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Strategic and Operational Improvement in a Mexican high-Volume Distribution Center

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Abstract

Mexico features a high volume of food product mobility; however, distribution centers located in Mexico City face significant challenges regarding space allocation and utilization. This study presents a practical Industrial Engineering focused on supporting decision-makers within a Mexican distribution center to solve space optimization problems at a minimum cost while maintaining operational performance. Framed within the Business Process Management (BPM) methodology, low-cost solutions are offered to optimize the material flow of the distribution center. Under this approach, the project addresses both strategic and operational levels through the development of a daily operational KPIs dashboard in Power BI, enabling real-time monitoring and data-driven decision-making. Moreover, layout reconfigurations were proposed for the picking and packing areas under Kaizen methodology strategies, contributing to a reduction in operational times and improved workflow efficiency. Quantitative techniques such as the Direct Clustering Algorithm (DCA) and a preliminary process simulation in Arena software were applied to dynamically analyze layout and the proposed To-Be process in order to enhance space and resource utilization. Ultimately, this methodology addresses space-related challenges within the facility, preserving productivity and optimizing resource allocation. The BPM methodology and the addressed tools were applied in a Mexican company with over 30 years of experience in distributing a wide range of products. Currently, the company serves more than 200 restaurants, 80 franchises, 500 HORECA (Hotel, Restaurant, Catering) clients, and over 900 self-service stores. The results obtained aim to improve the flow of materials by optimizing processes in key operational areas. Notably, the preliminary simulation and layout adjustments indicate a significant reduction in the internal movements required for operations. The contribution of this case study is to demonstrate that the integration of advanced analytics, visualization tools, and layout optimization techniques can effectively address complex operational and space-related challenges in a distribution center.

Keywords
Distribution Center (DC), Facility Layout, Business Process Management (BPM), Kaizen, Power BI, Process Simulation

1. Introduction

Due to the importance of optimizing material flow in Distribution Centers (DC), this study applies Business Process Management (BPM) in a real operational setting to address practical process inefficiencies, following the structured phases outlined in Figure 1. The analysis focused on applying tools such as process flow analysis, clustering algorithms, and low-cost methodologies. Based on findings, the order fulfillment process was selected for intervention, incorporating practical tools such as Kanban, poka-yoke, 5S methodologies, and data-driven communication mechanisms. The project is currently in the implementation and monitoring stage. The proposed improvements were presented to decision-makers, and interviews were also conducted with operational staff. This approach enabled a more rigorous evaluation of the feasibility and long-term sustainability of the proposed implementation. Based on this validation, current efforts are directed toward the final stage of implementation.

1.1 Problem Statements and General Scope

Together with the company, two primary challenges were identified: a lack of space and budgetary constraints. To accurately define the project scope, and through the framework of the BPM methodology, these problems were divided into three main areas of focus. The first problem classification is about the DC infrastructure, which refers to the lack of available space. The second problem targets the communication mechanism related to the lack of information among the workers. The third problem is in the picking processes, where constant errors are common. With this in mind, the objective of the project is defined to optimize the material flow in a food product DC through the use of low-cost methodologies.

2. Literature Review

The BPM has been widely applied and recognized as a structured approach for managing and improving organizational processes (see Figure 1). It comprises six integrated stages, including process identification, discovery, analysis, redesign, implementation and monitoring, which together aim to improve process performance (Dumas, 2018). Each stage facilitates the integration of methodologies, techniques, and tools that support both the definition and the redesigning of the processes under analysis.

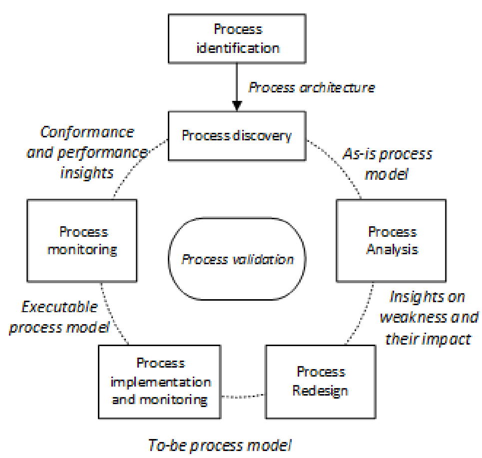

Figure 1. Adaptation of Business Process Methodology (BPM). (Dumas, 2018).

In applied BPM contexts, methodologies such as 5S, Kanban, and poka-yoke have been widely used to improve operational efficiency in distribution centers. Additionally, data-driven tools as Power BI have been integrated to enhance communication flows within processes (Teixeira et al., 2024). Given the human-driven nature of the DC operations, these approaches focus on improving the human factor while supporting the feasibility and sustainability of process improvements.

