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Restructuring picking and restocking processes on a hypermarket

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Abstract
The purpose of this paper is to identify challenges and opportunities for exploring Lean approaches in managing instore logistics processes of a hypermarket, wherein data collection made to quantify the state of the system, methods, and instruments will be applied to improve picking and restocking processes between the two main stock areas, the store and the warehouse. This article reports on a case study work, comprising direct observation, and analysis of the data collected, which was developed in three main phases: identification and characterization of problems, improvements in management of stock and restocking information, and finally improvements in the picking and restoking processes and teams. After analysing the hypermarket, some problems were found such as a high percentage of non-productive time in restocking, a daily average of 132 products to be restocked, a lack of standardization of tasks in the warehouse, and outdated restocking management system. Therefore, there will be some proposals to change the restocking management system, the picking and restocking work method and the warehouse layout, which makes it possible to decrease stock breaks in the store by 17%, the number of employees dedicated to these processes from 14 to 11, and finally, to reduce 2 daily hours of non-adding value time. This work makes an innovative contribution to fulfil a lack of publications dedicated to hypermarket inbound logistics between the warehouse and the store. Thus, it reveals the significant importance of focusing on instore logistics to the point of sale, concerning the efficiency, the lean production, and social benefits to the retail hypermarket, from the reception of products in the hypermarket warehouse until they are placed on the store shelves.

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1. Introduction

A good logistical planning is crucial for a business to stand out from competition. Higher levels of efficiency in processes and waste reduction will allow a company to offer a better level of service, improving areas that previously could not be done due to lack of resources availability and still keep workers motivated (Rehme and Abrahamsson, 2010).

The sustainability of industries depends on the performance of its supply chain and a balance between responsive and efficient warehouse operation. The concept of retail hypermarket is very recent, so the industry still has many challenges and there is still room for improvement. (Saleheenet al., 2014)

A logistical process will not be effective without an efficient flow of information, so it is essential to propose the interconnection of all functional information areas in order to have useful and updated information in real time.

Additionally, an activity that has been considered to be the most costly and most labour intensive is order picking, which is the act of retrieving items from the warehouse (Berg and Zijm, 1999). Studies estimate that its cost is about 55% of the total warehouse operating expense. Consequently, if the order picking system is not performing as it should be, then the

whole supply chain will have higher costs (Koster et al., 2007). So, it was concluded by analysing the order picking that creating a better system should be one of the main priorities.

Moreover, during the research phase, it was noticed a lack of papers focusing on applying the concept of lean principles in warehouses of hypermarket chains (Bashir et al., 2020). So, it is hoped that this article can contribute to a wider knowledge of this business area, specifically bringing more attention to the link between warehouse inventory and stock in store, and what it entails. Another hardship faced was the variety and number of products, which were tackled using a micro approach like Scarpin & Steiner (2011), who focused their approach on a specific product section.

The main purpose of this case study is to apply Lean principles in managing instore logistics of a hypermarket, to improve picking and restocking processes between the two main stock areas, the store and the warehouse. Thus, considering the lack of articles identified, this work will contribute both for researchers and practitioners interested in hypermarket internal logistics.

Throughout the article, firstly it will be presented the data collected from observations and measurements at the hypermarket, where certain problems were identified regarding restocking and picking system. Then solutions for each one of these areas will be proposed, alongside the results that should be expected. Lastly, there are conclusions regarding the study for this article.

2. Literature review

Logistics involves all operations necessary for the delivery of any product (or service) to the customer, except those directly associated with the conception of the product. The logistics is responsible for the management of material flows between the different production areas (commonly called internal logistics), manages the flow of information inherent to the flow of materials, such as operations exchange, forecasting, production planning, and others.

Supply chain is defined as a system which includes people, activities, information and resources related and intrinsic to the product or service, with the goal of creating a product and delivering it to your customer. Terms like speed, quality, cost and flexibility are indispensable when dealing with this theme (Antunes et al., 2013). As a matter of fact, Lean principles have been increasingly used in the field of logistics operations to reduce wastes, delivery times and increase value to the customer (Bashir et al., 2020; Shakoor et al., 2017; Abhishek and Pratap, 2020; Shah and Khanzode, 2018). According to Liker (2004), every organization business can benefit from lean, not necessarily by using the tools that Toyota used in a specific manufacturing process but also by developing principles that meet the organisations or business's needs and by practicing them, to achieve high performance that adds value to customers and society. There are many elements in a hypermarket that can have a significant impact on consumer's buying behaviour and create a considerable demand for other products, such as different product views and allocation of shelf space. There are few empirical research studies about the effect of proximity of goods within shelves layout on changing their sales. Knowing what groups of goods can be brought together to improve or decrease their sales, can help in the proper ordering of the goods to improve their sales (Shakeri and Hesari, 2020).

