SCHOOL OF SOCIAL SCIENCES

Supply Chain Management

Postgraduate Dissertation

"An empirical study in warehousing. A case study in the
tobacco industry."

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Supervisor: Dimitris Folinas

Patras, Greece, January 2023

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Abstract

Logistics and Warehousing are essential parts of the Supply Chain and the company. Raw materials and Finished goods are received, stored, and delivered from suppliers and the production to clients with handling, storing conditions, quality procedures and time schedule always followed.

Products and material have an actual value as described in invoices, although it is the added value of delivering and receiving in time, in proper condition. In addition, keeping costs low is a constant challenge, especially under a fluid, unstable environment where the same cargo may cost even 30% more or less in a 12-month period.

Furthermore, there are always internal factors to deal with during working hours like Human resources management, equipment and space management, new and urgent tasks to be dealt by Logistics department.

Logistics is dealing with the unexpected and finding solutions for expected and unexpected matters. It is an outgoing department in a company. It is essential to communicate with other departments inside the corporation, but also outside of the company's boundaries, with suppliers, forwarders, tax authorities, custom brokers, recycling companies and equipment suppliers.

There will be listing of the operations of the department the actions taken to improve performance and reduce costs as well as future plans. The challenges of the global supply chain and the impact in the company's operations.

This dissertation focuses on analysing and presenting procedures of Logistics and Warehousing in Tobacco Industry, especially in the logistics dept. of Real Tobacco S.A. in Panteleimon, Kilkis. The company has started its operations a few years ago and there is a gradual implementation of procedures in the supply chain of the company. The personnel of the logistics dept are asked about their experience and propositions about the Warehouse and the department.

Keywords

Supply chain, Logistics, Warehousing, ERP, WMS, Tobacco, Cigarettes

"Εμπειρική μελέτη στον τομέα της αποθήκευσης. Μελέτη περίπτωσης στην καπνοβιομηχανία."

"Νικόλαος Νούλης"

Περίληψη

Τα logistics και η αποθήκευση αποτελούν βασικά μέρη της Εφοδιαστικής Αλυσίδας και της εταιρείας. Οι πρώτες ύλες και τα τελικά προϊόντα παραλαμβάνονται, αποθηκεύονται και παραδίδονται από τους προμηθευτές και την παραγωγή στους πελάτες με τη διακίνηση, τις συνθήκες αποθήκευσης, τις διαδικασίες ποιότητας και το χρονοδιάγραμμα πάντα να τηρούνται.

Τα προϊόντα και τα οι πρώτες ύλες έχουν πραγματική αξία όπως περιγράφεται στα τιμολόγια, αν και είναι η προστιθέμενη αξία της έγκαιρης παράδοσης και παραλαβής σε σωστή κατάσταση. Επιπλέον, η διατήρηση του κόστους σε χαμηλά επίπεδα είναι μια συνεχής πρόκληση, ειδικά σε ένα ρευστό, ασταθές περιβάλλον όπου το ίδιο φορτίο μπορεί να κοστίζει ακόμη και 30% περισσότερο ή λιγότερο σε μια περίοδο 12 μηνών. Επιπλέον, υπάρχουν πάντα εσωτερικοί παράγοντες που πρέπει να αντιμετωπιστούν κατά τις εργάσιμες ώρες, όπως η διαχείριση ανθρώπινων πόρων, η διαχείριση εξοπλισμού και χώρου, νέες και επείγουσες εργασίες που πρέπει να διεκπεραιωθούν από το τμήμα Logistics.

Το Logistics ασχολείται με τα απροσδόκητα και η εξεύρεση λύσεων για αναμενόμενα και απροσδόκητα θέματα. Είναι ένα εξωστρεφές τμήμα σε μια εταιρεία. Είναι απαραίτητο να επικοινωνεί με άλλα τμήματα εντός της εταιρείας, αλλά και εκτός των ορίων της εταιρείας, με προμηθευτές, μεταφορείς, φορολογικές αρχές, εκτελωνιστές, εταιρείες ανακύκλωσης και προμηθευτές εξοπλισμού.

Θα παρατεθούν οι λειτουργίες του τμήματος οι ενέργειες που έγιναν για τη βελτίωση της απόδοσης και τη μείωση του κόστους καθώς και τα μελλοντικά σχέδια. Οι προκλήσεις της παγκόσμιας εφοδιαστικής αλυσίδας και ο αντίκτυπος στις λειτουργίες της

εταιρείας. Η παρούσα διατριβή εστιάζει στην ανάλυση και παρουσίαση διαδικασιών Logistics και Αποθήκευσης στην Καπνοβιομηχανία, ειδικά στο τμήμα logistics. της Real Tobacco S.A στον Παντελεήμονα Κιλκίς. Η εταιρεία έχει ξεκινήσει τις δραστηριότητές της εδώ και λίγα χρόνια και υπάρχει σταδιακή εφαρμογή των διαδικασιών στην εφοδιαστική αλυσίδα της εταιρείας. Το προσωπικό του τμήματος logistics ερωτάται για την εμπειρία του και τις προτάσεις του για την Αποθήκη και το τμήμα.

Λέξεις – Κλειδιά

Εφοδιαστική αλυσίδα, Logistics, Αποθήκευση, ERP, WMS, Καπνός, Τσιγάρα

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1. Introduction to Supply Chain & Logistics

The Council of Supply Chain Management Professionals (CSCMP) (2004), (formerly The Council of Logistics Management (CLM)), a major professional organization supporting SCM practice, education, and development, gives the definition of SCM as: "SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities, including coordination and collaboration with suppliers, intermediaries, third-party service providers, and customers" (Thus the supply chain encompasses all activities involved in the production and delivery of a final product or service, from the supplier's supplier to the customer's customer). In short, supply chain management integrates supply and demand management within and across companies (www.cscmp.org). CSCMP mentions that SCM encompasses the management of supply and demand, sourcing of raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, and distribution and delivery to the customer. Cooper et al. (1997) define SCM as the management and integration of the whole set of enterprise processes that provides products, services and information that add value for customers.

Several authors have defined supply chain management. Christopher (1998), New and Payne (1995), and Simchi-Levi et al. (2000) define supply chain management as "the integration of major business processes among a network of interdependent suppliers, manufacturers, distribution centers, and retailers in order to enchance the flow of goods, services, and information from original suppliers to final customers, with the objectives of reducing system-wide costs while maintaining required service levels" (as cited in Stapleton et al., 2006, p. 108). The Global Supply Chain Forum (GSCF) defines supply chain management as "the integration of key business processes from end user through original suppliers, that provides products, services, and information that adds value for customers and other stakeholders" (as cited in Lambert et al., 1998, p. 1). The APICS dictionary (1995) describes SCM as – "the processes from initial raw materials to the ultimate consumption of the finished product, linking across supplier-user companies".

All organisations move materials. Manufacturers build factories that collect raw materials from suppliers and deliver finished goods to customers; retail shops have regular deliveries from wholesalers; a television news service collects reports from around the world and delivers them to viewers; most of us live in towns and cities and eat food brought in from the country; when you order a book or DVD from a website, a courier delivers it to your door. Every time you buy, rent, lease, hire or borrow anything at all, someone has to make sure that all the parts are brought together and delivered to your door. Logistics is the function that is responsible for this movement. It is responsible for the transport and storage of materials on their journey between suppliers and customers.

It is essential for companies to understand the importance of proper inventory management. Nowadays a rapidly increasing number of companies invest on management tools and inventory systems. Inventory is one of the most precious assets of a business as the management needs to be proactive, accurate and efficient. The company can take competitive advantage with proper track of Inventory management since it secures the uninterrupted supply of the production process, reduces the ordering cost of inventory and helps to avoid potential loss on sales. The idea is to utilize and optimize the warehouse capacity and reduce the unnecessary stock and the total price.

There are many different definitions for the inventory management. It can be depicted as the total stock of any item or resources that are used in a company or organization (Chase et al. (2006). Other definitions depict inventories as the stock of items classified under 3 categories: 1) raw materials, 2) work in process and 3) finished goods (Ballou, 2004):

Raw material: It refers to the unfinished items which go in the production process.

Work in Progress: It refers to the semi-finished goods which are not totally completed but only a part of them.

Finished goods: It refers to the ready for sales goods. The procedure has finished and there is no need for extra work.

In general, the inventory management controls the inventory levels and determines at what levels the inventory should be kept, at what time it should be replenished, and how big is the quantity that would need to be ordered (Norazira Abd Karim, Anuar Nawawi, Ahmad Saiful Azlin Puteh Salin). In other words, an efficient inventory management secures the

smooth flow of goods from manufacturers to final customer. The main goal is to keep a balance among stock, demand and real sales (West, 2009). It can be clearly understood from Lankford, 2004 how difficult is for companies to acquire a competitive advantage at present. However, an efficient handling of Supply chain management is the key to success as it can account for 75% of total operating expenses. Retailers must focus on managing inventory in order to reduce the costs and create higher inventory turnovers. Just in time delivery practices is one of the most essential processes for retailers. This technique has become popular as companies desire to reduce the waste and receive only the goods that according to real sales are of necessity. Thus, flexible systems that respond to customer demand and inventory uncertainties are of the utmost importance in commerce (Lankford, 2004)

- Holding excess inventory and overstock leads to the following:

- Unnecessary investment and reduction in profit.

- Increase in holding costs.

- Deterioration in inventory.

- Delivery problems.

Of course, there is not only one rule for companies to follow concerning the inventory level. Each company must evaluate some significant factors so as to choose the best strategy and determine the proper stock level. Some of the factors that companies have to think first are given below (Odisha State Open University):

- Nature of business: The level of inventory depends on whether it is a retail business, manufacturing business or trading business.

- Inventory turnover: refers to the amount of inventory sold and the frequency of its sales.

- Nature of type of product: there are different sizes and the raw material of products.

- Inventory costs: the higher the inventory stock, the higher the operating costs of holding inventory will be.

- Period of operating cycle: The cycle life of the product is really important not only so as to understand how much stock is necessary to keep but also to have an idea where to display it and where it should be kept in a warehouse.