2.1 About 5S Methodology

Efficient management within a distribution center represents one of the most relevant challenges within the supply chain, where methodologies such as 5S have been widely adopted to enhance operational performance. In an increasingly competitive environment, organizations seek methodologies that optimize operations without a large investment in infrastructure; in this context, the 5S methodology is established as a relevant, low-cost, high-impact Lean tool. Some authors conclude that the 5S methodology constitutes an effective tool for increasing productivity and reducing waste in warehousing processes (Chacón-Olivares et al., 2025). This methodology is adaptable to environments with high regulatory restrictions, and its implementation can coexist with the storage best practice requirements specific to the pharmaceutical industry, expanding the viability of this methodology in sectors with strict regulatory frameworks (Ccancce, 2023). The implementation of this methodology in conjunction with other Lean tools has shown a positive impact on warehouse management and problem reduction. Other applications of this set of tools significantly improve efficiency rates within an air conditioning and heating services warehouse (Rizkya et al., 2023), thus demonstrating that the methodology acts as an infrastructure for other continuous improvement tools. This union is especially pertinent in high-volume distribution centers where multiple processes coexist.

2.2 Poka-Yokes Techniques

In high-volume and high-intensity environments, such as a distribution center, human error represents one of the main sources of inefficiency. In response, poka-yokes emerge as an error-prevention tool with high potential for application in logistics and distribution settings. Their fundamental principle lies in designing mechanisms, devices, or processes that make the occurrence of an error impossible or detectable. Research suggests that the poka-yoke should not be implemented as an isolated tool, but as an integrated component within a broader Lean system (Ccopa-Torbisco et al., 2025). For logistics managers, poka-yokes represent an investment in reliability and operational continuity, with a measurable return in terms of cost reduction from returns, reworks, and penalties for non-compliance (AR Racking 2026).

2.3 Kanban systems

In high inventory turnover systems with multiple SKUs, visibility of stock status, reorder points, and real-time replenishment needs constitute necessary conditions to guarantee operational continuity; in this context, Kanban emerges as a visual management tool to communicate clearly and precisely. The informative Kanban has diversified and evolved, moving from physical cards to digital boards. Some authors (León-Duarte et al., 2023) demonstrate that even physical, non-digitalized Kanbans generate significant operational improvements when they are well-designed and implemented, showing that informational clarity is the critical success factor, regardless of the technological medium used.

2.4 Power BI Dashboard for Real-Time Operational Monitoring

The adoption of Business Intelligence (BI) tools has recently become a fundamental pillar of modern logistics management. Recent research suggests that BI systems that integrate ETL processes and dynamic dashboards allow organizations to efficiently conduct clear, concise, and easy-to-interpret graphical analyses, supporting decision-making at both strategic and operational levels (Oliveira et al., 2023). More evidence showing that Kanban is an effective tool is the implementation of a BI application using QlikView in a pharmaceutical distribution center, where they structured KPIs according to dimensions such as indicator name, data source, calculation frequency, and responsible party (Orellana et al., 2020), providing a replicable framework for logistics operations. A dashboard is a graphical interface used in visual management that displays the most important information about organizational objectives (Vilarinho et al., 2018). Another advantage is the organization of critical performance indicators in a simple visual format (Sethi, 2023), which helps stakeholders. In 2018, dashboards were understood as a complex tool for small companies and as part of a low-level quality system (Vilarinho et al., 2018). Nowadays, there are multiple interfaces available to implement visual tools and to support communication throughout the operational and administrative facilities. To enhance operational effectiveness, information and communication technologies related to industrial production are now integrated into various operational systems (Vilarinho et al., 2018). In manufacturing processes, specifically on the shop floor, dashboards contribute to the agile organization of process performance, knowledge, and communication between key areas and stakeholders (Gröger et al., 2013). Nowadays, Microsoft Power BI has also become a leading platform for real-time supply chain monitoring. Dharmasiri, among others, found that organizations implementing live dashboards in Power BI significantly reduced decision-making time and reported improvements in inventory turnover and order fulfillment accuracy (Dharmasiri, et al., 2025). Other works include the application of a real-time Power BI dashboard to monitor supply chain performance (Nguyen et al., 2023), for helping to close the gap between operational information and managerial action. Despite this evidence, there is still limited research on the implementation of real-time dashboards specifically for incoming goods inspection and supplier rejection analysis in food distribution centers serving the HORECA segment in Mexico, being an important gap of the present study.