However, a literature review revealed that there has been an increase in lean warehousing attention in recent years. Despite that, the range of related contributions is still limited, particularly in the food industry warehouses which is characterized by the short life cycle of the perishable and non-perishable items. In warehouses, employing "lean" is one method that can be implemented to maintain a short turnaround time for the goods while increasing the usage of the warehouse resources (Bashir et al., 2020; Martins et al., 2018).

According to the research by Amorim-Lopes, Guimarães, Alves and Almada-Lobo (2021) the activities of retrieving the necessary items, i.e., order picking, are those that require the most labour hours in a warehouse, including the movement of operators, searching for items and the time to pick up the item. Chen et al. (2015) estimate that picking activities can reach 60% to 70% of a warehouse's operating costs. The terms picking and warehouse are considered a related problem and therefore it is very difficult to try to improve one and not the other. For example, even if the warehouse has an optimal order picking policy, if the layout design is imperfect, it can compromise order picking performance, and vice versa. Beyond these factors, it can be considered that there is not an optimal and unique solution that relates these two subjects (Guimarães, 2020).

As a sum up, lean warehousing deserves more attention, so there is a need for more studies to further validate the applicability of lean principles from a production environment to the context of warehousing. Continuous improvement is a systematic, organized and planned process of continuous change of existing practices in an organization to improve its performance. As so, the continuous improvement process in combining lean principles (Kroesb et al., 2018) with warehousing logistics (Jie and Gengatharen, 2019) should not be assumed to be finite but as something that has to be constantly updated.

3. Experimental

A case study implies a description analysis of an empirical problem within a real-life context, using practical methods to solve it and analyse its results (Saleheen et al., 2014). The current research was conducted as a case study of internal logistics of a hypermarket, which has two main stock areas, the store and the warehouse. The case study was developed in three main phases, identification and characterization of problems, improvements in management of stock and restocking information, and finally improvements in the picking and restoking processes and teams. The case study was developed in three main phases: (1) reconnaissance; (2) identification of problems and diagnosis; (3) proposals of improvement. The first phase started with a presentation of the company and main productive areas, followed by two weeks of meetings and observation *in situ*. After that phase, for the following 5

weeks, through meetings, observations and documental analysis, the research team characterized the process and identified the main performance problems. After that, with the support of the company, the research team developed a prototype of solution to those problems to be delivered at the end of week 13.

The store has a total area of 4000 m2 and is divided into several product sections: savoury and canned goods, sweet grocery, alcoholic drinks, non-alcoholic drinks, house supplies, stationery, pet, and parapharmacy, hygiene and perfumery. In practice, these sections are grouped together to make a total of 7 sections. Other areas such as butcher, bakery, and fresh and frozen areas are not relevant to the study, due to their peculiarity they end up being managed autonomously in relation to the previously mentioned sections.

The warehouse has an area of 1164 m2 and is divided into two zones, a transit area where they receive the orders, and a storage area where the various products are in stock. In total the warehouse is composed of 13 aisles that can be seen in Figure 1.

