5S Hybrid Management Model for Increasing Productivity in a Textile Company in Lima

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Abstract. In general, lean strategies in the textile sector are applied in production to improve productivity, reduce production time, and reduce errors, among other aspects. However, there are also documented studies, which are not common in the literature that uses these strategies to improve storage operations. This study shows the implementation of the Lean 5S Hybrid tool in the warehouse of a textile company based in Lima. The objective of the implementation was to improve productivity in the warehouse, as there were high response times when searching for materials, which reduced production time, warehouse redistribution, better using available space, and being able to strategically locate main materials. The results revealed an increase in warehouse productivity 3.95 times the initial one, an Inventory Record Accuracy of 98.17%, a decrease in the requirement search time by 66.12% (from 25 to 8 min), and stock rotation of 6.22 times.

Keywords: Warehouses · Lean · 5s implementation · Inventory management · Textile

1 Introduction

Today, there are several factors that affect companies, such as globalization, competition, rapid market changes, a product's life cycle, productivity, and faster time-to-market. These factors have increased the impact of production logistics than it was years ago [1]. In Latin America, small- and medium-sized enterprises (SMEs) are deemed very important. According to the World Bank, SMEs generate 28% of GDP and half of all jobs in the region [2]. In Peru, SMEs are influenced by various factors that affect their growth, such as the lack of access to technology, financing, and human capital. These, in turn, affect their productivity, export capacity, and growth [3]. Therefore, studies have been carried out in the SME sector to determine the most common factors. These factors are divided into five areas: administrative, operational, strategic, external, and personal.

The management of warehouses in our country is diverse in the SME sector; 72.1% of manufacturing companies claim to make storage and can store up to 50% of used

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consumables during the year. Of these, 31.6% companies claim to have concerns with the lack of space and storage conditions. In addition, 50% still perform manual tasks within their production and storage areas. This indicates that human labor is crucial within SMEs. Reports indicate that only 34.8% of workers have taken university-level education, and 19.5% of companies have conducted training or technical assistance programs for their workers in relation to management or production issues [4], which lead to problems in each of the aforementioned factors.

The purpose of this research is to successfully implement the Hybrid 5S as a quality and integration tool in a textile SME. First, successful cases of implementation are outlined. Next, a case study of a small company located in Lima, Peru, is explored in depth.

2 State of the Art

There are multifarious definitions of lean, which makes it impossible to validate a single definition as appropriate [5], but over the last 60 years [6], its main purpose has become clear—reducing waste and achieving a decrease in lead times [7]. Hence, principles of lean thinking have been widely accepted and successfully applied by different firms [8] although lean was originally associated only with production. In this line, King [9] states that understanding the complexity of the process rather than getting started with a solution is important.

In the textile sector, implementing lean principles can help improve the level of competition and market position, but more importantly, it can help increase a company's efficiency and effectiveness [10]. However, there are certain crucial barriers as well. Changing how work is done and transitioning from a traditional way to lean is time consuming, requires commitment, and involves many changes [11]. Organizational change as well as strengthening relationships with suppliers are also essential.

3 Methodology

At present, there are several methodologies to improve supply activities, among which are lean warehousing, logistics, and inventory. All come from the lean philosophy and are specialized in the relevant area. At the same time, in our literature review, we found studies indicating that lean tools go hand in hand with common engineering tools such as inventory management that gave birth to 5S Hybrid (5S + Inventory Management), 5S with value stream and Kaizen, and 5S with value stream mapping and process standardization. The objective of combining the 5S with other tools was to achieve different quality objectives where 5S plays a role, with it being the first step toward the TQM.

The Hybrid 5S technique has greater advantages than lean warehousing and 5S, owing to the fact that the Hybrid 5S not only focuses on Kaizen but also on process integration and inventory management techniques, thus always seeking to optimize the processes with the appropriate procedures. Inventory management is a critical function in any business because it involves inventory control, which, if not done correctly, can lead to delays and customer dissatisfaction. Therefore, it is important to map the current

processes within the warehouse and redefine them if required, with the creation of procedures and noting who is responsible.

Thus, the 5S Hybrid technique is the best suited to resolve a textile company's current problems.

This model has four phases that will be implemented in this case study; the design of the proposed Hybrid 5S model is presented in Fig. 1 below:

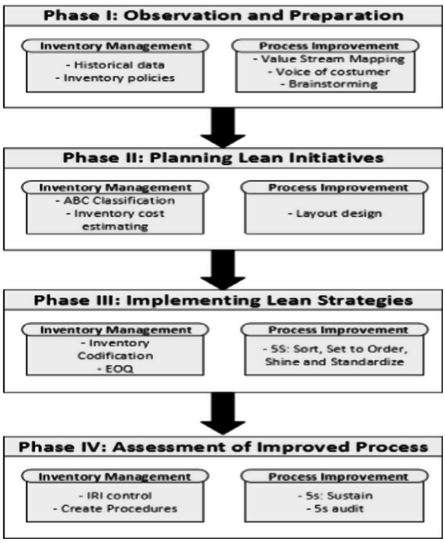

Fig. 1. Model of proposed 5S Hybrid

3.1 Specific View

3.1.1 Phase I

This phase is based on observing the process to identify problems such as inefficient procedures, delays in the area, and product loss. A value stream map should be made to identify the areas affected from the client's perspective [1]. Its advantage is that it describes the flow of materials, which makes it the most effective tool in identifying opportunities for improvement and distinguishing between the activities that add value and those that do not.