2.5 Non-monetary incentive Systems and Employee Retention in Logistic

The theoretical basis of non-monetary incentive programs is mainly grounded in Herzberg's Two-Factor Theory, which distinguishes between hygiene factors, such as salary and working conditions, that prevent dissatisfaction, and motivators, such as recognition, achievement, and responsibility, that generate real commitment (Herzberg, 1959). Recent research confirms that financial rewards function as hygiene factors that provide basic satisfaction, while non-financial recognition, career development opportunities, and employee appreciation promote intrinsic motivation, engagement, and improved performance (Manzoor et al., 2021; Adesina & Egbuta, 2025). Likewise, Maslow's Hierarchy of Needs supports the idea that, once basic compensation requirements are met, workers in operational roles seek to satisfy higher-order needs, including belonging, esteem, and self-actualization, which can be effectively addressed through non-monetary programs such as recognition, personal development, and workplace inclusion (Alshaidhani et al., 2024). Recent studies show that high employee turnover in warehouse and logistics operations represents a constant and actual faced by organizations. In a 2024 study on employee recognition in logistics companies, recognition was found to have a positive relationship with job satisfaction and employee retention, since workers who feel valued are more likely to remain committed to their organizations. High turnover not only reduces productivity, but also generates constant costs due to continuous recruitment, training, and the loss of institutional knowledge (Ndiango et al., 2024). As a talent retention strategy, empirical studies validate certain specific types of non-monetary incentives, such as flexible schedules, supplementary benefits, learning opportunities, and recognition programs linked to measurable performance indicators. A study on non-financial rewards in the retail sector found that these types of incentives have a positive relationship with employee retention, especially when they are connected to achievement, training opportunities, fair evaluation systems, and recognition (Tang, 2023). In addition, it has been identified that strategic reward and recognition systems can improve employee engagement and retention when they are integrated into talent management practices and aligned with organizational objectives (Adesina & Egbuta, 2025). This integration between incentive systems and operational dashboards represents a little-explored area in food distribution research in Latin America, which is addressed by the present study.

2.6 Direct Clustering Algorithm (DCA)

The principle of minimizing total flow represents the simplification of work as applied to material flow. This principle includes the following perspectives: a) Elimination of unnecessary material movements by reducing the number of steps or activities, b) Minimization of material handling by shortening transportation distances, c) Elimination of material handling through the mechanization or automation of the flow, d) Reduction of material handling by decreasing flow density using containers. Chan Milner developed the Direct Clustering Algorithm (DCA). This methodology is based on a machine–part matrix in which a value of 1 indicates that a part requires processing on a specific machine, and 0 indicates that the machine does not perform that particular task. Therefore, in this study, the DCA is used to identify areas with the highest activity within the distribution center, thereby enabling a focused optimization of material flow.

2.7 Simulation processes

Simulation is a powerful quantitative tool to analyze processes from different perspectives. As a preliminary approach, simulating the system allows for testing enhancement strategies without stopping operations or disrupting the floor with excessive observations. Based on key data, representative scenarios are obtained to identify process bottlenecks. This initial Arena simulation model follows a classical simulation methodology (Banks, 1999) under a rigorous Verification and Validation (V&V) process (Law, 2007; Kelton, 2014; Kellner, 1999) to ensure its reliability.

3. Methodological Framework and Tools

Within the BPM methodology, the Process Identification and Process Discovery steps involve the systematic documentation, categorization, and definition of the Distribution Center processes. In this phase, process mapping techniques were applied to capture the full set of operational activities. Additionally, on-site observations, time measurements between activities, and structured interviews with operators were conducted to ensure data accuracy and completeness. The Process Analysis phase focused on waste identification, aiming to detect activities that did not contribute to the minimization of material flow time. An analytical flow process chart was employed to identify inefficiencies and time losses. Furthermore, DCA was used to identify physical areas in which process improvements could enhance material flow and add operational value. In Process redesign phase, and in collaboration with decision-makers, the order fulfillment process was selected for intervention, as it integrates both storage organization and dispatch operations. Improvement actions included implementation tools such as Kanban systems, poka-yoke, among others. In addition, data-driven communication approach was proposed to enhance coordination among operational roles using Power BI.

The project is currently in Process Implementation, monitoring and validation phases. The improvements have undergone an initial review with decision-makers, and efforts are now focused on the continuous evaluation and implementation. To enhance this important phase, a simulation model of the picking process is undergone aiming to establish a first approach of to-be process approximation. The following sections describe the integration of techniques and methods using the BPM methodology.

3.1 Process Identification and Discovery

The DC operations process consists in receiving, picking, shipping, and billing different materials that arrive every day. However, this project focuses on the picking process as a critical point of the flow materials through the DC. The picking process consists of collecting products according to the order sheet; this sheet contains the order number, the customer's name, the lot numbers for each product, and the quantity of products required. The operator is in charge of taking the order sheets and performing the consolidation on the pallets; when the consolidation is ready, a slip with the order number is placed on top and it is moved to the customs area, where they are responsible for verifying that the order is correct before heading to shipping.

In order to identify the problems that must be addressed, a diagnosis of the process is carried out, which consists of making visits to the plant to analyze how the operators work, what the flow of materials is, what the area in which they operate is, etc. By visiting the entire plant, the identification of the main processes and activities allows us to develop a process mapping that synthesizes all the information gathered (see Figure 2).

