

Implementation of a procedure to improve warehouse logistics

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Abstract

The procedure developed allows self-assessment according to the level of certification chosen. Quality management tools are used, the application of which increases in complexity as excellence in product storage is sought. In addition, the aim is to test the adaptability of the applied tool and to analyze the data obtained from the different entities. Once the procedure is applied, it allows to analyze and improve the logistics of the warehouses in the studied entities. It is also carried out the survey of the logistics status of warehouses to initiate the implementation of logistics 4.0 in Cuban entities of products and services. This procedure incorporates the knowledge of logistics 4.0 to the tools, and highlights the importance of updating logistics processes. The research is applied: in the Central Ronera Agustín Rodríguez Mena, in the beverage and liquor warehouse of the hotel "Las Cuevas", in the UEB #1 Tabaco Torcido de exportación Santa Clara and in the warehouse of the commercial unit La Sandalia. The problem to be solved is to obtain the level of certification of the warehouse in the different entities according to the preceding level they had certified, allowing to check the adaptability of the applied tool and to analyze the data obtained from the different entities A procedure is offered to search, analyze and provide solutions to the problems faced by entities in countries with fewer resources in the process of achieving the objectives of logistics 4.0. Among the main limitations are: little knowledge of logistics 4.0 on the part of the

workers and managers of the entities, as well as resistance to change on the part of the workers of the entities. The application of the selected procedure concludes with an analysis of the problems detected and proposed solutions to achieve the improvement of logistics in the warehouse so that it can be certified at the current level or at a higher level.

1. Introduction

Today's business world is becoming increasingly complex and unpredictable for global companies. The accelerated development of science and technology, together with the globalization of the market, make all organizations, especially Cuban ones, face a race to find solutions that ensure the satisfaction of the needs of the population, optimize their processes and improve their competitiveness. In this scenario, logistics plays an important role since it has been established in recent years as a new way of approaching business management, having become a competitive tool within the development strategies of companies. Authors such as [1],[2],[3] state that the supply chain today includes from the design and administration of all the activities necessary for the acquisition of resources and their channeling for transformation to final distribution or delivery. This in turn is interrelated with aspects of quality, customer loyalty, timely presence in the market, sales momentum, operating costs, foreign trade,

and the design and redesign of the product or service itself.

Taking into account the author's idea, [4], [5] companies require a rational use of limited resources (inventories, human capital, equipment, space and economic resources). Either in the administration of medicines, industrial supplies, perishable products, electronics, fabrics, food, beverages and others. It is not only important to maintain optimal inventory levels, but also to keep your properties in good condition and make sure that the worker performs their work in safe environments, so that the offer to the client is correct. Based on their concept of "due diligence" (the ability to be able to demonstrate that all reasonable measures have been taken to avoid an incident), European retailers have established specific rules to ensure the quality of goods in logistics food (and non-food) products, safety and legality in the SC of food and beverages. Food safety standards such as:

The English British Retail Consortium (BRC)
The German International Features Standards (IFS)
The Australian Small Quantity Generator (SQG)
The Dutch Hazard Analysis Critical Control Point (HACCP)

These standards are safe and operational management systems, applicable to both food and non-food products. They were created to ensure supplier compliance, taking into account storage, transportation and distribution, to ensure the skills of the retailer and guarantee the quality and safety of the food products they sell [6]. All these certifications have one point in common, the standards for storing the products to be evaluated. This is caused by the different priorities that countries give to products and their storage conditions.

Since the new millennium, different norms and resolutions have been created in Cuba to regulate the procedure for certifying storage systems in the country, as well as those who were authorized to categorize them. Since 2007, with Resolution 153 MINCIN (2007)[7], one of the first steps was taken in the creation of a logistic file (EXPELOG) that allows the evaluation of storage systems in companies; later it is complemented with other ministerial resolutions that consolidate the implementation in Cuba. In 2020, the procedure for accreditation of storage systems and the requirements to obtain certifications are updated in Resolution 47 MINCIN (2020)[8]. In addition, Resolution 64 MINCIN (2020)[9] creates the National Commission of Experts in Warehouse Logistics, with the objective of controlling and certifying everything related to the category obtained by warehouses in the country and the

content of the warehouse logistics improvement courses.