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- Strategy of management: The strategy and philosophy of top management may support different tactics. Could be zero inventory concept like JIT or huge inventory level.

Inventory management is a very significant part of logistics and supply chain management. Every organization holds inventory for different purposes. Appropriate quantities should be kept for a successful and efficient Inventory management. The goal for a company is to keep the inventory costs low while at the same time not having a negative impact from lost sales due to inventory shortages. Companies apply a variety of different methods and techniques in order to control the level of their inventories. These techniques can be divided in two main methods: a) The traditional and b) modern methods (Padmanava Samanta 2015). The main difference is that modern techniques have the vision of using scientifically evolved formulas for calculating optimal inventory levels. In this case, the business can make decisions on optimal ordering quantities and on frequency of the orders. More specific, these techniques include the calculation of order quantities, limitations of levels, average level and re-ordering levels. Most of the times, organizations use a combination of traditional and modern techniques to manage and control their inventory levels.

Increasing globalization, development of world economies and growing consumerism of societies leads to increase demand for transport, movement and logistic handling of material goods. It causes creation of new as well as expansion and increasing complexity of existing logistics systems and supply chains. Consequently, they are expanded with new logistics facilities performing a wide range of logistics tasks. These tasks are aimed at efficient and effective transformation of materials in such way to satisfy customer needs (with rationalization of incurred costs at the same time). This in turn determines the necessity of solving a number of decision-making problems regarding the designing of efficient and effectively manage supply chains.

Ordinarily we only notice a small part of logistics. We might see lorries driving down a motorway, visit a shopping mall, drive through a trading estate, or have a parcel delivered to our homes. These are the visible signs of a huge industry. In this book, we take a more detailed look at this complex function. We discuss the issues and developments, and see how managers can get the best results from their logistics. (Waters, 2003)

The role of logistics facilities is a crucial for all supply chains, because they have significant contribution to handle materials which are moved from the places of production to consumers. Correct operation of warehouse facilities enables the realization of their logistic tasks at appropriate and acceptable by customers quality level. Consequently, it determines validity, cost-effectiveness and need of their functioning in supply chains. Therefore, a lot of attention in the literature is given to issues related to the design of storage facilities as well as modelling and organization of their warehouse processes.

1.1. Basic principles of warehouse organization and management

The warehouse is today playing a more vital role than it ever has in the success (or failure) of businesses (Frazelle, 2002). Warehouses play a critical intermediate role between supply chain members, affecting both supply chain costs and service (Kiefer and Novack, 1999). To rationalize supply chain processes and to manage them more efficiently, many companies have set up centralized production and warehouse facilities over the last decades (HIDC/BCI, 2001). This has resulted in larger warehouses responsible for the distribution to a greater diversity of more demanding customers in a vaster region and, consequently, with more complex internal logistic processes (see the survey of ELA/AT Kearney, 2005).

Flow of materials through all kinds of logistics facilities is a strictly defined sequence of transformations performed on these materials. These transformations may involve transformations of time, place, or form of handled materials. In the first case, it concerns buffering and storage of materials in logistic facilities. Place transformation is understood as a movement and transport of materials within warehouse. However, during the form transformation, materials are processed due to their physical form, i.e., co-packed, consolidated, unconsolidated, assembled, packaged, etc.

Warehouses are usually large plain structures used for commercial purposes for storage of goods and are commonly used by exporters, importers, wholesalers, manufacturers etc. Warehouses or distribution center are usually equipped with loading docks to load and unload trucks and they have cranes and forklifts for moving goods, and are placed on ISO standard pallets loaded into pallet racks.

Warehouses are crucial parts of most modern supply chains. They are likely to be involved in various stages of the sourcing, production and distribution of goods, from the handling of raw materials and work-in-progress through to finished products. As the dispatch point serving the next customer in the chain, they are critical to the provision of high customer service levels.

Some scholars have defined warehouse in different literatures as follows: Warehouses are an integral part of the supply chains in which they operate, and therefore recent trends, such as increasing market volatitlity, product range proliferation and shortening customer lead times, all have an impact on the roles that warehouses are required to perform (Alan, R., Phil, C. and Peter, B., 2010).

A warehouse is "a commercial building for buffering and storage of goods, or an intermediate area for storage of raw materials or products until they are needed for production or consumption" (Chua & Teo 2008). Warehousing, being an essential component of logistics, is a key aspect of modern supply chains and plays a critical role in the success or failure of businesses today (Frazelle, 2002a).

A warehouse is a commercial building used for the storage of goods. The most important element of warehousing is order processing which generally refers to the workflow coupled with delivering products ordered by a customer. The prime objective of most warehouses is to facilitate the movement of goods from suppliers through the supply chain to the end consumer while meeting the customers' demand in a timely and cost-effective manner.

In the old days of warehousing, inventory was seen to represent the wealth of a company. However, these days this is not the case anymore. Instead, many companies have noticed the high cost associated with holding inventory. In practice, however, there are overriding factors such as meeting customer demand and expectations that make it hard to operate without inventory.

Even though the new technologies in e-commerce, supply chain integration, quick response, just-in-time delivery and efficient consumer response that connect the manufacturing with the end customers, businesses are still struggling to eliminate the existence of a warehouse. Thus in order to meet the customer's requirements warehouse needs to be properly coordinated and maintained. (Cooper. J.C, Davis. Matthew, 1984)

Valid reasons for holding inventory include, for example, buffering cycles between two production processes, covering demand during supplier's lead-time, enabling savings by using volume discounts, coping with seasonal fluctuations, providing a variety of products in a centralized location, or holding anticipation and investment stocks (Krajewski & Ritzman, 2005). As a result, the basic aim of most warehouses is simply to minimize the total cost of operations while providing a desired level of service.

Warehousing also plays an important role from the supply chain perspective. Despite all of the integration initiatives, supply chains will never be so well coordinated that warehousing can be completely eliminated. Frazelle (2002) states that warehouses are important for a supply chain because they provide storage for raw materials, components, work-in-process, and finished goods; operate as distribution and order fulfillment centers; and perform localized and value added warehousing. Figure 4.2 illustrates warehouses performing these functions in a logistics network.

Traditional warehousing continuously is declining since the last decade of the 20th century with the introduction of Just in Time (JIT) techniques, which are specially designed to enhance the return on investment (ROI) of a business by mitigating in-process inventory. Recent developments in marketing field have led to the development of warehouse designing style, where the same warehouse is used for warehousing and also as a retail store. These types of warehouses are equipped with tall heavy-duty industrial racks, with the items, which are ready for sale, are placed in the bottom parts of the racks and the palletized and wrapped inventory items being usually placed in the top parts.

Today's warehouse requirements are:

- Execute more, smaller transaction

- Handle and store more items

- Provide more product and service customization

- Offer more value-added services

- Process more return

- Receive and ship more international orders

At the same time, warehouses today have

- Less time to process an order

- Less margin for error

- Less young, skilled, English-speaking personnel

- Less WMS capability (Tompkins, Smith, 1998).

Warehouse process is a set of actions which are associated with receiving, storage, picking and shipping of material goods, in a suitably adapted places for this purpose, and under certain organizational and technological conditions. Therefore, it can be concluded that warehouse process includes such sub-processes as receiving, storage, picking and shipping. Nevertheless, it is a very general approach, and warehouse process may take many different forms, and include multiple sub-components. Selection and appropriate connection of this process elements (sub-processes) is determined by functions and tasks of logistics facility. In fact, production warehouses, distribution warehouses or crossdocking warehouses usually perform variety kinds of transformations.

Each of these warehouse process components is characterized by an appropriate sequence of actions that must be performed to complete a given goals and objectives. It is closely related to materials and information transformation by labour resources (labour resources include warehouse employees, transport means, warehouse equipment, tools for information flow management, etc.).

Therefore, managing complex warehouses effectively and efficiently has become a challenging task. An important question therefore is how warehouse management, as a cluster of planning and control decisions and procedures, is organized in order to meet today's challenges. Warehouse management encompasses the control and optimization of complex warehouse and distribution processes (Ten Hompel and Schmidt, 2006), and it depends on the tasks to be performed and on the market the warehouse operates in. In the area of production management, it is commonly accepted that the produced volume and product variety (i.e. task complexity) and the rate of change of the external environment (i.e. market dynamics) are the main drivers of the planning and control structure (Bertrand et al., 1990; De Toni and Panizzolo, 1997; Hatch, 1997; Peterson and Silver, 1979; Van Assen, 2005). However, systematic research into the drivers of the warehouse planning and control structure seems to be lacking.

Warehouse processes that need to be planned and controlled include: inbound flow handling, product-to-location assignment, product storage, order-to-stock location allocation, order batching and release, order picking, packing, value-added logistics activities, and shipment (Ackerman and La Londe, 1980; Frazelle, 2002). Particularly storage and order picking are complex, often labor-intensive processes that determine warehouse performance to a large part. Task complexity measures the depth and breadth of the tasks a warehouse has to perform and is internally oriented. Market dynamics measures the rate of change of the external environment in which a warehouse operates

Analogous to production management (Bertrand et al., 1990), the objective of warehouse management is to coordinate all warehouse processes and activities efficiently and effectively (Harmon, 1993; Tompkins et al., 2003). Warehouse management includes all planning and control procedures to operate the warehouse. Planning and control are concerned with managing the ongoing activities of the operations to satisfy customer demand (Slack et al., 2001). The main purpose of planning and control is to ensure that operations run effectively and produce products and services as they should (Slack et al., 2001). Whereas planning involves deciding what should be done and how, control is the process of ensuring that the desired output (plan) is obtained (Anthony and Young, 1984; Van Goor et al., 2003). Planning is therefore proactive and control is reactive. Together, plans and controls regulate outputs. Through planning, we distinguish a tactical and an operational level. At the tactical decision level, warehouses draw up plans to make efficient use of resources and to fulfill market demand. However, due to the highly dynamic environment, for many warehouses the tactical planning horizon is only days or weeks rather than months. At the operational level, decision rules are used to sequence, schedule, and optimize planned activities (Slack et al., 2001).

