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Resumo In an increasingly competitive and consumerist market, consumer demand for an increasingly varied range of products requires companies to adapt their logistical processes. These oscillations generate pressure and contribute to the complexity of the supply chain in the retail market, where companies face the challenge of positioning themselves at the vanguard of logistics efficiency. The project was developed in the warehouse of a multi-brand company that operates in the clothing retail market. T...

Reorganization of a warehouse in a multi-brand clothing retail company

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Abstract. In an increasingly competitive and consumerist market, consumer demand for an increasingly varied range of products requires companies to adapt their logistical processes. These oscillations generate pressure and contribute to the complexity of the supply chain in the retail market, where companies face the challenge of positioning themselves at the vanguard of logistics efficiency. The project was developed in the warehouse of a multi-brand company that operates in the clothing retail market. This warehouse satisfies the orders of about 50 stores, and it has identified intervention needs in terms of the layout and the picking process. Improvements included reorganizing the warehouse layout, eliminating wasteful time and space, and making the process faster and more efficient. To reduce times in the picking process, the printing of the merchandise transfer code was streamlined, the use of trolleys was implemented in the picking activity, and the picking route was updated. The treatment of the objectives was carried out with the help of Sketchup 3D and quality management tools, namely the spaghetti diagram, ABC analysis, and the registration and treatment of problems. The reorganized layout resulted in gains in

space and time, namely, annual gains of €2,700 with the reduced use of the area. The reorganization of product storage and the implementation of trolleys made the picking process faster and more efficient, reducing waste in the activity by €3,200. With the standardization of the use of personal protective equipment, the guarantee of the protection of the physical integrity of all the elements inside the warehouse and the preservation of the stored goods was achieved. There was a faster and more effective handling of problems in the warehouse, which made it possible to eliminate frequent errors.

Keywords: Warehouse management; Layout; Logistics; Picking.

1. Introduction

In an increasingly competitive and consumerist market, consumer demand for an increasingly varied range of products requires companies to adapt their logistical processes constantly and systematically. These oscillations generate pressure and contribute to the complexity of the supply chain in the retail market, where companies face the challenge of positioning themselves at the vanguard of logistics efficiency.

With the increasingly competitive market, there is a greater demand for continuous improvement in the design and warehouse operations of production-distribution networks which, in turn, requires greater warehouse performance [1].

The project was developed in the warehouse of a multi-brand company that operates in the clothing retail market. This warehouse satisfies the orders of about 50 stores, and it has identified intervention needs in terms of the layout and the picking process. Thus, the objective of this project was to reduce waste related to the underused area and collection times during the picking activity.

The article presents a literature review in section 2 that supported the project. The identification of intervention needs in the warehouse is described in section 3. Section 4 presents the improvement proposals applied throughout the project and in section 5 the results are evaluated. Finally, section 6 analyses the general conclusions of the project.

2. Literature Review

Warehouses represent one of the most important elements of the supply chain: they play a key role in stabilizing periods of great variability so that the level of service is not compromised, in consolidating all goods for later shipping to the customer, and, depending on the warehouse, in adding value to the product through personalization [1, 2].

The company's success is due, in large part, to the efficient management of the warehouse, since the operations that take place there are critical to providing high levels of customer service [3]. One of the challenges for the warehouse is to achieve short lead times to respond to customer needs. For this to happen, there needs to be increased efficiency in the various warehouse processes, so that the response is immediate, there is precision in the tasks, and there are no defects.

Concerns about the environment generate new pressure for companies to incorporate more sustainable practices into their operations [4].

Warehouse operations are triggered in different phases, the first being the arrival of goods and the last being the output of products. Whenever the goods arrive at the warehouse, three activities are triggered: reception, checking, and storage. Picking activity starts whenever a customer order is posted. It is the process that represents the most weight in the warehouse, both in terms of labour and cost, since around 55% of the operational costs of a warehouse correspond to this activity [5, 6]. It is also one of the activities that has the most weight in optimizing delivery times, quality and, consequently, customer satisfaction [7, 8].

The search for excellence has been growing in companies, either through the application of concepts or principles inspired by Toyota. The lean philosophy is governed by the following principles, [9]:

- Identify value – what the market interprets as value in the products marketed by the company;
- Identify the value chain – identify all processes involved in the production of the product, even those that do not add value, such as waste, which must be removed or minimized;
- Create continuous flow – prevent products from being idle for longer than the time allocated for value-added operations on them;
- Implement customer-pulled production – an operation/process should only be performed when a downstream operation/process triggers;
- Constantly looking for perfection – eliminating waste due to movements without added value, permanently considering the safety of employees, and exposing employees' capabilities by entrusting them with greater responsibility and authority.

