Technologies Involved in the Material Storage Processes

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Technological advancements in storage logistics have been gaining strength and bringing benefits to companies. We highlight the automation of operations and the optimization of storing materials' process. However, it is still perceived nowadays that several companies need to use these technological benefits, providing a direct reduction in their organizational competitiveness. This work aims to analyze the impacts of technology's absence in companies' processes of storing materials. We used bibliographical research to visualize the reason for the non-investments in technologies in the storage processes. The results revealed that companies that make technological investments in the storage of materials obtain a significant cost reduction and productivity improvement, eliminating work's repetitions, improving the internal processes, and turning the operations into a continuous flow model. Therefore, it is crucial to invest in technologies to obtain these results.
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Introduction

Modern logistics demand that all activities within a company be done at the right time and the right moment with the lowest cost. So, logistics can be defined as managing finances, people, materials, and information flow to satisfy the customers' desires.

Within the scope of logistics, the storage area has unique importance because it is responsible for receiving, storing, and dispatching various products, raw materials, and inputs, among others, to meet the needs of internal and external customers. Therefore, more administration in the storage process is needed to avoid a mismatch of information, customer dissatisfaction, excess or lack of products, and a failure to control warehouse inputs and outputs.

There are several technologies and/or technological tools to mitigate problems in the storage area, such as Warehouse Management System (Warehouse Management System); Radio Frequency Identification (RFID); Picking by Light; Picking by Voice; among others. Based on the above, the problem of the present work is: how does the lack of investment in technologies affect the processes of storing materials? In this sense, the general objective is to analyze the impacts of the lack of technology in the storage processes of materials. Moreover, the specific objectives are: to define storage logistics and its activities, list the principal technologies involved in the processes of storage of materials, and demonstrate the impacts of the absence of technologies in the storage of materials

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Storage Logistics

Storage is the management of products received, stored, moved, and shipped from a location, whether raw materials or finished or semi-finished products. As it is an important area in logistics processes, it is necessary to have efficient and qualified management in this space, good organization, correct addressing, product labeling, and a place to move the materials and equipment used for storage.

For efficient storage logistics, it is necessary to have good planning and control in performing operations, which products will be stored and managed, who the customer is, and which operation

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will be used at the time of shipment of the materials. The main advantage of a storage structure is to generate better use of space. According to Paolheschi [1], it is necessary to have minimum rates of breakdowns, ease of movement of products, and good inventory evaluations, providing cost reduction and improving its efficiency when serving its customers. The disadvantage is the financial value applied in this structure and expenses with administrative processes.

The main advantage of a storage structure is to generate better use of space. According to Silva, the objective of the warehouse is to reduce handling and the time spent on handling because this activity adds cost to operations but does not add value to the customer. The ways to move products in a warehouse vary from someone manually loading an item to computerized equipment that separates the item and places them on automated conveyor belts.

In addition, warehouse operations also use forklifts, pallet trucks, and conveyor belts, among other equipment used to transport products. The choice of handling equipment should be determined according to the following variables: route to be traveled, frequency of movement, the internal environment of the warehouse, and the direction of flow [2].

So, storage is a meeting of receipt of goods to store and ship finished or semi-finished products, organization of space, and administration of this so that there are no losses or customer dissatisfaction. Moreover, an advantage is the better use of space, and a disadvantage is the high investment to acquire these structures.

Thus, storage is also the conditioning of finished and/or unfinished materials, which follow steps such as receiving, checking, storing, and picking, among others, making it meet the demand and satisfy the final customer. In this sense, in the storage area, there are routine activities so that the materials are stored and shipped correctly; these are: receiving goods, in which the operator checks the documentation, the quantity, and the quality for later the goods to be stored using the appropriate handling equipment and the structure as well. As orders are placed for the area, the picking activity is initiated. It consists in checking the list of materials, separating them according to characteristics and destinations, and then packaging, generating the documentation, and placing them in the shipping area. The expedition is responsible for ensuring that the products are sent to their respective destinations at the right time and in the correct quantity.