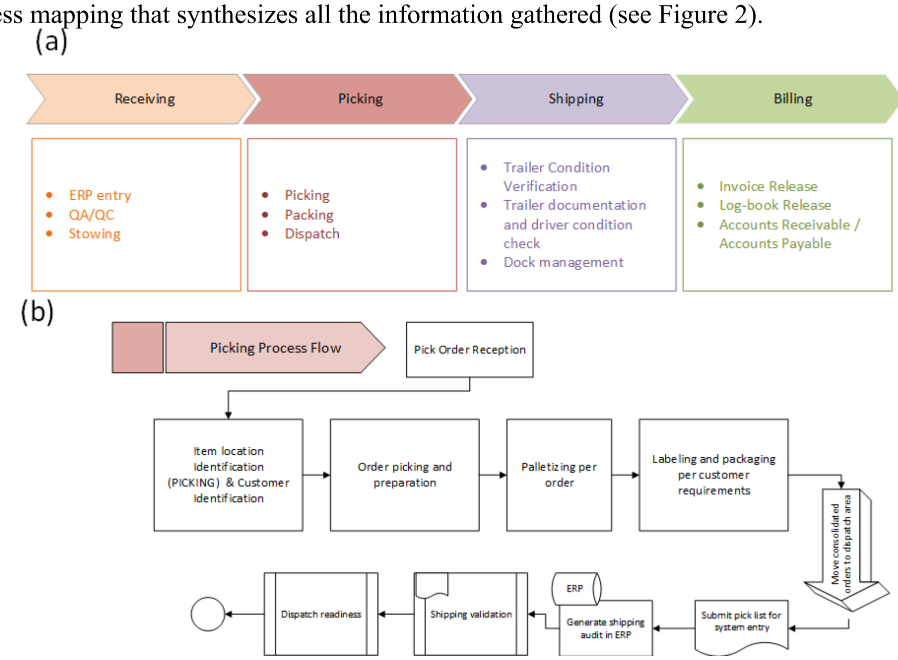

Figure 2. Process mapping developed from in-site observations and interviews: (a) main activities for general DC steps, and (b) detailed flow of picking process.

3.2 Process Analysis

After visiting the entire plant, we focused on the restaurants and retails zone (Picking Area), observing and measuring the times and distances of two operators: one restaurant operator and another from retails meanwhile they fulfilling orders. Using this relevant information an analytical process chart was created (see Figure 3). Besides, the times and distances involved in order fulfilment were measured as part of a waste analysis aimed at identifying inefficiencies in the process flow. In order to enhance relevant information and integrate the personnel perspective, an interview of two operators was applied in the shop floor.

Analytical Process Chart								
Diagram No.	First							
Item: Pallets		Symbol	Current	Proposed				
Activity: Palletizing		○						
Method: Current		⇨						
		D						
		□						
Operator:		▽						
Composed by	Date: 26 septiembre 2025							
Approved by	Date:	-	-	-				
Description		-						
		-						
		-	-	-				
		Distance (m)	Time (sec)	Simbolo				
				Operation	Transport	Delay	Inspection	Storage
				○	⇨	D	□	▽
TOTAL		499	2461.69	17	26	1	12	0

Figure 3. Current analytical process chart restaurant. Source: Authors.

To add value by improving space utilization and material flow within the DC, the main material-handling activities were analyzed and grouped into four key processes: receiving, picking, packing, and billing. The study focuses on the order fulfillment process, which takes place in the dry storage area. Optimizing material flow in this process will free up space in the customs or buffer area, while also improving dispatch and material movement. The DCA developed in this study was applied to identify high-activity such as "heat zones" in the operations floor. Identifying these critical areas supports decision-making by enabling the selection of zones for optimization, facilitating risk analysis, and improving the organization of workers and materials in the most relevant areas. The DCA algorithm uses a matrix that shows where activities start and end, with clustering depending on the location of each activity. It was applied using 36 activities (origins) and nine operational zones (destinations). Initial clustering identified five zones with uneven activity distribution; however, further optimization (2-8 clusters) improved balance across zones. Based on silhouette performance, scenarios with 6 and 8 zones were selected, and an additional 7-zone configuration was introduced to refine the balance between activities and segmentation. Figure 4 illustrates the zones with the highest concentration of activities within the DC layout (b), as a result of the Python-based algorithm (a).

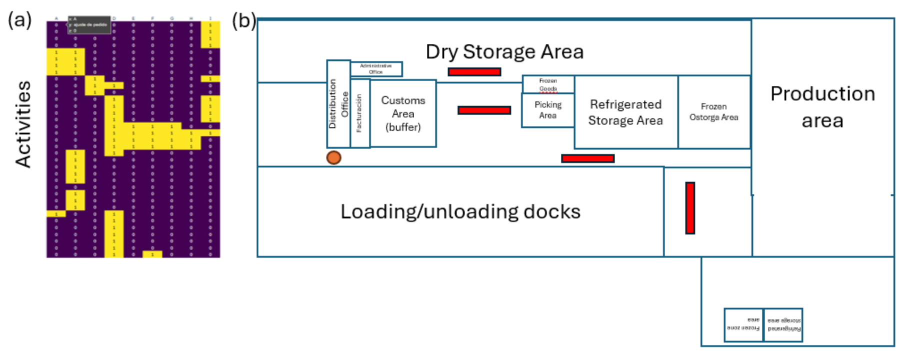

Figure 4. Results of DCA implemented in Python Language. In (a) the clustering of activities and zones is shown, while (b) highlights the zones with the highest activity concentration marked in red.