The research is carried out in four entities where they have the need to evaluate their warehouses to obtain the second level of certification. These companies are:

1. La Ronera Central "Agustín Rodríguez Mena" produces high volumes of rums with the premise of satisfying the requirements of its customers, ensuring the quality and innocuousness of the productions. Expansion plans include entering new markets in Europe, but there are weaknesses, including the fact that the finished product warehouses are not certified by any international European standard for food and beverages. [10]
2. The commercial unit La Sandalia, belonging to the Central Division of the CARIBE Chain of Stores in Villa Clara, which shows some difficulties and insufficiencies in warehouse logistics, increasing the expenses associated with this activity, specifically in its warehouse.[11]
3. The warehouse or "showcase" of UEB #1 Twisted Tobacco for Export in Santa Clara. This center is dedicated to producing and marketing hand-twisted tobacco for both domestic and international consumption. This warehouse is of utmost importance to obtain an excellent cigar with permanence in the world market. [12]
4. The Hotel Cubanacán "Las Cuevas" is a three-star city hotel that welcomes most of the transit tourists who visit the city of Trinidad. Its warehouse was categorized in 2019 with the first technical level, which is not satisfactory for its aspirations, since this is the lowest of the categories. There are also several points regarding the overcrowding of goods.[13]

Cuba does not have qualified agencies to certify with these specific international standards; but the new regulation aims those warehouses are evaluated by standards comparable to the standards or systems most used in the world, to generate confidence in the customer and preserve the final quality of the stored product.

Among the methodological tools consulted, several were found to be provided by the authors in the international and national arena.[14] From their study, it was found that they have relevant aspects such as Lean Logistics and the different national procedures for the improvement of warehouse logistics. In the latter, it is always necessary to adjust considering the types of products stored, aspects related to the warehouse itself, international experiences and the emergence of new national regulations, in addition to the fact

that this procedure can be better structured. The entry into force in May 2020 of the new regulation places these companies in a position to improve, since they were certified at the first technical level. In Cuba, there is already some research on the subject of warehouse certifications, considering only national standards and focusing only on the characteristics of these entities. However, the proposed procedure is different from the others, due to its versatility and ease of adaptation to different fields of action. This procedure has been applied in service entities, in a production company and in a food production chain, showing satisfactory results by allowing the entities to prepare and obtain the certifications of the evaluated warehouses.

In accordance with the above, the general objective is defined as: to improve the logistics of the warehouses of the companies under study in order to obtain the second level of certification. In order to achieve the general objective, the following specific objectives are established:

1. To carry out a deep bibliographic review, which allows to have all the theoretical bases and fundamental applications linked to the subject of the research.
2. To design a procedure for the improvement of the storage logistics of the different companies.
3. To apply the proposed procedure to the warehouses under study.

In order to meet the objectives, set out in the research, the current storage system in the finished products warehouse of the entities studied was evaluated. In addition to complementing the evaluation with the review of the reports of the audits carried out. Possible

corrective actions that can be taken to improve the system will also be considered.

2. Methods or experimental part

The procedure developed is the result of the bibliographic analysis carried out, as it contains in a rational manner what has been proposed by the different authors with respect to warehouse logistics, the different resolutions in force in the country related to this activity and the different certifications studied. Figure 1 shows the procedure for improving the storage of Ron Cubay.[10]

2.1. Preparation of the Study

The characterization of the current situation, as the first step or stage of the work, is important in order to have a general knowledge of the organization and in particular of the warehouse under study. For this purpose, it is necessary to describe a whole set of aspects that are detailed below: the corporate purpose, mission, vision, integrated management policy, product lines, strategic analysis of the organization, warehouse layout, analysis of storage technology, technical condition of the equipment, among others.

When assessing the requirements and restrictions demanded by the stored products, compliance with the standards and resolutions established for each type of product stored or to be stored should be considered, as well as the specifications described by the manufacturers regarding handling, storage and conservation. It is necessary to evaluate all the activities that take place in the warehouse in order to guarantee the correct handling and conservation, since this result can lead to a significant reduction in logistics costs.

