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Model for warehouse shipping and store provisioning: Worten Case Study

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Master's in management of Services and Technology

Supervisor:
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ISCTE Business School

November, 2021

BUSINESS
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Acknowledgments

This project marks the end of a chapter in my life and the end of my academic path. Through these years of learning, studying, making friends, and creating stories I know I became a better and more complete person. It wasn't always a perfect path but considering all the bitter moments and all the ups and downs I can now affirm that I'm ready and prepared for what is yet to come. Hereupon it's just fair to say that this was not possible without the help of some important people.

To my friends, the one's that I bring since I remember and to the new ones that I knew during the master's degree, for all the support and strength that they gave me to finish this project.

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Resumo

Com o aumento da concorrência e de clientes cada vez mais exigentes, é normal que as empresas sintam necessidade de melhorar os seus processos internos, utilizando-os para ganhar margem sobre a concorrência e chegar aos clientes com maior rapidez.

A Worten, é considerada a melhor empresa de retalho eletrónico em Portugal, mas para aumentar o seu valor, reconhece que deve procurar estar em melhoria contínua na sua cadeia de abastecimento e nos processos internos que estão em prática há demasiado tempo, tornando-se obsoletos e não acrescentando valor para o cliente final. A capacidade da Worten em identificar oportunidades de melhoria e querer fazer melhor, culminou na realização deste projeto.

Neste projeto foram descritos os processos em prática atualmente, no armazém da Worten e posteriormente analisados assim como foram apresentadas propostas de melhoria e bem como o impacto antes e depois da sua implementação.

Palavras-chave: Worten; Retalho; Processos; Armazém; Melhoria Contínua

Sistema de classificação JEL: L81; L89

Abstract

Nowadays with the increase of competition and demanding customers, it is normal for companies to feel the need of improving their internal processes, using them to gain a margin over competition and reaching the customer faster.

Worten, is the best electronic retail company in Portugal, but to increase its value, can recognize that should be in continuous improvement on its supply chain and on internal processes that are ruling for too long, becoming obsolete and not adding value for the final customer. The capability of Worten to always identifying improvement opportunities and wanting to do better, culminated in the realization of this project.

In this project, the actual processes in practice in Worten warehouse were described and afterwards th were analysed and improving proposals were presented as well as the impact before and after their implementation.

Keywords: Worten; Retail; Processes; Warehouse; Continuous Improvement

JEL Classification System: L81; L89

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Glossary

AR – Action Research

B2B – Business-to-Business

DIN – Dynamic Racks

EAN – European Article Number

FTE – Full Time Equivalent

JIT – Just in Time

KPI – Key Performance Indicators

LS – Luis Simões

OLPN – Outbound License Plate Number

PBL – Pick-by-Line

PBS – Pick-By-Store

PTL – Put-To-Light

PTS – Put-to-Store

PTSL – Put-to-Store Location

RF – Radio Frequency

SCM – Supply Chain Management

SKUs – Stock Keeping Units

SM – Slowmovers

TCM – Transfer Conflict Maintenance

VM – Visual Management

VSM – Value Stream Mapping

WH – Warehouse

WMS – Warehouse Management System

1. Introduction

1.1. Introduction

This chapter is intended to talk about the main problem of this project and the context on which it fits. Furthermore, it also approaches the research question, the objectives of the study and the methodology necessary to reach an answer for the problem in question.

1.2. Problem Statement

Nowadays with the increase of competition and demanding customers, it is normal for companies to feel the need of improving their internal processes, using them to gain a margin over competition and reaching the customer faster. Currently, inefficient practices in supply chain processes can have a negative impact in an entire company. For example, and according to Chin et al. (2010), Supply Chain Management (SCM) is one of the most effective management tools for stability, growth, and prosperity in companies. The same authors also reached the conclusion that the implementation of a good SCM can indeed improve not only operational performance but also the satisfaction of the final customer. Worten Portugal, a market leader company in the electronic retail sector from SONAE Group, is no exception to this subject.

In a company like Worten, the shipping process is one of the most important in their warehouse (WH) operations. It is the last step before the products reach the stores and consequently, the final customer. It is mandatory that the products reach the customer on time. As the expedition process occurs more frequently in the night shift and it is depending on other internal processes, time and quality are a problem.

Another process under study in this project is the store provisioning. It is important for stores to receive all the products that were ordered, but sometimes this doesn't happen. This is due to lack of space in the main warehouse, in other words, with the lack of space to arrange the already finished pallets in the right places the cargo operators can have troubles to find those pallets which leads to not loading them in the trailers. In conclusion, the stores not receiving the products leads to the customer disappointment.

With this said, this project is based on the challenge of improving some processes of Worten operations between the warehouse and the stores. Namely, the expedition process and store provisioning with the objective of reducing truck loading time and ensuring that every order leaves the warehouse and reaches the stores, accomplishing noticeable operational improvements, keeping Worten as the market leader in Portugal in the electronic retail area.

1.3. Research Question

Considering different variables involved in the supply chain and logistic operation of Worten, this research question, to which this project intends to answer is the following:

"How the processes of shipping and store provisioning at Worten's warehouse can be improved, becoming more efficient?"

1.4. Objectives

To solve this research question is necessary to establish a general objective and then specific objectives, to provide accuracy and organization to the research and to the developed work.

The main proposal of this work is to present one or more solutions to improve Worten expedition and store provisioning processes as well as understanding the impacts of the implementation on the company. The research for these problems is based on different variables used in logistics and in process improvement methodologies.

To sustain the organization of the research, some specific objectives are recognized:

- Analysis of Worten's warehouse operational processes through process mapping.
- Identification of the inefficiencies in the mapped processes.
- Proposal and implementation of improvements.
- Evaluation of the proposed improvements, comparing the current processes with the processes after the implementation of improvements.
- Presentation of recommendations.

1.5. Methodology

The present project is an in-company project presented by Worten that involves the implementation of improvements in the processes of expedition and store provisioning. To determine the best research method for this project is necessary to consider the current research question and what is aims to solve.

The research question is aiming to solve an operational problem in a company, in other words, it is trying to solve and research about real problems in action. According to Lewis et al (2007), the action research methodology is based on an investigation created by the need of solving real problems in a company and implies changes on the people which deal daily with those problems.

"In business and management, action research plays a particular role in bridging the gap between researchers and practitioners" Bryman et al (2011). In this specific situation,

"practitioners" are the employees and operational managers of Worten, which are extremely important for the proper functioning of the company. Because they are the ones in the center of the company success, accomplishing and guaranteeing the good behavior of the business, they are a fundamental key for the research and the researcher. Gummesson (2000) also points out the importance of business and management researchers being involved in practice.

So, as the focus of this project is to solve the research question **"How the processes of shipping and store provisioning at Worten's warehouse can be improved, becoming more efficient?"**, and all the participants in these processes need to be involved, to solve a real problem, this project is based on an action research methodology.

1.6. Scope

This project takes place at Worten main warehouse in Azambuja. The processes under study in this project were proposed by the shipping team operational manager and the transports area Manager and came from the necessity of improving them, being two processes with a big requirement of improvement, mostly at an efficiency level.

1.7. Structure of Document

The structure of the present thesis is divided in 5 chapters, being them the following:

Chapter 1: Introduction of the project, framing the main problem and the research question, the objectives of this thesis, the scope, the methodology that must be followed and the structure of the document.

Chapter 2: Literature review, the theoretical part that presents all the main concepts that support this project as well as tools with potential to solve the research question.

Chapter 3: Methodology used as the guideline for the accomplishment of the current project.

Chapter 4: Presentation of the case study with emphasis on the mapping of the warehouse processes, data collection and analysis/identification of the improving points.

Chapter 5: Project conclusion where all the conclusions are exposed as well as the answers to the research question and the results.

2. Literature Review

2.1. Introduction

This chapter approaches the theory that will sustain this study and presents all the references and other relevant searches. This review was based on searches within different platforms such as Scopus, Emerald, Science Direct and books related with the main theme. To narrow down the search, keywords such as *supply chain*, *logistics*, *retail*, *warehouse*, *operations*, and *process improvement*, were used, among others.

As the main objective of this project is to answer the research question – "*How can expedition and store provisioning processes be improved at Worten, becoming more efficient?"*- it is necessary to provide an introduction. This chapter will focus first on the concepts of supply chain and logistics and then narrowing them down to the core of this project, process improvement and the best methodologies to deal with the proposed research question.

2.2. Supply Chain Management

Christopher (2011), states that logistics and supply chain are well-defined concepts that already come from the building of the ancient Egyptian pyramids. These are both old notions and if they were important on the construction of such an important building, they are even more important for companies nowadays.

According to the *Council of Supply Chain Management Professionals* (CSMCMP, 2010), the concept of supply chain includes all the planning and management of all the sourcing and procurement of a company and their logistic activities. Christopher (1992) alleged that the supply chain management involves "the management of upstream and downstream relationships with suppliers and customers to deliver a superior customer value at less cost to the supply chain as a whole". It is possible to notice that a supply chain is much bigger rather than just an internal concern. Companies need to focus on the chain as a whole and not only in specific processes. In certain cases, it is mandatory to review all the processes between the suppliers to the final customer, to create more value. With the increasing competition between companies, a good supply chain is seen as a weapon to ensure an advantage over the main competitors, but to gain such advantage, every company needs to allocate accurately their resources. For Chopra and Meindl (2003) the success of a supply chain is directly related to its profit. In other words, all operations in a company originate costs whereby is necessary to manage those costs in a correct way to gain success over this matter.

2.2.1. Logistics

The term logistics was coined for the first time in the 1900s and came a long way until what it is today. According to Kent and Flint (1997), logistics had several eras. Firstly, a military stage, helping in the planning and in the execution of the transportation of the people and provisions in wars. Then, it became much more customer focused and the primary concern of companies, until it completely integrated the supply chain of organizations. Nowadays, in the words of Stock and Lambert (2001), logistics is "the part of the supply chain process that plans, implements, and controls the efficient, and effective flow and storage of goods, services, and related information from the point of origin to the point of consumption, to meet customer requirements". From this statement it is understandable that logistics is considered to be a connecting link that connects all phases of the supply chain. Although, for Carvalho (2010), the difference between supply chain management and logistics is on their coverage. Supply chain management is a much bigger concept, meaning that it embraces much more, involving the planning and management of all the logistic activities of a company and the connections between partners. Logistics on another hand can be seen in different perspectives, as the author explains:

- In a client perspective, logistics pretends to get the right product to the right customer, in the right amount, in the right condition, in the right place, in the right time and at right price (also known as the 7R's of logistics)
- In an inventory and stock management perspective, logistics deals with the question of material management, whether they are on the move or in stock in a warehouse.

