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Improvement Proposal Model Based On 5s, ABC Method and SLP to Improve the Level of Order Fulfillment in A Company in the Commercial Sector

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Abstract

The commercial sector in Peru has a sustainable growth over time, playing an important role and projecting an average growth of 3% by 2025. For this reason, commercial companies must be in constant development to be able to meet new market demands and solve new problems. In this sense, it is crucial to identify the main causes of the problems, such as the low level of order fulfillment, which is directly related to disorganization and suboptimal distributions in the warehouse, as well as high waiting times to serve customers. This research develops an improvement proposal model based on three tools (5S, ABC Method and SLP) which has as its main objective to improve the level of order fulfillment in commercial companies, in order to improve the standard time and obsolescence. The results obtained demonstrate the effectiveness of the model by increasing the order fulfillment level from 78.75% to 90%.

Keywords
Commercial company, order fulfillment, 5s, ABC, SLP.

1. Introduction

In the latest INEI reports, the commercial sector presents sustainable growth over time, which is very attractive in the business industry. It also plays a fundamental role in the generation of employment and in the contribution of economic growth, regardless of their level, development or political system (ILO, 2023). In Peru, the importance of this sector lies in its contribution to GDP, representing 10.4% and having a growth of 3% compared to the previous period (INEI, 2021). On the other hand, the sector witnessed a negative percentage variation of 13.3% in 2020 and a positive percentage variation of 17.2% in 2021 (INEI, 2023). Likewise, a report carried out by the Central Reserve Bank of Peru indicates that GDP growth expectations for 2025 will be 3% (Banco Central de la Reserva, 2023), which is why companies in this sector must be in constant preparation to meet the needs of new demands and face problems such as a low order fulfillment levels.

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According to the literature review, one of the main problems that commercial companies encounter is related to the lack of an inventory structure, which impacts order fulfillment, search times and the amount of obsolete stock. This problem is evidenced in various investigations, for example, in a commercial company located in Lima, which, by not having an adequate classification system, presents high stock levels, obsolescence and high storage costs (Franco et al., 2021). Another investigation carried out in a company that sells agricultural machinery spare parts demonstrates a deficiency in inventory classification since it only presents a mono-criteria classification, which generates inventory overruns and a drop in the order fulfillment levels (Salazar et al., 2019). Finally, a company that sells tires and automotive items in Ecuador presents an empirical definition of the process, which leads to inefficiencies in response times to customers, since time is lost in the search for spare parts (Granizo et al. ., 2018). Therefore, it is important to continue with these investigations, to focus on possible solutions and opportunities for improvement.

The objective of this research is to develop a combination of specific tools that allow for improving the inventory system in commercial companies. In this way, a model is proposed that involves the following tools: 5S, ABC Method, and Systematic Layout Planning (SLP). Likewise, it is important to note that the amount of research focused on inventory optimization in companies that sell spare parts machinery is limited. This scientific article is divided into introduction, literature review, methods, data collection, results and discussion and finally the conclusions regarding the stated objectives.

1.1 Objectives

The study aims to demonstrate that applying the model based on 5S, ABC Method and SLP increases the level of order fulfillment of companies in the commercial sector. Firstly, 5S will be applied to eliminate waste and minimize unproductive processes; secondly, the ABC method will be applied to classify the spare parts according to their rotation and thirdly, systematic layout planning (SLP) will be applied to improve inventory distribution and workflow.

2. Literature Review

2.1 5s in the commercial sector

The 5's methodology is a tool for continuous improvement that seeks to increase the value of processes for clients through waste reduction; their task is to create a highly efficient, clean and ergonomic work environment, that manages to visually control the workplace (Dominguez et al., 2019). This methodology is considered a work philosophy that has the following stages: seiri - classify, seiton - order, seiso - clean, seiketsu - standardize and shitsuke - discipline (Calderón et al., 2022), which optimizes the productive processes, eliminating stages that do not provide significant value. Usually, it is used with other tools such as inventory management because allows not only to focus on Kaizen but also on process integration and inventory management techniques, always seeking to optimize processes with appropriate procedures (Neyra et al., 2019) and also aims to build a stronger work ethic within management and workers, who are expected to continue good practices (Guillen et al., 2018).

