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Improvement model to increase the efficiency of the sewing area in a textile SME by applying SMED, 5S and Standardized Work - A Peruvian case study

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Abstract—The textile industry in Peru is one of the most representative in terms of its contribution to GDP; however, in the last 10 years the industry has suffered a 1.5% annual drop in its share of GDP. This is due to the fact that the sector suffers from a series of deficiencies such as low productive efficiency, which is 70.2%. Faced with this problem, some authors opted for the application of some tools such as SMED, SW and 5s to counteract it. But according to the literature review, there is a lack of knowledge of the application of the mentioned tools in textile SMEs, since SMED and 5s are mostly applied in large companies, while SW has little history of applicability despite being a powerful tool that achieves positive changes in production. Therefore, in order to provide a solution to the problem studied, it is necessary to apply the aforementioned tools. This article proposes an improvement model that aims to increase the efficiency of a textile SME through the applicability of tools such as 5S, SMED and SW. The effectiveness of the model was validated with the use of the simulation developed in arena software, obtaining as main result that the efficiency of the sewing area in the textile SME increased from 64.71% to 80%. This leads to the conclusion that the proposal manages to improve the company's productivity, which allows it to generate higher income by making efficient use of its resources.

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Abstract*– The textile industry in Peru is one of the most representative in terms of its contribution to GDP; however, in the last 10 years the industry has suffered a 1.5% annual drop in its share of GDP. This is due to the fact that the sector suffers from a series of deficiencies such as low productive efficiency, which is 70.2%. Faced with this problem, some authors opted for the application of some tools such as SMED, SW and 5s to counteract it. But according to the literature review, there is a lack of knowledge of the application of the mentioned tools in textile SMEs, since SMED and 5s are mostly applied in large companies, while SW has little history of applicability despite being a powerful tool that achieves positive changes in production. Therefore, in order to provide a solution to the problem studied, it is necessary to apply the aforementioned tools. This article proposes an improvement model that aims to increase the efficiency of a textile SME through the applicability of tools such as 5S, SMED and SW. The effectiveness of the model was validated with the use of the simulation developed in arena software, obtaining as main result that the efficiency of the sewing area in the textile SME increased from 64.71% to 80%. This leads to the conclusion that the proposal manages to improve the company's productivity, which allows it to generate higher income by making efficient use of its resources.

***Keywords*-- Lean Manufacturing; Time unproductive times; Standardized work; sewing; efficiency**

I. Introduction

Worldwide, the average productive efficiency of the textile sector is approximately 80% [1]. However, in Peru, this indicator reaches a figure of 70.2% [2]. As a result, domestic prices are not competitive compared to other apparel exporting countries [3]. In Peru, SMEs represent 99.5% of the business sector, of which 16.5% are engaged in garment manufacturing activities [4]. This representative percentage of textile companies in the development of the Peruvian economy encourages to propose improvements that allow them to be more competent, since their contribution to GDP is 6.4% and generates more than 900 thousand jobs [2]. However, in the evaluation of the last few years, this participation in the GDP has fallen by 1.5%, while that of the country has increased by 3.6% [5].

Efficiency is the key economic indicator that represents the administrative capacity of a company to produce its product to the maximum with the minimum use of resources [4]. A low efficiency indicator reflects poor management of resources, both material and human [2]. This causes severe impacts for the company ranging from economic losses, loss of business opportunities and loss of customers due to the dissatisfaction generated in them [3]. A potential methodology that contributes to improve this indicator is Lean Manufacturing, this can be evidenced when after applying the methodology in [6] the efficiency of the forming area improved by 8%. On the other hand [7], they apply the 5S and Line Balance tools with which they manage to increase efficiency and productivity by 6% and 4% respectively. In [8], after using tools such as 5S, SW, SMED, they were able to optimize production times by reducing the cycle time of garment manufacturing, thus increasing efficiency by 7%. Another research that validates the success of the Lean methodology to improve production efficiency is described by [9] in which after applying the 5S, Poka Yoke and TPM line tools, the production times of a metal-mechanic company were optimized, contributing to an 8% increase in efficiency.

Considering the above, it is important to detect errors in the production process, since this would result in products with a lower percentage of defects. Tools such as Poka Yoka, SMED, SW and 5S bring substantial changes in each process of the textile industry. One of the areas that requires greater application of these models is sewing, which is the center of garment manufacturing and the main source of errors that lead to waste. [8] For this reason, it is necessary to take measures to identify with great precision the different causes of these activities that do not add value; you cannot improve what you do not know.

