Management Model Based on 5s and Systematic Layout Planning (SLP) to Improve the Level of Service in the Cleaning Sector

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***Abstract*—In Peru, the cleaning sector has played an important role in recent days, allowing its continuous development. However, non-delivery of materials, whether due to quantity, delay or damage, is one of the most recurring problems in the sector. Therefore, the management in the storage of materials, to later distribute them to the units, plays an important role in the classification and collection of materials, the transfer without the need for reprocessing, optimizing the picking time, maintaining the durability of the material without damage and ensuring the care of the workers in the area. This study analyzes a warehouse of a cleaning company, which has problems in meeting the delivery time of materials due to the time it takes to pick them. The main causes are damaged materials due to incorrect picking, the delay in locating the material generated by the lack of knowledge of the materials, the disorder that occurs in the area, the lack of cleanliness in the area, and the inefficient distribution of the materials. which are located in different parts.**

***Index Terms*—Level of service, 5s methodology, systematic layout planning, cleaning sector**

I. Introduction

Worldwide, the cleaning industry is undergoing constant changes in the way of providing a highly efficient and effective service, due to the sanitary crisis generated by COVID-19. Cleaning has become an essential service for companies in order to provide greater security and peace of mind to their employees [1]. This research highlights the growth of the sector, using the capacities and resources of the sector by means of a methodological approach, since this sector became an essential and important service, companies began to invest much more in issues related to disinfection and the use of virucidal products [2]. In the case of Peru, the cleaning industry moves between 3 billion and 4 billion soles per year [3]. Likewise, the pandemic forced the purchase of technological machines that ensure a high percentage of virus elimination, particularly of SARS-CoV-2. However, statistical studies highlight that the cleaning sector companies present fines, better known as penalties, mainly in the delivery of materials to the units in which the cleaning service is provided in 88.5% [4].

The problem identified, according to the sources of the items, may be due to different types of deficiencies such as delay in locating the material, planning in delivery orders, disorder and disorganization of the materials, which results in a low level of service [5]. This problem is reflected in other regions of the world. For example, in a company in the cleaning sector in Spain, due to problems in the delivery of materials on time and lack of material for workers to perform their work, 200,000 euros in fines were recorded [6]. As mentioned above, it is clear that companies in the cleaning sector have problems in the delivery of materials, so it is important to continue investigating new solutions to this problem, which leads to costly fines.

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II. State of the Art

A. Level of Service

Having a good level of customer satisfaction will determine that the customer will become familiar with the company and thus have a loyal customer to order the service again. It is recommended that the customer has a pleasant experience with the service provided and thus the brand would be more recommended. To measure customer service level satisfaction, surveys can be developed to collect customer opinions and observe the results [7]. We can define the level of customer satisfaction by the attributes that the customer has. The company should take into account three important aspects: Optimal performance, flexibility of performance, and punctuality of workers. Adequate personnel should be hired for the job as the work performed helps the company to give the customer a better experience of using the service. Workers must follow the company's parameters and regulations when performing the service [8]. In conclusion, it defines what the customer expects from the service, the expectations that are given by the communication between customer interactions, external information, past experiences and the conscious and constant needs of the customer [9].

B. 5S Methodology

The lack of inventory accuracy would be affected in a large part of the companies worldwide. Implement standardization (Seiketsu) by making a work program in order to improve the cleaning methods and integrate them into the sorting actions in order to integrate the work and make the storage area more standardized in order to find the average annual inventory [10]. Unnecessary materials will be analyzed and what, if any, should be kept in the work area, and materials that do not contribute to the cleaning process will be discarded. In addition to propose processes and strategies for the fulfillment of the work order and the scope of the action plans and designate and train the cleaning staff to solve the

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problems in the area and the process that the cleaning worker performs [11]. It is observed that the storage problems are caused by a lack of a culture of order among the cleaning workers and a lack of training to perform these services, which would generate a disorderly area [12]. A proposal to improve the correct distribution of spaces in the storage area would be to implement the classification. This consists of improving the distribution and order of the most indispensable materials and the ones with the highest rotation at the time of a cleaning job, so that they are more visible and can be accessed more quickly [13].