1.2. Types of Warehouses

Warehouses come in many different sizes and forms, such as:

1.2.1. Private Warehouses

Private warehouses are owned and managed by suppliers and resellers to fulfil their distribution activities. Examples of private warehouses are retailers renting out warehouses to store their items, warehouses used by producers that are near their places of work and

warehouses that are either owned or leased by a wholesaler where they will store or distribute their inventory.

1.2.2. Public Warehouses

Warehouses that are owned by the government are referred to as public warehouses and they can be used by private entities to store their goods, as long as they can pay rent. These warehouses can be of assistance to small companies that need storage facilities but cannot afford to have their own.

1.2.3. Bonded Storage

Bonded storage refers to warehouses that are owned and managed by both the government and private firms. These warehouses are used to store imported products where an import duty has not been paid yet, and the private firms need to receive a license from the government. Bonded storage ensures that private firms pay their taxes to the government.

1.2.4. Co-operative Warehouses

Co-operative warehouses are owned by co-operative societies. They are meant to be accessible storage facilities as the rates that they charge are not as high as other types of warehouses. Co-operative warehouses are not intended to make a profit, but they are to assist those members who cannot afford to rent warehouses at the usual rate.

1.2.5. Distribution Centres

Distribution centres are storage facilities that can keep large amounts of inventory for a short period of time. Their purpose is to be used as a distribution system where goods are moved quickly from the supplier and then to the customer.

1.3. Functions

1.3.1. Maintain Price Stability

Warehouses play an important role in avoiding unexpected fluctuations in prices that occur, so you store goods when there is currently no demand for them. When demand increases for goods, and they are not in production, then you can sell them. Warehouses also guarantee a steady supply of items into the market, which assists in price stabilisation as there is always a match in supply and demand.

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1.3.2. Creates Storage Space

The primary function of warehouses is to store goods, but they can also be used to store extra goods that are not in need now. These goods are stored and need to be preserved until a time when there is a demand for them from customers.

1.3.3. Minimizes Risk

Warehouses can be the safest place where goods are stored. In the case of perishable goods, they can be kept in a cold storage facility to preserve them. They are also able to reduce the chance of goods incurring damage from theft or fire as all the goods within the warehouse are usually insured. If those goods were to be stolen or are damaged, then the owner of the said goods would receive compensation from the insurance company.

1.3.4. Packing and Grading

Products such as coffee and tobacco need to go through processing and conditioning before they are safe for human use and consumption. Warehouses can be used to provide things like processing, packing, grading, etc. of goods until they reach the point of being safe for human use when they are sold. During this packing and grading process, interested buyers can inspect the goods while they are still in the warehouse.

1.4. Equipment and warehouse storage systems

Warehouses are a crucial part of the proper functioning of any business. They have secured spaces where you store your inventory before shipping it out to the end customers. It might come across as an unnecessary expense to many, and many small businesses might think of self-storage facilities. Still, outsourcing warehousing to a 3PL can save you money and boost the productivity of business.

A customer journey doesn't end when an order is placed. A warehouse gives you better control over your inventory and ensures that your customers receive on-time delivery of products, ultimately leading to higher profits. Warehouse storage is one of the most crucial parts of a warehouse that stores inventory safely and securely.

1.4.1. Storage Cabinet

Like in a household, storage cabinets are high-density steel storage containers that offer quick access to the inventory and are an easy and convenient way of storing goods. These storage cabinets are typically used to accommodate bulkier items. A single type of storage system will not be enough for a warehouse, as the supplies and equipment stored in different warehouses vary greatly. You would need to use different storage cabinets and storage systems to store various kinds of inventory effectively.

1.4.2. Pallet Racks

Pallet racking is one of the most common forms of warehouse racking systems. Pallet racks are storages designed to stack materials (SKUs) in horizontal rows with multiple levels. The pallet racking system's benefit is simple – why spend more money adding extra space in the warehouse when you can utilize the vertical space? These racks are topped with pallet, and forklifts allow for movement between the racking systems that add efficiency to warehouses.

There are different types of pallet racks that warehouses employ.

1.4.3. Selective Pallet Racking

It is the most common pallet racking system and comes in two configurations: roll-formed or clip-in configuration and a structural bolt-together configuration. Pallets rest on horizontal load beams held in place with mounting clips and can be moved quickly and easily adjusted to accommodate differing load sizes.

1.4.4. Push-Back Pallet Racks

These are used to maximize storage space at the cost of reducing aisle space. Push-back pallet racks are often used to maximize storage space at the expense of lowering aisle space. Each bay is displayed up to six pallets deep and stored on wheeled carts fitted onto rails. A forklift can set the pallet onto the cart, drive forward and bump into the next pallet, rolling the entire group backward to maximize storage space

1.4.5. Motorized Mobile Pallet Rack

This is another system designed to maximize storage space. These systems convert static access aisles into productive storage space and have helped companies eliminate new building costs by maximizing usable storage space.

1.4.6. Multi-tier Shelves

Multi-tier shelving is the construction of shelves or racks on more than one level. Multi-tier shelving provides storage space at multiple levels, thus maximizing the utilization of vertical space available in a warehouse, making it easier for businesses to store more of their inventory, thereby increasing the warehouse's capacity. This system is an excellent choice for large stocks of items that have small unit sizes.

Each level of the multi-tier storage can be accessed by staircases, main aisles, and cross aisles. Mostly, multi-tier racking concerns relatively lightweight items that are picked and organized manually. To get the most out of this warehouse storage system, organize each tier strategically and pack items as densely as possible while at the same time paying attention to weight limits and ceiling-to-rack height compliance guidelines.

1.4.7. Mezzanine Flooring

A warehouse mezzanine floor can yield a massive amount of extra storage space. Effectively, you're just constructing a second floor above existing aisles, which provides extra shelving space, working areas for staff to pick and pack or check and move stock on. Mezzanines don't always need to be restricted to a single level; they can provide two or even three extra levels.

Mezzanine flooring technology has advanced in recent years, with a whole variety of custom designs to offer. Because of these advances, virtually all mezzanine flooring is custom designed and fitted to integrate with most storage situations in almost every warehouse situation.

1.4.8. Static Shelves

As the name suggests, shelves are used to keep the goods and products static – they aren't movable and stay in one place. They are designed in a way that they can store lightweight inventories that have to be handpicked or placed. This type of storage is not compatible with forklifts and must be done by hand.

1.4.9. Mobile Shelves

It is similar to static shelving, but the only difference is that it can move and offers adjustable shelves. Such systems are designed to accommodate more goods in less space. Some of

them can also contain locking systems and level tracks. The level tracks can either be mechanized or manual.

1.4.10. Wire Partitions

Wire partitions are secure wire cages, and sections are an essential accessory for improving warehouse security. They are typically made of fence-like wire mesh materials, creating a durable and robust enclosure that makes it easy to designate high-security storage areas or sections within your facility. Wire partitions are also practical additions as they help you section off areas without investing in major renovations.

It is easy to restrict access to areas where you store sensitive or high-value materials or products with a wire partition. They are ideal for securing medical products, chemicals, and similar types of items that should not meet other products, thus eliminating the risk of contamination or damage.

1.5. Dock Equipment

Choosing the wrong dock equipment can put employees at risk. As the docking area is the junction of the receiving and shipping processes, its safety should always be your top priority. If you are looking to optimize your dock area workflow, you need quality warehouse loading equipment to transfer goods to and from the trucks. As truck designs keep changing and safety is becoming a huge issue, selecting the right dock equipment can make your process more efficient, customizable, safer, and less time-consuming for workers.

Examples include:

- Dock Boards and Plates
- Edge of Dock Levelers
- Truck Restraints
- Dock Seals and Shelters
- Dock Bumpers
- Yard Ramps

- Wheel Chocks

- Dock levelers & Dock Lifts

1.5.1. Conveyors

Conveyors are material handling machines that can move cargo from one location to another. Compared to manually moving materials, this can speed up or automate the process to save time and labor.

Additionally, because they involve minimal human intervention, they can reduce the risk of injuries and serve as safe warehouse equipment, in the same way, forklifts do. They can help improve the picking, packing, and dispatching times while also helping automate and streamline the dimensioning, weighing, and sorting process.

Lastly, conveyors can be expensive; however, the benefits mentioned above make them a worthwhile investment if used in the right processes and installed optimally.

Examples include:

- Gravity Roller Conveyor

- Belt Conveyor

- Plastic Belt Conveyors

- Flexible Conveyors

- Vertical Conveyors

- Spiral Conveyors

- Pneumatic Conveyors

- Chain Conveyor

- Dust Proof Conveyors

- Automotive Conveyors

1.6. Lifting Equipment

Lifting equipment refers to the different types of machines that help streamline transportation and storage of goods. Unstable lifting equipment can wobble, which can result in poor handling while lifting the goods. Moreover, it can damage the equipment/property, putting a halt on warehouse operations.

To help choose the right lifting equipment, you must consider factors such as the type of inventory (pallets or smaller units) and the shelves' height.

Costs often fall on the higher side while purchasing such equipment, but they have the functional advantage to prove. They can reduce manual operations, be used across different areas, are highly customizable, and easy to maintain.

Examples include:

- Forklifts

- Pallet Jacks

- Hand Trucks

- Service Carts

- Cranes, Hoists, and Monorails

- Dollies and Castors

1.7. Packing Equipment

Packing involves wrapping a product or designing a container to provide protection and easy handling. Hence, packing equipment plays a crucial role in shipping goods by assisting the staff in packing faster and increasing productivity.

The right packing equipment can reduce labor costs and provide consistency in the wrapping process. Moreover, packing equipment also improves inventory control by eliminating product separation, which saves time in inventory counts.

Examples include:

- Industrial Scales

- Strapping and Banding Equipment

- Stretch Wrap Machines

- Packing Tables

2. Research methodology

2.1. Introduction

In this chapter, I will analyze the methodology of this research. The research is conducted using two approaches:

a) Observation (as I am working in the examined company as Logistics Executive), and

b) Qualitative approach, through in-depth interviews with the member of the Logistics department of the company. Separate questionnaires were used to each member, depending on the position, role, and experience in the company.