3.3 Process Redesign

As a part of the redesign, the proposed improvements are rooted in Kaizen, understood as a philosophy centered on making small, continuous, and low-cost changes aimed at enhancing communication across different areas. Consequently, the proposals were divided into three main parts: (a) focuses on low-cost methodologies and tools, (b) centers on a communication mechanism, and (c) explores improvements regarding the human factor.

a) Low-cost Kaizen applications

As is well known, the Kaizen methodology approach includes 5S, kanban and poka-yokes implementations across different processes. To enhance material flow without a high budget, we propose applying these strategies directly on the operational floor. As previously mentioned, the primary challenge in the DC is its very limited area relative to the volume of products handled. This situation directly impacts the palletizing zone, reducing the working area for the operators. Furthermore, due to this lack of space, some products pallets are placed on the floor, obstructing the workers' pathways and limiting their movements. During site visits, it was observed that material organization could be substantially improved. Therefore, the use of the 5S methodology is proposed to organize pallets in a way that clears the floor and expands the active work area. Consequently, implementing zone demarcation with colored tape enables a more efficient allocation and organization of palletized goods. This strategy prevents workers from encroaching on the zone and maintains organization as a best practice.

Beyond the organization of palletized goods, an information flow issue was identified among the workers. It was observed that not all personnel have the pertinent information required to ensure an optimal workflow and guarantee agile performance. This lack of information delays worker activities and, consequently, slows down the entire process. To address this situation, the implementation of a Kanban board was proposed to stakeholders. The Kanban board must be highly visible on the floor and divided into three classifications: “To Do”, “Doing” and “Done”. The recommendation is to post high-urgency orders and daily departures; for forklift operators, the specific products that need to be retrieved should be listed. Moreover, it is necessary to use one kanban board for retail and another for restaurants, strategically placing them in areas visible to all employees. In addition, a person responsible for the Kanban must be assigned to update the information daily.

Due to each restaurant has specific packing labeling requirements and instructions for palletizing consolidated cargo, there is a high incidence of non-compliance errors. If the consolidated cargos are not properly prepared, pallets are returned for corrections, resulting in longer lead times and additional rework. To address this problem, the use of informative poka-yokes was proposed to stakeholders, which consist of visual reminders of the main quality check points on the walls. To ensure the effective operation of the these poka-yokes, a secondary card system is proposed. These cards consist in a checklist that pallets must pass before being moved to the dispatch area. Workers will carry these checklist behind their ID badges at all times. Finally, daily huddles and continuous personnel training regarding the importance of these topics must be systematically applied. None of these mitigation strategies will work without periods of auditing, validation, and performance verification.

b) Application of Power BI on the Shop floor.

As part of the general objective of improving the flow of products within a food-industry distribution center, the study focused mainly on picking and packing activities. However, during the diagnostic phase, the raw material receiving and unloading area was also identified as a relevant source of information for further analysis, since this stage directly influences product availability, internal movement, and the activities required to complete customer orders.

For this reason, a complementary Power BI dashboard was developed using the available records from the receiving process. The initial database included operational inputs such as date, start time, end time, supplier code, delivered quantity, sampled quantity, expiration date, final supplier verdict, rejected quantity, rejection reason, unloading time difference, net unloading time in minutes, and accumulated net quantity per day. These variables made it possible to analyze the receiving process not only in terms of daily volume, but also in relation to supplier performance, rejection behavior, inspection results, and unloading duration.

Before building the dashboard, the database required a cleaning and preparation stage. First, the format of each column was reviewed and corrected, especially in the fields related to dates, times, numerical data, and supplier codes. In addition, missing or non-applicable values, such as N/A entries, were treated in order to avoid errors when performing calculations within the program, applying statistical functions, or generating visualizations in Power BI. This step was necessary to ensure that the indicators were consistent and that the dashboard could operate without errors or interruptions caused by incomplete records. Although a formal star schema model was not developed (see Figure 5), the operational database was organized and separated into analytical fields in order to make the interpretation and calculation of the information easier. This structure allowed the development of both direct and indirect indicators derived from the original records, as well as calculated indicators generated through Power BI.