C. Systematic Layout Planning

The research on the SLP methodology reviewed for this research work points out the simple application of this methodology in different plants or warehouses in different sectors [14]. Systematic Distribution Planning (SLP) is a planning process that helps to identify, visualize and link activities involved in facility management and distribution [15]. Among the benefits generated by this methodology is the efficiency in productivity and time reduction in picking, since the distribution of products is done to reduce unnecessary routes. This procedure begins with the collection of data on the inputs and activities performed in the area. Then, the relationship between the materials and the flow of activities performed in the area is analyzed by means of a relational diagram. In this way, by means of these relationships and interactions, plant design proposals are plotted. From this, the impact on the activities is evaluated and if it is beneficial to then change the current plant layout [16]. Systematic design planning is a methodology that helps to optimize plant design, through the identification of activities and the relationships between them during the sequence in the flow of activities. In an investigation in a company, it is estimated an increase in production and a reduction of 40 the route [17].

D. Systematic Layout Planning and 5s

In the research on Systematic Layout Planning (SLP), a better flow of materials is obtained, and a Layout is presented to the needs of the warehouse. As a result, it generates an optimization in the travel time between facilities. [18]. In another study on the application of 5s in the warehouse of a distribution company, the efficiency in the management and order of the products generated an improvement in productivity from 0.71 to 0.96, improving the orders delivered on time. Regarding this result, it was concluded that one of the factors that affect the delivery time of the materials is the disorder and lack of management in the warehouse. [19]. In a combined model of the 5s methodology and the SLP system applied in the printing industry, a 79% reduction of non-productive times related to the layout has been achieved. In addition, a 39% reduction in the time lost in transfers was achieved. As an improvement, they have contributed to the optimization of the cycle time from 66.58 minutes to 45.53 minutes, which means a 32% reduction in time [20].

III. Contribution

A. Proposed Model

The value generation of our improvement proposal was established through the two Lean tools. These two tools are integrated into an inventory management model to achieve order and control of materials. The objective of this model is to improve efficiency in the delivery of materials, which ensures a high level of service and customer satisfaction. There are several Lean tools; however, for this article, the SLP and 5S tools were taken as the main tools for the improvement process in the company. The ordering and control of materials will be done through 5S and the planning, formalization and control at the time of supplying and then distributing the materials to the units will be done through the SLP tool.

As a proposal for the model, we have considered the most appropriate tools used in service companies in situations of material inventories and problems at the time of distribution. For the development of the proposed model, two phases will be carried out, which will be explained below.

B. Model Components

For the development of the model, two models proposed in the comparison matrix are shown below (See Table I).

TABLE I. Comparison between Articles of Other Authors and Objective

Objective / Articles	**Level of service**	**Materials ordering and management**	**Material supply and distributio nplanning**	**Inventory control**
Chourasia,R. [8]	Level of service			
Bonilla, K., Marcos, P.[3]		SLP		
Cisneros, B., Raúl , V., & Tirado, C.[9]	5S		5S	5S
Camino, E., & Ibañez, R.[5]	5S		5S	
Cardoso, M., Fernández, D.[7]		SLP		5S
Victor, C. [19]	Level of service			
Proposal	Level of service 5s	SLP	5S	5S

1) Phase 0: Activities prior to improvement implementation

Phase 0 is made up of the activities prior to the implementation of the improvement. It basically consists of preparing and enlisting all workers for the improvement project. To begin with, Figure 1: Proposed Model Lean Warehousing philosophy and its economic impact on the different processes of the companies is explained. Then, the current situation of the company is communicated by detailing some deficient processes and the urgency and importance of solving them. The main objective is to sensitize and raise awareness among all workers to generate a commitment during the implementation of the improvement process.