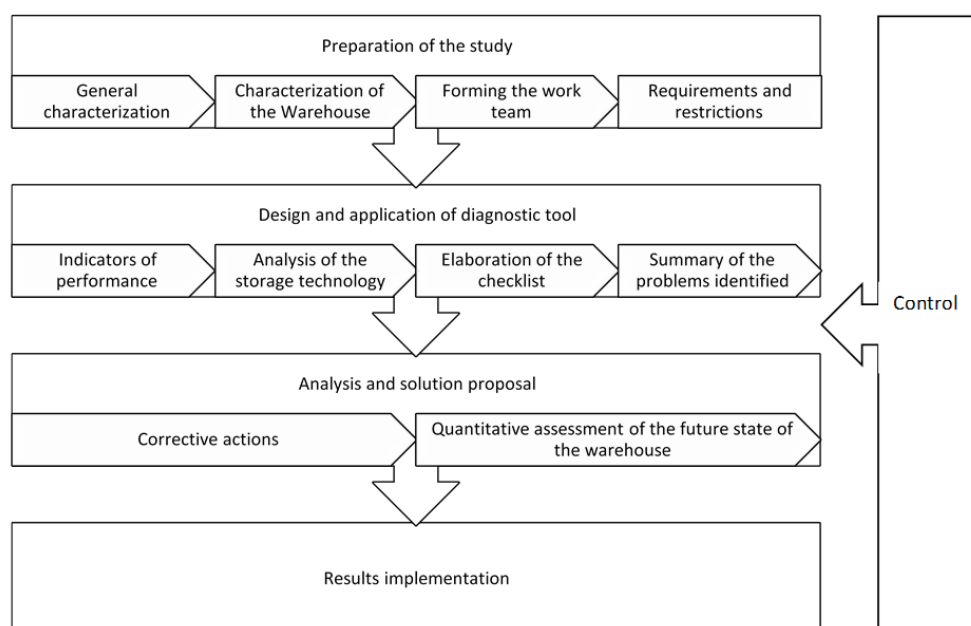


Figure 1: Methodology

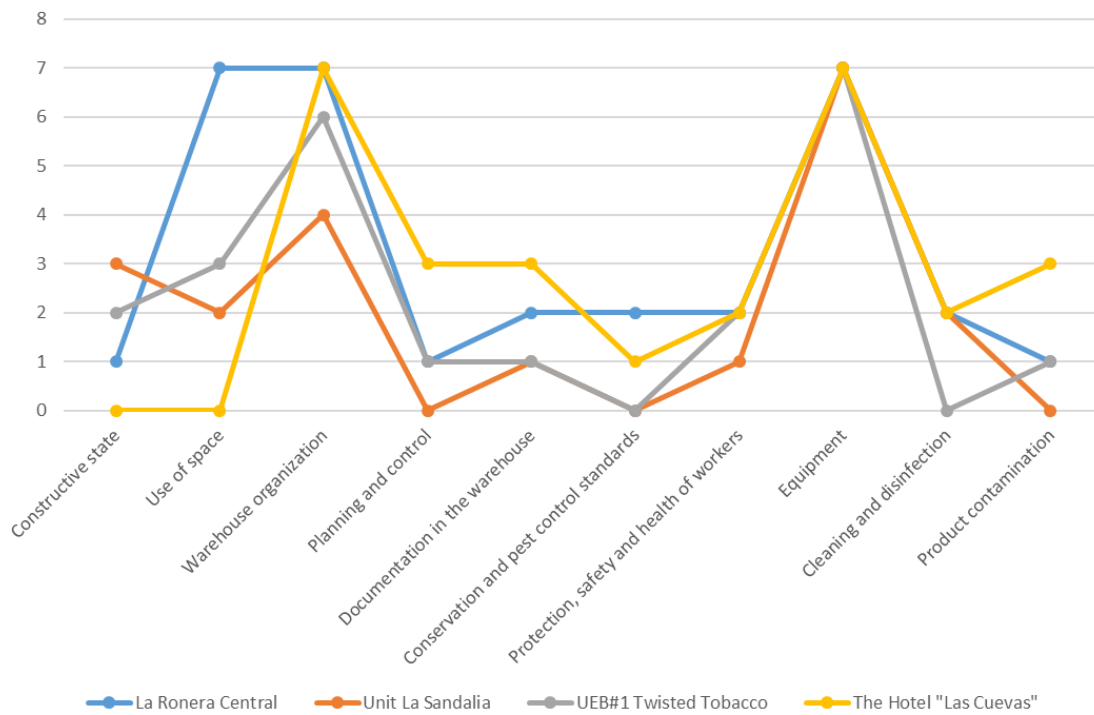


Figure 2: Problems affecting the warehouses of the entities under study

The result of this assessment will make it possible to evaluate the efficiency of the type of installation selected and to propose the optimal-viable technological variation to achieve the best results in management. All the requirements and restrictions demanded by the products and the warehouse under study.

2.2. Design and application of the diagnostic tool

This stage of the work is the core of the diagnosis of the warehouse and covers the study of the physical installation and its management, preferably qualitatively and quantitatively. The aspects to be analyzed are: space utilization, warehouse organization, receipt and dispatch of goods, planning and control, documentation, safety and security, and conservation standards. For the evaluation of these aspects, several essential tools were used, which are analyzed in the system. These are: checklist (developed to detect problems from a qualitative point of view), storage space utilization indicators, warehouse operation and customer service indicators, and cause-effect diagram, which is a qualitative tool recommended in this case to integrate all the problems detected graphically. Table 1 shows a summary of the checklists and their scores by key areas.

It is important to point out that in order to reach a level of categorization, all aspects of the previous level and the level for which it is chosen must be fulfilled. This is represented in the checklists, as it avoids losing achievements that have already been

reached. The three checklists will have a value of 100 points each, although the values of the evaluated areas and aspects vary according to the technological level.

Checklist 2 is applied in the research, by way of example some of its unique characteristics are highlighted, in the points that most affect the evaluation of the warehouse. These are:

2.2.1. Use of space

- Digital organization of the warehouse.
- Working with scanner and codes on secondary packaging.
- Use of machinery to avoid double handling.

2.2.2. Warehouse organization

- Efficiency of control methods.
- Building facilities for reception and dispatch.
- Procedures or technologies to reduce handling.
- Training of workers in logistics and in the use of equipment in their work area.