There is little research that focuses on improving the low efficiency in the sewing area. One of the motivations for developing this research revolves around the academic contribution of the few studies that analyze the various problems of Peruvian SME. Another transcendent motive was the projection of improvements proposed for the company after applying the model proposed in this document. Increasing the efficiency of the core area of a textile SME in order to establish its competitiveness in the Peruvian market was the main projection established.

This document is organized in 5 systematized blocks with content such as: presentation of the research in which the problem to be addressed, use of tools and the context of the current situation are detailed. Then, the literature review is presented, in which 20 articles with impact factor are analyzed with the main objective of providing a literary basis for the study. The description of the model and its contribution to the

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study is also presented. Immediately afterwards, the validation of the model and conclusions of the study are presented.

II. Literature review

An in-depth research related to improvement management in small and medium-sized companies was carried out, focusing on selecting those that were carried out in the textile industry. For this process we followed the stages of Systematic Literature Review (SLR), this technique is one of the most valid, since it allows us to choose those investigations based on three essential factors: results obtained, professional judgment and decisions with scientific support. [10]. The following is a synthesis of the articles consulted grouped by category:

A. Reduction of non-productive time

One of the most common types of unproductive times in organizations is the one that corresponds to the configuration of machines. In response to this, the application of SMED and work methods in a company in the plastics sector was proposed. With this, a 41% reduction in changeover times was achieved [11] Another study explains that the SMED methodology, when applied in a company dedicated to the manufacture of hygiene products, allowed a 30% reduction in setup times. [12] In the same way, the combination of VSM with SMED, when developed in a company producing household appliances, generated savings of $4254 [13] At the same time, it was shown that the implementation of SMED, when implemented in a plastics company, achieved annual savings of approximately $40,000. [14] The integration of SMED and Centerline, applied in a complex environment, such as the food industry, made it possible to go from 193 min to 173 min in terms of changeover time [15].

B. Improving SMEs through Lean Manufacturing

Lean manufacturing is a philosophy that became popular at the end of the last century, because it focuses on eliminating waste and maximizing the added value of each company [16] Lean is composed of a set of tools and techniques that when applied can significantly increase the competitiveness of a company. One of the most used tools in companies to improve the production flow is the line balancing, a study proposes that the integration of this technique with lean production and the simulation program SIMUL8, manages to increase the efficiency of a plastics company by an average of 10.41% [17] VSM is a visual tool that allows to detect precisely the processes, activities and tasks in a company, in this way it is possible to determine the waste that exists in each of our processes. Thus, when VSM was combined with a waste assessment model (WAM) and implemented in a textile company, unnecessary movements were reduced by 21.15% [18] Another study showed that the application of VSM together with ECRS in a furniture manufacturing company contributed to the reduction of order delivery times by 4.79% [19] Likewise, a proposal explained that by developing 5S, SMED and Poka, it is possible to reduce the costs associated with manufacturing and increase the quality of the products. Thus, at the end of the development of the proposal, a cost reduction of 67% was obtained [20] Similarly, through the application of 5S, SMED, TPM, Visual management and standardized work in a company of the plastics sector.

The delivery of orders was improved, since the time of this process decreased by 70% and the percentage of rejected products was reduced to 10% [21].

C. Order and organization in work areas

A research project carried out in the sewing area of a textile company applied 5S, 5W2H following the PDCA methodology demonstrating that this fusion allowed to improve working conditions, lost time decreased by 10%, whose results had an impact on the increase of 6% with respect to Lead Time [22] It is important to emphasize that the application of 5S through the classification principle, was developed through the use of color cards (green, yellow and red), which contributes to a 40% decrease in the time of not adding value in the production process, that the application of 5S through the classification principle was developed through the use of colored cards (green, yellow and red), which contributes to a 40% decrease in the time that does not add value to the production process [23] This tool also, when executed with Visual Management and standardized work, helps to improve the efficiency and productivity of the operators. This was demonstrated by being developed in a pharmaceutical company, the validation was done with the use of statistical analysis, which indicates that these three tools provide great benefits with respect to productivity and efficiency. These results were supported by obtaining a Cronbach's Alpha value of 0.70 [24] Likewise, the integration of 5S and standardized work becomes a powerful model, which was carried out in a cable production company. At the end of the development of the proposal, it was possible to increase productivity by 12% and efficiency by 7% [25] Similarly, the fusion of 5S, JIT, TPM and VSM has shown that during the first five years of application, it increased efficiency by 16% in the sewing area. Based on this result, the authors explain that this is due to the fact that before the application of these tools, barriers must be considered, such as: lack of commitment from top management, outdated Lean methodologies, among others [26] Through the development of VSM and Kanban in a plastics manufacturing company, it was demonstrated that this combination helped to increase daily production by 40% [27].