The effectiveness of 5'S is visualized in a study developed in Mexico on a commercial company that obtained an 84% reduction in unproductive time accompanied by the FIRO tool, so this is usually developed and complemented together with other tools or methodologies (Bellido et al., 2021), to achieve greater scope in results. In addition, this work philosophy allows the reduction of time in the production system, up to a possible reduction of 30% of transit time within the warehouse. Some studies indicate improvements of 82% and 79%, respectively, for the process of loading and unloading products in large companies when using the 5s tool (Espinoza-Camino et al., 2020). Furthermore, the final values obtained from the pilot test on a peruvian company demonstrated that the implementation of 5S on commercial enterprises helped improve order fulfillment levels by 12% in the first month of implementation, in addition to halving the time of key processes, since the activity time was reduced (Campos, 2022).

2.2 ABC method in the commercial sector

The ABC method is a technique used in inventory management by business organizations that involves the division of several elements, such as finished products and items in stock (Emar et al., 2021). The process involved in ABC classification consists of various objects such as finished goods and items in stock (Emar et al., 2021). The value of category A accounts for the highest 20% of all spare parts, the value of category C accounts for the lowest 50% of all spare parts, and the rest are category B (Xu, N & Xu, W, 2020). This method goes hand in hand with the Pareto principle since it can be interpreted as 80% of the annual investment is consumed in 20% of the SKUs (Kharka et al., 2021).

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The impact of the ABC method can be seen in the optimization of the order preparation process based on product groups, thus achieving cost reduction in the process of optimizing metal consumption of transport structures, reducing equipment costs. (Nosko et al., 2020). Additionally, the shape of the optimal zones depends largely on the asymmetry of demand, the number of selections on each route, the storage allocation policy and the length/width ratio of the warehouse (Silva et al., 2022). Furthermore, on a study focused on commercial companies with lacked of efficiency on the storage system, shows that the ABC method time can be reduced by relocating the inspection area, thus reducing the distance from 42 meters to 18 meters, as well as the number of workers moving the products can be reduced, decreasing the cost of hiring workers to move products amounts to 1,800 THB per day (Udomraksasakul & Songserm, 2018).

2.3 SLP in the commercial sector

Systematic layout planning (SLP) consists of a framework of phases through which each layout project passes, a pattern of procedures for systematic planning, and a set of conventions for identifying, visualizing, and rating the various activities, relationships, and alternatives involved in any layout project (Vizcarra et al., 2020). A good warehouse reduces the distance between activity areas, reduces picking errors and provides operators with greater freedom of movement. Therefore, SLP includes the allocation of warehouses to ensure an optimal flow of work, workers and materials, since the method obtains the logistics flow diagram of the factory production system by analyzing the logistics process of the manufacturing process (Ramírez et al, .2023).

The results of the studies focused on companies on the commercial sector, show a relationship between design improvement and cost reduction, by reducing the total flow of materials and delivery time (Montalvo-Soto et al., 2020). On other hand, a study carried out in commercial company with poor distribution of work areas and disorder in the aisles, proposed the application of the SLP, having as results the reduction of bottlenecks and the distance traveled, thus increasing its effectiveness (Ramírez et al., 2023). Finally, it allows analyzing the design of a plant's facilities using the process flows and the distance between stations, through the preparation of a diagram with the location of the production unit according to the logistics relationship to improve the system. plant logistics (Liu H et al., 2020).

3. Methods

This article is a case study, as it is based on a specific company. In this case, a commercial industry, and a combination of methods are used to analyze this industry.

The proposed model has as INPUT (input), the low levels of order fulfillment and it is expected that the OUTPUT (output) will significantly increase this indicator. In this way, the proposed model is based on three phases: problem analysis, intervention and implementation of the intervention, as can be seen in Figure 1.