In a supply chain, as mentioned in the previous sub-chapter, there are a lot of costs concerning all the operations. One of the biggest concerns is the transportation of materials or products through the chain, which can reach as much as two thirds of a company total logistics expenses. Carvalho (2010) defines transports as "the movement of products, which can be raw materials or finished products, from the supplier to the final consumer". It is easy to understand that transportation is a fundamental area of a supply chain. It must be well tuned to reach and answer the customer expectations. The success of a supply chain is directly related to a good use of the transportation network. Ballou (2004) refers to the transport activity as the key to a logistic system.

2.2.2. Warehouse Management

As in part of a supply chain, there are warehouses, which are an important part of the logistics management system, especially in the retailing area, because it compromises receiving, put away, storage, picking, packing, and shipping, all in a single space. However, they need to be centralized to save money and to facilitate client and store deliveries.

According to Frazelle (2002), warehouses can play an important role in the success or failure of a company. Nowadays with the big explosion of e-commerce, their role is even bigger, although they are an intermediate between the participants of a certain supply chain and impact the supply chain and service costs. Despite the costs, to Frazelle (2016) "warehousing adds value in customer service, by facilitating high inventory availability, shorter response times, value-added services, returns, customization, and consolidation among others". Although the value that warehouses carry, to Faber *et al* (2013) as many companies are centralizing their activities in big warehouses, managing those warehouses effectively and efficiently is becoming a difficult and demanding mission.

Ten Hompel *et al* (2006) says that warehouse management commonly means the control and optimization of complex warehouse and distribution systems, relying on the tasks performed by the company and on the market where it operates. In Worten's case, a company operating in the electronic retail sector, the tasks performed in their main warehouse are the same mentioned by Frazelle (2016), which articulates that "Although the roles and names of warehouses may differ, the internal activities are remarkably similar". Those tasks comprise the following:

- **Receiving** is the unloading and reception of all the orders entering the warehouse. Basically, is important to assure the quantity and quality of each order and preparing the ordered products to put-away.
- **Put-Away** is the action of moving the products in storage, moving the orders to their respective location.
- **Storage** is the physical containment of products while these are waiting for a demand. It depends on the size and quantity of items in inventory, but storage systems are normally characterized as pallet storage systems, case storage systems and broken-case storage systems.
- **Order Picking** is the process of removing items from storage to meet a certain demand. This is the most common function between all type of warehouses.

- **Shipping** is normally the act of loading trucks with cargo, but it can also include the examination of customer orders for completeness and accuracy, packaging merchandise in an appropriate shipping container and accumulating orders by outbound carrier.

As warehouse management is seen as the day-to-day control of a warehouse, more specifically of its processes and activities, it is hard and almost impossible to control everything with manual systems nowadays. To rectify this, there is a great amount of Warehouse Management Systems (WMS) in the market. A WMS is a tool used by companies to manage and optimize the internal warehouse system, according to the Warehouse Logistics WEBSITE. As it is an automated warehousing system, which provides less effort, more efficiency and reliable results when compared to a manual system, a WMS is an essential approach in a warehouse. Atieh *et al* (2015), sees the first goal of a WMS has a way to manage the movement and storage of the goods in the most efficient way possible and it was designed to help reduce costs through effective warehouse processes.

Although a WMS was designed to help in the control of the processes and activities of a warehouse, those processes need to be constantly improving.

2.3. Business Process Improvement

With the constant strategy changes of a company and the difficulty of keeping a warehouse constantly efficient, the tasks and processes mentioned above must be in a continuous change and must be improved, to guarantee the quality for the final customer and advantage for the company.

A process, according to Boutros and Cardella (2016) is “a sequence of linked tasks or activities that, at every stage, consume one or more resources to convert inputs into outputs”. A process can be compared to a project, both have a beginning and an end, and their success depends on the way they are carried. Nowadays process improvement is considered as one of the main concepts in management. This happens because of the increasing competition between companies as explained by Tamás (2017), “continuous improvement of production processes based on customer demands is necessary in order to increase or maintain competitiveness”. In other words, to stay competitive a company need to be constantly improving and adapting to changes.

Process improvement is relevant to all the different areas of a company and has the objective of making a process more effective, efficient, or transparent (Boutros and Cardella,

2016). Bendell (2005) considers process improvement to be a simple activity that consists in process mapping and analysis, which can guide to process understanding. But, as all activity must have an outcome, Boutros and Cardella (2016) identify the benefits of process improvement as being the following:

- Increased accountability.
- Improved reliability.
- Simplified regulatory compliance.
- Waste avoidance
- Enhanced safety and security.

It is stated by Tamás (2017), that organizations to stay competitive in the long-term need to carry on with improvement approaches throughout the time. Despite of the truth in this sentence, each company need to understand their own system first and only then applying the right techniques and methods.

One of the most used methods in business process improvement is Lean Thinking. Many authors like Ohno (1988) and Womack et al (1990), agree and accredit the origin of Lean Thinking to the automotive manufacturer Toyota.

2.3.1. Lean Thinking

As mentioned in the previous chapter, the origin of the Lean Thinking is coined to the automotive manufacturer, Toyota.

Lee (2016) states that lean thinking is an important factor to reach efficient improvement. According to Womack & Jones (1996) it is a set of principles which the main goal is to increase the number of tasks that add value to a service or product. To Damle et al. (2016) companies apply Lean Thinking to maximize value-added but also to eliminate the non-value-added activities and consequently unnecessary costs. According to Hines et al. (2002) the non-value-added activities are called waste. This is something that doesn't add value from a customer point of view. So, it is possible to understand that companies apply lean tools with the objective of improving processes and maybe saving money and time to reach more profit.

For Hines et al. (2004) the concept of Lean has more than a strategic level. The author divided it into Lean Thinking, which focus on value creation and in the customer and Lean Production that is concerned about the application of tools at a production level. To the author this is vital to understand lean as a whole and to apply the right tools.

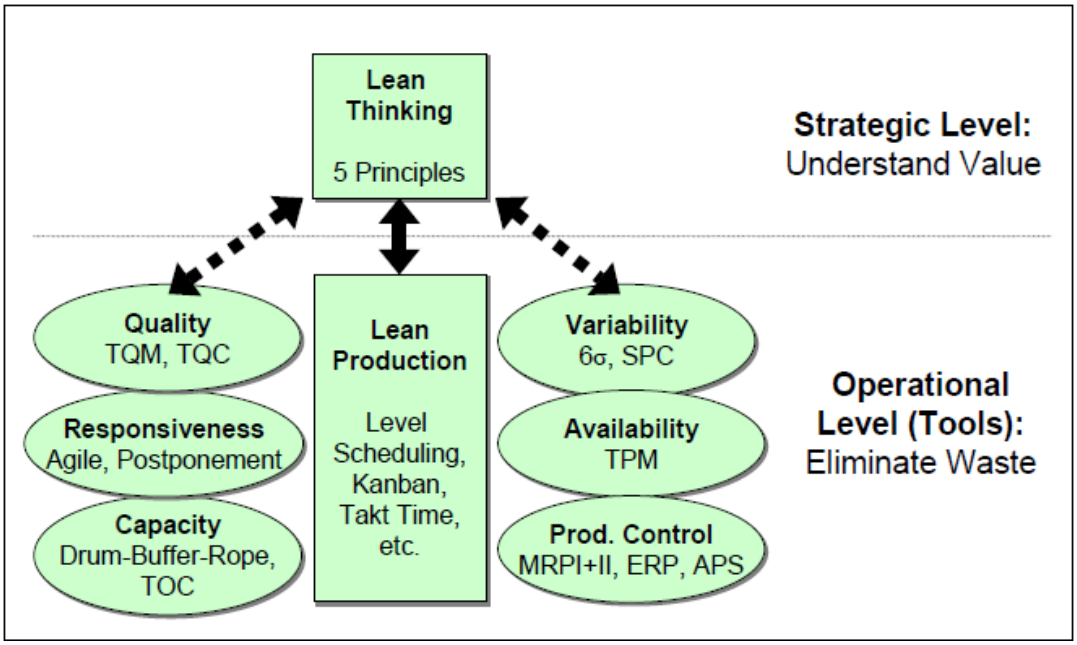

Figure 2.1 - Levels of Lean thinking (Souce: Hines et al, 2004)

Lean encourages continuous improvement on a company, so Womack & Jones (1996), described five Lean principles, in a specific order, which are:

- **Specify Value** - find what does and do not create value from a customer point of view.
- **Value-Stream -** highlight the non-value-added activities through process mapping.
- **Flow –** Sequence the activities that add value.
- **Pull –** Follow a pulled based system, limiting the inventory and work in progress items.
- **Perfection –** Continuing with whit the identification and removal of non-value-added activities.

For the same authors these principles are linked as “a way to specify value, line up value-creating actions in the best sequence, conduct these activities without interruption whenever someone requests them, and perform them more and more effectively” (Womack & Jones, 2003). They also state that before a company going Lean is mandatory to understand who buys from you, in other words, a company needs to know and understand their customers. Furthermore, is necessary to get a company focused on what matters and in the internal value streams, all the important activities. This way, Lean can improve not only a company but also its supply chain.

2.3.2. Lean Tools

In the Lean literature, there is a great number of articles and books related with the tools and techniques that can be used to identify waste in warehouse operations and consequently gain efficiency in a company.

To those lean tools there are some very well-known philosophies associated, which are:

- **Kaizen** – This term can be divided in two different words. According to McLoughlin & Miura (2018), *Kai* means to change, and *Zen* means to be right, or in other words, continuous improvement. The Kaizen culture promotes knowledge and the generation of new ideas from all the people involved in a certain operation. According to the Kaizen Institute (2021), this expression characterizes itself as a group of small changes through time that in the end represent big and better results.
- **Just in Time** (JIT) – According to Monden (2012), the main goal of JIT is to produce the necessary items in the necessary quantity at the necessary time. This is also considered by the author has an "eternal driver of production and operations management". It was first used by the Toyota Motor Corporation, and it is based in a pull system, meaning that the production will only start when a certain necessity from a certain customer emerges.

To achieve the purpose of the philosophies mentioned above there are many tools that can be used. For the present project the ones that fit the better are the following:

- **Value Stream Mapping** (VSM) – According to Singh & Singh (2018), VSM is a visual tool that helps in the identification of the value-added activities and in the elimination of the non-value waste. As it considers all the activities involved in the operation as well as all the resources necessary, to a big number of authors like Piercy & Rich (2009) VSM is considered as one of the best tools to identify waste and improvement opportunities. First a VSM must be mapped with the current processes applied in a certain operation, As-Is. After the identification of all the wastes and value-added activities a To-Be map should be created to develop an action plan. Taking the big picture in mind and mapping all the processes from the suppliers to the final customer, the benefits can be the reduction of the time in each activity and the financial costs.

