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INCREASING THE LEVEL OF SERVICE THROUGH THE IMPLEMENTATION OF 5S AND MRP TOOLS IN SMEs MARKETING PHARMACEUTICAL PRODUCTS: AN EMPIRICAL INVESTIGATION IN PERU

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Increasing the level of service through the implementation of 5S and MRP tools in SMEs marketing pharmaceutical products: An empirical investigation in Peru

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Abstract

Nowadays, Peruvian SMEs, with an initial business model, seek and achieve good acceptance in the market, which are obliged to acquire the necessary knowledge and tools to be able to continue and manage a great change in the growth of the company. In this context, the research aims to implement the tools of industrial engineering in order to achieve the improvement in the level of service in a pharmaceutical SME.
It was decided to perform an external analysis of the company to know the situation in which it is compared to others in the same sector and an internal analysis to determine its strengths and weaknesses.
To identify the problem, a deeper analysis of the process will be carried out using the root-cause tree methodology, in which it is concluded that, due to poor management in the warehouse, there are delays in the attention of orders.
For the implementation of the improvement, constructivism has been chosen as the theoretical framework, this choice is made with the purpose of knowing in depth the different theories that allow corroborating the benefits that the implementation of the different tools to be investigated have brought to the companies.
In this case, the normative networks are studied in two ways, 5S and MRP tools. The methodology used for this purpose is based on a quantitative-descriptive analysis, which frames the registration, analysis and interpretation of an audit and checklist, as well as the times or processes of the phenomena that occur within the company.
Finally, after implementing the 5S and MRP tools, the technical validations are carried out through audits and the Arena Simulation Software, respectively.

Keywords

Service level, pharmaceutical sector, Lean manufacturing, 5S, MRP

1. Introduction

The pharmaceutical sector in Peru presents a growth between 2 to 3% (Terranova, 2022), since, during the pandemic, the demand for the pharmaceutical portfolio is growing and therefore the sales of the sector were high. That is why this study focuses on a marketing company belonging to the pharmaceutical sector that decides to start its business model, and the good management of this, achieves a good acceptance in the market, which achieves high growth due to its large customer acquisition, but today, entrepreneurial companies do not have the knowledge or tools necessary to continue and manage a large change in growth, as well as not having established specific indicators to retain customers.

Therefore, this case study aims to increase the efficiency of the level of service, because although it is true that the company had good growth, on the other hand, presented a low percentage of the level of service provided to the customer, since it did not meet the 3 pillars: quantity, quality, and time. Today, "the quality-of-service influences 60% of the decision to purchase a product" since it is part of the points that buyers evaluate ("Quality of service influences 60% of the purchase decision of Limeños", 2019).

That is why it is important to apply the tools of Industrial Engineering to improve the level of service of the company, since the problem is directly related to the fact that there are delays in the location of products in the warehouse for

subsequent order preparation, as well as not having a flow of purchases for the acquisition of products from the supplier, causing stock breakage. Consequently, the following question arises: How does the implementation of the 5S and MRP tools improve the level of service through the fulfillment of perfect order indicators?

1.1 Objectives

The objective of this study is to implement the 5S and MRP tools to improve the level of service in a pharmaceutical company. Given that the company's mission is to satisfy and meet customer requirements, it was observed that the company does not have a competitive service level in the pharmaceutical industry, which is why there is a technical gap that must be covered to achieve improvement. For this reason, during the research, the process, classification, and distribution of the warehouse had to be identified, in order that after implementing the 5s, audits could be carried out to validate compliance. Likewise, for inventory management, MRP is also proposed to improve the adequate and indispensable planning and communication between the areas involved such as purchasing, sales, accounting, and warehouse, in order that after implementing the previously mentioned tools, considering the improved points, the total order preparation time would decrease, which is directly related to the percentage of orders delivered out of time and incomplete. Therefore, the application and implementation of these tools are necessary to meet customer expectations.