2.2. Research info

During the qualitative research, the interviews were conducted with the executives and workers of the Logistics department. Each of them has different role and responsibilities. They also have different level of knowledge and usage of the ERP & WMS systems. The qualitative research provides an opportunity to analyze the progress of the department on procedures, effectiveness and cost reducing.

The questions are open type, they cannot be answered with a single yes or no. further details, descriptions and explanations are required.

The interviews of the qualitative research took place during the working hours of the company. They are structured, and the interviewees were asked a certain number of questions with a certain content.

2.3. Sampling procedure

Sampling is the process of choosing the group of people working in the company and the executives, who will be the representative sample. In the research, in person communication is used to approach the interviewees. Sample is a representative part of the total population

2.4. The purpose of the questionnaire

For the purposes of this dissertation, empirical research is used to collect data, in order to reach conclusions regarding the use and the usefulness of the ERP/WMS systems and the implementation of new procedures and operations.

The questionnaires are personal, different questions are asked to each member. With this approach, we can reach safer conclusions regarding the level of usage and usefulness of the Warehouse systems and procedures.

2.5. Questionnaire contents

For the purposes of the research interviews have been conducted with the Logistics Manager, the Warehouse Supervisor and the Logistics Executives responsible for Inbound and Outbound Logistics procedures of the company. The interview includes questions about the job description and the duties the person in responsible for, how long he or she is holding this place and any previous experience in Warehouses and Logistics departments. Next questions are related to the information systems of the company, the level of knowledge and usage, past and present experience

Next questions include factors effecting the choices made on different sections of the logistics operations, such as ERP/WMS system, racking system, equipment, waste and recycling management, external partner choice. The interviewees were asked about advantages and disadvantages of the systems and procedures applied in the daily routines and how the workflow improved and what are the parts that are obstacles that must be solved. Especially regarding ERP/WMS, members are asked about how familiar and easy is to work on these systems. How is their current experience and what would their suggestions be to improve easiness to work.

The members of the department were encouraged to provide their suggestions regarding the improvement of the basic functions of the department.

2.6. Interview conclusions

Studying the interviews' answers, there are some main conclusions. Warehouse need demanded the installation of racking systems for the storage of raw materials. Implementation and proper usage of the system required the deployment of WMS in the warehouse. Receipts, picking and delivery processes have improved significantly using new storage systems and the use of WMS.

It helped organizing the physical locations of warehouse, while inventory is properly stored. Inventory checks are important tasks in all warehouses, and preparation is easier with the reporting functions of ERP/WMS.

Information systems offer new ways of working providing operational speedup related to better organization of the warehouse and logistics. ERP and WMS come from the same company, which means that there was an easy deploy.

2.7. Analysis of the findings

The results of the two proposed approaches (Personal observation and Analysis of the responses) are presented in the next chapters. First, in the Chapter 3, the logistics system of the targeted company is presented and analysed. Then, in the Chapter 4 the responses of the logistics staff of the company is presented and discussed.

3. Case study of REAL TOBACCO S.A.

3.1. Profile of the company

Real Tobacco SA is a cigarette manufacturing company established in 2017. The two main shareholders are Openmark Bulgaria Ltd and Real Tobacco Trading FZE.

Openmark Bulgaria Ltd based in Sofia, Bulgaria. The company is established in 2010 with main scope of business design, marketing, brand creation, brand development, consulting and project management focused on the food, wine and tobacco industry.

Real Tobacco Trading FZE is a UAE based company registered with special purpose – ownership, shares holding and asset management covering mainly the activities related to Real Tobacco SA.

Implementing the latest state-of-the-art technology, Real Tobacco SA specializes in manufacturing high-quality cigarettes, packed in new and innovative 'Multilock' (hermetical & re-closable) packs. The new Multilock packing has proven to keep the cigarettes fresh even after opening the pack. Multilock packing also guarantees up to two times longer shelf life of the product. These advantages make our Multilock products more attractive to both smokers and distributors.

The company is comprised of highly experienced professionals with extensive background and deep expertise in all aspects of cigarette manufacturing, coming from some of the world-leading tobacco companies. By applying the best practices of the tobacco industry, Real Tobacco ensure the highest quality standards of our processes and our products. The

company's standards and policies are constantly improving to insure high quality and efficient operation.

Figure 1: Real Tobacco factory

Real Tobacco S.A.'s factory is located on the 26th km of the Old National Road Thessaloniki – Kilkis, near the village of Panteleimon, Kilkis. The factory belongs to the industrial area of Nea Santa.

The 30,000 sq. m building of the RT factory is situated on a lot of 100,000 sq. m in the heart of the tobacco growing region of Northern Greece, in the area of Kilkis. It is a mere 20 km from the port of Thessaloniki, with direct access to Old National Road "Kilkis – Thessaloniki" and the new highways connecting Thessaloniki with the ports of Piraeus (Athens) and Igoumenitsa, and with neighbouring countries Bulgaria, North Macedonia and Turkey.

The RT factory is the only one of its kind worldwide, capable of manufacturing several different formats of cigarettes, all in Multilock packs.
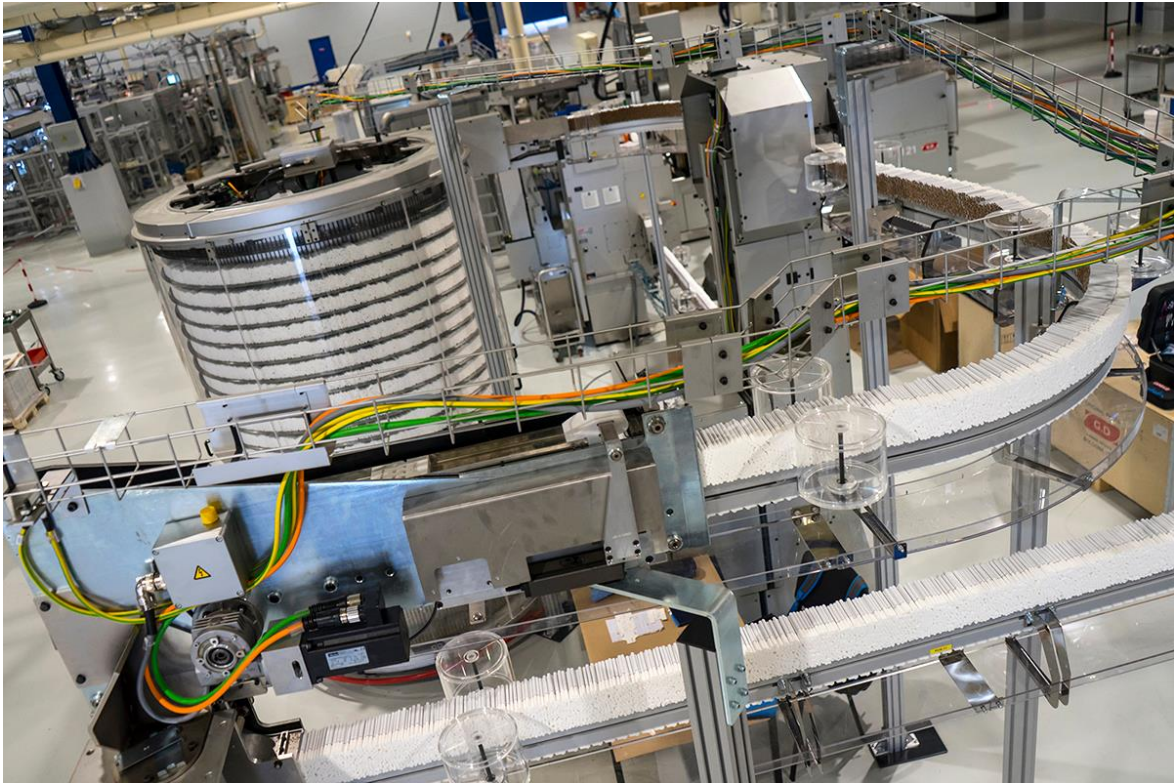
Figure 2: Production Line

Six brand new high-speed production lines, a modern infrastructure in combination with state-of-the-art technology and software solutions, allow a level of flexibility and efficiency, unachievable for many in the industry.

Figure 3: Cigarette packages in the production line

Fully-equipped quality assurance laboratory and specialized software systems, as well as our qualified personnel, guarantee the high quality of the finished products.

3.2. Location of RT

The factory is established in an old tobacco leaf processing industrial building of SOCOTAB, built in 2001, an investment of 20 million euros, to house the processing operations of Greek tobacco production. However, since 2005 when the agricultural policy of Greece, excluded state funding from tobacco agricultural production, greek production reduced to from 120 million kilos to 20 million kilos in 2005. This change affected SOCOTAB, a company employing 1000 people permanent and seasonal. In 2008, it was the last year of operations. The company folded regarding its leaf processing operations, while the production was moved to Skopje.

So, two main factors of choosing this location are the almost new building and the tradition of the area in tobacco industry. In addition, although the factory is in the administrative Prefecture of Kilkis, it is almost 35km away from Thessaloniki, and its port which is the main import and export point for Finished Goods and Raw Materials. The proximity with the industrial area of Sindos and Greece's northern borders make the company a close partner for suppliers. RT employees come not only from the area around the factory, but also from Thessaloniki. Therefore, bus service is available for all the employees living in Thessaloniki.

Choosing this location is an absolute commitment for the company. Moving is a difficult task, demanding time, and money to take place. RT has already invested in renovating the facilities and there is still a serious will in investing more in the facilities.

3.3. The industrial area of Nea Santa

RT is one of many factories located in the industrial area of Nea Santa. Some of them include KEBE (Keramourgia Voreiou Ellados, brick manufacturer), FAIDON (food industry, pastry), TORRE (dairy products, ice cream), ELVIAL (steel products), AYGODIATROFIKI (egg products), FIERATEX (textils) and JANNIS (pastry). Access to this area is possible with 2 ways. The first is through the Old National road Thessaloniki – Kilkis, a narrow rural route passing through many villages and agriculture areas. The other

is passing through a part of Egnatia Odos, to provincial road of Nea Santa – Drymos exiting through Nea Santa's interchange or through the village of Monolofos.