The clothing retail sector has gone through many changes over the last few decades. The causes of these changes range from the volatility of consumer preferences, technologies, economic pressures, competition, stakeholder relationships, environmental concerns to government regulations. Many of the changes were sustained by the ad-

vances in information technologies that allowed the creation of new business models, new strategies, and new forms of communication, allowing them to shape the behavior of the supply chain stakeholders [10, 11].

3. Methodology

To quantify the waste of space in the warehouse, using AutoCad, the square meters of lost areas (with obsolete material or empty space) were calculated. The spaghetti diagram quality tool was used to identify waste in movements during the picking activity.

To quantify the time wasted in picking activities per employee per order, time measurements were collected using a stopwatch over a period of 3 weeks.

4. Picking System Description

The project was developed in the warehouse of a company that sells multi-brand retail clothing. The warehouse is organized between two floors, the ground floor accommodates reception activities, merchandise handling, storage, and dispatch. The first floor accommodates part of the storage of items for picking.

Intervention needs were detected in terms of layout organization and in terms of reducing times in picking activities.

In terms of the organization of the layout, a lack of signs identifying the different areas was detected, which resulted in exchanges of merchandise leading to losses and errors. The free movement of employees and goods transport equipment was not guaranteed due to the lack of area delimitation.

The area intended for temporary storage was not used at heights, and in times of high workflow, the space was insufficient to accommodate all the goods to be treated. As a way of measuring the waste with unused area, the monthly rent value of the warehouse was considered, around €1 600 for a total area of 1 161 m2. The cost of the warehouse per square meter was calculated, obtaining 1,38 €/month. Considering that the wasted area in height was equivalent to around 398 m2, a cost of wasted area of around 549 € per month was obtained, totaling 6 593 € per year.

Additionally, there was no standardized use of personal protective equipment (PPE) inside the warehouse, contributing to the danger of injuries resulting from falling boxes.

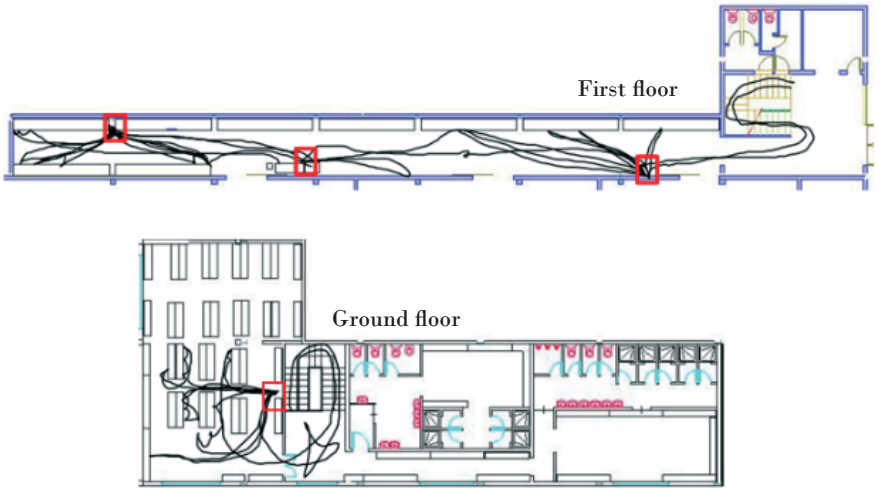

Figure 1. Picking spaghetti diagram in two floors.

Regarding the picking process, the disorganization of the picking route in the computer system was identified as a need for intervention. This configuration triggered repeated and excessive movements during picking, mainly in large orders. On the other hand, as the PDA did not allow filtering or ordering items by floor, in the same order, there is more than one trip to the first floor. At the same time, the items were randomly located in an alveoli, and there was no use of carts to support the collection of items. All these configurations were portrayed through the spaghetti diagram developed during a picking order. Through the spaghetti diagram represented in Figure 1, it was possible to identify the most heavily loaded lines and the support points (marked in red) with excessive displacements, caused by the non-use of support equipment for the collection of items and by the random allocation of them to alveoli.