D. Reduction of reprocessing in the sewing area

The application of TPM and Poka Yoke were applied in a textile company in order to reduce the number of reprocessed products. At the end of the implementation it was evidenced that the OEE increased to 82% and reprocesses were reduced by 2%. [28] Another study showed that by using the bimanual diagram, the flow chart and standardized work it is possible to standardize the sewing process. At the end of this study, a 10% reduction was obtained with respect to manufacturing time, achieving process optimization and eliminating activities that do not add value [29] By integrating 5S, Standardized Work, Visual Management and BPMN it is possible to optimize resources, standardize processes, improve the mapping of the flow chain. [30]

Based on the studies analyzed in this chapter, it is concluded that the application of Lean Manufacturing tools is essential to improve the conditions of a company. Manufacturing tools are essential to improve the conditions of a company. Within which the organization's budget, the number of workers involved and the company's environment must be considered.

III. CASE STUDY

A. *Organization description*

The case study was conducted in the Peruvian company Textiles Torres FL Peru SAC, which is dedicated to the manufacture and production of clothing for the children's sector, its products are focused on children between one and six years old. Compared to companies in the same sector, it is notable for its flexibility, since it provides a variety of customized products according to customer requirements. This competitive advantage has allowed it to open to markets in countries such as Bolivia, Chile and Brazil. It is important to point out that these achievements have been possible because the company has been in the market for almost ten years, a period that has allowed it to establish solid alliances with suppliers and adapt processes based on customer needs. The main areas of the company are warehouse and sales, design, and production. Within these areas there are sub-areas that complement the fundamental activities.

It should be noted that the company has five sub-processes to elaborate garments: design, cutting, sewing, embroidery and finishing, and that the printing process is outsourced because it does not have the appropriate machinery to carry out this activity. It should be noted that not all garments go through these six processes; generally, this change occurs in the embroidery and printing processes, which depends on the model of garment being produced, so that some products may go through both processes or only one of them.

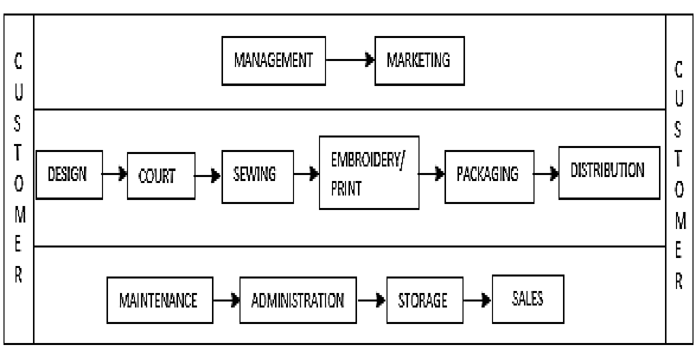

Fig. 1 Process Map

At present, the company works with the Make to order modality, whose average monthly income from sales is approximately more than two hundred thousand soles, being carried out at national and international level, being Bolivia and Brazil the main countries to which it exports.

B. *Object of investigation*

The purpose of this work is the application of Lean Manufacturing tools to reduce waste, mainly dead times, defective products and reprocesses.

To carry out this, it is pertinent to determine the problems that affect the company's operations, which is why it is necessary to delimit the research. According to the information provided by the company under study, it manufactures a wide variety of garments, which were divided into eight product lines. In order to define the most important one, we performed a general analysis of all of them through an ABC chart, as a result we were able to identify that the main line is the jackets, which represented 51.7% of the company's total revenues in 2021. Therefore, we will focus on this line for the development of our study.

With the completion of this study, we expect to reduce unproductive times by 30%, reduce reprocesses in the sewing area to 5% and minimize the variability of production time in the area to 7%.