2. Literature Review

2.1 Lean Manufacturing

Lean Manufacturing is known as the waste elimination machine through tools such as 5S, TMP, SMED, and Kanban System. According to (Antosz & Dorota, 2017) Lean Manufacturing is not only applied to this type of pharmaceutical company if not there are different methods to improve the activities that are carried out in any work environment. A company needs to have good coordination in the supply chain to get all the materials on time with good quality and at low prices. In addition to functioning as a process methodology, it can be adopted as part of the organizational culture, since through it will be possible to reach the company's vision and give more support and prominence to its use in all areas. (Alvarado-Siete & Gomez, 2022)

On the other hand, (Daniel & Mercedes, 2022) mentions lean leadership as a critical factor for the implementation processes of the methodology in a company or process, considering making change agents and role models to the collaborators of the different hierarchies. To this end, they point out that it starts from the leaders to their chains of command in cooperation for the search, evaluation, and overcoming of the present errors, making use of effective and transversal communication.

Likewise, (Ruiz-Sotelo & Munive-Damian, 2022) argues that the implementation of a maintenance model is required to improve the availability of machines and industrial equipment that serve as pillars to maintain the competitiveness and profitability of the company belonging to all sectors of the industry through Lean tools.

In the paper by (Campos-Espejo & Coronado-Zamalloa, 2022) use is made of a model that combines the implementation of an ERP, the JIT method, ABC classification, and standardization of work to improve a real inventory turnover model. To this end, they considered the use of lean tools to eliminate irrelevant activities and focus on those that generate value. After their application and subsequent simulation of the process, a favorable result was obtained, reducing overall process time, labor use, and increasing attention capacity.

2.2 5S Methodology

According to (Willis,2017) if you have gone through a 5s project you have been exposed to the 5S: sort, set in order, shine, standardize, and sustain. Maintaining the 5s not only involves cleaning and fixing any taping issue but also is implementing visual controls into a current process.

The 5S methodology is considered the work cleaning tool, since it is innovative and improves productivity, therefore, through the research applied by (Socola, 2020) it was possible to obtain as a result, that after the application of this tool, great changes could be evidenced concerning the attention of perfect orders, which leads to conclude that it is a very important and efficient tool. Therefore, as a mechanism for improvement in a pharmaceutical product commercialization company, the topic of 5S and its implementation is of interest, since it serves as a first step in the search for business excellence, which is presented positively and internationally. (Piñero, Vivas Vivas, & Flores de Valga, 2018)

It is noteworthy that for the successful implementation of the 5S tool, according to (Mudhafar, Konstantinos, & Yuchun, 2017) there must be a commitment from all those involved in the company.

This industrial engineering tool will benefit the company, providing safety, efficiency, quality, and help to workers, since it will allow them to perform their functions with the least possible effort.

2.3 MRP Methodology

The MRP methodology is also extremely important for the fulfillment of the demand within companies of this type since the competitiveness of the market faces problems in inventories, therefore, according to, (Rivera Poma, 2020) this comes as an ideal complement for the planning and control of production to achieve success.

The drug market in Peru is small and dynamic compared to other sectors, therefore, it is necessary to raise strategies to carry out improvements in the company, in this case, a pharmaceutical marketing company. According to (Ubilluz, 2019) establishes through a study, this market is always in constant growth, however, by focusing on the private sector, it handles more expensive products than generics, and although in recent years the public market has been predominant, the private system is still accepted.

In addition, the research conducted by (Cardozo, Chavarro, & Ramirez, 2018) concluded that pharmaceutical industries are the most profitable in the industry, generating an income of 42%, however, this depends on the quality of the service provided. On the other hand, even knowing that the sector is profitable, it is essential to maintain a good level of service and achieve a good positioning in the market. To achieve this, according to (Siguenza-Peñafiel, Erazo, & Narváez, 2020) there must be a nexus between the consumer and the company, in such a way that a favorable perception of the company is achieved.