First, a diagnosis of the current situation of the company was developed, carrying out the following steps: analysis of indicators (evaluate the current performance of the organization), Pareto chart (which allowed us to quantify and weight the main causes of the main problem), the Ishikawa diagram (which helped identify root causes) and problem tree (schematizes problems and causes). Thus, it was possible to identify low levels of order fulfillment, directly related to the lack of order (lack of cleanliness and visibility of spare parts), lack of an inventory classification model (location of spare parts according to arrival date) and a suboptimal inventory distribution.

Once the problems and their main causes were identified, an exhaustive search was carried out for the solutions and tools to be applied to improve the indicators, where the main result is expected to be an increase in the level of order fulfillment. Unlike the other models applied in sectors other than the commercial one, the proposed model considers the integrated application of three engineering tools, which are the following: 5S, ABC Method and SLP. Finally, phase 3 aims to measure the level of improvement after the implementation of each of the tools and make a comparison between the results of the indicators obtained during the development of the diagnosis of the current situation and the situation based on the model proposed. Considering the above, Figure 1 shows the proposed model for the development of the proposal.

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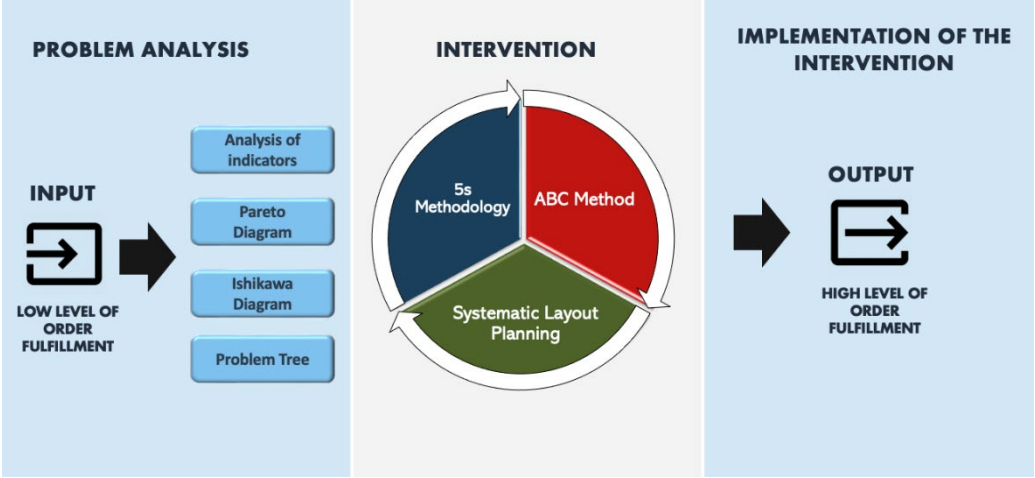

Figure 1. Proposed model

4. Data collection

Data collection for this research was based on the collection and measurement of information from various bibliographic sources (articles, reports, books, etc.) for a complete evaluation. Likewise, to capture all the information about the company, certain tools such as surveys and interviews were used to learn more about the processes and shortcomings of the organization. As mentioned above, in addition to surveys and interviews, an analysis of indicators was used to know the current state of the company. A Pareto chart was used to determine the most critical problems, then the Ishikawa diagram and finally the problem tree to summarize and identify the main causes. Once the information was collected, it was determined that it was feasible to use tools such as the 5'S, ABC Method and the SLP. Figure 2 shows the process that was followed to obtain the results of this research.