As a way of determining the losses associated with travel time during the picking activity, measurements of activity time and orders with an average of 60 items were carried out, totaling 1.80 hours: 24 minutes were spent traveling, approximately 1 hour was dedicated to looking for items, and 21 minutes were spent finalizing each order. These times were translated into monetary value, knowing that the cost per hour with the employee was €7.62, and the expense per year in time wasted in the picking activity for two employees was €7,221.93 per year.

In the final stage of the picking activity, the goods transfer code had to be manually pasted, requiring the use of adhesive tape and the requirement for cutting. This activity resulted in a high amount of time that the employee dedicated to adapting the transfer code and a waste of paper because part of the document was expendable.

During the time measurements of the picking activity, it was detected that the non-conformities identified in the computer system, such as bugs, were not registered. When the employee encountered failures, these were communicated by telephone call, and there was no follow-up on the implemented measures or evaluation of their effectiveness. During the three weeks of measuring time in the picking activity, the bug that resulted in the duplication of units of a certain piece picked up happened at least once a week, with the employee communicating whenever he detected this bug. It was found that there was a waste with the lack of a communication channel for occurrences and suggestions by employees.

5. Improvement proposals

In this section, we will present the improvement actions that were implemented throughout the project.

The most impactful improvement proposal, which was the last to be implemented, was the restructuring of the entire warehouse layout. Using the Sketchup 3D tool, the warehouse layout was redesigned, and all suggestions were applied.

Figure 2 represents images of the room that was used for office supplies and obsolete material that was no longer used by the warehouse. The improvement implemented involved adapting the room to the pickers' workstation and to the warehouse dispatch activity, as it is connected to the outside, and, in this way, it was guaranteed that the input and output flows did not cross (Figure 3).

Figure 2. Room 1 before improvements.

Figure 3. Room 1 after improvements.

Room 2, shown in Figure 4, which was intended for consumable materials such as cardboard boxes, was adapted to accommodate items that were located on the first floor to satisfy picking needs (Figure 5). In this way, it was possible to concentrate all picking activity on the ground floor, contributing to the reduction of travel times during the activity.

Figure 4. Room 2 before improvements.

Figure 5. Room 2 after improvements.

Figure 7 represents the temporary storage area. In this area, twenty more shelves (in height) were installed to accommodate pallets, the circulation aisles were delimited, and the workstation for handling merchandise was repositioned in the central area.

Figure 6. Storage zone before improvements.

Figure 7. Storage zone after improvements.

During activities in the warehouse, it was detected that PPE was not regularly used. Thus, the standardization of its use was proposed, defining a sequence of activities: 1. Evaluate the need to implement the use of PPE; 2. Select the appropriate PPE; 3. Notify users of the need to use PPE; 4. Internally standardize the use of PPE; 5. Replace and distribute new PPE; 6. Supervise the correct use of PPE by employees.

The picker's travel time depends on the distance to be covered to pick up the items. With the redefinition of the picking route, the aim was to reduce the number of trips to the same areas during picking and improve picking activity time. Since the IT department manages the platform that manages picking orders, the proposal for the problem of excessive picking time was to carry out an update of that picking platform so that the respective routes were ordered sequentially by location, avoiding repetition of zones (floors, corridors, alveoli, etc.).

It was proposed to implement equipment for transporting goods, more precisely, picking carts, that would allow the employee to pick up all the items he needs without

having to move to the support points while picking up the entire order.

Seeking to eliminate waste related to movement and, consequently, time, an ABC analysis of invoicing by brand indicated that the intent was to store next to the pickers' workstation the families of items classified in the class A category since they represent a greater weight in the company's annual turnover and are the most requested in orders, assuming that the monetary magnitudes of the clothing items of the company are around the same average values.

In the final phase of the picking process, after collecting all the items in the order, to eliminate waste of time and paper and as an opportunity for improvement, the possibility of the transfer code being printed on labels was identified, reducing wasted time to cut the document and paste it in the respective box.

To record and account for faults associated with picking, a form was proposed where occurrences and suggestions for improvement would be recorded. Through this form, the analysis of these occurrences would be carried out using the PowerBI tool, where the intention was to create a registration dashboard with performance indicators to monitor the most reported types of occurrences and their frequency. In Figure 8, it is possible to verify that nearly 30% of the occurrences registered on an example day are due to an informatics bug, 24% to a configuration error, and others.