2) Phase 1: Execution of the 5S tool

The execution of the first phase is composed of the 5S tool that aims to maintain order, cleanliness and inspect the workplace through activities related to the 5 steps of the 5S tool.

3) Phase 1: Implementation of the SLP

The second phase of the model consists of the application of the SLP. This tool consists of structuring the process from the sourcing to the distribution of the material and finally the implementation of the new distribution

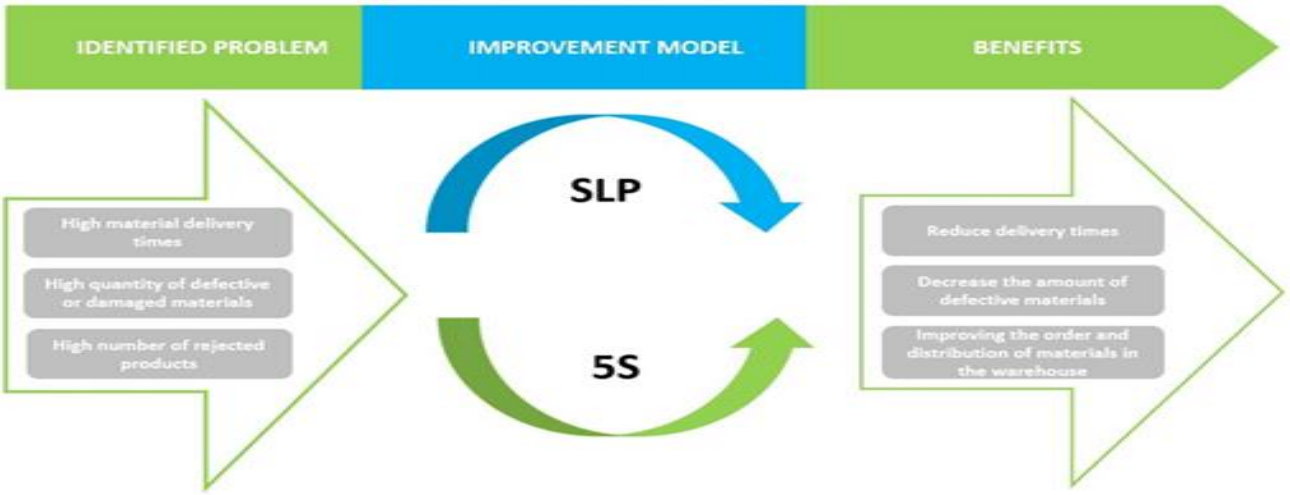

Fig. 1. General structure of the proposed model.

C. Indicators of the Proposed Model

For this project, the following three indicators will be used to analyze and evaluate the impact of the improvements obtained. It will help us to verify if the improvement implementation had a positive impact on the positive impact on the shipping and materials management process.

Orders delivered on time: Allows to calculate the efficiency or level of compliance of the company to deliver orders on the dates established by the client.

$$\text{ODT} = \frac{\text{Orders delivered on time}}{\text{Total orders delivered}}$$

Audit performance: Allows to calculate the percentage of improvement with respect to the number of effective audits with total audits performed.

$$\text{AP} = \frac{\text{Effective audits}}{\text{Total audits}}$$

Stock out: Quantity of defective materials over the total quantity of stock during the month.

$$\text{SO} = \frac{\text{Amount of damaged materials}}{\text{Total amount of materials}}$$

IV. Validation

For the application of the first S, it is necessary to be clear about the objects needed in the warehouse. Then, the materials that do not contribute any value must be identified. After classifying and identifying the materials in the warehouse, proceed to place codes on each group of cleaning materials and their location in the warehouse area.