According to (Socconini, 2019) one of the main tools to improve service in terms of delivery, time, and quantity, greatly affects the innovation of the organization, acquiring technology that can support workers. Therefore, investing in machinery and instruments that make time yield, quality and service will increase productivity. In addition, for (García Fernández, 2019) the implementation of Lean Manufacturing, although it can be a long process, can solve or decrease any type of internal problem of the company, supporting that the processes and the worker's training are always in continuous improvement.
It is considered essential that there is a good implementation of MRP in the company since according to (Fernandez-Rios & Salas-Guillen, 2022) a bad implementation causes cost overruns due to a lack of inventory control.

3. Methods

The research design is quantitative-descriptive since data and information are collected on the variables proposed and it is a method based on observation. All of this allows us to analyze and predict the behavior of the population. This population includes companies that sell pharmaceutical products. When analyzing the diagnosis of the company's service level, the result is that the company's productivity is affected by the late delivery of products, and the delivery of incomplete and defective orders. In addition, a poor organization in the warehouse, lack of inventory, inadequate use of transportation, and poor condition of the machines, cause unnecessary variation in the performance of planned tasks, causes downtime of staff, and, as a result, affect efficiency, performance and increases the standards of working time. As can be seen in Figure 1, a tree diagram was developed to diagnose the current situation of the pharmaceutical products trading company, thus identifying the problem and its main causes.

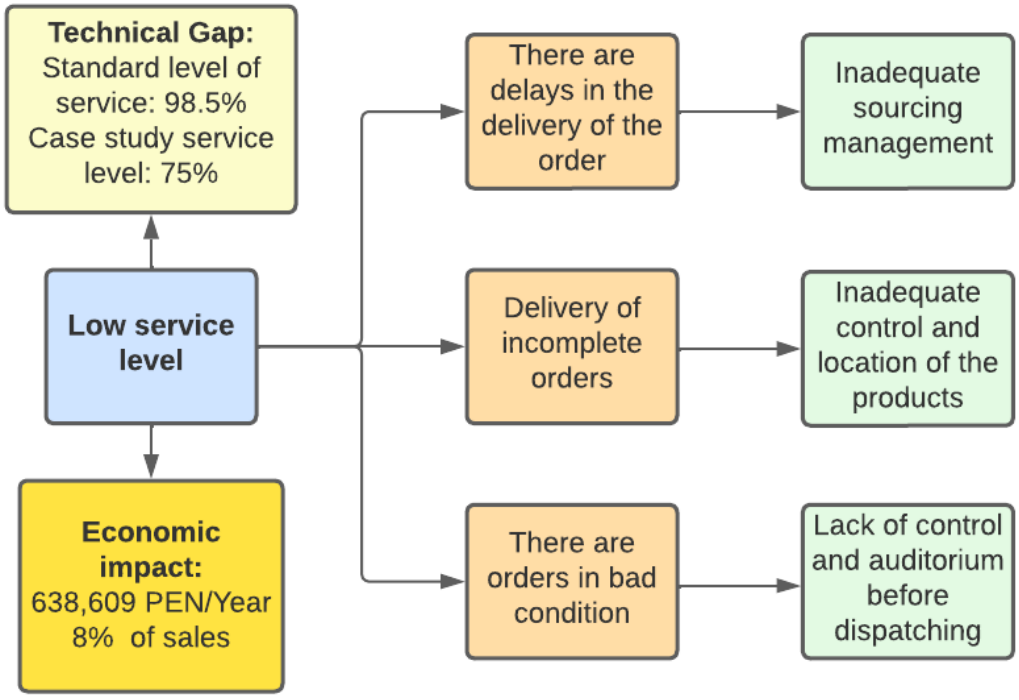

Figure 1. Problem tree

With this analysis of the problem tree, we can see the causes that lead to the main problem, which is to have a low level of service (75%), since there is a gap in the pharmaceutical industry. This is because, in the first place, the company measured the service level indicator partially, since it was only based on the delivery of orders attended over the total number of orders, which did not show the reality. Therefore, it was concluded that the system managed by the company did not map the other 2 indicators that relate to perfect order. Then, it was identified that the main causes are the delay in the location of the products in the warehouse for the preparation of the order and the lack of inventory since they do not have correct planning. Finally, for the design of the solution, the objective was to increase the level of service provided to the customer, which, focusing on the above-mentioned causes, allows the application of 5S and MRP tools.
The 5S tool, which corresponds to the initials of the following 5 Japanese words:

- ✓ "Seiri": Sort.
- ✓ "Seiton": Organize
- ✓ "Seiso": to clean up
- ✓ "Seiketsu": To standardize
- ✓ "Shitsuke": Discipline (Quesado Pinto et.al., 2018).