3.4. The design of RT facilities

RT's activities are housed in a 30.000 sq m main building and a smaller office building used for administrative purposes. The main building is separated in Manufacturing part, about 30% of usable space and the rest 70% is warehouse and corridors. The building is one floor across warehouse and manufacturing. However, related to the perimeter of the lot, Warehouse is higher that the ground, creating clearance for trucks to unload in hydraulic automatic ramps located in 8 places across the building.

Warehouse is split in 8 rooms (Labeled P1 – P4 & S1 – S4). In the middle, a T-shaped corridor (Labeled C1 & C2) connecting the warehouses and manufacturing. Each warehouse houses different items Finished good products, non-tobacco materials, Cut Rag (manufactured tobacco ready to be used in cigarettes), inactive materials, materials stored in Customs Warehouse, recycling and waste materials and pallets. Separation is decided for many reasons. Tax laws dictate where finished good and tobacco are located. In addition, active and inactive raw materials need to be in different areas for inventory and usable space reasons. Finally, tobacco and cigarettes are sensitive to insect infestation and extreme weather conditions, if tobacco is not monitored and considered free of pests, it cannot be stored with "clean" tobacco Lots. Each room is sealed and doors remain closed when there are no movement of materials for safety and quality reasons.

Each warehouse has its own automatic ramp for loading or unloading respectively. The bulk volume of receipts is by semi-truck vehicles. The ramps are suitable for Cab over trucks and container platform trucks, smaller trucks can also use the same ramps. For loading and unloading, the use of a forklift or pallet truck is required.

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Nikolaos Noulis, "An empirical study in warehousing. A case study in the tobacco industry."

Figure 4: Warehouse for Non Tobacco Materials

Figure 5: Pallet trucks used in warehouse

3.5. Organizational structure of RT and the Logistics department

RT has an organizational structure based on each department's duties and correlation with other departments. Logistics department is within the Supply chain of the company. The hierarchy of the department is defined like this: Warehouse team (warehouse workers and forklift drivers) refer to the Warehouse supervisor. Warehouse supervisor and Logistics executives refer to Logistics Manager.

3.6. Non tobacco materials – Warehouse racking system

Most raw materials used in the productions of cigarettes are shipped by the suppliers on pallets (Europallets or other dimensions) that can be stored or racks. A racking system is chosen to utilize the height of the warehouse, which is 15-20 meters tall.
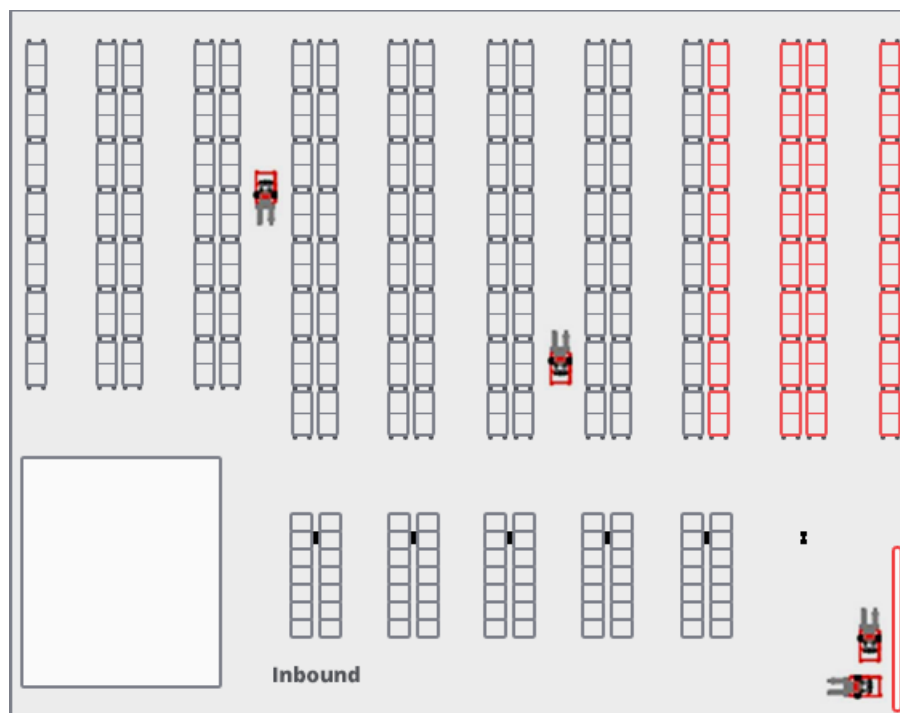
Figure 6: Racking system layout

For the needs of the company the simplest of all racking systems, selective racking permits only one-unit-deep pallet loads to be stored side-by-side. This makes all pallets accessible from the aisle. Storing and picking actions take place with the use of a reachtruck, a forklift

suitable for narrow spaces and racks almost 12 meters high. The system can currently store 2565 pallets of various weight and dimension.
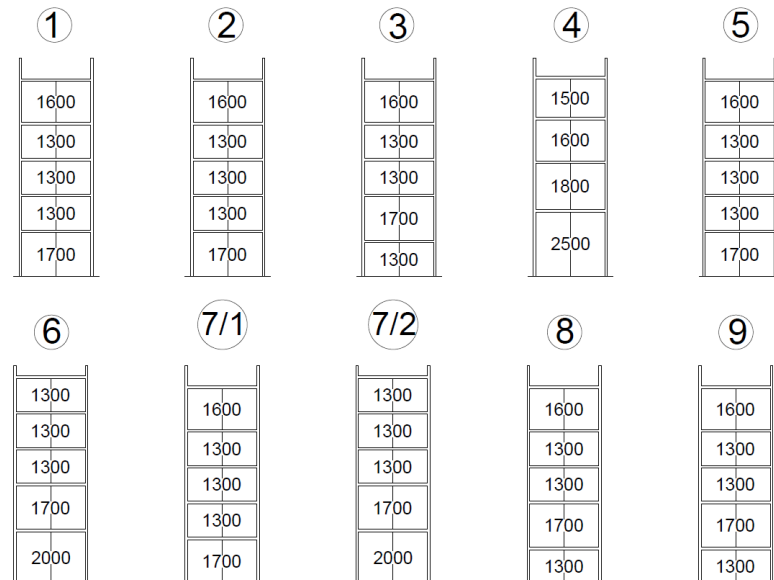
Figure 7: Rack height layout

The racking system has all the pallet locations assigned to the WMS system. Each location has a name created by the position of the rack in the warehouse. The position name would be e.g.

Figure 8: Rack position label

- First number (01) is the aisle. RT warehouse has 8 aisles.

- Second number (1) is whether the rack is on the left or right side of the aisle.

- Third number (01) is bay. Each bay can normally store 3 europallets side by side. In case the materials on the pallet are wider than the pallet, they are stored horizontally occupying two places.

- Fourth number (1) is the position within the bay. Each bay has a maximum of 3 places.

- Fifth number (0) is the level of the position in the racks. The racking system has 5 levels. Heavier pallets are stored on lower level, while highest are reserved for lighter pallets and materials that are not usually ordered by the manufacturing.

Figure 9: View of the Rack Corridor

Before the racking system was installed, materials on pallets where just stack one on top others. The result was anarchy and created daily difficulties in storing, picking and inventory checks, in addition to quality issues because materials used in high precision machinery, like those in cigarette making and packing are too sensitive and accurate. It is reported that since the installation of the racking system, production has increased the uptime of the production lines due to better storage of the materials.

Of course, there are still materials stored stacked. Filter rods are shipped in double stacked pallets, which are stretched, allowing warehouse to stored them off the racking system. The stacking method is a pyramid shaped tower with two levels, when two double pallets have one on top of them. All these pallets are assigned to a floor position.

Every pallet has its unique SSCC label code. This number contains all the data of the pallet so WMS locates the pallet in a position. Every physical move is followed by a WMS move.

Figure 10: SSCC label

3.7. Cut Rag – stacking storage

Tobacco industry uses the standardized C48 carton box to store and transfer tobacco in leaf form and Cut rag processed tobacco. These 110x67x72 cm boxes secured with straps contain a plastic bag filled with tobacco.

Quality process requires tobacco to be monitored for 5-8 days, depending on the season, temperature and humidity, special bug traps are used to track any bug infestation, and if tobacco at any stage, receipt, or storage, is considered infested, c48 boxes are sealed in special chambers for fumigation with the use of phosphine and the product is then pest free. This is a very critical procedure, because tobacco bugs may harm the final product, making it unsuitable to sell and customers will reject the brand.

Unloading, moving to and from fumigation chambers, storing and supply of the manufacturing is a warehouse duty. The tobacco boxes' handling needs the use of forklift with a special accessory attached called clamps. This accessory's surface is covered with a special, rubber like, material that increases the grip needed to hold boxes together and carry

them safely. These boxes are stored stacked due to their strength and size. The stacks are made in pyramid shape, 6 boxes on bottom and 3 on top.