- **Visual Management** (VM) **–** The main goal of VM is to help managers to get a better view of what is happening in an organization. According to Galsworth (2017), there are

two main purposes for using VM: “First, to share the company’s direction and intent; and second, to frame critical results data so their meaning is clearly understood”. Basically, VM is a tool that allows the improvement of the workflow through action that promote the visual stimulation. The same author also states that VM is an approach that monitors the results of an organization displaying them in 2-D formats. Those formats can include for example, Key Performance Indications (KPI) dashboards or LCD data monitors.

To Hirano (1995), visual management is supported on five pillars. These pillars are known as 5S’s, which is a tool that every company must use to improve their efficiency though five Japanese terms, *Seiri, Seiton, Seiso, Seiketsu and Shitsuke,* which are, according to Drew (2016), translated to Sort, Set in Order, Shine, Standardized, Sustain. These expressions although most used in companies and operations are also present in people daily lives without them even knowing. This tool has the objective of arranging and maintaining the workplace organization, resulting in the waste reduction, and leading to better production levels.

2.4. Lean in Retail and Warehousing

Although the Lean concept had its first appearance in the automotive industry, in the Toyota production line, Womack and Jones (2005) stated that it could be applied to other areas beyond the manufacturing industry. Over time, Lean spread out to other areas, such as the sector of retail and warehousing. To Hines et al. (2004) the application of Lean on different areas, not only creates and promotes customer value but also helps a company to achieve their goals.

To achieve success, a retail company need to have a good and competitive inventory as well as good service levels, this are crucial factors to be competitive (Salam et al, 2016). In a retail warehouse, poor service levels could result in the loss of customers and sales.

Garcia (2004) articulates that warehouse improvement requires different types of optimization, such as in the material flow, order picking, replenishment, and dock operations. The optimization of this flows and the waste elimination can be combined to improve the warehouse lead time.

The image below, shows an example of a Lean tool called Value Stream Mapping.

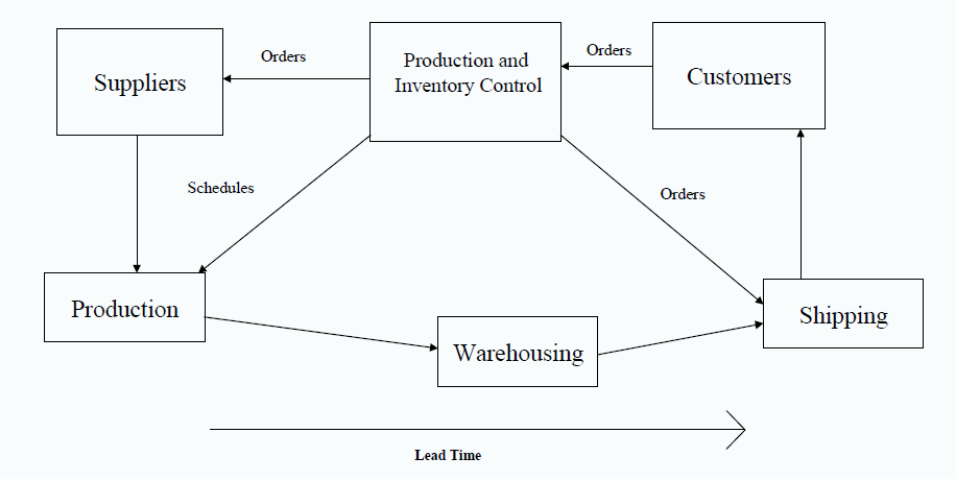

Figure 2.2 - Example of a warehouse value stream

This image can be interpreted as a start point (AS-IS), for all the transformations in the warehouse, to achieve a To-Be value stream mapping. To Garcia (2004), some opportunities to reduce the lead lime, can be, for example "the reduction in material handling time in order picking, put away and palletizing; reliability issues with the strapping and metal detection machines; reduction in truck loading time; reduction in time spent checking inventory location and aging". After the To-Be value stream map is finished, the company need to create an implementation plan to apply all the ideas and correct the defects in the processes.

If a company could implement efficiently a Lean approach in the retail sector, they will get a good cost efficiency, greater worker productivity and less waste of time, according to Lukic (2012). Beyond the profitability, this also affects the customer satisfaction.

2.5. Summary

Through the literature review presented previously, this project will propose improvements to the processes of truck loading and store provisioning at Worten, improving the efficiency and quality.

This literature review starts with an introduction to supply chain and logistics and then narrowing down to the concepts of process improvement and ways to improve the processes presented in the research question. With the objective of this thesis in mind, a Lean approach is the most suitable to achieve the main objective, with the use of visual stream mapping and visual management.

After a search in the current literature is clear that the concept of Lean and its applications are spreading out to more and more sectors, beyond the area where all started, the automotive area. To become competitive more and more companies are applying the Lean concept, becoming more efficient and achieving greater productivity, the retail area is no exception.

3. Methodology

3.1. Introduction

Considering the research question and the objectives mentioned in chapter 1, this chapter presents the details of the methodology followed on the current project. The action research methodology and the investigation stages are described.

3.2. Investigation Methodology

The current project is built over an action research methodology. As mentioned in the first chapter of this thesis, to Lewis et al (2007), the AR methodology is based on an investigation created by the need of solving real problems in a company and implies changes on the people which deal with those problems daily. So, AR is an approach in which the action researcher and a client collaborate in the diagnosis of a problem and in the development of a solution based on the diagnosis. According to Eden and Huxham (1996), the outputs from and action research approach come from "involvement with members of an organization over a matter of genuine concern to them".

To Eden and Huxman (1996), the outcomes from action research should be the following:

- It should have implications that relate to situations other than the one that is studied.
- As well as being usable in everyday life, action research should be concerned in theory.
- It should lead to the generation of emergent or grounded theory, which emanated from the data in gradual incremental steps.
- Action researchers must recognize that their finding will have practical implications and they should be clear about what they expect participations to take away from the project.

In AR the participation of both researchers and practitioners is very important, as well as their relationship. As shorter the gap between these two participants, the better. Gummesson (2000), mentions the importance of business and management researchers to be involved in practice and suggests that there is almost no difference between the roles of the academic researcher and the management consultant.

3.3. Investigation Stages

This section is based on the objectives of this project and presents all the investigation stages followed to its conclusion. To a correct application of the AR concept, Susman and Evered (1978) considered five phases necessary.

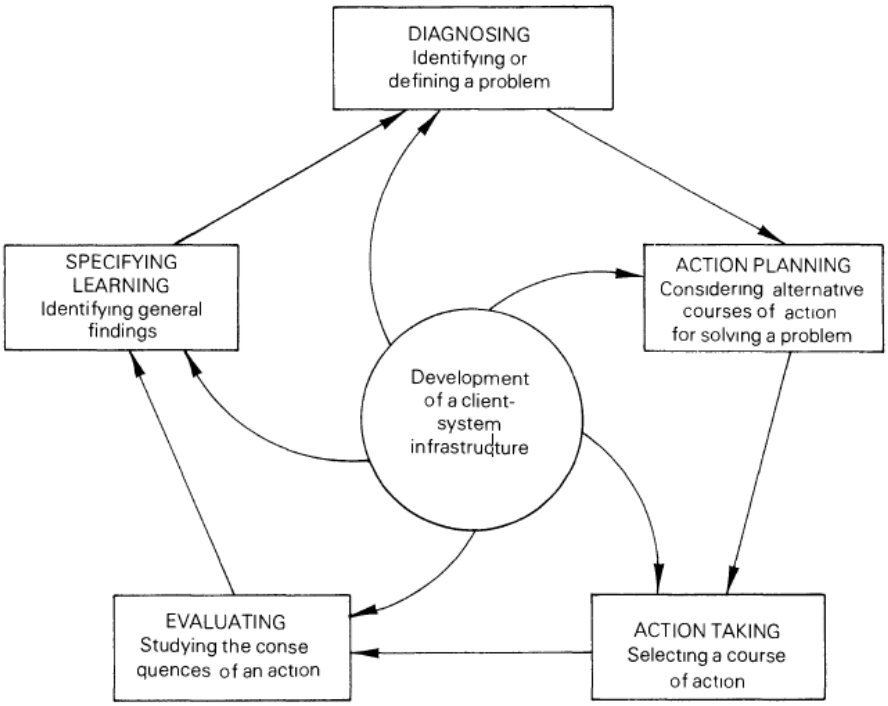

Figure 3.1 – Action Research process cycle (Source: Susman and Evered, 1978)

1. Diagnose – Description and definition of the main objectives, collection, and analysis of pertinent data to describe the current situation. To better understand the current situation, some diagnostic tools were applied, to identify the main weaknesses in the processes.
2. Action Planning – Creation of action plans and improvement proposals, based on the identified inefficiencies.
3. Action Taking – Implementation of the proposals presented in the previous stage.
4. Evaluating – Following the previous stage, control, and evaluation of the implemented ideas as well as the verification of the results.
5. Specifying Leaning – Presentation of the project conclusions as well as suggestions for the future.

In a first phase, all the warehouse operations are mapped As-Is but giving more emphasis to the processes of the order preparation, distribution, and shipping. The objective is to search for activities that add or not value to the company and can impact the processes under study. For this stage the data collection method used is direct observation and semi-structured interviews (Annex A). All the processes will be observed and described since the moment the products enter the warehouse until the moment they are shipped to the stores. Process mapping is used to describe the processes and the chosen program to create the mapping is Bizagi.

After the analysis of the As-Is processes in necessary to identify inefficiencies in the processes. This analysis also identifies which of the inefficiencies can be improved to enhance the processes in study. In this investigation stage, the methods to collect data are semi-structured interviews with workers and operational managers.

Subsequently to the analyses of the processes, it is necessary to present solutions to improve those processes to turn them more efficient by eliminating or reducing wastes. So, it is necessary to present another process mapping, this time a To-Be map is created, presenting all changes made in the processes. For this is necessary to create semi-structure interviews, once again to members of Worten logistics operation, such as operational managers and staff.

For the evaluation of the proposed improvements, it is necessary to analyze the To-Be map created in the previous stage, comparing it with the As-Is model, to understand what the possible implementations in the company are, to reduce the truck loading time and to guarantee that the stores were provisioned with every correct order. To evaluate the proposals, data is collected from semi-structured interviews and direct observation, but also from the analyses of Key Performance Indicators (KPI's) that measure, error and quality.