On the other hand, materials planning or MRP, as the name implies, is a planning and management system, usually associated with a production planning software and an inventory control system.

4. Data Collection

The following images show how the picking process is developed. To analyze this image, it is necessary to consider the warehouse area and the conditions in which it is located. There is no order in the storage of products; however, if there were better organization and cleanliness, there would be better results, optimizing time and thus increasing dispatches. On the other hand, the excessive number of boxes, as shown in Figure 2, negatively affects the location of the products, i.e., these locations are not fixed correctly.

Figure 2. Warehouse initial situation

To carry out the study of the times of the operators in the picking and dispatch process, access was gained to the warehouse area to visualize the work performed and quantify the time taken for each activity, considering any interruptions that may exist. The data was collected using the observation technique, considering that it is a non-intrusive method in which the time taken by the personnel to perform the operations involved in the process to be studied is rigorously recorded through the system.
Based on the aforementioned information, the time of each operator is expressed in minutes, considering that the process starts when the guides are received, then the lot code is entered to get the location on the shelf. Afterward, the orders are picked and packed, so that they can be finally dispatched.

5. Results and Discussion

5.1 Numerical Results

Table 1 shows the tasks and times of the picking and dispatching process of the company, it is important to identify the activity with the longest time. Therefore, this table shows that the total time of the process is 43.65 minutes. This time is reduced after applying the tools mentioned above and validating that it is recommended to add as the last task the activity of "verifying" as a good practice, in which the operator performs a checklist of the order to be dispatched. The reduction of time improves the productivity of the company; the number of orders and the number of operators involved in the process must be considered.

For the Value Analysis of the activities that make up the picking and dispatch process, first, they are classified into VA (Value Adding Activity), NVA (Non-Value Adding Activity), and NVAN (Non-Value Adding Activities). Then, certain NVA activities such as Muda, Mura, or Muri will be identified to optimize them and show the approximate savings per cycle.

Table 1. Initial Ava matrix of the picking process

Nº	Activities	Value	Cycle time per operator				Muda/Mura/Muri	Suggestions for removing NVA	Approx. CT savings(Min)
		VA/NVA/ NVAN	1	2	3	Mean			
1	Receipt of the guide to be shipped	NVAN	1	1	2	1,33			
2	Guide on standby on a first-come, first-served basis	NVA	2	5	3	3,33	Muri	Increase the number of workers	0.5
3	The lot is entered in the computer to have the location of the product	NVA	3	2	5	3,33	Muda	Avoidance of manual activities	2
4	Note the location of the item	NVA	5	10	7	7,33	Muda		
5	Performs picking	VA	10	8	15	11			
6	He goes to the worktable to prepare the order	NVA	3	7	5	5	Mura	Maintain order and cleanliness in the warehouse	1
7	Kardex is completed	NVAN	3	10	5	6			
8	Packing is elaborated	VA	3	6	10	6,33			
9	The order is moved to the dispatch area	NVAN	2	1	3	2			
Total						**43,65**	**Minutes**		

Figure 3 shows the percentages represented by each type of activity. It is concluded that 33% of the activities generate value, 22% of the activities do not generate value and 44% of the activities are necessary that do not generate value. The table helps to identify opportunities for improvement in the processes involved in picking.

Two opportunities were observed:

- → In the reception of the guides and waiting for attention according to the order of arrival, "muri" waste is observed, since if it does not have enough staff, it is not possible to start with the orders, which causes a bottleneck in the process.
- → In the process of entering the lot in the computer and noting the location of the item, time can be reduced by implementing a coding and acquiring a bar code reader gun.