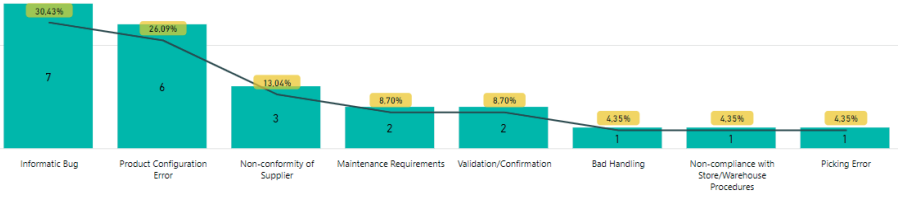

Figure 8. Example of an occurrences registration.

6. Results and Conclusions

As results, it was possible to delimit areas, create circulation corridors, reduce travel time by 60%, reuse rooms 1 and 2, and, with the increase in shelves and reorganization of the temporary storage area, reduce the value calculated in the reuse of space by around 50%, totaling an annual reduction of €2 700.

The standardization of PPE allowed the normalization of compliance with safety standards in the warehouse by all the company's employees. The guarantee of the protection of the physical integrity of all the elements inside the warehouse and the preservation of the stored goods was achieved through the safety indications in the use of the forklift.

In the picking activity, with the improvements implemented, it is possible to verify, on the new spaghetti diagram represented in Figure 9, that there is a more fluid circuit without repetitions of displacement or stops at the support points to temporarily place items while finishing the collection of the missing items to complete the order. order. The organization of the collection route and the proximity to the pickers' workstations of the most profitable products for the company resulted in greater efficiency during the picking activity.

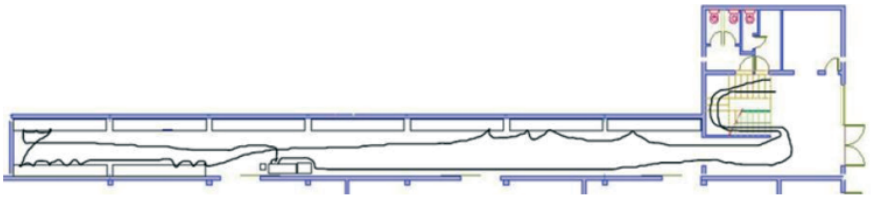

Figure 9. Spaghetti diagram after the improvements.

After a new measurement of the picking activity times, there was an efficiency and productivity gain of around 40%, which translates into a cost reduction for the company of around €3 200. At the beginning of the project, waste in the picking activity totaled around €7 200 and, after implementing the improvements, the value reduced to near €4 000.

Travel time was reduced by 60% after implementing the use of a support cart. The time spent looking for the product was reduced by 40% with the updating of the picking route and the restructuring of the organization of brands in the cells.

With the acquisition of a label printer, it went from 21 minutes and 30 seconds to 15 minutes and 16 seconds to complete the order, which corresponds to a gain of around 30% in working time.

With the implementation of the occurrence report, it was possible to measure the number of problems in each period, their recurrence, the department that reported them, and the person responsible for the occurrence, that is, who should take action and contribute to the resolution of the problem. In this way, it was possible to mitigate the number of occurrences of the same nature, such as computer bugs, which, until the implementation of the occurrence report, occurred between two and three times a week.

A project that has been implemented in a company is not exempt from limitations. Thus, it should be noted that the implementation phase of the improvements in the layout coincided with the time of greater workflow in the warehouse, and, as a consequence, the employees were not available on the scheduled date, having taken longer than expected. Another limitation of the project were the measurements taken during

the picking activity, which were done in person using a stopwatch because there were no tools to monitor picking times.

Concluding, improvements included reorganizing the warehouse layout, eliminating wasteful time and space, and making the process faster and more efficient.

With the restructuring of the layout, there are gains in terms of visual management, fluidity in the flow of materials, gains in storage capacity, reduction of wasted time and movements, and reduction of waste in poorly used areas.

For future work, it is proposed that a study be carried out to assess gains with the implementation of picking by line. The fact that there is a high turnover of certain items can add value to the application of this proposal. It is also proposed that an analysis be made of the implementation of an RFID system for more efficient entry and exit of goods in the warehouse and transfers between stores. The fact that some brands with which the company works already have RFID tags inside the items is already a step towards this implementation.

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