Lastly, the recommendations are presented to explain how the improvements in the processes of expedition and store provisioning are achievable. This is based on the analyzes of the KPI's presented in the previous topic and in the collection of data from semi-structured interviews and direct observation.

4. Case Study

4.1. Introduction

In the current chapter the company under study (Worten) is described as well as the group where it belongs. Afterwards all the research steps will be accomplished, and the most suitable Lean tools will be applied to solve the research question.

4.2. Sonae Group

Sonae is a multinational group headquartered in Portugal but present in 90 countries. It operates in different business sectors such as retail, financial, shopping centres management, software and information as well as communications. In Portugal, Sonae is the largest employer, with more than fifty thousand employees.

Sonae was founded in 1959 by Afonso Pinto de Magalhães, a Portuguese businessman. It started as a company which produced laminated wood panels, but in 1982 after the death of the main founder of the group, Belmiro de Azevedo took the lead and the control of company.

During the 80's Sonae started its growth and in 1985, Sonae Investments SGPS was created. This was the entry door to the stock market and in the following years Sonae started a strategy of business diversification, entering the market of distribution and founding the first hypermarket in Portugal, Continente.

After acquiring several companies, Sonae could grow and compete in different areas. In the 90's, Sonae entered in the telecom sector with Optimus in market of specialized retail with the launch of Worten.

4.2.1. Worten

Worten is an electronic retail company from Sonae's group and the current leader in this sector in Portugal. The first physical store was inaugurated in 1996, in Chaves, located in the north of Portugal and now it counts with more than 200 stores in the country. Besides Portugal, Worten is also present in Spain with 49 stores including Canary Islands.

Since 2001, the company is committed to an omnichannel strategy complementing the physical stores with online sales. In that year the website with the online store was launched. This is a strategy where customers can make the best use of digital assets highlighting the variety and convenience of a website, complementing with the experience of contact with the products in the physical stores.

Besides this, in 2018 Worten launched a marketplace in their website, allowing small entrepreneurs, sellers and other small companies to sell their products, and adding more variety and other choices to the customers.

Worten sells everything related with technology, since big house appliances, to small house appliances, telecommunications, gaming, sound, and image related products. Since the beginning, Worten is focused on a single mission: “Delivering the best technology to everyone, without exception, today and always”.

4.2.2. Worten Warehouse

To supply all the stores there is a main warehouse in Azambuja (Portugal), where all the products are received from the suppliers, stocked, prepared, and shipped.

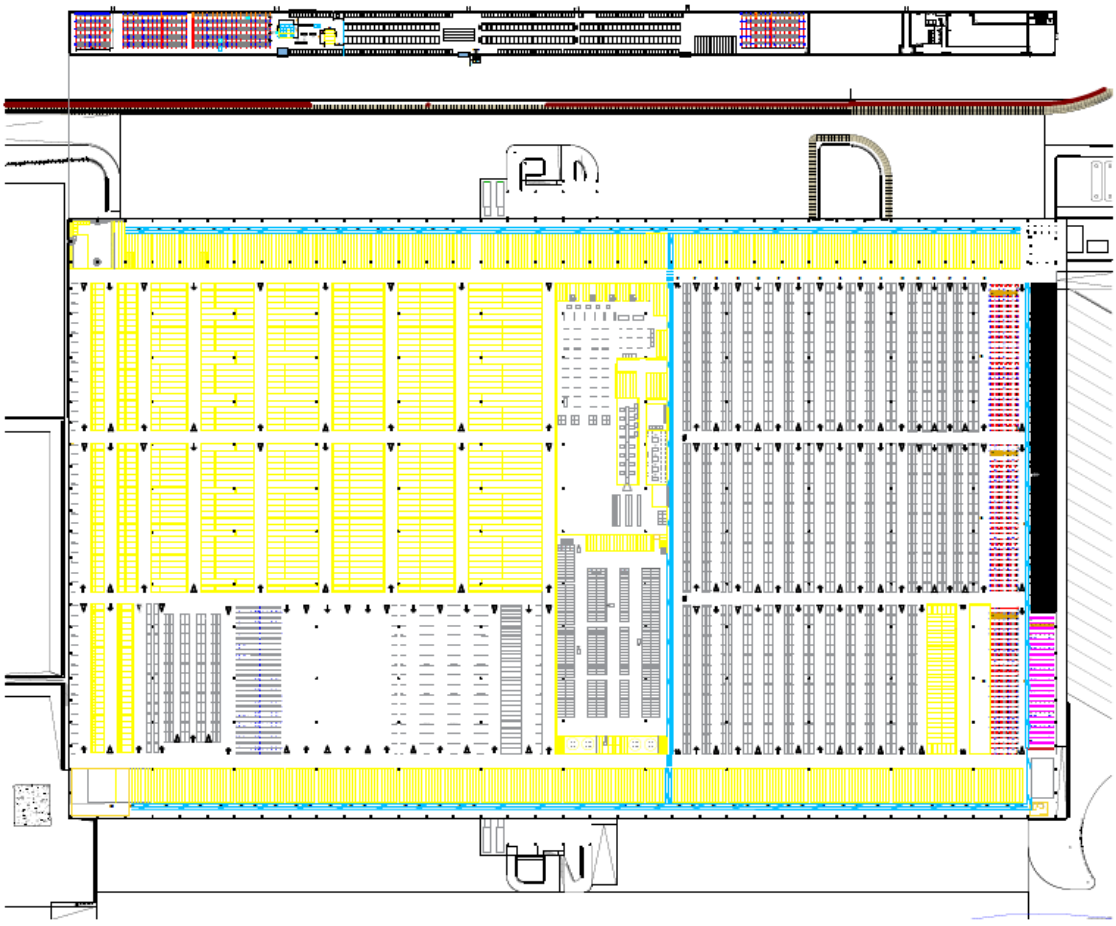

Figure 4.1 - Worten warehouse plant

This warehouse has an area of approximately 40.000 m2 and it’s divided in two main warehouses. These warehouses are virtual, to distinguish the category of articles available. So,

the layout is the following (see figure 4.1), these two warehouses are known as "*701*" and "*708*", the first one is related with big house appliances like washing machines, refrigerators and televisions and it has product locations both on the floor (solo) and on racks, while the second one is only composed by racks and where all the small house appliances are stocked, such as toasters, headphones, and vacuum cleaners. Adding to the "*708*" there is also a high value logistic zone called "*Mezzanine*", this is like a balcony where the most expensive products are located, like smartphones, smartwatches, and laptops. In addition, both warehouses have a zone called "*slowmovers*" (SM) where products with low rotation are stocked and, also dynamic racks (DIN) to create reserves of all the products.

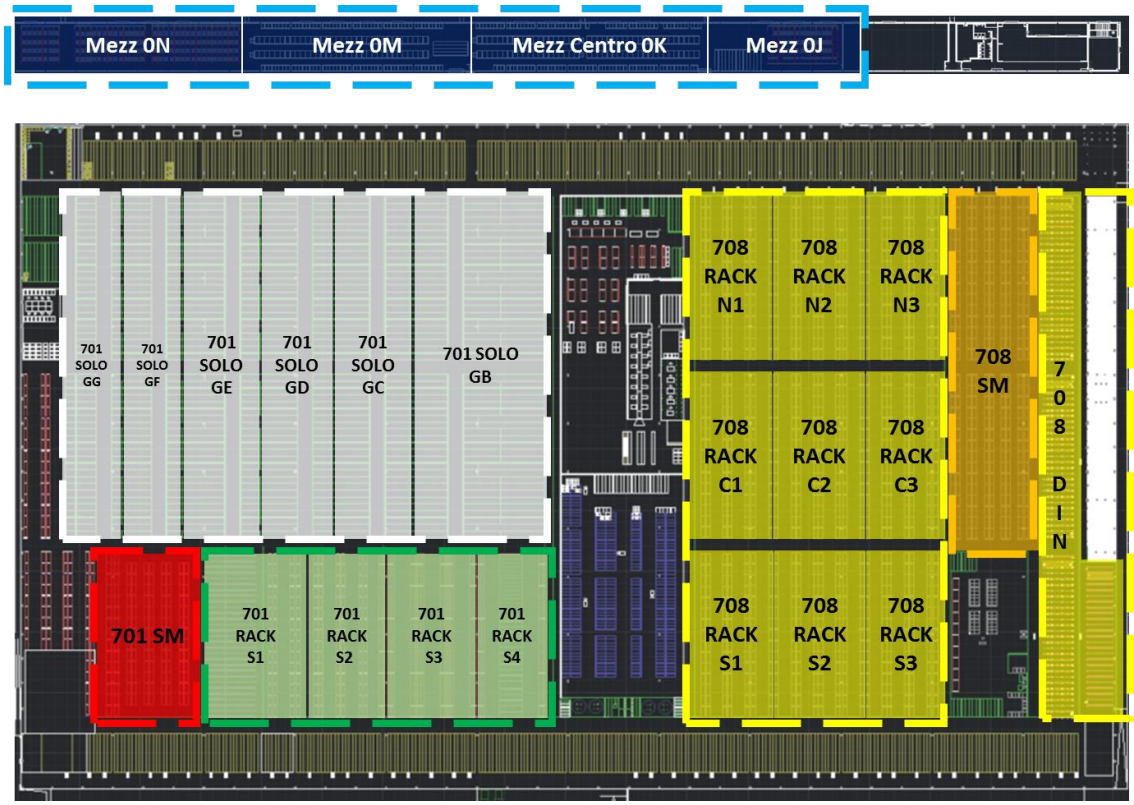

Figure 4.2 - Worten warehouse layout

Besides these, there is still one virtual warehouse left which is "*2928*", which have products from both warehouses, but the stock is captive to Business-to-Business (B2B) sales.

Taking in mind that this warehouse supplies all Worten physical stores in Portugal and Spain, and online customer orders, there is a great number of products with different Stock Keeping Units (SKUs) stocked. On the date of the realization of this project the quantities in stock are the ones showed in table 4.1 and 4.2.

Table 4.1 - Number of different SKUs in warehouse with stock > 0 units

WH	QTY of SKUs
2928	**704**
708	**12980**
701	**2546**

Table 4.2 - Stock available per warehouse

WH	Stock / units
2928	**26140**
708	**85615**
701	**2343178**

To supply all the orders to stores and customers, Worten outsources the transportation to three different companies depending on the flow, which is going to be addressed latter on this chapter.

The next sub-chapters will address to the process description of all the main activities in the warehouse but giving more emphasis to the ones that matter for the realization of this project.

4.3. Process description

This subchapter will describe all the processes in the warehouse in a broader way.

The following figure represents all the activities and product flow in the warehouse, starting with the reception of the products from the suppliers and ending with the shipping of the orders to the respective destination.