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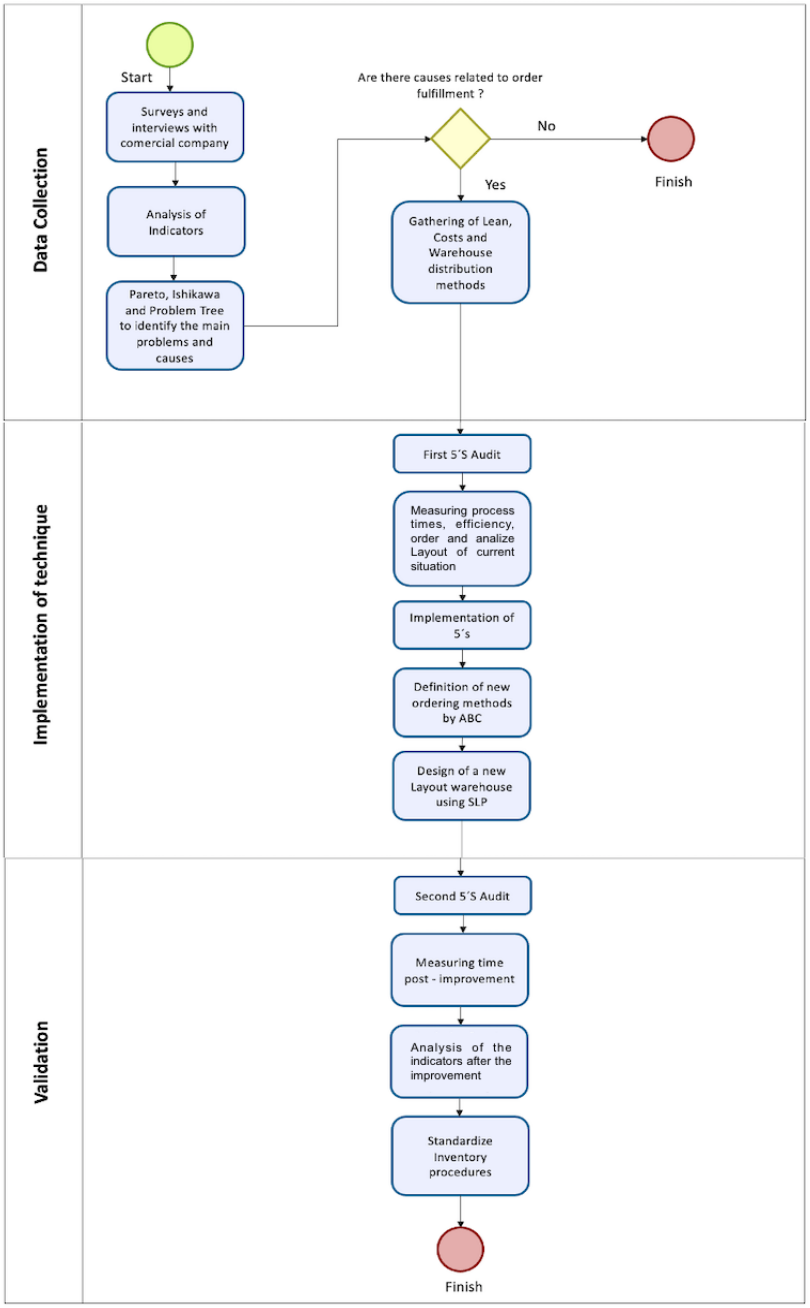

Figure 2. Diagram of the results

4.1. Implementation of 5S, ABC Method and Systematic Layout Planning

This phase is oriented towards the application of the selected tools, according to the main problems of the case study, the order of application of the tools was as follows: 5S, ABC Method and SLP. In the case study, the company has an inventory problem, caused by excessive disorder, lack of classification of spare parts and poor warehouse design, which in turn generates low order fulfillment levels. All these deficiencies result in spare parts not being found on time, leading to extra costs and generating a bad experience for the customer.

In this sense, a time study was carried out in which, through the relevant calculations, the standard time of each activity related to the dispatch and search of spare parts was obtained, which is shown in Table 1. In this way, we can analyze

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the current state of the company. Likewise, consider that in order to determine the standard time, the clearances (personal needs, worker fatigue, standing posture supplement) are considered.

To carry out the time study, the activities that lead to the sale of spare parts will be taken (customer at the counter) first, the search for spare parts is carried out (begins when a customer arrives at the company and asks the seller for a code), once the spare part is located, cleaning is carried out followed by visual confirmation from the customer (it is carried out at the counter), once this is completed, the box is assembled, continuing with the packaging and finally the delivery of the spare part. In this sense, to begin the time study, we proceeded to record times for all activities for 1 week, where the standard time was finally obtained, which is presented in Table 1.