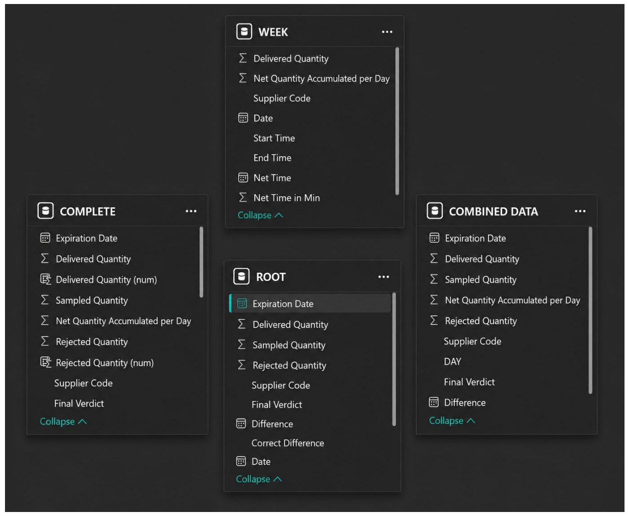

Figure 5. Structuring and separation of operational data

Among the main indicators included in the dashboard were the rejection percentage, average unloading duration, total delivered quantity, total rejected quantity, accumulated net quantity per day, delivered quantity by final verdict, delivered quantity by day, and rejection percentage by supplier code. In the same way, the dashboard also incorporated visual graphs and dynamic filters, which allowed users to analyze the receiving process by day, supplier, and inspection result. This provided a clearer view of the operational behavior and simplified the identification of suppliers or days with higher rejection levels, longer unloading times, or higher delivered volumes. In this sense, the dashboard did not only work as a visualization tool, but also as a communication mechanism between the different job profiles involved in the process. By presenting operational information through a visual channel, the tool supports coordination, monitoring, and data-based decision-making within the distribution center. Overall, the application of Power BI strengthened the analysis of the receiving area by transforming raw operational data into useful performance indicators. This contributes to the general approach of optimizing the material flow within the distribution center and improving the control of raw materials, which can ultimately have an impact on the decisions made regarding picking and packing processes.

c) Human factor enhancement

All processes within the distribution center are based on the human factor; they do not have automated processes or automatic identification and data capture systems that would facilitate certain activities and prevent errors that the human factor naturally generates. The company experiences high employee turnover and a physically demanding workload. This high demand leads to worker fatigue, resulting in operational errors and subsequent rework. Due to this problem, the implementation of non-monetary incentives is proposed, since in the long run, monetary incentives can become detrimental rather than beneficial. The proposed non-monetary incentives are divided into additional free time (e.g., extended lunch breaks or flexible shifts) and complementary benefits (e.g., meals, restaurant vouchers, or event tickets). These incentives can be awarded individually or on a team basis, such as for outstanding performance or minimal picking errors, and distributed weekly, biweekly, or monthly frequency, depending on company objectives.

4. Data Basis for proposals

Data regarding process times, operational activities, and resource utilization were systematically collected directly at the DC facilities through a combination of site visits, stakeholders' interviews, and direct workplace interactions. Additionally, a flow process chart was developed to map these activities, which served to outline the simulation model and identify operational bottlenecks. Ultimately, this empirical evidence provides the foundation to support the application of proposed low-cost conceptual methodologies, all of which have been thoroughly validated by the decision-makers.

5. Results, Discussion, and Operational strategies

After the proposals were presented to decision-makers, they were evaluated and validated. Additionally, the interviews were conducted during site visits to gather workers' perceptions and opinions regarding the implemented proposals. These proposals yielded the following results: the delimitation of areas based on the OSHA standard 29 CFR 1910.144 (see Figure 6), including waste storage areas (a), in-process raw materials, and finished products (b).

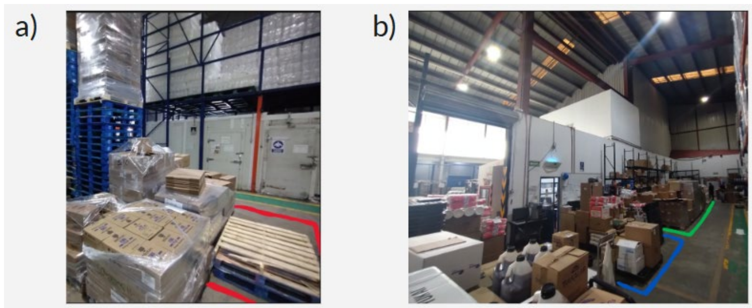

Figure 6. Photographs showing the area delimitation within the company facilities: (a) delimited waste storage areas, and (b) designated areas for finished products and in-process raw materials. Source: Authors.

Color-coded labeling for consolidated shipments was initially planned based on the scheduled shipping day; however, following a consultation with decision-makers, it was agreed to assign color labels according to the specific client, as this approach demonstrated greater operational feasibility (See Figure 7).

Figure 7. Implementation of color-coded labeling for consolidated shipment assigned by specific customer. Source: Authors.

Additionally, another proposal involves implementing a Kanban system visible across the entire operational floor. Consequently, two examples of Kanban board organization were created (see Figure 8), containing the most relevant information for the workers in the picking area.