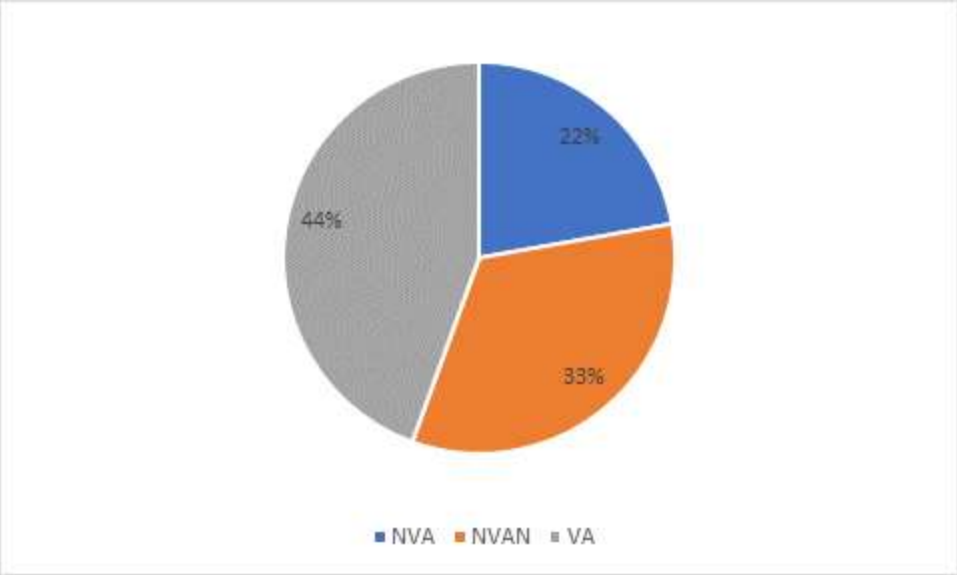

Figure 3. Graph of Ava matrix picking process

With respect to table 2, it can be observed the times of the activities, after implementing the improvements and how the average final time is reduced to 19.49 minutes.

Table 2. Final Ava Matrix of the picking process

Nº	Activities	Value	Average time per operator (in minutes)
		VA/NVA/NVAN	
1	Receipt of the guide to be shipped	NVAN	0.83
2	Guide on standby on a first-come, first-served basis	NVA	3,33
3	MRP System Query	VA	1
4	Performs picking	VA	1,5
5	The medication is transferred for order preparation	NVA	2
6	MRP system is updated	NVAN	1,5
7	Packing is elaborated	VA	6,33
8	Verify by means of a check list	NVAN	2
9	The order is transferred to the dispatch area	VAN	1
TOTAL			**19,49 minutes**

5.2 Graphical Results

Once the picking time has been calculated, the simulation of the process is started, considering that this is an important tool that allows the analysis of the current situation. It should be noted that the objective of the special event simulation is to achieve the optimization of complex processes. Also, the unequal distribution during the production of the processes carried out within the company is observed. After this simulation, it was found that there are multiple problems in the study process, which generates delays in the delivery of orders, incomplete orders and orders delivered in poor physical condition.

For the picking and dispatch process, the simulation is developed using ARENA simulation software, which is shown in figure 4.