Table 1. Standard time for activities before upgrading

No	Operation	Standard Time before the upgrade	Responsible
1	Spare Parts Search	9 minutes and 13 seconds	Operator
2	Cleaning	3 minutes and 10 seconds	Operator
3	Customer confirmation	2 minutes and 40 seconds	Operator
4	Box Assembly	3 minutes and 30 seconds	Operator
5	Packed	7 minutes and 15 seconds	Operator
6	Spare Parts Delivery	2 minutes and 50 seconds	Operator

In this sense, carrying out the pertinent calculations, it has been obtained that the current standard time for the total of all activities is 28 minutes and 38 seconds, where in each activity the time it takes the operator to go to each station is being considered. With this we were able to identify an important indicator because the time it takes to carry out all the activities is relatively high, considering that there is a customer at the counter waiting for their response. Once the time study was carried out, the 3 selected tools were implemented:

- 5S Methodology: This methodology allowed the elimination of waste, reduction of time searching for tools and the establishment of order in the warehouse, considering that in the initial evaluation only 28 of the 50 possible points were obtained in the 5S Audit that covered the fields select, order, cleanliness, standardization and discipline, which represents 56% compliance.

- ABC Method: In the initial evaluation of the company, it was observed that the SKUs are not classified correctly, since they are placed according to the order of arrival. Therefore, the application of the ABC method was considered since it allows the inventory to be partitioned according to three sectors according to the three-week sales of the spare parts, thus ensuring that those with more movement are placed closer to the entrance, being this zone called A, while those with less movement will be found in zones B and C. This allows a reduction in the time to attend to orders, as well as avoiding losing sales due to a product not being found or for high search time, which was identified as a problem in the initial inventory review. Table 2 presents the classification.

Table 2. Classification according to the ABC Analysis Technique

Classification	% of SKUs	% of Movement
A	5-20%	80%
B	25-30%	15%
C	50-60%	5%

- Systematic Layout Planning: This tool allows you to organize the workplace according to the procedures of a productive activity to achieve sequentiality in the processes and reduce the movement of the operator from station to station. Because this work addresses the process of fulfilling an order, the workstations and processes involved were analyzed, observing the following results: the shelves and cabinets with the highest turnover products are far from the entrance, the two work stations, assembling and cleaning area, are away

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from each other and also from the stairs that lead to the counter, this is where the spare parts are reviewed by the customer, leasing to unorganized flow of material, increasing the response time to the client.

Below, we present the results of the current indicators. For the order fulfillment level, we carry out a weekly sample, taking an average of the attended demand and unmet demand, the results of which will be presented below. Regarding the percentage of obsolescence, an ERP was used to know the amount of total stock and for obsolete stock, we considered those spare parts that have been in the warehouse without movement since 2019.

- Order fulfillment level (%) : $\frac{Fulfill\ Demand}{Fulfill\ Demand+No\ Fulfill\ Demand}\ x\ 100 = \frac{220}{280}\ x\ 100 = 78.57\ \%$
- Standard time in activities: 28 minutes and 38 seconds
- % Obsolescence: $\frac{Obsolete\ Stock}{Total\ Stock}\ x\ 100 = \frac{40{,}512}{128{,}805} x\ 100 = 31.45\%$

5. Results and discussion

The application of the improvements was carried out through a pilot test that lasted 3 weeks, where all the guidelines and proposed improvements were applied, obtaining the following results of the indicators (Table 3):

Table 3. Standard time for activities after upgrading

No	Operation	Standard Time after the upgrade	Responsible
1	Spare Parts Search	6 minutes and 36 seconds	Operator
2	Cleaning	2 minutes and 00 seconds	Operator
3	Customer confirmation	2 minutes and 20 seconds	Operator
4	Box Assembly	2 minutes and 10 seconds	Operator
5	Packed	4 minutes and 00 seconds	Operator
6	Spare Parts Delivery	1 minute and 30 seconds	Operator

With the new times, a total time of 18 minutes and 36 seconds was obtained. This indicator presents an improvement, since it has been observed that the warehouse has more organized spaces, classified spare parts, a better workflow, a structured warehouse and the reduction of time in customer service.