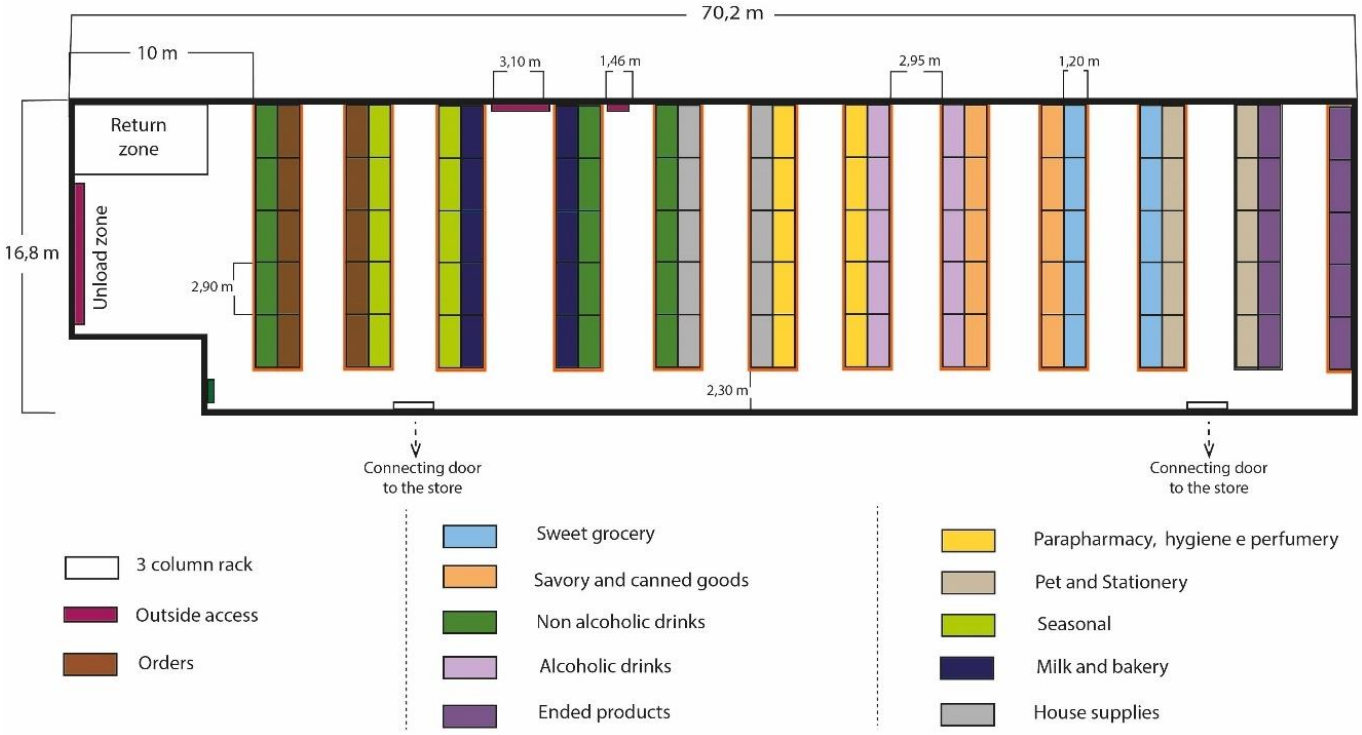

Fig. 1. Current warehouse layout

Also, there are no criteria in the use of the connecting doors to the store and in the allocation of the sections according to the proximity to the corresponding area in the store. There are 115 racks (5 racks per 23 shelves) and some of them are unused, and others are not used properly.

When it comes to storage units, this hypermarket uses boxes and pallets. As picking materials, storage and transportation they have registration cards, forklifts, stackers, ladders and pallet trucks.

Orders are received by 1 or 2 workers from Monday to Saturday between 5 am and 2 pm. Restocking and picking tasks are done from 5 am to 1 pm from Monday to Sunday, with around 10 workers. There are also 4 workers who do the afternoon shift from 1 pm to 9 pm.

Each one of the 10 workers are allocated to one of the 7 sections of the store, being responsible for ensuring, during the morning, the registration of the missing products on the store's shelves in the first 2 hours of the shift, picking these products and restock them in store. During the afternoon, workers sort out incoming pallets and store the transit area.

Finally, in what comes to inventory management, there is none and this hypermarket only works with a total inventory and not with a store's inventory and warehouse's inventory. Also, there is no restocking list, so workers have to spend 2 of the 8 hours of their shifts in search of the missing products in the store that must be restocked.

4. Results and discussion

In this section, it will be demonstrated the proposed solutions to the problems found. These are based on an improvement in the efficiency of the picking task and so the consequent restocking management system. It will also be presented a new and improved warehouse's layout.

4.1. Identification and Characterization of Problems

After performing different measurements for three days, the daily average of the number of products out of stock and to be restocked observed in the section in study was calculated. It

was noticed that, on average, per day, 78 products were out of stock and 132 products were to be restocked.

It was also concluded that the products that had run out of stock were the same during several of the days of measurements. A total of 85 items were out of stock for 2 or more days.

Regarding the data collected in the restocking of the store, a daily average of 9 pallet transports from the warehouse to the store and a restocking of 127 products were observed.