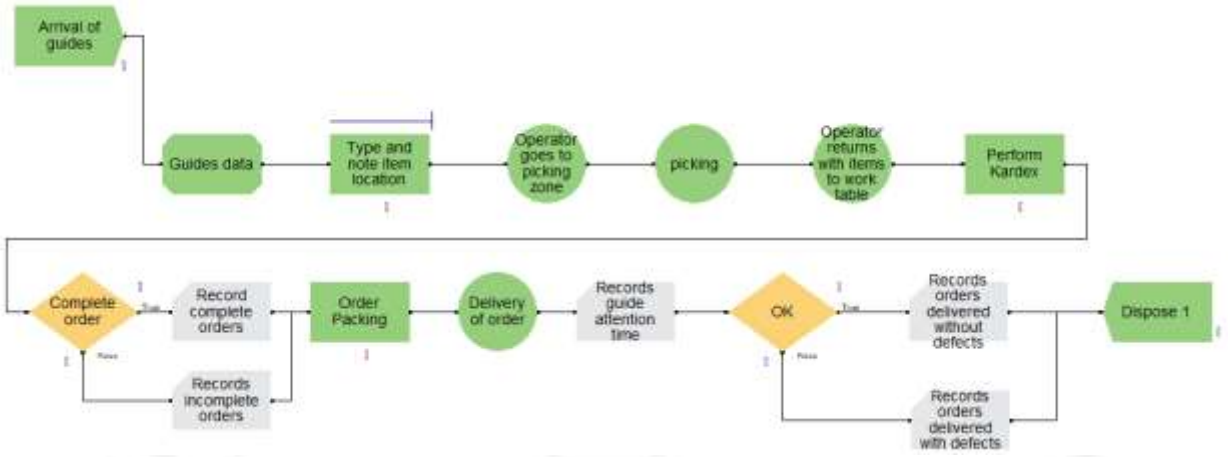

Figure 4. Initial Simulation

5.3 Proposed Improvements

To validate the proposed improvement, the variables to be used in the simulation were first identified. Then the information was collected considering a sample of 100 with a probability of 95%. The developed model, shown in Figure 5, is after implementing the improvements by applying the 5s tools and the MRP system in the picking process.

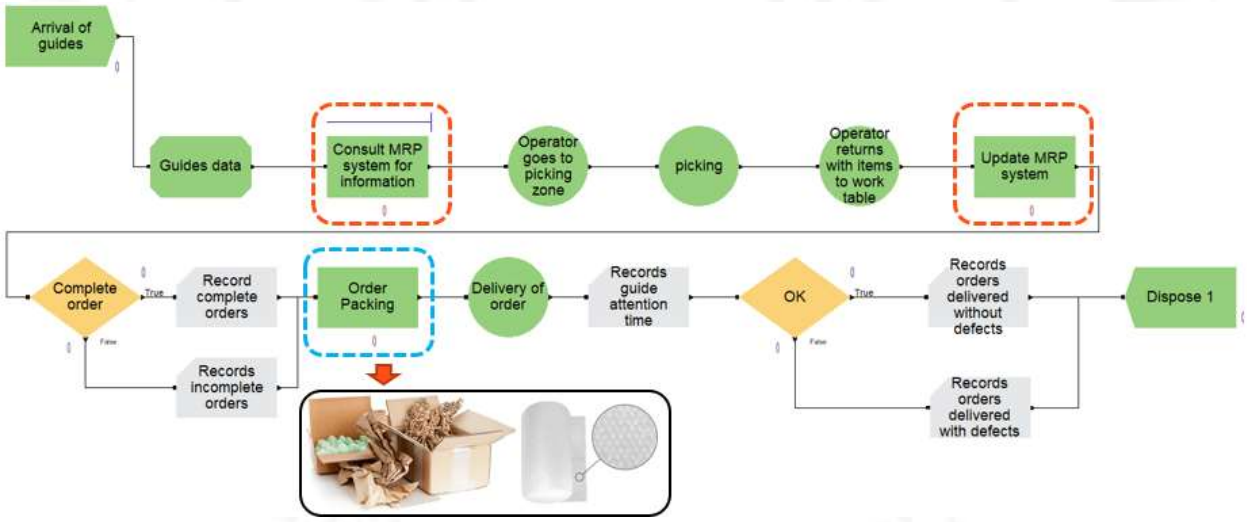

Figure 5. Simulation after the improvement

On the other hand, with the implementation of the 5S tool, there was a noticeable change in the warehouse as shown in Figure 6. There is more order in the products, cleanliness in the area and there are no items out of place that will not be used. With this result, the workflow and efficiency are improved, since we save time in daily tasks, improve spaces in the work area and this is related to the fulfillment of perfect orders. Also, the packing time increased slightly, because at the time of order preparation, material is included to protect the products such as bubble wrap, kraft paper, among others. With this, the percentage of orders attended in good condition increases to 90%.