In the final stage of handing, delivery, and receipt from manufacturing, c48 boxes, stacked on threes, are placed on pallets for easier handling by the manufacturing workers with the use of a pallet truck with clamps.
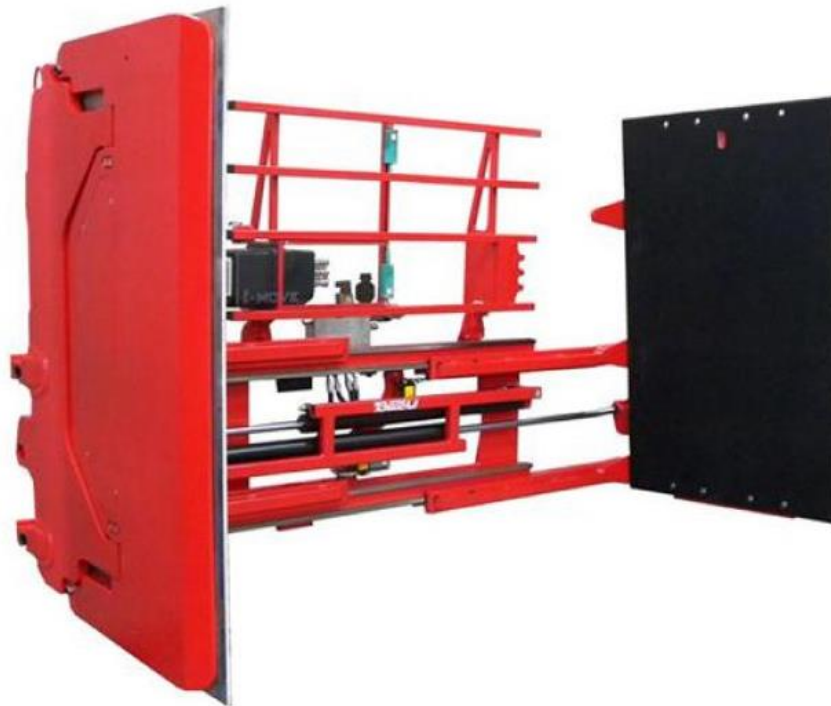
Figure 11: Clamps - Special attachment for forklifts

3.8. Finished Good products

Cigarettes are sold, transferred, and stored in units called Master cases. The Master cases are carton boxes containing a total of 500 packs of cigarettes. There is an intermediate packaging called Outer box, containing 10 packs of cigarettes each. So, 10 packs are an outer box, 50 outers fill a master case. The creation of master cases in automatic. The production line makes all the packaging procedure, while human hand take the finished master case a place it in a pallet. When a pallet in filled with the right number of master cases it is wrapped with stretch film, and the pallet is ready to be moved to warehouse.

Figure 12: Pallet SSCC for finished good products

Each master case has its own track & trace QR code which relates to an SSCC pallet code during the placement on the pallet. Warehouse is handling master cases only on pallets, transferring pallets from a finished goods buffer twice a day, using forklift with forks 160cm long, capable to lift and carry two pallets at once for more efficiency.

Figure 13: QR code sticker for track and tracing

There are two options for storing those pallets. If the product is to be exported within a week, pallets are moved directly to the designated loading spot, where they will be scanned by PDA scanners, will be invoiced, and stuffed to a container. The other option is for more long-term storage time on a Pallet Shuttle System installed in the Finished Goods warehouse. Shuttle racking enables high-density storage. Pallets are placed and taken from the same point. This system uses a semi-automatic shuttle which carries pallets deeper, creating a vertical 16 row X 4 level X 18 pallets total of 1.152 pallets for storing, securing a long-term way to use less space for more pallets.

Figure 14:Finished goods warehouse: Drive In system with shuttle

Figure 15: Shuttle of drive in racks

3.9. Recycling and waste materials

Warehouse is responsible for handling all the materials that can be recycled. Production creates different categories of waste that can be recycled. Plastic, brown carton, white and colored paper, and tobacco dust. C48 boxes and pallets are sorted and reused or sold. Sorting is partly a warehouse and production job.

There are currently 4 container presses for recycling. The recycling partner of the company provides the presses, brings empty presses to replace them. Production sorts the materials in different containers on pallets. Warehouse uses forklifts to bring the recycling materials to the presses and empty the boxes in the presses.

Figure 16: Press container used for recycling

Tobacco waste materials are handled and stored separately. Law requires Customs' officer presence during the destruction of waste materials. Quality assurance requires the materials to be stored in a different warehouse location to avoid infestation. Warehouse organizes and loads the trucks.

Finally, c48 boxes can be sold, there is a need for used c48 boxes from the tobacco leaf industry. The c48 is a two-part box, the inner and outer part. Warehouse sorts them and stores them on pallets by 50. Using forklifts, the pallets are stacked for better space usage. Pallets and wooden lids are the other useful material. Production needs pallets to move Finished Good, and also there is a pallet surplus for the raw materials receipt by the suppliers. Warehouse sorts them, supplies production with clean pallets and sells the rest to clients.

Figure 17: Pallets are sorted and stored for future use.

3.10. Inbound, Outbound and Warehouse operations

The Logistics department is responsible to take care of all the deliveries that are initiated by our suppliers. Tracking of the shipments is required to ensure the workflow of the warehouse according to a weekly schedule. Warehouse has enough inventory to provide materials for the production, although long delays in transportation may disrupt the supply chain. In addition, materials originated from non-EU countries require customs procedures, taxes & duties costs that must be paid, communication with the customs broker, transportation arrangements and tax books keeping.

3.10.1. Outbound logistics

The priority of RT's Logistics department is exports. Logistics organizes export procedures by arranging sales orders with the production one month prior. Products are transported by

sea, in 40' High cube containers. Bookings for containers are made through our forwarding partner at least 3 weeks prior. This is where the challenging part begins. Tobacco products are subject of excise tax.

Shipping companies and port authorities allow containers to be received between a certain time window. During this window, finished products must be ready, shipments are invoiced, trucks and empty containers are arranged a day before. The day of the export products are loaded in the containers, customs procedures and checks take place and trucks deliver the containers into the container terminal of Thessaloniki. An export is not complete until the ship departs. Related to exporting process, monitoring of the shipment is required until arrival to the destination and cost reporting.

3.10.1.1. Export procedure

There are standard steps for exports to take place. Sales orders are sent by the commercial department to Logistics. There is always cooperation with Planning, so products are ready before the export date. Updates are usual, because there are conjunction among sales, production and logistics issues and needs.

Logistics asks for bookings on container ships 3-4 weeks prior. Shipping companies and port rules demand precision on exports half on loading dates. Charges will occur if the exporter is not on time for delivery.

Sales orders are created in the ERP system. Production will reserve production with sales orders. Lot of production relates to orders too. Clients receive draft documents of upcoming exports for check and approval. In addition, information flow is very important, so logistics informs other departments in RT about exports and changes to days of loading, even time of loading.

Picking process from warehouse follows, the sales orders are sent to WMS for picking with PDA scanners, so invoicing will reserve only products with certain serial numbers. The forwarder sends information about the export (container number, truck, trailor, driver name etc), to be added to ERP for invoicing and document creation.

Documents have many recipients. Not only clients, but also tax and customs authorities, the shipping company and port authorities need information to proceed with the export on their

behalf. Some of the documents are invoice, packing list, delivery note, Certificate of Origin, Verified Gross Mass etc. Original hard copies are sent to the client via mail.

Warehouse oversees loading, so information is sent early enough for them to check if the container is the one ordered. Inspection of the container so it complies with Quality Assurance regulations about dirt, odor, holes, humidity etc, takes place before stuffing.

Export declaration is made once the container is loaded. Customs proceed to check and seal the container. The truck now can go to the port for dispatch. Products must be declared to taxbooks and Track & Trace partners. Then, there is the departure of the ship, so the Bill of Lading is received. The client then can claim ownership of the products.

Other duties regarding exports are costing of the export, creating market forecast and reporting.

3.10.2. Inbound Logistics

Inbound procedures include scheduling of the deliveries by the suppliers, calculation of the tax and duties cost of the materials imported, tracking of the trucks, and arranging transport for shipments that are not delivered at RT factory and keeping tax books for tobacco and finished good products.

Scheduling of deliveries is important for the smooth workflow of the warehouse regarding its daily duties and human resources management. Information flow is essential for all the departments of RT. Delays in deliveries may cause halting in production, and problems with the exports. Transport arrangements for imported shipments requires coordination among logistics, accounting, the forwarding partner, customs broker, and the customs authorities. Tobacco products are subjects of high taxation in the form of excises, customs authorities require daily declaration of the production, while officers can come for inventory check at any time. Tax books must be updated daily, and documentation for production, tobacco consumption and imports/exports must be available.

3.10.2.1. Import procedures

Import of raw materials has its challenge regarding the nature of the material, the country of origin and whether the materials are going to be stored in the bonded warehouse. It requires coordination among the departments of the supply chain. Inbound logistics oversees the information flow withing the company, external communication with the suppliers,

communication with the Customs broker to calculate taxes and duties to be paid and also Customs Bonded warehouse monitoring.

Scheduling and shipment monitoring is a great part of Inbound logistics work. The resources needed for incoming deliveries are not unlimited so suppliers must comply with logistics needs.

Finally, tax book keeping is also an inbound logistics job. Tobacco and cigarettes are required by law to be declared to official books and tax authorities daily. Correct information is essential and check daily and monthly during the month closure.

3.10.3. Warehouse

Warehouse has the personnel and equipment to handle, receive and supply materials from suppliers to the production, and load containers for exports. The team includes warehouse workers and forklift drivers. With the use of rider pallet trucks, electric forklifts and reach stacker, warehouse moves pallets with finished goods, raw materials for production, unload trucks and load pallets of cigarettes for exports. Handling by hand is kept to a minimum.

Figure 18: Forklift used in RT – Toyota Traigo 16

3.10.3.1. Warehouse procedures

Warehouse has daily duties that take place in a certain schedule to insure uninterrupted operation of the supply chain. Twice a day WH must receive Finished Goods from

production. The FGs are stored in pallets in the Finished Good Buffer. The designed warehouse for FG storing is S2. Transfer has the physical movement and ERP/WMS movement. Along with physical movement, the warehouse team scans each pallet to the new location. Tobacco supply is another process handed by warehouse. Warehouse decides the Lot to be supply on the principle of First Expire First Out. Tobacco must be in the controlled climate of the production before been used. Scanners are used for moving tobacco boxes.

Non-tobacco materials are necessary for production. Once per day, productions orders materials and warehouse delivers. Picking is also done by FEFO. WMS provides the location of the items to be picked. A reach truck is used to lift the materials from racks. Warehouse personnel delivers the materials on pallets, in a designated place for the production to have materials in all shifts.

Figure 19: Reach truck used in warehouse - TOYOTA BT reflex

Warehouse receives materials from suppliers. The receipt is prepared, unloaded, input in the ERP/WMS, label and take away the materials on racks for storing. The same happens for tobacco receipt. There is special equipment for handling C48 boxes. Tobacco must be fumigated before stored with the rest of the tobacco.