It was also observed a high percentage of not useful time in the restocking because of time spent unpacking boxes, looking for the current place of each product and, mostly, because the employees spend 2 hours at the beginning of their shift taking notes of the missing products. Of the 449.2 min of restocking per day, an average of 328.8 min corresponds to ineffective time (73%) and 120 min to effective time.

In relation to the analysis of the picking results, the picking time per day varies considerably in the range of approximately 2 to 5 hours, due to the fact that there are some days that the picker has orders to pack in addition to the pallet preparation.

We can also conclude that the average non-productive time per day (0.69 h) is very little considering the total working hours and also that the forklift has the highest utilization rate per day (20.15%) compared to the pallet truck (2.54%).

After the analysis of the data collected in the previous phase and the problems detected, it was possible to draw up a table with the main problems found, their causes and effects (Table 1).

Table 1. Problems, effects and causes

Problems	Effects	Causes
High percentage of non-productive time in replacement	No restocked products	Wasting time writing down shop absences Poor information flow
High number of products to be restocked and out of stock products	Lost sales Low service level	Lack of stock Lack of available time for restocking Poor information flow
Ineffective internal flow information	Over stock or products out of stock	Workers don't have access to the information system
Outdated information system	Excess or lack of stock Restocking and picking ineffectiveness	Software limitations Lack of applied efforts to improve the system

4.2. Improvements to support restocking management system

After analysing the main problems, it becomes logical that it is necessary to work on the information flow between employees in order to have constantly updated information and improve the restock management system. The proposed solution starts with the distinction between the two different types of inventories in the hypermarket, following the calculations of inventory and consequent restocking alerts and finally the creation of restocking lists.

4.2.1. The distinction between inventory in the store and inventory in the warehouse

The first major proposed solution to improve the restock management system is the distinction between inventory in the store and inventory in the warehouse. In this hypermarket, as it was said before, it is common to call inventory to inventory in the store together with inventory in the warehouse. This can lead to inventory control errors in the ordering process and in products out of inventory in the store. This will be useful for the automatic calculation of the quantities to be restocked.

For the operationalization of this distinction, it is necessary to count both inventories at the beginning of the implementation of the solution. Furthermore, it will be necessary to do inventory counts on regular periods of time. Inventory documentation will enable the management in keeping updated information about the stock in their warehouse and in the store, which will easily let them know when to make a new order or not and the products that must be restocked.

4.2.2. Calculation of inventory in the store and inventory in the warehouse

The inventory in the store is calculated by sales numbers and quantity restocked, which is updated constantly whenever an item leaves the store. Thus, the store's inventory, at a given moment, is given by the equation (1)

$$\text{store\_inventory} = \text{store\_inventory}_{i-1} - \text{sales} + \text{quantity\_restocked} \quad (1)$$

The inventory in the warehouse is, in turn, calculated by orders' numbers and also from the item quantities restocked, which is also constantly updated whenever an item enters the warehouse. Thus, the inventory in the warehouse is given by the equation (2).

$$\textit{inventory in the warehouse} = \textit{inventory in warehouse}_{i-1} + \textit{quantity ordered} - \textit{quantity restocked} \quad (2)$$

At an early stage, it will be necessary to do an inventory of all products in the warehouse and in the store, gradually, section by section. Only after that it is possible to perform the calculations correctly.

4.2.3. Calculation of inventory that fits on store shelves and shelves' fronts

The following equation (3) was used to calculate the maximum number of products that fits and must exist on the shelf.

$$Si = \frac{qi\ x\ S}{Qi} \quad (3)$$

This expression will determine the space for product i (Si), in square centimetres, through the number of units sold of product (i) in a given period (qi), the total category space (S) in square centimetres and the number of units sold in the total category in the same period (Qi) (Ramos, 2014).

For the application of this calculation, it is necessary to divide the products under study by categories. It is understood that a category is a distinct group of products within a family of products that consumers consider as related and/or replaceable, in the satisfaction of a need.

There is no optimal method for the allocation of products on the shelves, however, through this space Si, the size that each article occupies, and the arrangement chosen on the shelf (for example through ABC analysis) it is possible to find the number of products that should be on the shelf of the hypermarket as well as the number of fronts of the shelf.

4.2.4. Restocking alerts and quantity to restock

Regarding restocking alerts, it is required to define a restocking level for each product. The restocking level is given by the average weekly sales. Comparing the inventory in the store with the restocking level, the restocking alert is given and updates to "Urgent" or "Very Urgent", depending on the quantity in the store: urgent alert, when the quantity in store reaches the store restocking level; very urgent alert, when the quantity in store reaches 50% of the restocking level in the store.