Figure 6. 5S applied to the warehouse

5.4 Validation

The main problem of this study is the low service level, due to a high number of incomplete orders and not delivered on time. With the implemented 5S and MRP proposal, after simulating the model for twelve hours in sand, it was possible to reduce the percentage of orders delivered out of time and incomplete.

As a first result, the average lead time decreased by 51.29% on average. In addition, the number of orders delivered in good condition and complete increased from 7 to 23 orders per day. Similarly, because the proposal plans to handle more orders per day, the total number of orders delivered with defects increased from 2 to 3 orders per day and the number of incomplete orders increased from 3 to 5 orders per day. Finally, the average operator utilization decreased from 99.97% to 98.70%.

For the 5S tool to be managed correctly, it is very important the dissemination of everything worked during the development of the implementation and maintenance. The options to disseminate are through posters, flyers, whiteboards, wall newspapers, among others. For this case, it is important to consider the following points for a 5S panel, as shown in Figure 7.

Figure 7. 5S Panel Model

For the validation of the 5S tool, audits were conducted to verify compliance and follow-up, which aims to collect the evidence presented, allowing to address the knowledge acquired and to be able to act correctly. Likewise, present corrective actions, which begins with the identification of nonconformities, determine causes, implement the proposed solution, validate the effectiveness, conduct a re-audit to verify completion and finally file and record the evidence.
For this case study, figure 8 shows the radar graph from the 5S audit, which presents a good indicator with respect to 3 vertices: classification, organization, and standardization. Following a disciplined approach and cleanliness, which helps us to take immediate corrective actions.

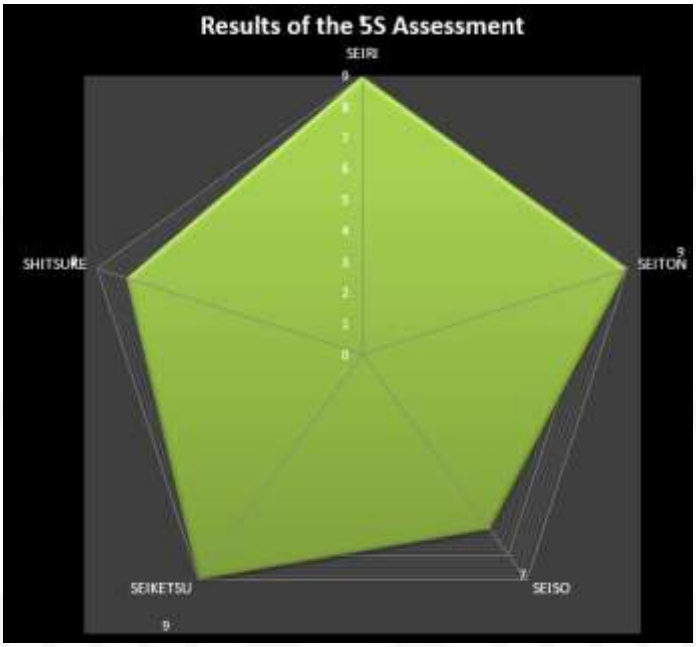

Figure 8. 5S Audit Radar Graph

6. Conclusions

It is concluded that the service level increases due to the proportional increase of perfect orders, through the implementation of the 5S and MRP tools. These tools allow for reducing time in the processes, improving order picking, and better inventory control, which had been previously detected as the root causes of the problem tree when the company's initial situation was analyzed.

In addition, it is concluded that for the improvement to be successful there must be a commitment of all the people involved in the activity, as well as the feedback is fundamental, since it allows to achieve the efficiency and effectiveness of the tool, achieving a sustainable and not temporary continuous improvement.

By having a customer satisfied with the quality of service provided by the company, complaints are reduced and savings for the company, both in the reduction of discounts for orders delivered out of time or incomplete. All the above is related to customer satisfaction being positively impacted.

This research will contribute to the 5s and MRP implementation in Peruvian SME's and show the importance, financial feasibility, and the results of applying the tools to the process and to the warehouse. However, it also shows limitations and risks, such as, the organizational culture and time management problems.

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