurements for loading performance; one with all the forwarding methods and one with only the nominated forwarders. This would better indicate the impact a non-nominated service has on the loading performance. The company could the compare the data and use it to provide insight on the problem to higher management to get sufficient results in adding more customers to the nominated forwarder system.

6.3.2   Employee training

As the current loading times of the goods will be changed, there will be a requirement for employment training on how to do the bookings and order management for the shipments. Currently, orders for ocean shipments must come before Monday evening for them to be able to be picked and packed in time for the booking which happens on Wednesday mornings. This of course puts a huge load on the warehouse operating staff to get all the orders ready in time and in good fashion. Wednesday is currently known as "ocean booking date" as all of the LCL bookings and some FCL bookings happen on that specific day. Only the USA full container loads are booked on a separate date due to the massive volumes. Due to the change in the loading dates, which can be seen in figure 4, the booking dates will also change. The plan is to move the booking date two days in advance from the loading date. For example, a shipment to South Africa will be booked on Monday as the loading date is Wednesday. Mondays pick-ups will be booked on Fridays.

Measuring loading performance at the company is done by comparing the transport planning date set by SAP route and the actual loading date of the order. New routing in SAP will be set according to the new plans indicated in this thesis for improved and comprehensive view of the loading performance.

7   Conclusions

As the thesis was finished just in time, there were no time to attach the actual conclusions to the final written product. However, every subject written in results will be investigated and implemented if found to be usable for the company and to the warehouse. Results will be further developed along the way and will be implemented to other warehouses and actions in company's supply chain. Both parties were and are active in improving the mutual performance in the loading process.

All in all, thesis was found to be useful to company and it is willing to put time and money in improving the performance as suggested by the thesis.

During the last steps of the thesis process, it was announced that the nominations for ocean and air forwarders will be changing during the summer. That means that the timetable presented in appendix 2 is not valid after that. However, the company may use the now old timetable as a foundation on which to build the new timetable. Some forwarders and times will stay the same but there will be a lot of changes done to the timetable in the future. The other processes and implementation plans will be carried out as intended.

8 Reflection

The main objective of this thesis was to improve the loading performance at the company's outsourced warehouse. Current procedures at the warehouse were unefficient and the loading performance was not monitored well enough to be able to be improved and the company was facing problems with deliveries to customers sites. Due to these aspects, it was wise to seek new ideas and plans for the company to improve the loading performance at the warehouse in the Netherlands. The research was started by doing an analysis of the curernt situation by having interviews with the companys and warehouses employees and managers and observing the procedures and performance at the warehouse. By investigating these aspects, three research questions were found to which answers were needed. The research also had a theory section, in which important theory packages and aspects are covered. Both literature and network references were used in this thesis. Research theory aspects gave the thesis a solid foundation for success and finding answers to reasearch questions.

The new timetables for loadings will help to decrease the load from a single day and distribute it more evenly throughout the week. Ocean LCL loadings happened on Tuesdays and Thursdays which were already the busiest days when it comes to laoding trucks and containers. These would be distributed as shown in figure 4. The warehouse also opened a new timeslot between 16 and 18 CET to help to distrbute the loading. In addition to distributing the load, a new booking system for FCA forwarders was introduced. This would help at having more better forecasting on the impact of loading un-nominated forwarders as they would notify their arrival in

advance. It is crucial that the timetable was finished first as it was the basis of the other develpoment targets and marked as a priority 1 in the action plan table (Table 2). The timetable can be seen as a success from the thesis and can be seen as a foundation for the future when new nominations are planned.

By improving warehouse performances the company would help to clear the congestion in the warehouse and in its premises. Improving plans would also help to decrease the load from one warehouse operators as the volumes would be distributed more evenly from worker to another and the newly opened timeslot also helps to decrease the load even more well. Improving storage area has to happen in the future so that the warehouse can fully use all of the available loading docks and areas so that every shipment and item gets loaded as planned. These processes are to be checked and improved after the loading timetable and KPI measuring is on order. The warehouse barnch of the company is also develoing new and improved ways constatntly for warehosue processes to which a loading process can be positioned. The warehouse is developing all the time to serve the company better in every process in the warehouse.

As the new timetables for forwarders and different shipping types were implemented, new routing in SAP was necessary to keep the loading performance KPI up and running. And as the new routes are being implemented, a training needs to be had for the logistics coordinators and order desk representatives for the usage of the new routes correctly. The new SAP routing has to be done soon after implementing the new timetables to keep the KPI measuring on time and accurate.

The credibility of the results can be found to be questionable as there was not enough time to actually test the results during the thesis process. However, the meetings held with managers of the company suggest that the results are what they were seeking for and will use the results to improve the loading performance.

New improvement plans and development ideas were created during the thesis process which the company and the warehouse service provider can use to improve the loading performance in the warehouse. Thesis answered the research questions quite well. As the thesis was done in May and most of the development ideas were created during the last steps, the plans were not fully carried out yet. The company plans to investigate these options during this year but as the compnay is having quite

a few of big projects, these improvement pland might be put on hold until further notice. But as the field in which the company is operating on is constantly developing, it has to invest on the warehousing as well. Development ideas suggested in this thesis are quite easy to implement but that is to be determined by the company in the future as it will bring added value to its customers.