In what comes to the quantity to restock, the calculation will be applied when there is an urgent or very urgent restocking alert. The existing quantity on the shelves becomes known from the subtraction of the products' sales and the existing inventory in the store of each product as it can be seen by the equation (4). Consequently, through the maximum inventory that fits on the shelf and the existing quantity, it is possible to know how many units of each product need to be restocked as it can be seen by the equation (5).

$$Existing\ quantity = Shelves' inventory - sales \quad (4)$$

$$Quantity\ to\ restock = Maximum\ inventory\ fitting\ the\ shelf - existing\ quantity \quad (5)$$

4.2.5. Creation of restocking lists

In addition to the proposed solution explained above and making sure that this solution is taken into consideration, another major proposed solution is the creation of automatic restocking lists.

The restocking lists must be done by seeking information from a database. This database must have information about all the internal management of the hypermarket. It must have an orders' parameter which represents all the products ordered, that contains the orders' status by comparing the expected date of arrival with the date of the day. Also, it must have a sales' parameter with all products' sales. All of this information, together with inventory from the store, inventory from the warehouse and inventory from shelves, the restocking alerts already explained, and the product section must be represented in the list.

Then, restocking lists will be generated automatically when the worker needs, grouping all the relevant information taking into account definitions such as the identity of the product (name, EAN and family), the quantity to be restocked, the restocking alert of each product ("Very Urgent" or "Urgent"), the number of the section of the warehouse where the product is allocated (it is assigned a specific number from 1 to 8 for each section) and a forecast of the number of "Very Urgent" pallets used for the distribution of picker tasks. This list must be organized in a pre-established order, beginning with the products with "Very Urgent" alert and then the products with "Urgent" alert. Within the urgent alerts, the list must also be ordered by a stipulated order of sections that takes into account the warehouse's layout.

Picking and restocking teams and warehouse layout

The current picking and replacement method have some disadvantages: the lack of normalization, because each employee ended up adopting a specific working method for his section; high movement in the warehouse, because, with this method, there could be, at the same time, 10 people doing picking at the warehouse; a high number of stock breaks in the store at the time of opening, because in most cases, in the first 2:30h of shift no product was replaced (annotation and picking). This way a new method will be proposed for the work organization that seeks to eliminate these problems.

4.2.6. Defining working teams

To overcome the problems mentioned above, it was decided to implement a method of working as teams. The hypermarket would then have 3 teams: a picking team, with a shift from 5:00 am to 1:00 pm, a restocking team, from 6:00 am to 2:00 pm and an unpicking team (besides unpicking, they do also other tasks) that would work from 1 pm to 9 pm. Unpicking is the term used to describe the process of sorting out the packages arrived in the transit zone and putting the products in their respective section of the warehouse.

4.2.7. Calculation of the number of pallets required per day

After collecting data in the section of savoury and canned goods we concluded that the 10 employees that work in the morning shift on average, per day, can do the picking and replacing of 45 pallets. Furthermore, we concluded that in the section of savoury and canned goods, there were high amounts of out-of-stock products in the store and a lot of products to be restocked. In conversation with the company, it was possible to verify that such situations occur, beyond the lack of time, due to several external causes, such as, delays in the hypermarket central, issues related to promotional brochures and delayed orders from local suppliers.

So, all out of stock products and products in need of restock seen during the 3 days of the data collection, were removed if they were out of stock or not restocked for 2 days and for 3 days. It was assumed that if those patterns do not repeat, it was because the product existed in stock and was not restocked due to lack of time on that particular day. Thus, it is concluded that, on average, per day, in the savoury and canned goods section, 29 products are not restocked due to lack of time, which is equivalent to approximately 2 pallets. Assuming this

scenario applies to the 7 sections of the supermarket where employees are divided currently, on average, it is needed to restock 14 more pallets per day, which leads to a total of 56 pallets needed per day to restock the entire hypermarket.

4.2.8. Calculation of the number of workers

Currently, the hypermarket only restocks products in the store in the morning shift, which despite being simpler, reveals other disadvantages such as greater likelihood of creating out of stock products throughout the day which results in lost sales. Thus, it is proposed to do the picking and restocking 3 times per day: at 5 am, at 1 pm and at 5 pm.