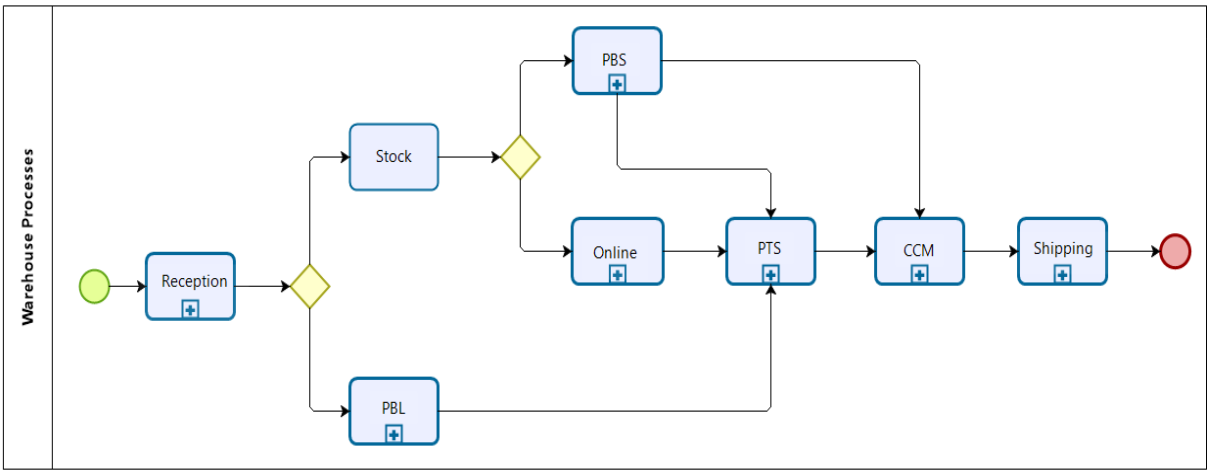

Figure 4.3 - Warehouse product flow

In the warehouse there are different teams that help in the success of the operation. Although being different, they are all connected somehow:

1. **Reception** – In the first place, the reception, receives and checks if the orders that arrive from the suppliers are correct, checking the units mentioned in the supplier's documents and comparing with really came in the pallets. Next, after the verification, the pallets with the goods are provisioned in the right place. Depending on the type of product they can be stocked in warehouse "*701*" or "*708*", always using forklifts. Besides provisioning, the products can also go directly to production to another team, called Pick-by-Line (*PBL*) .
2. **PBL** – PBL or pick-by-line, works only with smaller items from "708" type, that fit in boxes. First there are three sectors of put-to-zone, which are used for sorting the products and are directly related with the volume of the different products, these sectors are: small, medium, and big. After this sorting, the products advance to different sectors of put-to-light (PTL), where they are distributed to different boxes and each box represent a different store. Finally, the boxes are closed and distributed in put-to-store (PTS) area, where each store has a matching pallet.
3. **Online** – This team satisfies all online customer orders from "708" type. This implicates making picking of the orders, invoicing, distribution, and dispatching. Depending on the type of order, home delivery or store delivery, each parcel has a different destination. If a customer chooses store delivery, the parcel advances to the PTS area where it is consolidated in the respective pallet and then it is shipped by the shipping team once a day, if the customer selects home delivery, the order follows a different path and is loaded by the online team directly in the trucks of two different companies, CTT or

DPD, that guarantee the delivery of the order in the costumer home. Besides this team, there is also another online team (not mentioned in the diagram) called “SCED”, that deals with all the customer orders of big house appliances (701).

4. **PBS** – PBS or pick-by-store, just like PBL, satisfies all offline orders. These orders are made by Worten stores to fill their inventory needs. PBS team performs batch picking in both warehouses, including “mezzanine”, dealing with big and small home appliances, this means that every pallet made by an employee corresponds to only one store, with the possibility of producing more than one pallet to a single store. After the pallets are produced, they are wrapped in plastic film and then distributed to the shipping lines where every store has a correspondent line, to simplify the work of the shipping team, avoiding mix-ups between pallets that have different destinations. There is also the possibility of doing batch picking of small orders, small enough to not optimize a pallet, in this case, that order is consolidated also in the PTS area.
5. **PTS** – This area is where all the production from PBL, home delivery order from online and some production from PBS converge. Every store has a pallet where these orders are consolidated, this way optimizing the space in the trucks for the shipping team because some orders can’t fill a pallet as mentioned above. This zone also supports bulk picking production, where a full pallet of a single item is distributed to different stores.
6. **CCM** – Control and Conference of Merchandise (CCM), is a team that guarantees the quality of the orders. By a sample, they check and audit the pallets made by PBS, by PBL and the ones consolidated in the PTS area. Only a sample of all pallets is verified because unfortunately there is no capacity of checking all the pallets produced daily in the WH. All the errors found are fixed, thus avoiding exchanges between pallets or sending the wrong items to the stores or to the final customer.
7. **Shipping** – This team is responsible for the dispatching of all the orders to the stores. All the pallets from PBS production and PTS, are carried to the shipping lines and then loaded into the respective trucks. The trucks are outsourced from Luis Simões (LS), a transportation company from Portugal.

Every team mentioned is connected to a WMS called “WM” from Manhattan Associates. This system leads with every process, since the reception of the products, to them correct storage, to the picking tasks, pallet auditing and shipping.

As mentioned before, not all the activities are directly related with this project. In the next subchapters, the processes that really have impact and matter to the research question are addressed with more detail to find potential problems.

4.3.1. Online production and PTS distribution

As already explained in the last sub-chapter, Online team satisfies all customer orders made in Worten website, being them home delivery or store delivery.

All orders placed by the customers integrate in Worten WMS and the system generates the picking tasks. Picking tasks are all made with a Radio Frequency (RF) scanner that scans the products barcodes and is also linked to the WMS.

Figure 4.4 – Example of an RF scanner

All pickers have an RF and after connecting it, they start pushing tasks (see figure 4.5), after they go to the locations presented in the screen and collect the items on those locations, they scan their barcode or European Article Number (EAN). Afterwards, the items are carried to the invoice area, composed by computers where they invoice the items, printing an Outbound License Plate Number (OLPN) (see annex C). An OLPN is a label that is sticked to the items packaging and has all the information necessary to proceed with distribution and shipping, it shows the destination store number and address, the customer information, and a barcode with a number. This number can be accessed through the WMS and have all the information presented in the label but also the type of item. It can also be used for the tracking of the order, since the time of picking, distribution, and shipping.

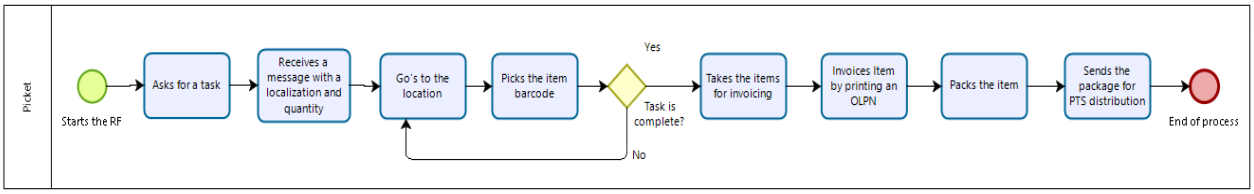

Figure 4.5 – Online picking and invoicing process

As mentioned before, these orders can have two destinations depending on the customer preference but for this project only the store delivery flow is studied.

Finishing the item invoicing and packaging, the orders are distributed in the PTS area.

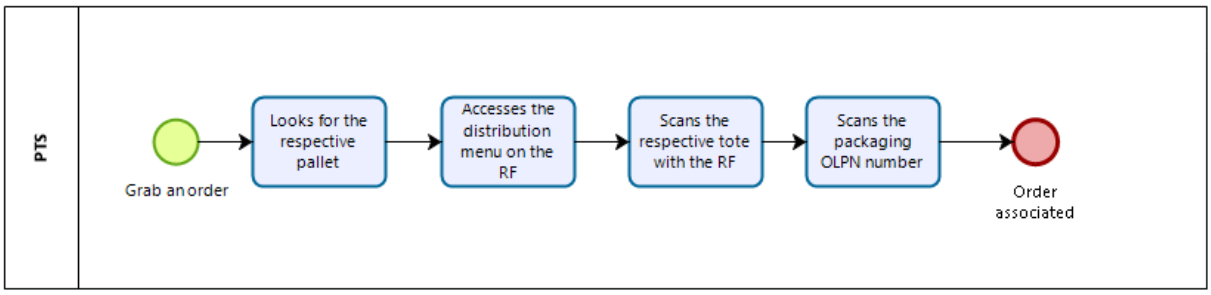

Figure 4.6 – PTS distribution process

PTS is an area of consolidation, where each store has a correspondent pallet which can be filled more than one time a day. This consolidation occurs to optimize space, adding different types of smaller production, that otherwise would be too small to carry on a pallet alone. In this area, the Put-to-Store Location (PTSL) number is important. This number exists on a board above every store pallet (see figure 4.7) as well as on the OLPN and it works like an ID card of the store and each store has a different number. So, to distribute the orders, a worker needs to match the number in the "OLPN" with the number in the board above the pallet and then with the RF, scan the "tote" barcode (see figure 4.7) in the board and the barcode in the label. It is important to add the product to the correct pallet, otherwise this item can go to a different store, not satisfying the customer needs and leading to complains. These types of error impact not only customers but also the store provisioning, causing the store not receiving the items requested for stock. This problem will be explained with more detail later.

Figure 4.7 - Example of a store PTSL number in PTS

To fit in a truck, a pallet must have a maximum height of 1,9 meters, so when a pallet reaches this size, it must be removed from the PTS area and moved into the shipping lines. To make this possible and to have track of all the different orders in a pallet there is another label called “Master Pallet” (see figure 4.8).

Figure 4.8 - Example of a Master Pallet

To transfer all the order information contained in the “tote” to the Master Pallet, the operator needs to access the RF Scanner and then in a proper transaction connected to the WMS, transfer all data (see figure 4.9).