Regarding the application of 5S, the 5 steps of the methodology were applied achieving a percentage of 92% (46 points out of 50 possible), which is a result close to the ideal situation, since progress has been seen regarding order (there are no longer materials, tools or unnecessary elements on the floor), when selecting spare parts (shelves with clear signs and correct locations), cleaning (waste-free places, staff responsible for cleaning the warehouse), standardization (control of operations) and discipline (promote a culture of continuous improvement). Considering that those spare parts that have been classified as obsolete and/or unnecessary after coordination with the company, have been sold or discarded. The results are presented in Figure 3.

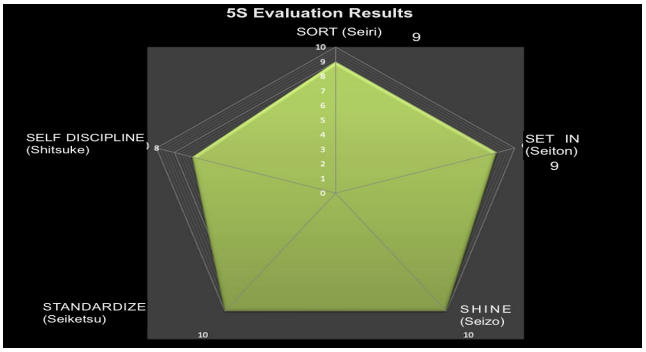

Figure 3. Assessment of the 5's after upgrade

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Regarding the application of the ABC method, it was possible to classify the spare parts according to the sales obtained during three weeks on the shelves closest to the entrance to reduce the operator's travel time, as well as the distance traveled in the store. The zones in the warehouse are composed according to the following: zone A is composed of two racks, identified by the letters Q and L, and a shelf, identified by the letter J, which contains the most frequently moved spare parts; Then, there is zone B, made up of five racks, identified by the letters P, CC-DD, EF and D, and two shelves, identified by the letter J, which contain the regularly moving spare parts; Finally, zone C is made up of four racks, identified by the letters K, C and B; four shelves, identified by the letters J and A, and pallets with spare parts outside the warehouse, which contain the spare parts with the least movement. Figure 4 shows the layout of the areas, racks and shelves that make up the three areas, as well as the warehouse plan:

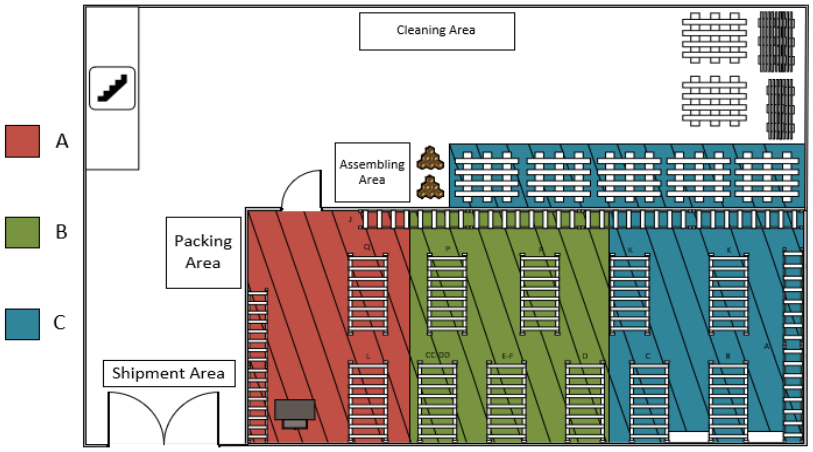

Figure 4. Warehouse distribution using ABC

Regarding the analysis with the SLP tool, it was chosen to distribute the warehouse in a way that ensures a better workflow, helping to reduce the time of all activities related to the warehouse. Figure 5 shows the proposed plan for the warehouse, in which the spare parts were organized in the warehouse racks according to the ABC distribution previously carried out on spare parts with greater movement, as well as the areas involved in the spare parts delivery process, placing the pallets with heavy spare parts outside the warehouse and locating the boxes near the assembly area, optimizing the space in the maneuvering yard and bringing together the areas involved to achieve greater fluidity in the processes.