Since it was assumed that it is needed 59 pallets per day to restock the whole hypermarket, on average, per hour, it sells an amount of products equivalent to 4.9 pallets. So 3 restocking scenarios were created: Scenario A, which assumes that at 1 pm 30% of morning sales are restocked (the equivalent of 6 pallets), at 5 pm 1 pallet, and in the morning shift 52 pallets; scenario B in which it is assumed that at 1 pm 50% of morning sales (equivalent to 10 pallets) are restocked, at 5 pm 1 pallet, and in the morning shift 48 pallets; scenario C in which it is assumed that at 1 pm 70% of morning sales are restocked (equivalent to 14 pallets), at 5 pm 1 pallet, and in the morning shift 44 pallets.

In the data collection we found out that on average the picking of a pallet lasts about 27 minutes and the restocking in store of a pallet lasts about 36 minutes. Using shifts of 8 hours for each team and assuming that per day the unpicking team works 30 pallets, value given by the company, we calculated the number of needed workers for each team, presented in the following table (**Błąd! Nie można odnaleźć źródła odwołania.**). In all scenarios the number of employees for the picking team remains 3, and for the restocking 4, the difference being for the unpicking team where in scenario A it needs 3 employees, and the other scenarios need 4.

Table 2. Number of employees for each restocking scenario

Scenarios	A	B	C
No Workers Picking Team (5 am-1 pm)	3	3	3
Extra Time (min)	10	45	81
No Workers Restocking Team (6 am - 2 pm)	4	4	4
Extra Time (min)	0	36	72
No Workers Unpicking Team and Others (1 pm - 9 pm)	3	4	4
Extra Time (min)	60	101	38
Total No of Workers	10	11	11

Scenario B is considered to be the one that would have a higher performance in practice since it does not overload the picking and restocking teams because they have the extra time needed to take a break or perform some urgent tasks. In addition, the afternoon team has plenty of extra time which is useful for performing other important tasks such as keeping the warehouse and store tidy, lowering pallets to be able to perform lower-level picking, and putting labels on products, among others. In this way, so that the work of the teams flows in the best way, it is considered that during the afternoon about 11 pallets must be restocked.

4.2.9. New layout proposal

The new warehouse proposal has 3 aisles and 5 shelves, (Fig. 2). There will be fewer racks of 3 columns, however, there will be 2 column racks and 1 column rack, to a better reuse of space. This change will essentially benefit the picking workers, it will be easier for them to follow the picking list without having to enter and leave each aisle constantly. The picking list will be in the same order of the layout of the racks, following them along this route and thus reducing the number of movements (Sousa, 2009). The aisle's width will be the same, 2.95 m, otherwise it is not possible for the forklift to access the upper levels. However, it will be possible to move from one aisle to the other on both sides of the warehouse.

There will be a temporary storage area for incoming orders, which will be close to the unloading zone to avoid more transports and to be of easier access. There will also be an area for seasonal products.

To the allocation of sections, the warehouse will be divided into 2 parts according to the condition of proximity of the doors connecting to the store with the area where the sections are in store (Sousa, 2009). Sections 1,3,5,7 and 8 will get out through door 1 and sections 2, 4, 6 through door 2.

Then, the allocation within each part it is based on the rotation calculation, ratio between the cost of products sold and the number of current products. Thus, the sections with higher rotation are closer to the connecting door to which they are associated. There will be only one exception, the water family, that will be allocated on the shelves facing the door for reasons of greater ease of movement of load due to volume and weight.

The 4.90 m wide aisle is due to the need to create an area to temporarily leave the pallets that are ready. This part of the warehouse will help the restock team from having to circulate through the warehouse, again reducing the movement, the time and the confusion in the warehouse. In this area, in the middle, on the red line, will be the pallets referring to the products of "Very Urgent", on the yellow lines will be the pallets of the other products according to the part to which they belong in the warehouse. At the beginning of each section there will be a box with cards of identification of the section, so that when the worker performs the picking activity in that section, place one on the pallet truck. This will facilitate the restocking process. Due to lack of data, we were unable to estimate the exact number of racks needed for each section, so it was considered that each section needs a maximum of 10 racks, as it is already what happens today even though they are not full.