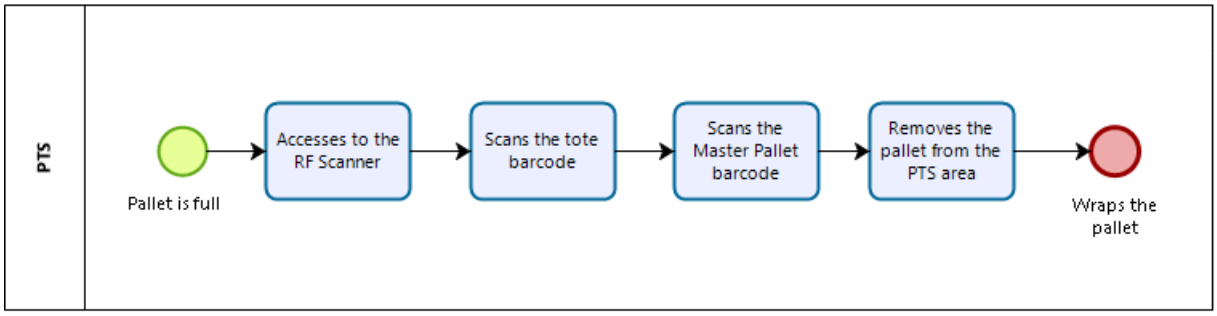

Figure 4.9 - Master Pallet association process

After the data transfer to the Master Pallet, the operator must wrap it in black film and then transport it to the shipping lines. Basically, a Master Pallet contain information about every order in the pallet, this way a cargo operator just needs to scan this label when loading the truck, instead of scanning each OLPN existing in the pallet.

4.3.2. Shipping

The shipping team works in two shifts between 8am and 2am of the next day. The first shift, from 8am to 5pm, is smaller having only five employees working, the second one works from 5pm until 2am. This second shift has more ten workers, summing up to fifteen but also considerably more operational stress.

Figure 4.4 shows the pallet estimative process, which is the most important job for who is working in the first shift. Every day, before 12am, an employee runs a query, which is linked to “WM”, and this gives the worker an estimate of how many pallets will be produced until the end of day. This estimate is based on the production of PBS team, PTS (which includes online orders to store delivery and PBL production). Is also important to notice that not every store has a delivery window every day, meaning that they will not be supplied every day.

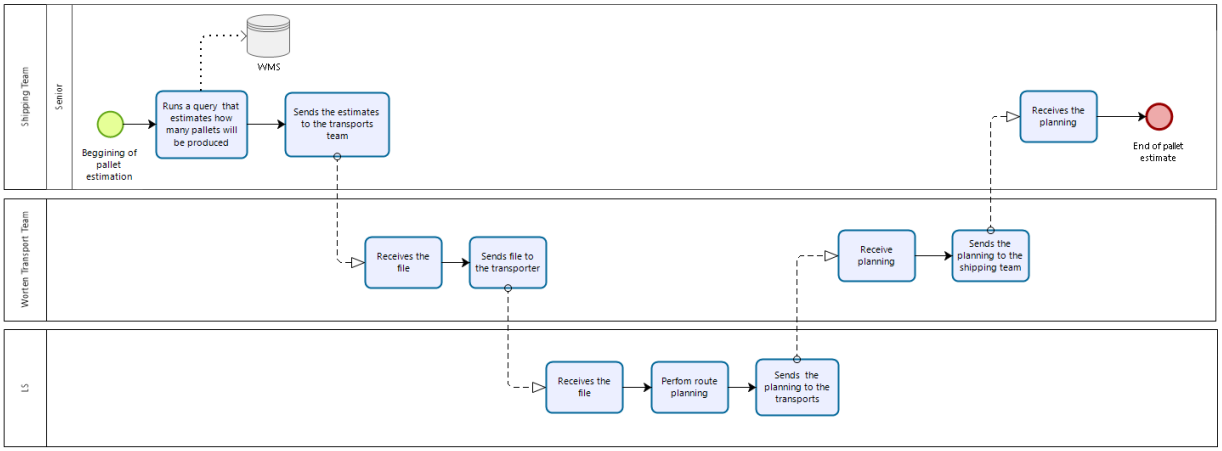

Figure 4.10 – Pallet estimative process

After the estimate file is ready, it is sent to Worten transport team, which deals with the main transportation company, Luis Simões, and send them also the file. LS creates all the routes with the flowing criteria: stores with delivery window in the following day and number of pallets estimated. Every route has more than one store associated, to a better optimization of the trucks, the routes are alienated by country zone. Next, the route planning is delivery to the transportation team and then again to the shipping team by 5pm.

Every day, at the beginning of the second shift, the route planning file (see figure 4.8) is divided by the cargo operators and every single one of them can receive more than one truck to load, depending on the quantity of orders that is under production by the other teams, normally in total there are circa 28 or 30 cars to load per day.

Plano de Carga Global Data planeamento 10-15-2021

Tour	Rota	Loja de Entrega	Ponto Entreg	Saida	Janela entrega	Plaza 2 prev.	Plaza 2 reais	Plaza 1 prev.	Plaza 1 reais	Spz pal prev.	Spz pal reais	Spz est prev.	Spz est reais	Faras	Galera	Tractor	Cais P 1	Encosto	Inicio Carga	Fim Carga	Selo P 1	Cais P 2	Encosto	Inicio Carga	Fim Carga	Selo P 2
900	102	14 CNT Antas	14	01:00	11:00-13:00	0,1																				
900	102	551 WRT ANTAS	551	01:00	08:00-14:00	9																				
900	102	5827 WRT BARCELOS RETAIL	5827	01:00	08:00 -15:00	4																				
900	102	574 WRT Marco	216	01:00	08:00-11:30	6																				
900	102	53 WRT NorteShopping	53	01:00	06:00-08:00	4																				
900	102	834 WRT Ponte Lima	299	01:00	08:00-14:00	5																				
900	102	579 WRT VIA CATARINA	579	01:00	08:00-14:00	3																				
900	102	599 WRT VIANA ESTAÇÃO	599	01:00	08:00-14:00	4																				
901	103	204 CNT Vila Real	204	01:00	10:00-12:00	0,1																				
901	103	228 MDL Maia	228	01:00	09:00-11:00	0,1																				
901	103	1055 MDL Regua	1055	01:00	10:00-12:00	0,1																				
901	103	511 WRT Braganca	239	01:00	08:00-13:00	7																				
901	103	588 WRT CHAVES RP	588	01:00	13:00-19:00	5																				
901	103	354 WRT Lamego	381	01:00	09:00-15:00	7																				
901	103	4963 WRT MIRANDELA	2075	01:00	08:00-13:00	7																				
901	103	1083 WRT Regua	1055	01:00	08:00-14:00	5																				
901	103	540 WRT Vila Real	204	01:00	09:00-15:00	1																				
489	104	1339 WRT MAR Shopping	1339	01:45	08:00-14:00	7								4												
489	104	515 WRT Matosinhos	1	01:45	08:00-14:00	10								9												
489	104	1 CNT Matosinhos	1	01:45	10:00-12:00	0,1																				
489	104	104 ENT. MAIA	104	01:45	06:00-08:00	8																				
489	104	530 WRT Maia	530	01:45	08:00-14:00	8																				
489	104	1191 WRT MAIA JARDIM	333	01:45	09:00-15:00	4																				
491	105	989 WRT VALONGO	699	03:00	07:00-10:00	9																				
491	105	521 WRT Paredes	247	03:00	11:00-17:00	5																				
491	105	247 MDL Paredes	247	03:00	00:01-23:59									1												
491	105	4820 WRT Penafiel	1943	03:00	11:00-17:00	7																				
491	105	222 MDL Amarante	222	03:00	08:00-10:00	0,1								5												
491	105	502 WRT Amarante	222	03:00	09:00-15:00	4																				
491	105	591 WRT Felgueiras	211	03:00	11:00-17:00	5																				
491	105	211 MDL Felgueiras	211	03:00	00:01-23:59									3												
491	105	1086 WRT Lixa	1056	03:00	09:00-15:00	3																				
491	105	1056 MDL Lixa	1056	03:00	00:01-23:59									4												

Figure 4.11 – Example of a route planning file

Figure 4.11 shows an example of a planning route file, which have the route number, for identification and all the stores that belong to that route. Besides this, the pallet quantity to load per store is shown with a maximum limit per truck of 33 pallets.

Annex B shows the process of loading a truck. After every cargo operator have received the route plans, they start preparing all the pallets to load. The pallets made by PBS team (offline production, ordered by the stores to fill their stock) are already on the shipping lines but the operators need to wait for all the priority production to finish. This priority production are the customers' orders to deliver in the store produced by the online team, as mentioned before. Since the customers already paid for the order, it is mandatory to send them in time. Worten has a commitment with the customers and every online order placed and paid until 9pm is delivered in the next day, meaning that the online team needs to prepare everything that was ordered until 7pm, until 10:30pm. This creates some stress in the shipping team because they only have from 10:30pm to 2am (end of shift), to dispatch all the cars in the plan.

After the production and distribution of priority orders, the cargo operators need to remove the pallets from the PTS area, like explained in figure 4.9 and move them to the respective loading docks, where they start the loading process. When in the loading dock they move one pallet at a time to the entry of the truck and with the RF scanner in the shipping menu, they start to scan the OLPN or Master Pallet label and associate it to a barcode in the dock door. This process exists to try to avoid mix-ups between pallets and trucks, avoiding the situation of loading a pallet in the wrong route. After this process each operator invoices its route in the RF invoicing menu.

4.4. Problem identification

In this sub-chapter the research question is divided in two different points, the problems in store provisioning and the problems in shipping.

Store Provisioning

Focusing on the second part of the research question about the store provisioning, and after analysing the process of distribution by process mapping and direct observation, some problems were found in the PTS distribution that impact the store provisioning.

The relation between the Worten warehouse and the physical stores can be compared to a "Monopoly" game, although they belong to the same company, each one has their own budget. This way, some errors made inside the warehouse have a direct impact both on the warehouse

budget and on the store budget. Namely, the type of errors (see table 4.3) caused by the workers that are distributing the orders in the PTS area.

Table 4.3 - Most common mistakes in PTS distribution

Types of mistakes in PTS distribution
OLPN consolidated in the right pallet but physically in the wrong pallet
OLPN not consolidated but physically in the right pallet
OLPN not consolidated in the right store pallet

These problems mostly happen due to human error like distractions but also because there is no visual help and the atmosphere can become monotonous, with pallets and boxes all over the place. Figure 4.12 shows the PTS area. It is noticeable that the pallets are in a “chess” configuration, being alternated to avoid errors, but all identification boards are in the same color (white), although they represent different stores.

Figure 4.12 - PTS store identification disposition As-Is

When mistakes like this happen, like the wrong distribution of an order, and these are not corrected before the pallet leaves the warehouse, a certain store may receive an order they didn’t place, not receive the order placed at all or they will receive more, or less quantity of a certain order, in these situations, the stores in question will generate a Transfer Conflict Maintenance

(TCM). A TCM is essentially a transfer for store compensation, and they occur in two distinct situations:

- Excess – The store received more quantity of a certain SKU's, more then what they originally ordered. In this case, they will adjust their inventory, and pay to the warehouse for the surplus.
- Absence – Meaning the store didn't received the ordered item or the right quantity and wants a monetary compensation for it since the order already took place.