Thus, storage is a place to store goods and the separation sequence of these items. There are steps such as receiving, checking, storing, retrieving, separating, packing, and shipping to ensure the minimum possible error.

Main Technologies applied in the Process of Storing Logistics

Managing stock is always a challenge. An organization with a large mix of products will need help with receiving, checking, storing, warehousing, retrieving, separating, shipping, and turnover of these items. Using information technology in these processes is a great option to reduce failures. A warehouse management system can guarantee the quality and speed of information, optimizing storage logistics. Warehouse Management Systems (WMS) are the primary tool used in logistics activities. A company with large flows of incoming and outgoing products must use this vital management tool.

The WMS is a warehouse and/or DC management system that optimizes all operational activities (material flow) and administrative (information flow) within the warehousing process, including activities such as receiving, inspection, addressing, storage, separation, packaging, loading, shipping, issuing of documents and inventory control [3]. Some of the main advantages of implementing the WMS tool are:

- Greater control of storage and inventory information;
- Reliability of information;
- Productivity control;

- Control of tasks performed by employees;
- Inspection and quality control;
- Inventory control;
- Resource planning and allocation.

Implementing a system of this complexity also has its disadvantages, among them are:

- Specialized labor;
- High investment in equipment;
- Integration with other systems;
- Long implementation period;
- Resistance from employees.

Besides the WMS, another software widely used in logistics operations is RFID. RFID technology is based on labels that work as chips, carrying product information. This data is captured by antennas that work as a reader. With the deployment of this information technology, the company gains more productivity of its employees, time and money savings, elimination of errors, more accuracy in the control of logistics processes, and security from claims and losses by customers, suppliers, and employees.

The RFID tool was developed to obtain better efficiency in tracking and locating products and physical assets, assisting inventory management, and also helping to increase productivity, thus making companies more competitive. To improve picking and reduce picking time, Picking by Light and Picking by Voice technology avoids paper lists and drastically reduces picking errors. Furthermore, companies need to decide which technologies suit their business and, from there, find the best way to use them to achieve competitive advantage.

Impacts of the Absence of Technology in the Storage of Materials

The constant race for the excellence of services that please the final consumer has impacted companies and organizations in the logistics sectors that seek to automate daily. Modernizing is essential for the company to seek to please its customers.

According to a survey conducted by Totvs disclosed by CIMM [4], it reveals that Brazilian industries still need to invest more in technology to support their logistics management. The industries appear among the shippers. It occurs with 84% of 740 companies heard between national and multinational, with revenues above or equal to R$5 million. However, the vast majority of industries have departments to take care of transportation management (97%) and storage (94%). However, in the same research, these sectors are not yet equipped with technology to support their activities, i.e., only 25% claim to have a transport management system and 42% a storage management system. Both results are below the average of the other shippers interviewed by the study (agribusiness, retail, and distribution). The use of technology is essential without the use of this tool, the number of errors and human failures in the processes will be high, which generates rework and more time for the execution of activities. For example, using the WMS system is essential in storing products because reading a particular product will determine which address it will be stored, containing the correct address, lot number information, reference, and bar code of the same. Thus, without this information, the number of errors is much higher. The storage of a product would be random, with the correct address where it will be stored, with the need for more information about the product type. It would lead to errors in separation, delayed delivery, stock-outs, and dissatisfaction of the end customer, which would generate financial losses for the company and low competitive power in the market.

So, it is essential for companies that wish to reduce costs, and time of execution of activities, among others, to use technologies.

Materials and Methods

This study utilized bibliographical research to visualize the reason for the non-investment in technologies in storage processes, analyzing what authors have to say about

and, thus, comparing these causes and effects. For Gil and Colleagues [5], the bibliographical research is a process that involves the stages:

a) Choice of topic;
b) Preliminary bibliographical survey
c) Problem formulation;
d) Elaboration of the provisional subject plan
e) Search for sources
f) Reading the material;
g) Summarizing;
h) Logical organization of the subject; and
i) Text writing.

The search for articles about "storage logistics" and "technologies involved in the process of storing materials" was carried out from 2000 to 2022. Figure 1 shows the materials used (11 articles, 2 theses, 3 books, and 1 news site related to the title.