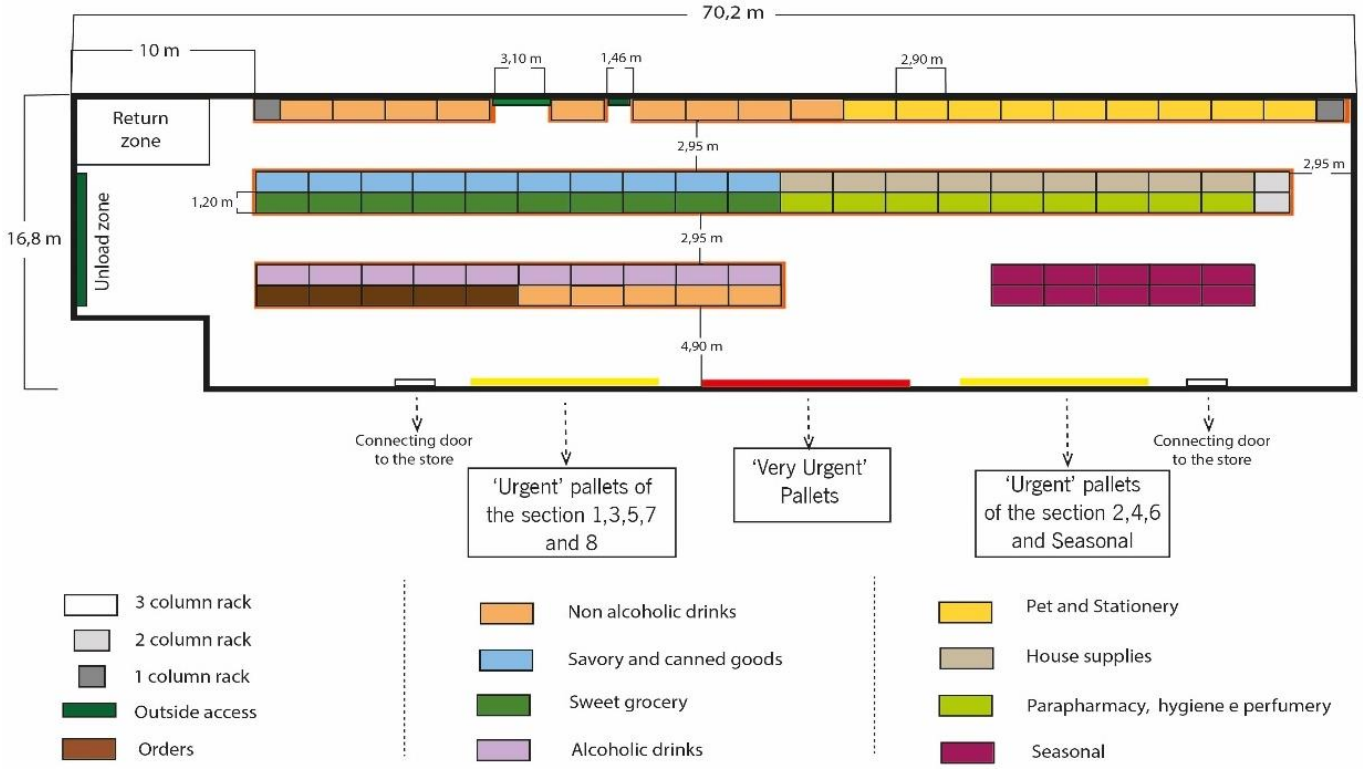

Fig. 2. New warehouse layout

4.2.10. Operation of the teams

The picking team starts its shift at 5 am with the visualization of the picking list in mobile phones. In the list there will be a forecast of the number of pallets of "Very Urgent" products. If such a forecast is equal to or less than 6 pallets, 1 worker starts picking these products, if higher, this job must be done by 2 workers. In this way it is guaranteed that such products that are about to go out of stock are restocked until 9 am, hypermarket opening time. In the first situation, each one of the 2 remaining pickers starts the picking from each of the two warehouse zones. As they do the picking, they must place the Kanban that identifies the section or sections of the warehouse in which they picked products in the pallet truck, always placing the most recent Kanban ahead of the already existing ones. When a pallet is finished, the worker must transport it to the respective lifting zone taking into account whether it is "Very Urgent", Zone 1 of the warehouse or Zone 2 of the warehouse.

The picking list should not be updated until the process is complete. Whenever they pick an article, they have to "check" the respective article in the list presented in the mobile phone. It will then be possible to see which articles were or not restocked, so that it is possible to update the values of the stock in the warehouse and in store.