There is a global indicator of error percentage that have can be at a maximum of 1%. This indicator is related with the errors shown on table 4.3, but sometimes it's above 1%. Even though there is an auditing team, from CCM, there isn't enough people nor capacity to audit all pallets searching for mistakes and guarantying distribution quality.

Shipping

Due to the long wait for the priority orders to be produced and distributed on PTS, before being possible to load trucks, as explained before, there is a lot of operational stress and a small-time window to load all the trucks. This stress can lead to mistakes in the loading process. For example, some pallets can be loaded in the wrong truck going to a different destiny. This is something that can occur regularly.

There are already some processes that try to avoid this kind of situations, like the process of scanning each OLPN and associating it to the barcode present in each dock door, but they are not enough, and some operators can bypass this process that guarantees the quality of the loading process.

4.5. Presentation and implementation of solutions

In this chapter, one solution is presented and implemented to solve the problems identified in the previous chapter.

4.5.1. Visual Management and Auditing

This solution main objective is to solve the identified problems with visual management and then reenforcing the pallet auditing to decrease the distribution errors and increase the store provisioning quality.

4.5.1.1.KPIs

To measure the success of the implementation the KPIs are the following:

- TCM's – Analysing the value of the transfers received from the stores.
- Auditing percentage – Comparing the percentage of pallets audited, before and after the implementation.

4.5.1.2. Implementation

The implementation is divided in two phases and started in 12th of July.

The first one is related with visual management and is essentially changing the colours of the PTS boards. So, all the acrylic white boards, presented in figure 4.12 were changed and now they are presented with two different colours, being this yellow and white (see figure 4.13). This way, with two colours intercalated, the environment will become less monotonous, and the employees will take more attention to where they are distributing the orders.

Figure 4.13 – PTS board disposition To-Be

With two colours intercalated, the employees will take more attention to where they are distributing the orders.

The second is increasing the number of pallets audited in the PTS area.

As the CCM team doesn't have the capacity of auditing every pallet in the area, this solution goes through the participation of the shipping team. So, this team will have one more process adding to the already existing ones. Taking the process map presented on figure 4.9, after the

conclusion of the priority orders and transferring the OLPN data from the tote to the master pallet they must audit the pallets, adding the auditing process (see figure 4.14).

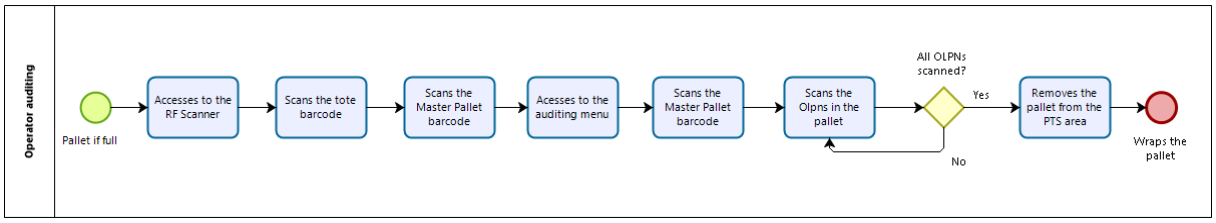

Figure 4.14 – Auditing process

So, after accessing the auditing menu in the RF, the master pallet must be scanned, and the screen will show how many OLPNs are inside that master pallet. Next all the labels need to be scanned, until the number of labels matches the number shown in the first place. After this the pallet is wrapped and an “audited pallet” sticker is sticked.

Although this process is adding some more workload to the shipping team, it is necessary to start improving the quality of the service.

4.5.1.3. Implementation Results

So, after the implementation there is possible to see some results.

There is a global objective related to the PTS distribution. This objective is to keep the error percentage below 1%, and this will depend on the production as well on the auditing.

Figure 4.15 shows the percentage of audited pallets on the PTS area before and after the implementation. Before the implementation, in the month of June the average of auditing was 66%, with big oscillations due to the quantity of pallets and the lack of operators to audit.

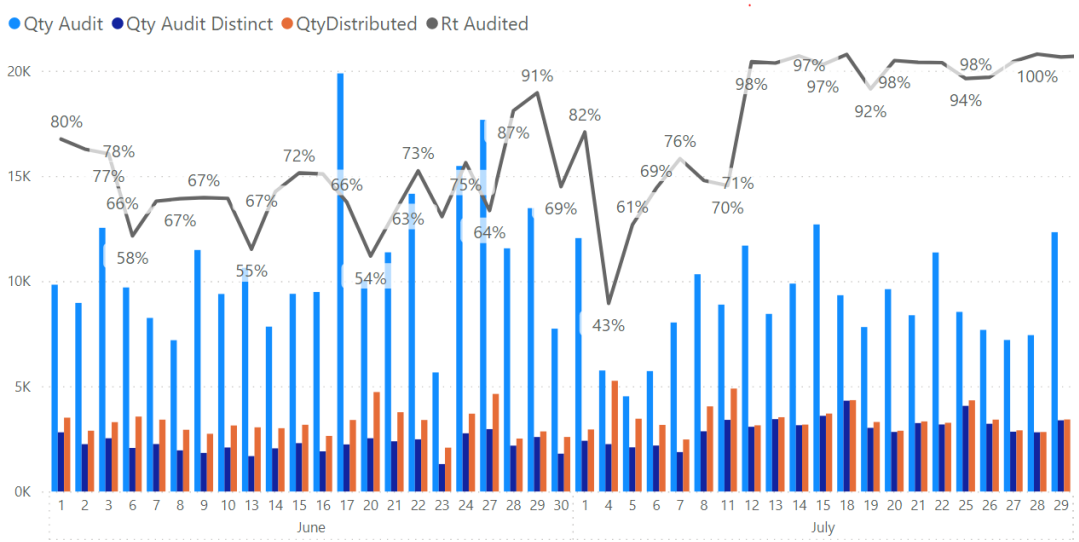

Figure 4.15 - Audited OLPN percentage in process transition

After the implementation, with the shipping team auditing the pallets the results are clear, after the 12th of July, the auditing percentage became almost steady and always above 90%. Of course, there could be some variations, but they are mostly about IT problems. Figure 4.16 shows the continuation of the process since the implementation until September.

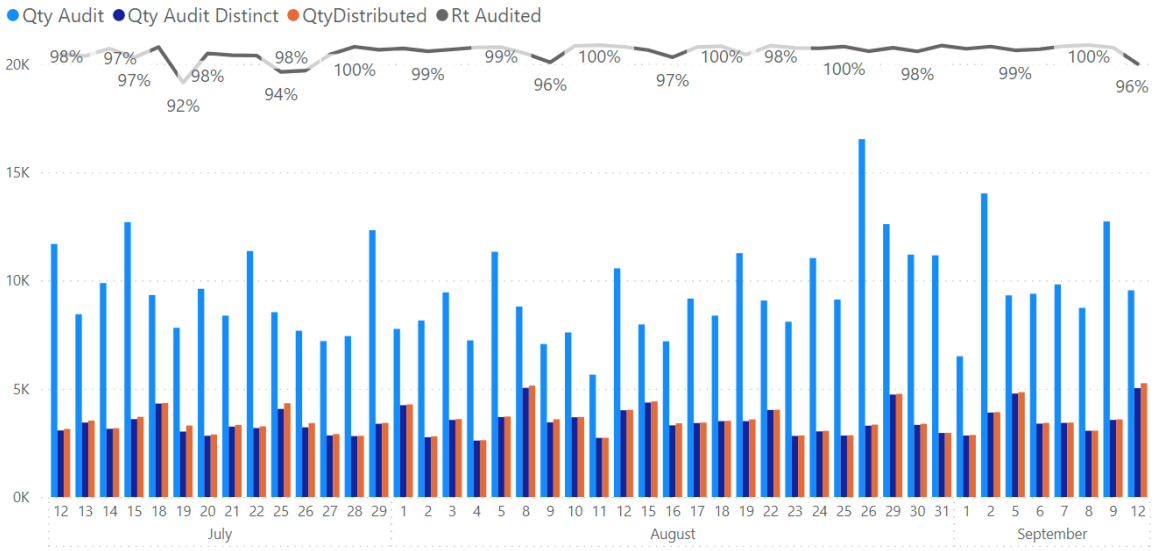

Figure 4.16 - Audited OLPN percentage from July to September

The result in the error percentage is also noticeable, as it's possible to see in picture 4.17 the decreasing when the transition process to the auditing reinforcement occurred, lowering from days with more than 1% to minimum lows.

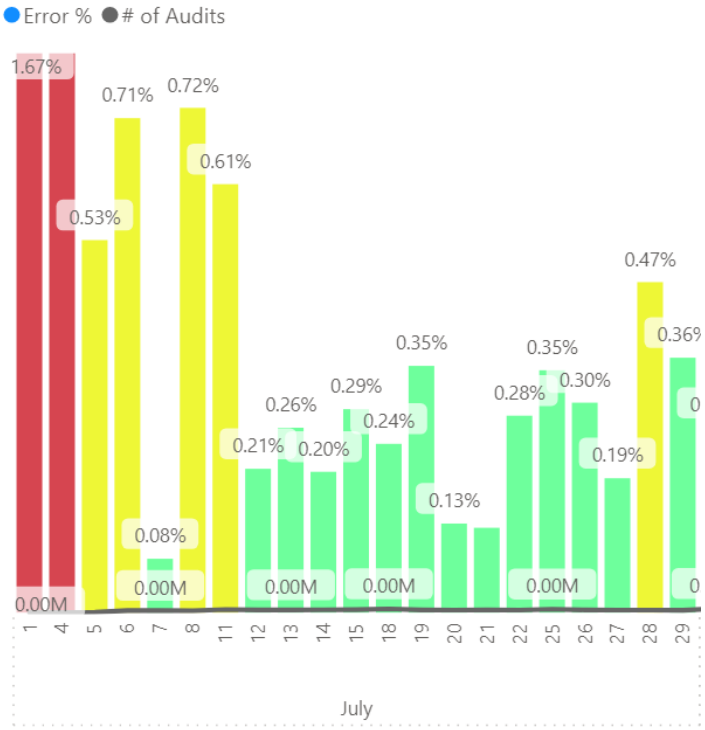

Figure 4.17 – PTR error percentage in July 2021

Adding to the success of the implementation, the value of TCM transfers suffered a decrease which is good for both the stores and the warehouse. In the beginning of 2021, in the month of January, and due to the high season and COVID-19 pandemic, the TCM value was on a maximum of 12k.