2.2.3. Warehouse documentation

- Traceability.
- Computer and data processing skills.
- Equipment
- The equipment on the technological floor is connected by network or Wi-Fi in the warehouse.
- There is human-machine interaction in the automatic or semi-automatic activities in the warehouse.

It should also be noted that as the level of certification increases, the areas to be evaluated increase and the scores between the areas in the different levels of certification change as well.

Table 1: Summary of the areas and evaluations in the checklists

Checklist 1	Checklist 2	Checklist3
Aspects to evaluate	Aspects to evaluate	Aspects to evaluate
Constructive state	Constructive state	Constructive state
-	Use of space	Use of space
Warehouse organization	Warehouse organization	Warehouse organization
Planning and control	Planning and control	Reception and dispatch of merchandise
Documentation in the warehouse	Documentation in the warehouse	Planning and control
Conservation and pest control standards	Conservation and pest control standards	Documentation in the warehouse
Protection, safety and health of workers	Protection, safety and health of workers	Conservation and pest control standards
-	Equipment	Protection, Safety and health of workers
-	Cleaning and disinfection	Equipment
Product contamination	Product contamination	Product contamination; Cleaning and disinfection

2.3. Analysis and proposed solutions

For the development of corrective actions, the starting point is an analysis of the storage technology. This factor is a determining factor in defining the form of storage to be selected. Once the problems have been identified, a set of actions aimed at eliminating or minimizing the problems detected are proposed. For the execution of the corrective actions, the conditions of the warehouse and the product of the factory must be considered, where the possible solutions tend to increase the economic results and the customer service.

For the generation of corrective actions, the use of the expert method known as Brainstorming is recommended, in which workers, specialists and managers should participate, being essential the following: quality specialist, warehouse clerks,

economic specialist, commercial manager (recommended as facilitator), members of the inventory commission, commercial analyst, distribution specialist.