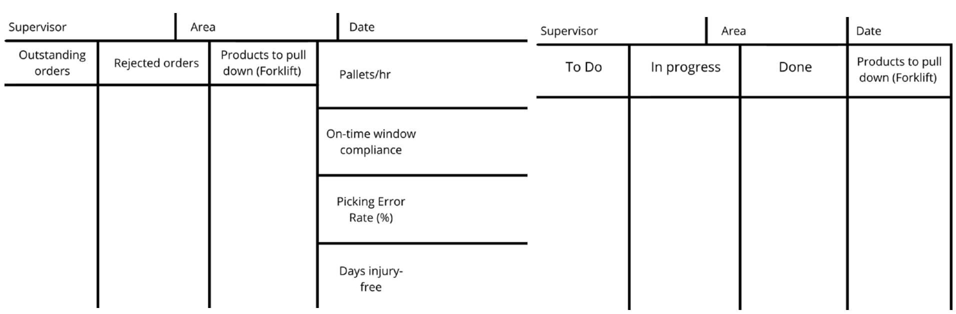

Figure 8. Examples of Kanban organization. Source: Authors.

With the aim of preventing frequent errors and subsequent rework, a visual guide was created, which includes four important sections to consider during pallet building, featuring images of correct and incorrect pallet configurations (see Figure 9). Additionally, a preliminary design for the checklist cards was developed, highlighting in red the points requiring special attention and in bold the most relevant items (see Figure 10).

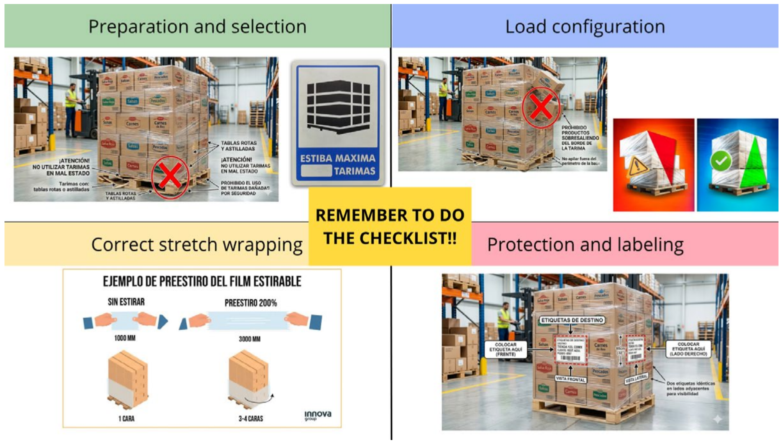

Figure 9. Example of an informational poka-yoke. Source: Authors

Check list

1. Are all my supplies (film, labels, tape) on hand?
2. **Is the maneuvering space around the pallet free of empty pallets or obstacles?**
3. Did I clearly identify the "base" (heavy) and "top" (light) products?
4. **Do all products match the picking order?**
5. Is the destination label placed on top of the stretch wrap, not underneath it?
6. **Is the packaging method correct for the customer?**
7. **Is the slip with the order number visible?**
8. **Did I return the pallet jack and the dispenser to their storage area?**
9. Was the work area left free of film scraps, labels stuck to the floor, or wood splinters?
10. Did I notify if the inventory of stretch wrap or corner protectors is running out?

Figure 10. Example of a checklist poka-yoke. Source: Authors

The results obtained from the Power BI dashboard show that the tool was able to organize the available records from the receiving process into clear visual indicators that support the diagnostic analysis of the process. More than functioning only as a set of graphs, the dashboard made it possible to identify relevant operational information related to delivered quantities, rejected material, unloading duration, supplier codes, and final inspection verdicts. As illustrated in Figure 11, the dashboard summarizes the receiving process through key indicators such as total delivered quantity, total rejected quantity, rejection percentage, and average unloading duration. These metrics provided a comprehensive overview of the receiving area's behavior, transforming raw data into an accessible, actionable format. Consequently, these results show that the dashboard's utility as an operational diagnostic tool capable to identifying specific areas requiring administrative or operational attention.

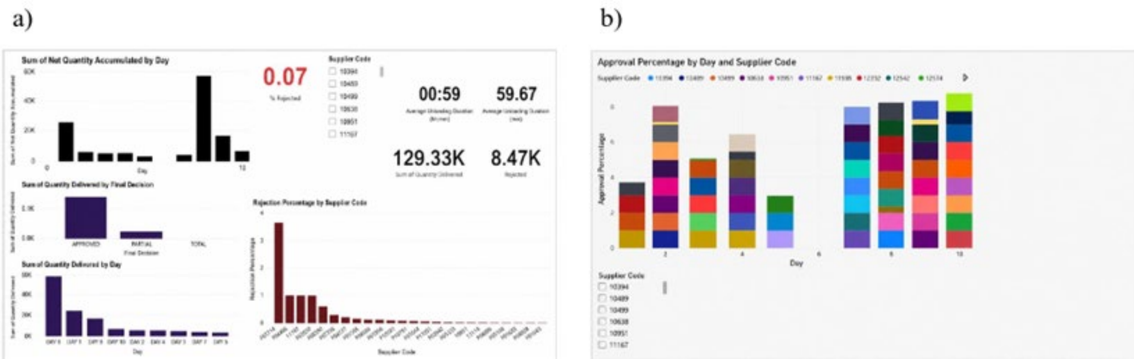

Figure 11. Key performance indicators displayed within the Power BI dashboard.