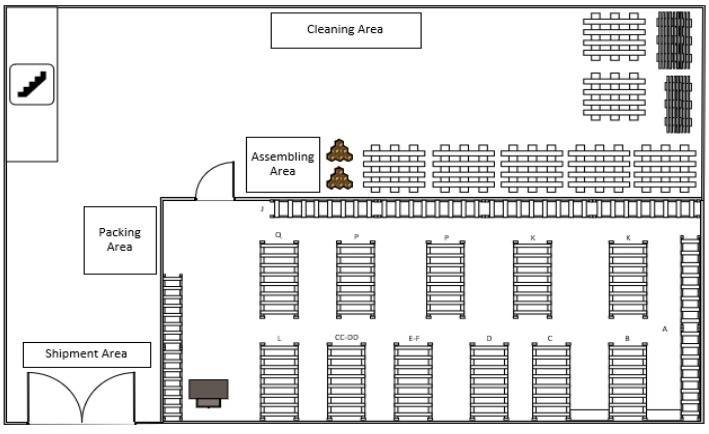

Figure 5. Layout Warehouse after improvements

The activities involved with the process of fulfilling an order are made up of searching for the spare part, cleaning it, validating by the customer that it is the correct spare part, assembling the packages, packaging the packages and

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delivering them. of spare parts to customers. The analysis of the relationships between activities can be seen in Figure 6, which has the following nomenclature between activities: A, being absolutely necessary; E, especially important; I, important and O as ok. Which finally allowed us to make improvements in the distribution of stations in the warehouse.

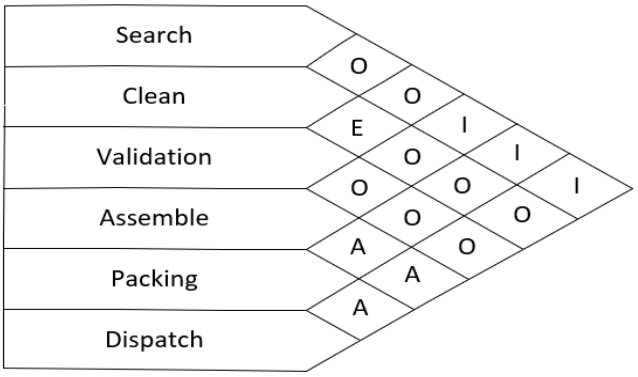

Figure 6. Relationship between activities

5.1. Numerical Results

The indicators after the application (pilot test) are presented below, considering that for the order fulfillment level is an average of the demand attended and not attended in the 3 weeks of the pilot test was taken.

- Order fulfillment level: $\frac{298}{330}\ x\ 100 = 90\ \%$
- Standard time searching for spare parts: 18 minutes and 36 seconds.
- % Obsolescence: $\frac{38{,}212}{128{,}805}\ x\ 100 = 29.67\ \%$

5.2. Graphical Result

Through the application of the tools we were able to obtain the following graphic results (Figure 7 and Figure 8):