Postgraduate Dissertation for Supply Chain Management

Exports are an important task of warehouse. Cigarettes are stuffed by hand on containers for better efficiency and volume usage. Preparation take place for picking, before the day of loading, then warehouse ensures that the container is in perfect shape and the master cases with cigarettes are stuffed carefully.

Another warehouse duty is inventory check. Warehouse must be in perfect condition. Materials must be stored according to requirements. Personnel uses all necessary means so inventory is correct and available for check.

Finally, recycling is a daily task. Production has waste and recyclable materials that have to be removed from production as soon as possible. There are 4 container presses installed in the factory and a separate space for pallets and other sellable materials. Warehouse is responsible to keep the materials in low quantities. Therefore, selling materials and replacing container presses is essential.

4. Responses of the interviews

Our source of information was the 5 executives of the logistics department of RT allowing for an in-depth investigation of the research objectives. This chapter provides an exploration of the themes derived from the data using thematic analysis.

4.1. Demographic Information

The participants of this research are the 5 executives of the Logistics department. 60% of them work in the department less than 3 years. 80% had no prior experience in Logistics procedures before their current position. 40% belong to 25-39 age group, and the rest are between 40 – 55. Although the sample size is small, the participants are the most responsible to speak for logistics as they run all the daily routines.

4.2. Themes

Thematic analysis was carried out by highlighting and coding themes from individual interview transcripts, and by cross-referencing with other transcripts to establish the most common themes. Six themes have been identified to address the research objectives and are presented in Figure below. Interviewees' direct quotes are presented throughout the analysis to illustrate suggested themes.
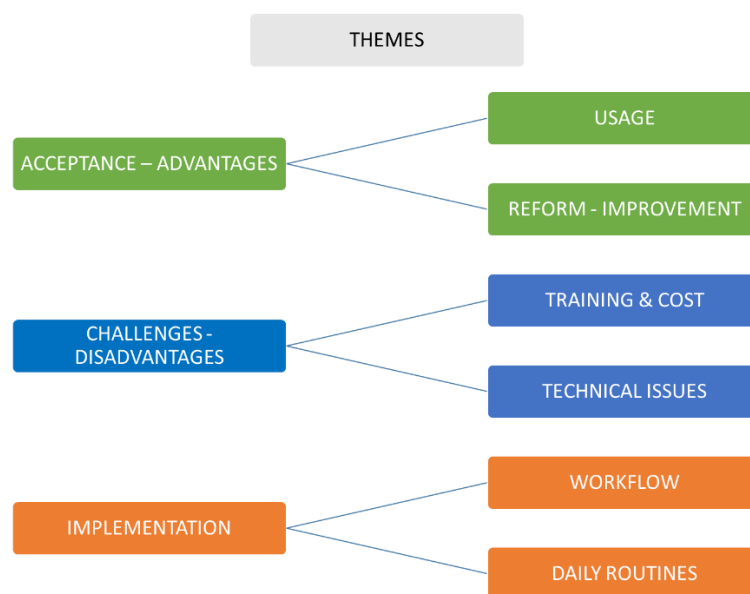

Figure 20. Thematic analysis map

4.3. Analysis of Themes

4.3.1. Theme 1 – Usage

It is a fact that the operations of the company are conducted through the ERP system. Warehouse is relayed on WMS for all the daily operations regarding inventory movement. 80% of the executives use the systems daily to perform processes like inventory movement and checks, invoicing and reporting of production and sales.

Accuracy and reduction of mistakes and discrepancies is essential. Automations comparing stock in both systems reduce mistakes to a minimum.

All the participants have different area of expertise in using the information system, but all of them relying on inventory check. The decisions are made based on inventory check. Exports, tax book keeping and warehouse organization are performed and scheduled by data taken from the ERP/WMS. KPIs are also derived from the systems.

The extensive use of WMS in warehouse allows better preparation of picking and put away processes.

All of the participants agree that the information systems are easy to use, although the user has to be already familiar with computers in general, and also the users must know basic terminology of these systems.

"The main control tool is comparing ERP and WMS inventory. We can see if there is any pallet move without the necessary inventory move."

"Our KPIs are analyzed monthly. The system provides us data about the production, exports, imports, stock availability, warehouse occupancy of racks. In addition, there are executive reports for the administration that come from ERP data."

"There is better preparation of picking and put away processes, we have much more protection from mistakes and we can apply Just-In-Time policy for our orders."

"it's easy even for a novice user. However, you need to know why are you using the functions and what is the theory behind an ERP system."

4.3.2. Theme 2 – Reform – Improvement

All the participants agree that importing functions and processes to ERP/WMS improved efficiency and there is a risk reduction. 60% emphasize the improvement of warehouse workflow, in combination with the installation of rack storing system, better organization and quicker and easier inventory check.

40% highlighted the fact that ERP creates printable documents needed for imports and exports. 80% mentioned the faster, accurate, and live depict of the production. All information is gathered in the information systems in a unified database. All the executives use different part of the systems on their daily duties, but they all agree on the fact that a unified database reduce mistakes and improves the consistency.

"Information systems improved workflow processes like approvals. We have better warehouse and inventory management; we have risk reduction and also the system allow us to operate the racking systems."

"What saved us a lot of time is the creation of printable Reports. Nowadays, all the necessary documents that have to be printed and presented to customs and tax authorities are computer generated. That process helped us also to reevaluate our procedures and update them to our current needs."

"All the data for inventory are stored in a database and not in excel files. We know where is every pallet and picking is easy and quick. Also, inventory check preparation is faster. Now, we can make part inventory checks by item or location."

"A big part of the job is implemented in the information system. However, reporting about delivery consistency is still done by hand."

4.3.3. Theme 3 – Training and cost

Regarding Training and cost of the ERP/WMS system, it is mentioned that there is a significant cost of buying and maintenance. IT department needs specific knowledge of Entersoft ERP/WMS to operate. There are also no manuals, so training cost is significant.

80% highlighted the fact that new user need enough training until they are considered reliable users. One of the participants said that "It is not easy for everyone" and good pc usage is required to proceed.

Regarding the use of WMS, it is considered easy to use and configurable especially the scanners. Backoffice WMS needs more training and supervising."

"We want to improve the reporting of WMS. There is a lot of data created using WMS that can be analysed and provide useful information."

"It has to be more responsive and faster."

"I haven't used an ERP or WMS before RT. It took my 2 weeks to operate fully on my own for daily activities and after a couple of months I can use it in depth even for new actions. But I think it is because I can follow ERP procedures and I am a good pc user."

4.3.4. Theme 4 – Technical Issues

The common view for all members of the logistics department is that there are more tools to be implemented in the ERP/WMS. Some delay is caused by slow support by the provider. 40% mentioned that some procedure must be simplified, because too many steps needed for some actions.

20% said that there are issues regarding exporting data to excel files. In addition, 60% would like more functions to be added like Bonded warehouse management and statistics in the form of KPIs.

"ERP & WMS have the capabilities to provide KPIs and we will soon prepare them and use them. For now, I gather data and analyze it myself. But it is definitely a matter of time spend on this issue."

"I am gathering statistics regarding the entire Logistics department. I would like to have data imported there so that the results are consistent and mistakes will be reduced."

4.3.5. Theme 5 – Workflow

80% of the participants said that ERP/WMS are easy to use, but during the years there were a lot of trainees who had difficulties in learning and using the system. 100% praised the fact that with the new storage system and the support of WMS, warehouse has become efficient and organized.

"I think it's easy to use. There is a need for basic guidance, but later on with some exploration in the parameters, I found some interesting ways to find information. "

"ERP is easy to use. Steps need to be taken for invoicing, for example, are certain clear. I was easy to show this procedure to coworkers."

"Yes, it is easy. Daily routine operations have improved by configuring aspects of the system. We have searched and found parameters that made our work faster and efficient."

"It is related to the knowledge and how familiar are the new users to it. I saw people to learn it in a couple of weeks and others, having many difficulties"

4.3.6. Theme 6 – Daily Routines

Daily routines had been a subject of reform and optimisation. 60% were positive to changes. However, all the participants recognised the positive effect of reform. Especially in warehouse, the new systems allow to reduce time needed in picking process. 60% mentioned the improvement of work condition related to recycling. The new way of handling recycling materials reduced tiredness and working hours needed. 100% said that the warehouse is in better condition than ever.

"We maximized our storing capacity and we increase our speed during picking and put away. And most importantly the quality of raw materials has increased and uptime of production has increased too."

"Last year, we closed a deal with a recycling company to provide us with 4 container presses for recycling. Production separates materials by type and warehouse handles disposal. Pallets and carton boxes that can be reused or sold are also handled by warehouse. All the above provide an important income source for the department."

"We made steps in managing our recycling and now we make profit of waste for us materials. Workflow for this operation is smoother. Warehouse has much more empty space and we look much cleaner and tidier."

5. Discussion

Interviews are basic method for qualitative case studies. In this case study, there is use of semi-structured interview, which is the intermediate form between a structured and a non-structured interview. The questionnaire of the interviews are questions of opinion and demographic questions.

In this dissertation, the main observation is that progress comes through reform of existing procedures and application of new technologies. This is a key factor to improve efficiency, reliability of the supply chain through the adoption of new technologies.

Information gathered by the interviews expose the difference between having information system like WMS or not on daily operations like order picking, receipts, inventory check etc.

Since the acquisition of the Entersoft WMS, that is combined with the existing ERP system, there are great benefits by the reform of warehouse operations. Quality of storage and time needed to find materials is improved. There is more efficient management of the available resources. The system was fully operational in 3 months and in that period, users had their training. The necessity of that system is significant, and it would be acquired regardless the cost.

The main advantage of WMS is the inventory management by pallets. ERP provides inventory as total quantity. WMS introduced the necessary to work concept of palletization. All warehouse movements are done on pallets. Materials must be stored in pallets with lids, covered with stretch film to ensure protection from dirt. Production receives only sealed pallets and opens them during manufacturing.