3.1.2 Phase II

In this phase, the ideas generated in Phase I are chosen, and an action plan is developed to carry out the improvements. The necessary permits are requested, and the managers are informed about the plan to be carried out and the results expected to be obtained.

3.1.3 Phase III

This phase is net implementation, including the execution of the first four Ss, sort, set-to-order, shine, and standardize. The 5S implementation manual described by Kumar

should be followed. It is important to carry out the inventory coding and calculate the required levels of space and, if necessary, acquire new shelves.

3.1.4 Phase IV

In this phase, the improvements made are measured by evaluating effectiveness, efficiency, relevance, and impact. It also includes the execution of the last S, i.e., sustain. This phase is the most important and challenging because one wants to maintain the improvements made over time, for which commitment from everyone involved in the process is essential.

4 Validation

The organization carried out the following steps when adopting the 5S model.

4.1 Phase I

A company VSM of a production batch of poles was carried out to find out improvement possibilities while observing the processes involved in production and storage. It was found that it took 54.5 h to find the material in storage before leaving production, and this was because of a lack of procedures in the warehouse and a lack of knowledge by employees on the different varieties of yarn. This impacted the inventory levels, which were high, and at the same time the Kardex was not updated, which meant that the raw material in the warehouse was unknown, thereby leading to duplicate purchases and yarn that was more than 10 years old.

4.2 Phase II

Before performing the multi-criteria ABC classification, an inventory of the company's yarn was performed. The results are presented in Table 1.

Table 1. Inventory carried out

Inventory summary		
Poorly positioned products	No. of products	% of total
E Level	13	21.31%
D Level	11	17.46%
Box of Skein 8/4	6	8.57%
Box of mercerized yarn	12	17.65%
Products not identified	76	29.01%
Products not labeled	250	95.42%
Total inventoried products	262	

Deteriorated material was also found, which was attributed to the passage of time and poor storage conditions.

4.3 Phase III

4.3.1 Coding

The inventory did not have an easy recognition coding system; therefore, we proceeded to code the 31 colors that the company had.

4.3.2 First S—Sort

We proceeded to create red cards for the implementation. These were fixed in plastic boxes to enable the search for yarn throughout the company. Yarn was found in warehouse 1 and in the production area. Then, for classification, the following criteria were used:

- Uniquely colored yarn had to leave the warehouse because it would no longer be used.
- The garbage found should be put in a bag for later disposal.
- Misplaced or queried colors should be separated for locating later on.

4.3.3 Second S—Set-to-Order

In this phase, the layout elaborated in phase III for warehouse 2 was used, and then the yarns were positioned in the warehouse according to their rotation. Beige colored yarns are those with the highest rotation stored closest to the door, followed by fashionable European colors. At the same time, an analysis of shelf capacity was carried out, resulting in 64 cones per level. Taking into account good storage practices in textiles, 60 yarn cones were stored per level. To maximize the use of space, the yarns were stored with the smaller base upwards, followed by the yarn with the next smaller base.

4.3.4 Third S—Shine

Cleaning schedules were established, wherein workers rotated monthly to clean the warehouse before and after the working day. At the same time, on a weekly basis, cleaning audits were carried out to verify that the schedule provisions were being complied with.

4.3.5 Fourth S—Standardize

The company workers follow the new policies and rules. To this end, the coding in the shelves has been replaced for them to be in accordance with the new order. The Kardex has also been replaced by an improved one, and different colors for quick identification of the yarn *types* and the company's color coded display, with its respective samples and codes, has been created. This is pasted on the warehouse wall as a visual indicator.

4.4 Phase IV

4.4.1 Inventory Registration Accuracy

Stocktaking was carried out to record inventory registration accuracy during the implementation.

4.4.2 Procedures

It was necessary to create procedures for the different processes that occur within the warehouse, such as inputs of raw materials and outputs as the case may be.

4.4.3 Fifth S—Discipline

To achieve and maintain this improvement over time, the format of the 5S audit was delivered to show whether the company retains the improvements.

5 Conclusions

The results obtained by the 5S Hybrid have had a significant positive impact on activity times within the warehouse. At the same time, there has been better supply management and use of space. The implementation of 5S Hybrid, as indicated by past studies, has brought more benefits than the implementation of traditional 5S did, which only focused on ordering and cleaning the warehouse. It has been used to perform inventory management with the space available at that time by the company, thereby generating the possibility of creating procedures, labels, and ordering as per the new inventory management.

The accuracy of inventory registration, a recurring problem faced in global companies today, was a concern that caused delays in agile responses between production and warehouses, consequently increasing the total lead time, bringing losses in sales in considerable amounts to the type and size of a company. Hence, a textile company must continue carrying out the weekly inventory until it reaches 100% and then change the frequency to monthly.

Although it is true that integration has been achieved between the two areas with the greatest delays in the studied company, it is important that storage and production management aim for the same strategic and operational objectives. Thus, MRP implementation or other tools based on the JIT would increase the benefits of the 5S Hybrid implementation.

In conclusion, with regard to experiencing the implementation, it is noteworthy that the 5S is easy to understand by workers, as it only requires conventional knowledge of the discipline and high commitment. However, understanding the management of inventories takes more time, for which workers must be trained and must develop criteria to make decisions in the face of less common situations.

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