2.4. Implementation of the results

his work step constitutes an ordering of the results of the previous step. It involves drawing up an implementation plan for the proposed corrective actions. At this stage, the implementation of the technological reorganization design of the warehouse is proposed for a trial period of 6 months. The sales manager will systematically bring together those responsible for applying each measure and verify compliance with the implementation plan. If any corrective action requires staff training, this manager will coordinate with the Human Resources area.

2.5. Control

The last step of the procedure is a control loop to rectify any deviations detected during the 3-month period of operation of the warehouse. The checklist and indicators proposed in the diagnostic stage are used again to verify whether the problems have been mitigated or eliminated and the indicators meet the requirements of Resolution 47/2020. If this does not occur, return to the corresponding work step of the procedure and repeat the rest of the procedure. On the other hand, if the warehouse is ready for categorization, the EXPELOG is prepared in the format suggested in the aforementioned resolution.

3. Results and Discussion

Using the information obtained from the diagnostics in the warehouses analyzed, it is possible to visualize and summarize the main problems affecting the warehouses and their main causes. Figure 2 shows the number of problems detected in each of the aspects of the checklists.

3.1. Deficiencies found in the warehouses

3.1.1. Warehouse organization

This aspect includes deficiencies such as: the aisles and access doors to the warehouse are not free of products or objects that obstruct or hinder the passage of handling equipment and personnel, due to the organizational problems of the warehouses, so it is sometimes necessary to place goods in the aisles, which also leads to blocked products in the warehouse. In addition, there is no procedure to reduce handling, nor are the loading schemes for each product defined, and the warehouse does not have a defined area for the repair and maintenance of the unitizing equipment.

3.1.2. Planning and control

Compatibility between stored products is not guaranteed, also due to overcrowding, since due to lack of space, products are sometimes placed in other areas that are not the right ones.

3.1.3. Documentation in the warehouse

There are no procedures for receiving, storage and dispatch. In practice, the personnel in charge know how to proceed, but the procedures are not designed as such.

3.1.4. Storage and pest control standards

Despite compliance with the fumigation program established for the warehouses and products, rodents are occasionally present.

3.1.5. Product contamination

There is currently no cross-contamination in the warehouses and there are strategies to prevent it, but there is no structured procedure in place.

For the analysis of the deficiencies detected in the warehouses, they are grouped into five fundamental problems, considering their similarity:

3.1.6. Overcrowding of goods

- The aisles and access doors in the warehouses are not free of products or objects that obstruct or hinder the passage of handling equipment and personnel.
- Blocked products are observed in the warehouses.
- Compatibility between stored products is not guaranteed.

3.1.7. No written procedures

- There are no procedures to reduce handling.
- There are no procedures for reception, storage and dispatch.
- There are no procedures to avoid cross contamination.

3.1.8. Impossibility of repair area for unitarizing media

There are no constructive facilities to define a repair area for unitarized media.

3.1.9. Vectors presence

Despite the existence of a fumigation and pest control program, there are still rodents in the warehouses.

3.1.10. Lack of loading schemes

There are no loading plans for each product.

3.1.11. Equipment

- The equipment on the technological floor is not connected by network or Wi-Fi in the warehouses.
- There is no human-machine interaction in automatic or semi-automatic activities in the warehouses.
- IT resources are not connected to the equipment on the technological floor.
- No data analysis or data mining is performed on the results obtained.
- There are no automated tasks in the warehouse.
- Not all warehouses are connected to the factory computer network or the company's cloud.
- Warehouse workers are not trained to work with automated equipment.

In addition, the Cause-Effect or Ishikawa diagram with a similar approach highlighting the main problem areas is shown in Figure 3.