Another key point is the LOT batching, which groups pallets by receipt of production process. It allows warehouse to pick the material with the shortest due date and supply the same LOT until the depletion of it.

Of course, most of the WMS work is done on site using PDA scanners that pick and put away pallets from locations. Backoffice initiates the processes. Inventory check is also available by using scanners.

Entersoft's ERP/WMS system is described as friendly and easy to use for anyone who has basic knowledge of these systems. It is chosen based on its popularity on the market, making easier to find people who know how to operate it.

6. Conclusion

Logistics must follow the technological trends in order to provide added value to the Supply chain. A well-organized warehouse is the heart of this chain. Organization requires a warehouse storing system that capitalizes the available space of the warehouse. The design will provide the maximum capacity, according to the needs and the cost that the company is willing to spend. The same requirements occur regarding supporting equipment. Height and narrowness of the racks require different type of equipment. This affects the hard skill of the employees. Heavier duty machinery requires employees licensed to use such equipment.

As the members of the logistics department confirm, the warehouse has efficiency and flexibility. Control and reporting on stock are an easy task, so inventory is correct and available at known location. Taking care of the available space save time to simplify procedures and reform others. Receipts are easier because there is more available space as a buffer to process the receipt (labels, quality checks etc.) and put away later. Fast moving materials can be stored in nearer locations that slow moving items. In addition, there is better conservation of the quality elements of the raw materials received.

More space and time reduce mistakes. There is more time to perform tasks like outbound procedures. Clients require the right product in the required handling way. Bad storage conditions cannot provide the environment for good service.

Better organization leads to taking care of other duties better, like recycling. Managing these materials return income for the company. Otherwise, it is just waste and throwing them away may cost more.

Investment in logistics in general are always profitable. Products are always on the move. Materials must be stored. Warehouse keeps a large portion of the assets of the company at any time. And availability is essential for uninterrupted supply chain.

6.1. Themes

The interviews' purpose was for the interviewees to describe their opinion about the current status and the recent changes that took place in the warehouse and in the logistics department in general. The questions were structured based on 3 categories. Acceptance – advantages, Challenges – Disadvantages and Implementation.

Acceptance and advantages describe the positive aspects of new and updated procedures in general and the involvement of the information systems in the daily duties of the department. From Acceptance and advantages arise two themes. Usage and Reform – Improvement. Usage depicts how deep the ERP/WMS affect the daily routine of the executives. Reform – Improvement describes the positive evaluation of the reform and the positive feelings about them.

Challenges – Disadvantages describe the negative aspects of the reforms and procedures of the information system implementation. The two themes derived from this are Training & Cost and Technical Issues. These factors prevent improvements from full implementation and create obstacles in reforms.

Implementation depicts the level of execution of the reforms in logistics operations. The two themes are workflow and daily routines. These themes describe the changes occurred through change.

6.2. Limitations of the research

The research unfortunately had limited scope regarding the interviews. The small number of logistics members did not allow to gather more opinions and have a larger sample size. In addition, the limited time available and the company's workload did not give me the opportunity to extend the research regarding the relation of Logistics with the other departments and also external relationships with clients and suppliers.

6.3. Managerial implications & recommendations

During the observation and research, it is obvious that there have been a lot of reforms and improvements recently that improved workflow and reduced costs. Dealing with problems

is the first step towards progress. Equally important is also the fact that evaluation of existing processes keep the quality at high level and prevents future problems.

For this reason, I have come to two conclusions and recommendations regarding a future raise in production. A raise in production will lead to more materials importing and more stock to be held in the warehouse. Disruptions in supply chain is prohibitive, since the production lines work 24/7. This sequence of events will lead to the following problems.

A time-consuming operation is inventory check. Checks are regular and take place at least once per month. Warehouse is not operating for several hours, while the daily operations are spread among the other days of the week. The whole procedure uses both human resources and equipment until the completion of the procedure.

The proposition is related to the inventory checks and the WMS system. The WMS does not include an inventory check module. The purpose of this module is to reserve the inventory to be checked and distribute the job to working teams. Preparation for this process is also a time-wasting job. Backoffice work for preparation could be reduced if WMS can make reservations and printouts using automations.

Of course, this module will not be free. WMS is a commercial product and implementation, training, and support cost. The proposition is to examine the capabilities of this module, the cost needed and how this implementation will reduce the costs of inventory check and provide added value to the company.

The second time-consuming operation is recycling duties of the warehouse. At the moment, warehouse used large carton boxes that are filled with the recycling materials. Then, with the use of a forklift, they are emptied in the container presses outside the factory building. The time needed for this operation is related to the volume of materials gathered by the production during manufacturing process.

The proposal at an early stage is the acquisition of special bins that can be carried by the forklifts that can turn upside down with a mechanism similar to those of garbage trucks. The goal is the reduce of cost in working hours and labor.

At a further point, a plan for new installation of waste disposal, directly from the production without the intervention of the warehouse. The container presses must be closer to the

building, so that production workers to leave the recycling materials to special disposal points.

6.4. Recommendations for future research

As it is mentioned before, unfortunately this dissertation had limitations but there are two recommendations for future research. New projects target covering future needs and challenges that will lead to the growth of the company. Logistics and especially warehousing is affected by increasing volume of workload, therefore examining an automation solution is a viable field to investigate.

Now, warehouse uses a storage system that is manually loaded and unloaded using forklift and reach truck. Future research could investigate the implementation of an automated racking system. The benefits of such a project can be the increase of storing space, less human intervention, reduction of misuse and mistakes, reduction of working hours for personnel, Just-in-time, faster inventory checks. The challenges can be the cost, the risk of not been as profitable as expected, design and installation challenges. This is an interesting scenario that can be analysed in another research.

However, I would be useful for future research a comparative research with other companies of the tobacco industry regarding their warehousing strategy. Comparing with an older, established company will show how a larger and more experienced logistics department manages the warehouse, its challenges and if the new company is based on good foundations and has the potential of growth. High standards lead to greatness and significant added value.

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Appendix A: "Interviews"

Interview with the Logistics Manager

1. What is your position in the company, and what is your role?

2. How long do you work here?

3. How many employees does the company have? How many of them belong to the Supply chain and Logistics department?

4. What are the information systems the company uses?

5. These information systems cover the needs of both financial and supply chain departments?

6. What were the criteria of acquiring this ERP & WMS? Which factors affected the most? (Price, user friendliness, popularity, tech support etc).

7. In which degree do you consider the use of these systems improve the following: Organization, warehouse management, better control, procedure speedup, CRM, cost reduction, profitability

8. What are the disadvantages of using information systems? (Cost of acquisition, difficulties in usage, source demands, insufficient knowledge of the employees, insufficient support by the provider, incompatibility with other existing programs)

9. In what degree do you use the information system in reporting about evaluation and control?

10. Is the information system of the company able to handle current and future operational procedures and ideas?

11. Did you use the information system to reform basic operations of the department?

12. In what degree did the philosophy and operation of the warehouse changed with the use of WMS?

13. Does the warehouse use extended capabilities of WMS?

14. WMS was implemented quickly, on schedule?

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15. Is WMS a complicated system?

16. What improvements do you consider WMS needs?

17. What warehouse systems do you use and why?

18. What is the philosophy on choosing these systems?

19. What is the equipment of warehouse? Why did you choose them?

20. Are there any potential changes to the equipment?

21. Regarding the recycling duties of the warehouse, what were the actions taken and what is the current state of operations?

Interview with the Warehouse supervisor

1. What is your position in the company, and what is your role?

2. How long do you work here?

3. In which degree do you consider the use of these information systems improves the following: Organization, warehouse management, better control, procedure speedup, CRM, cost reduction, profitability

4. What are the disadvantages of using information systems? (Cost of acquisition, difficulties in usage, source demands, insufficient knowledge of the employees, insufficient support by the provider, incompatibility with other existing programs)

5. In what degree do you use the information system in reporting about evaluation and control?

6. Did you use the information system to reform basic operations of the department?

7. What is the warehouse's philosophy on picking?

8. In what degree did the philosophy and operation of the warehouse changed with the use of WMS?

9. Does the warehouse use extended capabilities of WMS?

10. WMS was implemented quickly, on schedule?

11. What improvements do you consider WMS needs?

12. There are a lot to be done that are already planned. We must see what are the new capabilities of WMS.

13. Does the equipment of warehouse cover the needs of the warehouse?

14. Are there any potential changes to the equipment?

15. Regarding the recycling duties of the warehouse, what were the actions taken and what is the current state of operations?

Interview with the Inbound Logistics Executive

1. What is your position in the company, and what is your role?

2. How long do you work here?

3. How does the information system affect your duties?

4. Do you consider ERP an easy to use and user-friendly system?

5. How deep into your workflow is the information system involved? How much of your work is made by "hand" or self-made tools?

6. Does it need advanced knowledge to use a system like this?

7. Has there been reforms and improvement in efficiency?

8. Is there any part of your duties that should be implemented in the ERP system?

9. Is tax book keeping easy and user friendly?

10. In what degree do you use the information system in reporting about evaluation and control?

Interview with the Outbound Logistics Executive

1. What is your position in the company, and what is your role?

2. How long do you work here?

3. How does the information system affect your duties?

4. Do you consider ERP an easy to use and user-friendly system?

5. Do you think that the information systems are capable of all outbound procedures?

6. Is invoicing easy?

7. Does it need advanced knowledge to use a system like this?

8. Where there any reforms and improvements that increased efficiency?

9. Is there any part of your duties that should be implemented in the ERP system?

10. In what degree do you use the information system in reporting about evaluation and control?

Interview with the Logistics Executive

1. What is your position in the company, and what is your role?

2. How long do you work here?

3. How does the information system affect your duties?

4. Do you consider ERP an easy to use and user-friendly system?

5. In what degree do you use the information system in reporting about evaluation and control?

6. Does the system provide analysis on data and KPIs?

7. Does it need advanced knowledge to use a system like this?

8. Has there been reforms and improvement in efficiency?

9. Is there any part of your duties that should be implemented in the ERP system?

Author's Statement:

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