The restocking team starts its workday at 6 am so that there is a guarantee that there are already pallets available. The team must go to the warehouse to pick the pallets ready to restock the store. They must give priority to pallets in the "Very Urgent" area and only when there are no pallets in that area, they should take the others. Through existing Kanbans on the pallet truck, the worker will know which section of the hypermarket to move to, thus avoiding waste of time observing the pallet and understanding which products it contains. Then they go to the store to restock the products and repeat the process until there are no pallets available.

The afternoon shift team should be divided, with the suggestion that 2 start the picking process and restock at 1pm, in which they will have to generate a new picking list and see which items need to be restocked, giving priority to the "Very Urgent". The same will happen at 5 pm. The other 2 employees must start the process of unpicking the pallets in the transit zone. In addition, if they have extra time, the team must ensure that the entire warehouse and store are organised and perform other necessary tasks such as labelling products, a task often needed for products which are not translated, lowering pallets to perform picking without using the forklift, and others. This team must guarantee that all the conditions are met so that the work of the morning shift teams of the next day flows without problems.

Discussion

All the proposed changes will allow positive results to the daily life of the company. The new picking and restocking process will allow to restock the products out of stock due to the lack of time. It was concluded that it will be possible to reduce the out-of-stock products in the store by 17%, which translates to an additional 91 products available per day, on average, throughout the hypermarket. If each of these products costs 1 euro and is sold at least once a day for 1 year, the hypermarket would increase its annual revenues by 33 215 euros.

For the same reason, the products in need of restocking in the store would decrease by 28%.

The initial 2 hours currently spent writing down the products in need of restocking were transformed, 25% of the shift work of such employees, in useful time to carry out picking and restocking, with the creation of automatic picking lists. This way, non-productive time will reduce significantly.

As for its current team, the company can reduce from 14 employees to 11, which will lead to savings of 26,670 euros per year. On the other hand, such employees may be allocated to other tasks in need of development.

Finally, assuming that an employee has to collect a product from each section, according to the current layout, the distance to go is 363.21 m while, in the new change proposal, the distance is 264.3 m, a very significant difference. This distance decrease can be translated into less non-working time in the picking process.

5. Summary and conclusion

In this study, problems were identified in each section of the warehouse regarding poor information flow, disorganization, and a non-efficient working method as being the main roots of wastes of time and products out of stock.

After an intense phase of data collection and application of tools learned in courses, all waste and inefficiencies in the working method adopted by the hypermarket were specified, being this the starting point of the project.

The resources available in the company were rationalised, and solutions were found that are based on and supported by the improvement of the information system by providing updated and real time data to all employees, restructuring of the warehouse layout and weighted product allocation, and the reorganisation of the teams of workers as well as the standardisation of their activities and working method. In summary, there were positive results, not only in monetary terms, but also in terms of the performance of operations, reducing waste related to time and distance.

This work has the common limitations of a case study, which does not present generalized solutions. Nevertheless, it presents a context common in hypermarkets and a set of approaches that may be further explored and adapted to different contexts. As future work, this process created an opportunity and a starting point for the digitalization of the internal logistics of the company.

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重组大型超市的拣货和进货流程

關鍵詞
精益服务
大卖场
采摘
补货
仓库管理

摘要
本文的目的是确定探索管理大卖场店内物流流程的精益方法的挑战和机遇，其中用于量化系统、方法和工具状态的数据收集将用于改进拣货和补货两个主要库存区域（商店和仓库）之间的流程。本文报告了一个案例研究工作，包括对收集到的数据的直接观察和分析，该工作分为三个主要阶段：问题的识别和特征描述、库存和再库存信息管理的改进以及最后的改进在拣货和恢复流程和团队中。通过对大卖场的分析，发现补货非生产时间比例高、日均补货132件、仓库任务不规范、补货管理制度落后等问题。因此，将有一些建议改变补货管理系统、拣货和补货工作方法以及仓库布局，这使得可以减少 17% 的商店断货，以及专门从事这些流程的员工人数从 14 点到 11 点，最终减少每天 2 小时的非增值时间。这项工作做出了创新贡献，以弥补专门针对仓库和商店之间的大卖场入站物流的出版物的缺乏。因此，它揭示了关注店内物流到销售点的重要意义，涉及零售大卖场的效率、精益生产和社会效益，从大卖场仓库中的产品接收到将其放入商店货架。