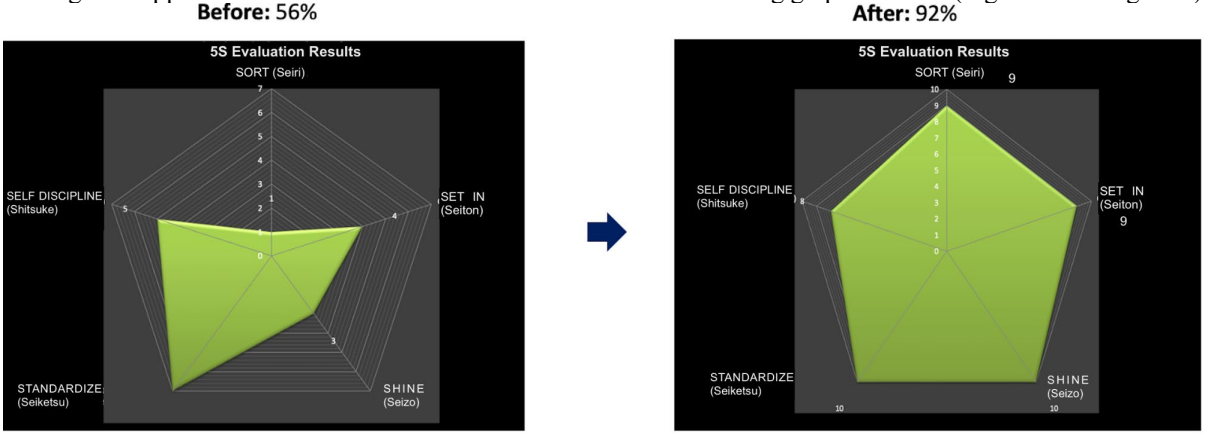

Figure 7. Assessment of the 5's Before and After

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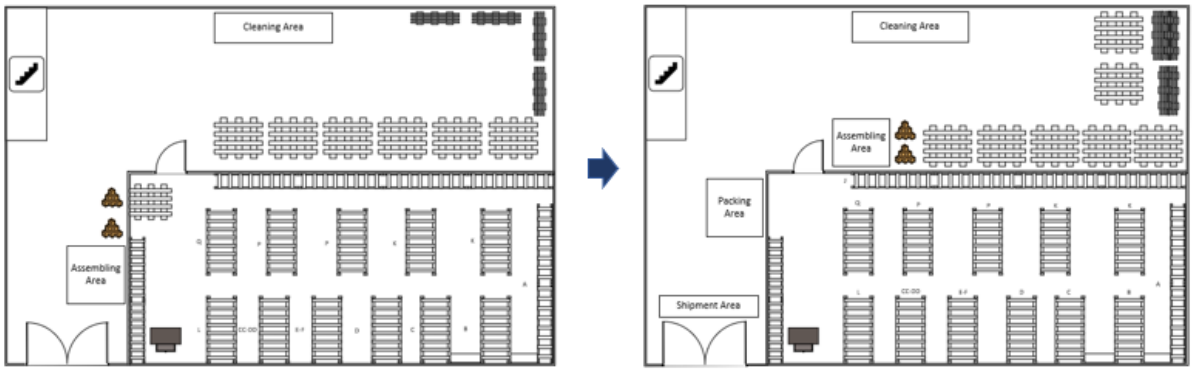

Figure 8. Layout Warehouse Before and After

5.3 Validation

The proposed model was validated through a pilot test lasting 3 weeks, with the new data obtained and after the implementation of the 3 tools, so that the indicators were calculated again. Table 4 presents the initial and final results.

Table 4. Comparison of indicators between scenarios

Indicator	Initial Situation	Improved Situation
Order fulfillment level	78.75%	90%
Standard Picking Time	28.38	18.36
Obsolescence	31.45%	29.67%

From the final indicators, we can conclude that the proposed objective was achieved since all the indicators showed improvements, and if the model continues to be implemented in the company, there is room for additional improvement.

6. Conclusion

With the results of the previous table, it is concluded that the implementation of the proposed model in the company under study allowed an increase in the order fulfillment level el from 78.75% to 90%, demonstrating the effectiveness of the model.

Regarding the other indicators, it is observed that the standard time and obsolescence were significantly reduced, obtaining great benefits and being more competitive in the commercial market.

It is important to have all the historical data on the times, especially the times in the search for spare parts, to be able to develop a better analysis of the indicators and thus reduce the error and have more precise information.

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