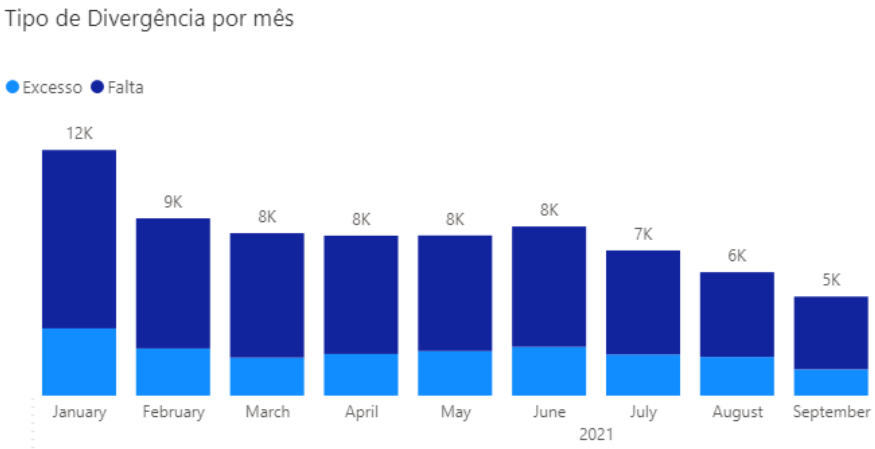

Figure 4.18 Value of TCM transfers (Euros)

In the next months it oscillated to lower values due to the decreasing in production but it's between the months of July and September of 2021 that the difference is noticeable. Keeping in mind that these months are considered has high season, due to the sales of fans and A/C's, lowering the TCM value to 5k was a victory and a year minimum until the date of the realization of this project.

4.5.2. Loading time reduction

The main objective of this idea is to reduce the time of the truck loading time, reducing some stress in the shipping team second shift and consequently the error this stress may create.

Although the main objective is to reduce the truck loading time, it was not possible to implement the idea to solve this problem.

4.5.2.1. KPI's

To measure the success of the implementation the KPIs are the following:

- TCM's – Analysing the value of the transfers received from the stores.
- Truck loading time – Comparing the time used in loading a truck, before and after the implementation.

4.5.2.2. Implementation

As mentioned before in chapter 4.3.2, the second shift has way more stress due to the waiting for the online team to finish all the production. This idea tries to divide the route planning file between second and first shift.

In the first place, all the trucks are loaded at night because the stores want to receive their orders at first hour of the day. Before the division, all the store delivery windows must be analysed and the stores that can receive the orders later in the morning must be chosen and will be loaded at the first hour in first shift. This is difficult when talking about store in the north, centre, or south of the country because of the travel time for the trucks and drivers. So, to begin, all the stores near the warehouse, marked in figure 4.19, must receive the orders later.

Figure 4.19 - Warehouse localization

This way, from the average of thirty trucks per night, at least five of them will be loaded in the early morning, releasing some tension in the second shift shipping team.

4.6. Recommendations

This chapter is the last step in the methodology and presents recommendations for the future.

To answer the research question - "*How the processes of shipping and store provisioning at Worten's warehouse can be improved, becoming more efficient?"* – the following recommendations are presented:

- Acquiring more full-time equivalents (FTEs) for the operation. With more employees, auditing pallets or loading trucks, it is easier to control the quality of the operation, reducing the time of loading and increasing the pallet auditing.
- Create more actions of awareness for the people already working in the warehouse to guarantee that the employees know the processes, and the impacts an error can have in the operation.
- Every time a new employee enters the company they need to be accompanied by an experienced or older employee, to know the processes and the right way to do them.
- Keep the warehouse in good conditions and organized, especially in the PTS area, where a lot of people is working at the same time, creating possible mistakes.

With the presented recommendation, Worten warehouse has everything they need to continue to be the market leader in the electronic retail area.

5. Conclusion

This project was developed in Worten warehouse in Azambuja, Portugal. This company has one of the biggest logistic operation in the country and is the market leader in its area with a warehouse that supplies more than 200 physical stores. Although, Worten has faced some inefficiencies in its warehouse operations and the main goal of this project was to improve the internal processes, by becoming more efficient and answering the research question "*How the processes of shipping and store provisioning at Worten's warehouse can be improved, becoming more efficient?"*.

To answer the research question all the processes of the warehouse operation were followed to guarantee the necessary knowledge to succeed. After knowing the processes, they were mapped and analysed, and this leaded to the identification of some problems. After the identification of the problems, some solutions were selected and presented to the operational managers to verify the possibly of implementation. Although just one of the solutions presented was implemented, the other needs to be perfected but also have the capacity of being implemented in the future and presenting great results.

Focusing on the implement idea, it showed great results, saving some monetary resources to the company, and keeping the KPIs in the green light, below the objective. Although, there were some difficulties in the implementation. The older employees that have been doing the same processes for over and over, were averse to change and to the implementation of new processes. This was overpassed by explaining the benefits of the implementation and what could be accomplished with their participation.

If Worten keeps their mindset of wanting to do more and better in the future, getting on with continuous improvement, certainly they will continue as the market leader in the retail sector in Portugal.

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Annexes

Annex A

To better understand the processes at Worten warehouse and to facilitate the process mapping, the following question were made to ask the people involved in the operation, being them, operational managers, and workers.

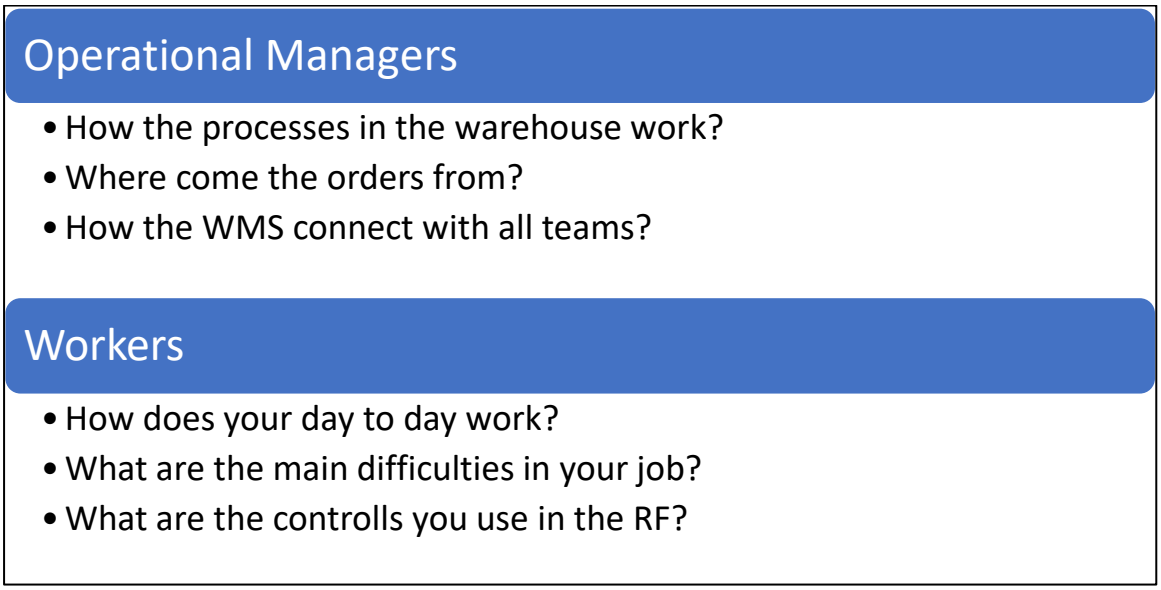

Figure A.1 – Questions from the semi-structured interviews

Annex B

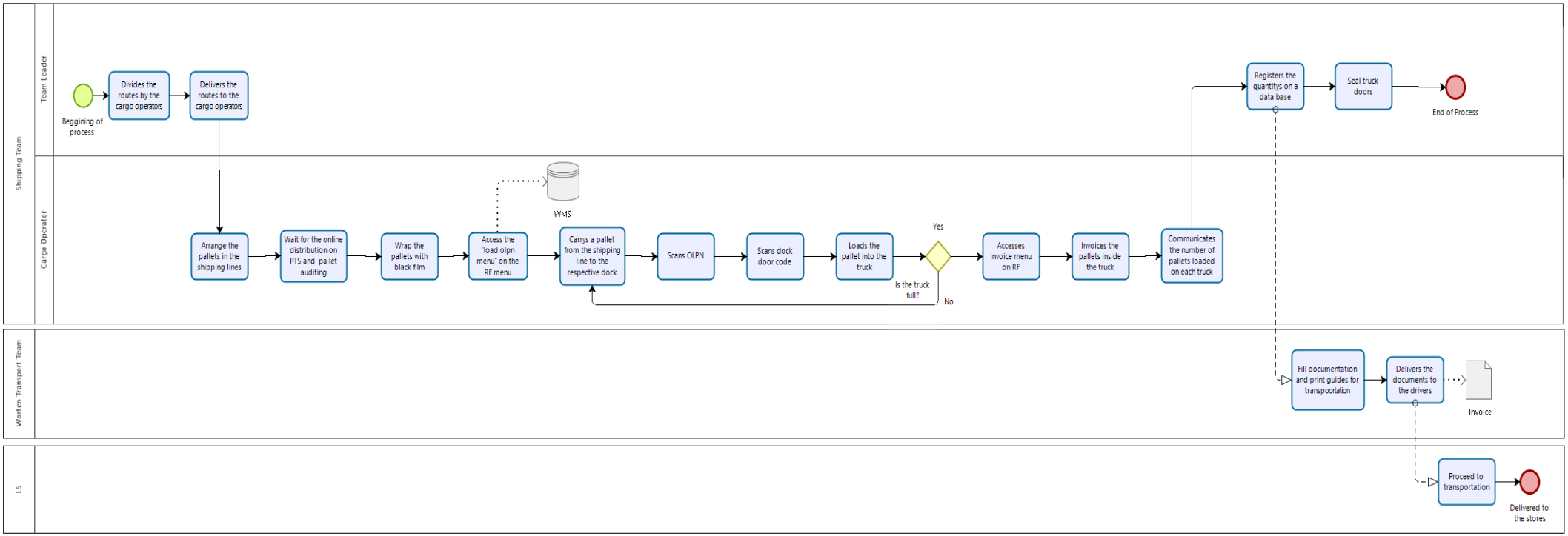

Figure A.2 – Truck loading process

Annex C

1. Information of the destination store.
2. Name and contact of the customer.
3. Number of units and weight in Kg.
4. Store number.
5. OLPN code.
6. Number of the store in the PTS area.

Figure A.3 – Example of an OLPN