To carry out the cleaning of the warehouse, the established cleaning schedule must be carried out, for which the check list indicating the workers in charge and the person responsible for supervision is used. For the last phase, reminder images are placed on each strategic wall of the warehouse in order to visually show the classification, order, cleanliness and respect the regulations in the 5S policy. The purpose is to seek the establishment and maintenance of order and organization over time. In this way, these new practices are established in the daily life of the warehouse workers.

After identifying and classifying the materials, the SLP will be implemented. To develop the implementation of the SLP, the first step is to collect information about the cleaning materials in the warehouse: location, weight, quantity and distance from the main door.

As mentioned above, it was found that there is no fixed location for the products, which increases the time for picking and this leads to a delay in the delivery of materials to the units. For this reason, taking into account the flow of materials, information, quantity and repetition of some materials at the time of making the requirement, a relational diagram of activities was made in which graphically shows the matrix that indicates the frequent interaction of the materials at the time of making the requirement.

Next, the levels of importance established by the following parameters are generated based on the close distance that each product has to be, due to the frequency that is requested in the requirements of the units, which is important that they are together to be able to perform the picking in less time and not to be traveling long distances or looking for the materials, due to lack of knowledge and lack of identification of the workers. The letter A indicates that it is absolutely important that these materials are together and the letter X means that it is not important or necessary that the materials are close together. Between these two parameters there are 4 more: E(especially important), I(important), O(ordinary importance) and U(unimportant).

According to what it highlights, it starts with the letter A,

which are the areas that have to be closer together. In addition, the materials that are frequent in the requirements have to be with type A relationship. The areas that are at a long distance and have no relationship are of type X. In the case of the bathroom and the office, it is located near the picking area to maintain the cleanliness of the area at the time of making the requirement, since some spillage may occur and prevent other products from being contaminated.

The wax storage area should not be at the front door, because it can cause a fall of the personnel due to its slippery texture. In addition, it can generate a fall of the picking and can be damaged. On the other hand, the materials of smaller or medium weight are located further away from the main door to appease or avoid the wear and tear of the physical effort of workers. Therefore, the bags are located closer to the main door.

The picking area, a space for gathering requirements, is located in the center to facilitate the joining of all materials. In addition, the liquid materials that are more likely to be damaged and cause spillage are closer to the area of cleaning materials such as brooms, dustpans and tissues to solve it immediately and the bathroom so that the worker can clean himself. In this way, an occupational accident can be avoided.

Finally, it can be seen in Table II that the proposed indicators were improved; however, in terms of delivery time, the planned objective was not achieved.

TABLE II: PREVIOUS VS. CURRENT SITUATION

Problem	Indicators	Actual	Objective	Improved
High rate of returns	Orders delivered on time (min)	91.1 min	75 min	80.4 min
	Audit performance (%)	41%	85%	88%
	Stock out (%)	5.13%	3%	2.99%

V. CONCLUSION

The implementation of the Lean tools was shown to be valid as the orders delivered on time improved to 80.4 minutes, getting closer to the initial goal. It could be shown that, by improving the distribution and order of the materials, the material picking time will improve and, therefore, the delivery time to the unit to be delivered will be reduced.

On the other hand, by implementing 5S in the warehouse area, it reduced the percentage of defective materials from 5.13% to 2.99%, exceeding the initial goal. In addition, after the implementation of 5S in the warehouse, an audit was carried out to verify the improvement. The results were 88%, exceeding the initial objective that was established as a goal.

In the future, priority should be given to the transportation of materials, since there are several factors that influence such as traffic, distance of the unit to be delivered, availability of the truck, storage and distribution inside the truck. One solution to optimize delivery time is to search for routes and optimize the weight of the materials in the truck so that it does not influence transportation.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Giannina Poma-Chavez developed the models and analyzed the data. Marco Huaman-Torres conducted the research and wrote the manuscript. Mart ń Collao-Diaz, Juan Carlos Quiroz-Flores and Alberto Flores-Perez, with their extensive knowledge and professional career, served as a guide for the course of the investigation. All the authors had approved the final version.

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