Currently, the company is determining who will have access to the dashboard and what type of information each person will be able to view. This access profile is assigned according to each employee's role and responsibilities, especially for those involved in process management and operational decision-making. Specifically, the company will define the level of access based on each position, including which sections of the dashboard are available to each user and what information they are allowed to consult. This approach complements the dashboard, since it helps ensure that the information is used properly and only by the personnel who require it for their work.

As a first approach toward the To-Be process design and to optimize the picking process, a preliminary simulation model was developed using Arena software (see Figure 12). The purpose of this model was to explore the operational capacity required to manage the flow of orders during a workday. The simulation represented the main stages of the picking and packing system, from order arrival to final packing, including activities such as forklift use, picking and grouping of orders into pallets. This model is not intended to serve as a definitive validation of the system, but rather as an exploratory proposed tool to identify the points where greater operational capacity may be required. Based on the results, it can be observed that the stages prior to packing concentrate a higher workload, particularly picking, batching, and forklift movement, while the packing area does not appear to be the main constraint under the simulated conditions.

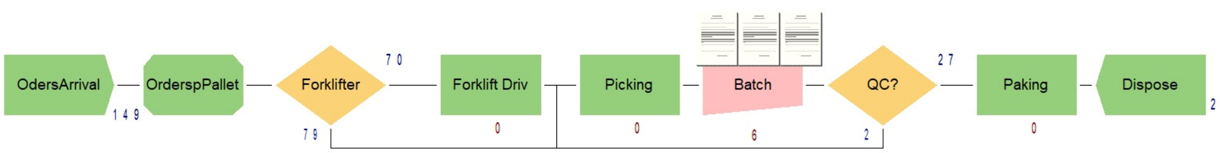

Figure 12. Preliminary Arena simulation model for the proposed To-Be picking and packing process.

For this first approximation, the input data were based on the company's historical records, assuming that approximately an arrival of approximately 200 over a 16-hour operational period, which corresponds to an average interarrival time of 4.8 minutes per order. Based on the flow process chart, the model considers a capacity of 20 picking workers and 2 packing workers during the operational workday. Processing times for picking and packing were modeled using triangular distributions defined by their minimum, mode, and maximum values. Specifically, the picking time parameters were set to Triangular(0.008, 1.5, 3) hours, whereas packing times followed a Triangular(2, 3, 5) minutes distribution.

The simulation logic assumes that workers receive orders for fulfillment, which are subsequently palletized and audited by Quality Control (QC). Under this baseline scenario, the primary output variables analyzed were throughput and resource utilization to evaluate system performance and identify potential capacity constraints.

The Arena simulation results indicated that the picking area demands the highest operator capacity due to its heavy reliance on labor resources. Furthermore, the stages before packing, specifically picking, batching, and forklift movement, exhibited the highest workloads and waiting times, estimated at 20, 54, and 56 minutes, respectively. Consequently, the model achieved a total throughput of approximately 150 packed orders across 30 pallets. These findings confirm that pre-packing activities act as the primary bottlenecks during the workday, whereas the packing stage requires no additional capacity under the simulated conditions. Therefore, future optimization efforts should focus on resource balancing within the stages preceding packing.

6. Conclusion

The use of the Business Process Management (BPM) methodology allowed for the structuring of the diagnosis, analysis, and redesign of the process within the picking area. Consequently, it was possible to identify critical areas related to space, material flow, and operational communication. Through the implementation of the 5S methodology, Kanban, and poka-yokes, low-cost proposals were developed to improve organization, reduce errors, and facilitate workflow. These proposals represent an excellent operational alternative with high potential for success within the area; however, once fully implemented, their subsequent improvements must be rigorously measured to quantify the actual impact on productivity. This demonstrates that the application of these methodologies and tools is highly effective in industrial contexts and that simple solutions generate a positive impact on the workflow within a distribution center. Regarding the Power BI dashboard, the integrated graphs and filters made it possible to observe the distribution of delivered quantities by day, the delivered quantity according to the supplier's final verdict, and the rejection percentage by supplier code. In addition, the dynamic filters included in the dashboard allowed users to explore the information by supplier, day, and inspection result. This functionality is important because it allows users to move from a general view of the receiving process to a more specific review of certain records.

Overall, the dashboard made it possible to visualize and organize the information from the receiving process through clear indicators. This facilitated the diagnosis of raw material control and provided a basis for monitoring the area, supporting future decisions related to material flow, picking, and packing. Finally, the development of the preliminary simulation model serves as a key transition toward the To-Be process design. Within the BPM framework, this tool ensures continuity for future process optimization, establishing that once the proposed changes are fully deployed, their operational improvements must be formally measured to validate and sustain the continuous improvement of the picking and packing system.

Declaration of AI Use

AI Tools were used exclusively for grammar correction, proofreading, and language editing to improve text clarity.

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