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Appendices

Liite 1.   Old forwarder loading schedule

CET	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00	South Africa FCL				
9:00	FI INBOUND	USA FCL Pan on MON		FI INBOUND	
10:00			DGF/PAN LCL	9-11 CET KZ	DGF/PAN LCL
10:30					
11:00	FCA pick ups	FCA pick ups	FCA pick ups	FCA pick ups	FCA pick ups
12:00/13:00	K+N Road / day before	K+N Road / day before	K+N Road / day before	K+N Road / day before	K+N Road / day before
13:00/15:00	DSV Rekkem & Puurs / driver first to come and ask, 12?	DSV Rekkem & Puurs / driver first to come and ask, 12?	DSV Rekkem & Puurs / driver first to come and ask, 12?	DSV Rekkem & Puurs / DSV Turkey	DSV Rekkem & Puurs / driver first to come and ask, 12?
14:00-15:00	UPS AIR / 13:00	UPS AIR / 13:00	UPS AIR / 13:00	UPS AIR / 13:00	UPS AIR / 13:00
13:00/18:00	DSV 2 trucks per hour	DSV 2 trucks per hour	DSV 2 trucks per hour	DSV 2 trucks per hour	DSV 2 trucks per hour
14:00		Ukraine	Polar		Polar
15:00/16:00	DGF/UPS/PAN Air FFO / 11 CET	DGF/UPS/PAN Air FFO / 11 CET	DGF/UPS/PAN Air FFO / 11 CET	DGF/UPS/PAN Air FFO / 11 CET	DGF/UPS/PAN Air FFO / 11 CET
16:00	DSV Norway	DSV Norway	DSV Norway	DSV Norway	DSV Norway
16:30	TNT Economy	TNT Economy	TNT Economy	TNT Economy	TNT Economy
17:00					
18:00:00/19:00	TNT / DHL	TNT / DHL	TNT / DHL	TNT / DHL	TNT / DHL

Liite 2.   New forwarder timetable

Forwarder timetable

CET	MO	TU	WE	TH	FR
7:00					
8:00	USA Ocean FCL				
9:00	USA Ocean FCL			Truck to KZ	
10:00	USA Ocean FCL		Truck to KZ		
11:00	DSV Rekkem	DSV Rekkem	DSV Rekkem	DSV Rekkem	DSV Rekkem
12:00	DSV Rekkem / Puurs	DSV Rekkem / Puurs	DSV Rekkem / Puurs	DSV Rekkem / Puurs	DSV Rekkem / Puurs
13:00	DSV Puurs / K+N consolidated	DSV Puurs / K+N consolidated	DSV Puurs / DGF Ocean LCL	DSV Puurs / K+N consolidated	DSV Puurs / DGF Ocean LCL
14:00	DGF Ocean LCL / Air	DGF Air	DGF Ocean LCL / Air / K+N	DGF Air	DGF Ocean LCL / Air / K+N
15:00	DGF Ocean LCL / Air	DGF Air	DGF Air / Polar Truck Russia	DGF Air	DGF Ocean LCL / Air
16:00			Polar Truck Russia		Polar Truck Russia
17:00					
18:00	DHL / TNT couriers	DHL / TNT couriers	DHL / TNT couriers	DHL / TNT couriers	DHL / TNT couriers
19:00	DHL / TNT couriers	DHL / TNT couriers	DHL / TNT couriers	DHL / TNT couriers	DHL / TNT couriers
20:00					

Liite 3.   Warehouse KPI meters by Sunal, H

1. Cost of Receiving Per Receiving Line: The expense that the warehouse has on the receiving process of each received line. Handling costs are included in this meter.
2. Receiving Productivity: Determined in terms of work hours by measuring the volume of goods received per warehouse operator per hour
3. Receiving Accuracy: Percentage of accurate receipts, the proportion of correctly received orders against purchase orders
4. Dock Door Utilization: Percentage of how many of the total dock doors were used
5. Receiving Cycle Time: The time taken to process each receipt
6. Put-away Cost Per Line: Expenses had for putting away stock per line, including work hours, handling, and equipment costs
7. Put-away Productivity: Volume of stock put away per warehouse operator per hour
8. Put-away Accuracy: Percentage of number of items put away accurately at the designated location
9. Labor and Equipment Utilization: Percentage of the work hours and material handling equipment used during the put-away process
10. Put-away Cycle Time: Total time taken during the entire process of each put-away task
11. Carrying Cost of Inventory: The cost of storage over a set time, including the cost of inventory, capital costs, service costs, damage costs, and costs of misses. The longer the stock stays in storage, the higher the cost to the warehouse
12. Storage Productivity: Volume of inventory stored per square meter
13. Space Utilization: Percentage of space occupied by inventory out of the total space available for storage
14. Inventory Turnover: The number of times the entire inventory passes through during a period of time
15. Inventory to Sales Ratio: Measure of stock levels against sales.
16. Picking and Packing Cost: The cost had per order line, including handling, labeling, relabeling, and packing
17. Picking Productivity: The number of order lines picked per hour
18. Picking Accuracy: The percentage of orders picked and packed without error
19. Labor and Equipment Usage: The percentage of work and pick/pack equipment out of the total work and equipment used during the process
20. Picking Cycle Time: Time taken to pick each order
21. Order Lead Time: The average time taken by an order to reach the customer once the order has been placed.
22. Perfect Order Rate: Number of orders the warehouse delivered without error
23. Back Order Rate: The rate at which orders are coming in for items that are out of stock.
24. Rate of Return: The rate at which goods, once sold, are being returned.