Once the fundamental causes of overcrowding of merchandise in the warehouse have been analyzed in the Ishikawa diagram, a series of measures are proposed in order to attenuate or eradicate the overcrowding:

- Search for a place with the appropriate constructive characteristics to establish it as the central warehouse of the hotel complex and that it works only for the insurance of the hotel "Las Cuevas", so that each unit of the complex carries its logistic management independently.
- Organize the warehouse by substituting some direct pallets for shelves to place the merchandise without secondary packaging, whenever possible, in such a way as to optimize the space used.
- Keep a strict control of the rotation of products in the warehouse so that there are no idle or expired products.
- Train workers with basic computer courses, handling and working with automatic machines and courses on updated logistic models (cross docking).
- Establish and leave in writing all the procedures that are currently absent, such as: a procedure to reduce handling, procedures for the reception, storage and dispatch of goods, as well as establishing the loading schemes for each product.

It is also proposed to analyze and solve in the short term the other deficiencies detected by the study, for which no significant resources are necessary. The way to validate the result is the application again of the checklist for the second level, considering that most of the problems are solved.

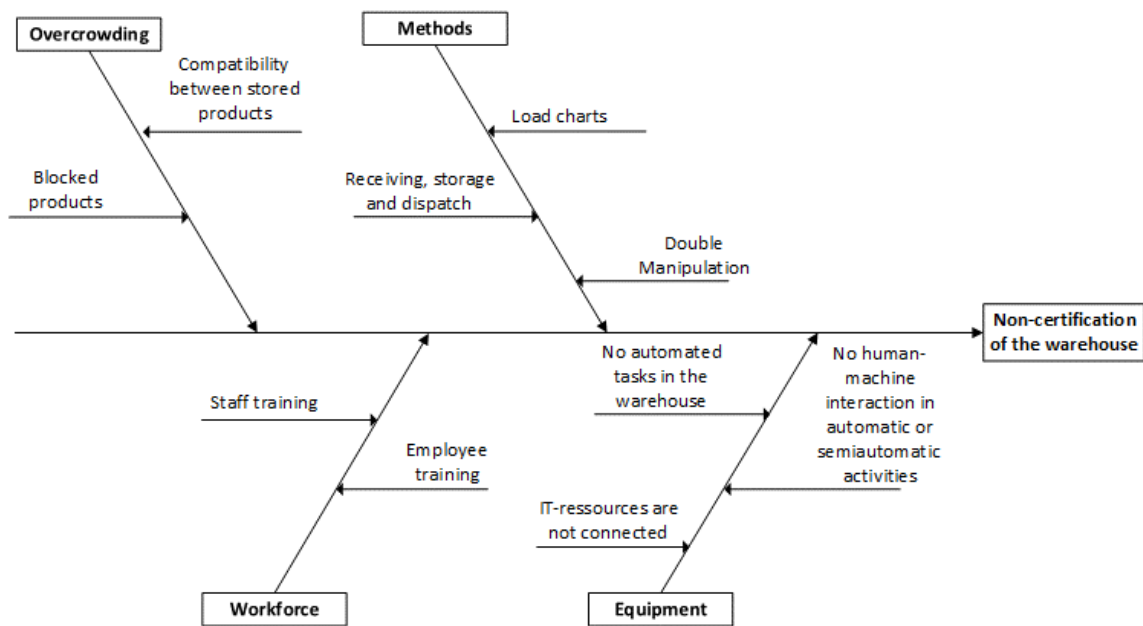


Figure 3: Modified Ishikawa diagram of the warehouses of the entities under study

Figure 3 summarizes the results of the application of the checklist in the warehouses, revealing that the main problems are in the use of computer equipment:

- There are no automated tasks in the warehouse
- The warehouse is not connected to the factory computer networks or the company's cloud.
- Warehouse workers are not trained to work with automated equipment.

4. Limitations and Conclusion

The procedure used, contains methods and instructions for the categorization of the warehouse, as well as qualitative and quantitative tools valid for its application in different entities or companies or warehouses, varying only small details; also, this allows proposing improvements to the deficiencies detected.

There are several deficiencies that affect the logistics management of the warehouses, highlighting the absence of written procedures and that the most important problem to be solved with the highest priority is the updating of logistics methods in the warehouses to improve the organization.

Many of the problems detected are soluble in the short term and do not require significant resources. In addition, their detection and subsequent solution is important to maintain the current level of certification and to work towards certification at a higher level, with the current regulations.

Resistance to the use of computer and automatic technologies by workers and some older administrative staff.

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