Results and Discussion

This study demonstrated that technologies change the aspects of companies, making them competitive in the marketplace because this process information will be constantly updated, leaving the production without mismatches of information, whether in the storage, receipt, storage, separation, or transportation of materials.

The search for implementing ways to automate processes with investment in information technology in the logistics area has become key to the growth of companies.

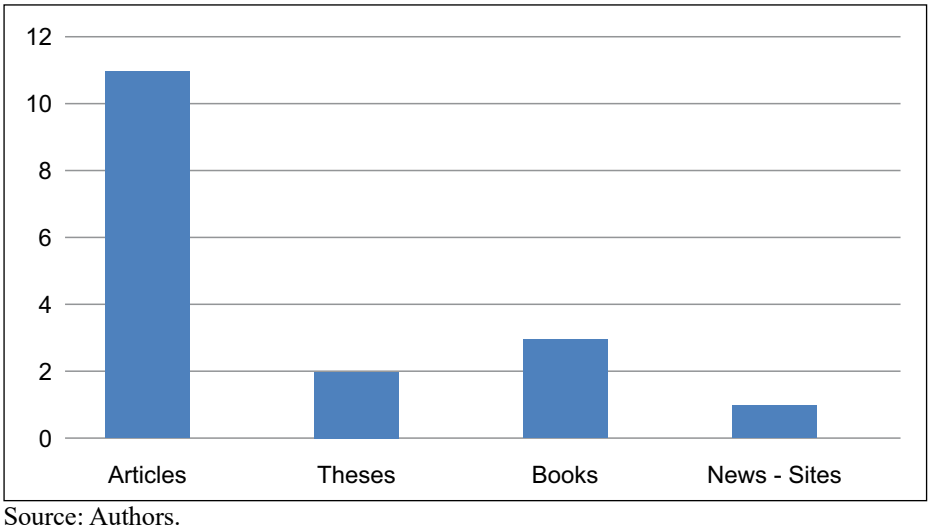
Subsequently, we realized that the Warehouse Management System is the technology that can more efficiently meet an inventory because of its ease in meeting the storage processes, leaving the entire sequence informed as to what is happening in the receipt and dispatch of goods. Using technology in storage brings cost reduction, competitiveness, and satisfaction to the final customer. On the other hand, the lack of technology in storage processes means that the operation needs to control what is happening in the processes, causing failures, and disorganization, among others.

Finally, the results of this research contributed to the understanding that, with the advancement of technology, companies need to keep up with this evolution to satisfy their final consumer, becoming agile in the deliveries and having productivity.

Conclusion

After all the analysis, it was possible to verify that the absence of technology in the storage process brings problems that affect the supplier, the production chain, and the final client. For efficient

Figure 1. Theoretical reference.



Source: Authors.

storage, several types of structures go according to the company's needs. Storage, as seen, is the management of products (inputs, finished or unfinished) with activities to be followed so that they get to the final consumer.

The research had its objective reached, and it is clear that there is much to be explored on the subject, one of them being the types of structures, their functionality, how much they support, and other technologies to be explored. For example, RFID is a technology that works through chips, thus being able to gain agility, accuracy, deviations, and others, which works processing data and the WMS, which controls the entry and exit of goods or inputs, providing a decrease in delays, low productivity, deviations, among others.

In addition, this research used a bibliography to define storage logistics, describe the activities of the storage area, list the principal technologies involved in storing materials, and demonstrate the impacts of the absence of technologies in storing materials. The question was: how does the lack of investment in technologies affect the processes of warehousing materials? It was based on the analysis of other authors on the subject. As an advantage of using technology, companies can have reliability in processes and inventory, information being updated all the time, and greater access to the quality of the products that arrive.

The results revealed that by reducing costs and improving productivity, they are able to eliminate the repetition of work due to human error during processes and leave operations more fluid. However, other studies can be conducted to identify, for example, the degree of technological maturity of companies in Brazil, and the use of technology in other crucial activities in companies (production and transportation), among others.

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