C. *Problem identification*

As mentioned in the previous section, the analysis of this case focuses on the line of jackets, since it is the most representative for the company. It is also essential to point out that in recent years the SME has been experiencing a reduction in its income despite having increased its client portfolio and therefore its production demand. Thus, it was decided to analyze the different problems of each area, to determine the one in which these deficiencies are found:

TABLE I
COMPANY PROBLEMS

Area	Problem	Opportunity cost	Percent
HR	Hight employee turnover	S/.19,338	7%
LOGISTICS	Increase in incidents due to lack of avios	S/.54,335	19.46%
QUALITY	Return of garments	S/.42,718	15.30%
QUALITY	Delay in the control of the quantity of garments	S/.7,914.78	2.83%
PRODUCTION	Low efficiency in the production process	S/.154,976	55.03%
Total		**S/.279,282**	**100%**

From the table shown, it is identified that the problem that covers 55.03% of the opportunity cost for the company is the inefficiency in the production process, since approximately

10% of orders are not fulfilled, causing constant rescheduling, outsourcing and overtime production. Therefore, the problem on which our research project will focus will be the low efficiency of the company's production process.

After identifying the main problem of the company, it is necessary to evaluate the production system in a panoramic way, to know the critical processes in the different manufacturing processes. Therefore, we proceed to calculate the Take Time of the main line of the company, from this analysis the area that causes the non-fulfillment of orders is the sewing, since the cycle time is greater than the Takt time. In other words, this is where the bottleneck occurs. In addition, it is this area that requires the greatest amount of production overtime, which leads to having the highest operating cost compared to the other areas of the company.

After knowing the critical process of the company, it is important to know the magnitude of the behavior of the main problem of low efficiency in each of the production processes by production line:

TABLE II
PRODUCTION EFFICIENCY BY AREAS IN 2021

AREAS	LINE 1	LINE 2	LINE 3	LINE 4	LINE 5	LINE 6	AVERAGE
SEWING	63.5%	64%	64.4%	64%	64%	64%	64.71%
LAYOUT	77.73%	76.70%	73.8%	72.6%	72.5%	70.9%	74.07%
EMBROIDERY	76.59%	75.64%	75.8%	72.6%	73.6%	74.0%	72.73%
FINISH	73.17%	72.48%	74.1%	73.6%	74.7%	74.5%	73.78%
COURT	77.73%	76.70%	73.8%	72.6%	72.6%	70.9%	74.07%

As can be seen in the table, the area with the lowest efficiency is sewing with an average of 64.71%, which affects the company's production performance. affects the productive performance of the company. This analysis shows that the sewing area, being the bottleneck, represents higher operating costs and because it is the process that sets the pace of production, it is necessary for it to be efficient. Therefore, we proceeded to analyze the causes of low efficiency in the sewing area:

TABLE III
MOTIVES OF THE PROBLEM

# GARMENTS	MOTIVE	PERCENTS
3552	Unproductive times	50%
3011	High percentage of reprocesses	42%
590	Others	8%

The percentage assigned to the causes were placed according to the incidents that occurred, which were recorded in reports for each reason. As the first and second reasons have a significant impact on the problem, we will focus on analyzing them:

MOTIVE 1: Unproductive times

When analyzing this reason, it was found that there is a total of 631.35 hours of unproductive time, 25% of which is caused by set-up times, the remaining 15% is caused by high organization and cleaning times. Also, 10% is due to material search times. As explained, unproductive time represents the highest percentage, so we will focus on this one:

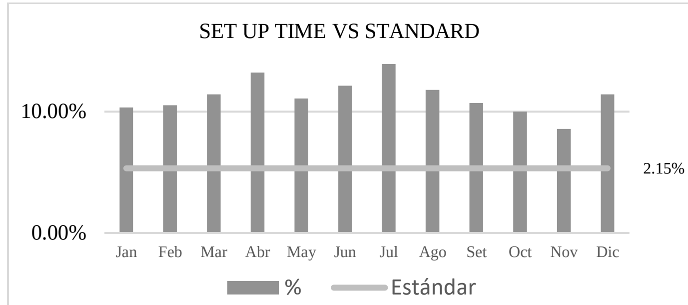

Fig. 2 Causes of the problem

To verify if machine setup times are high, we compared with the industry standard time are high, it was compared to the industry standard time reviewed in the literature, which is 2.15% of the total time.

MOTIVE 2: High percentage of reprocesses

The causes identified that generate reprocesses in the sewing area are caused by skipped stitches, misalignment, seam slippage, seam puckering, among others. These faults were identified after making use of the U control charts and the support of the person who reports the deficiencies that occur in the area in his daily reports:

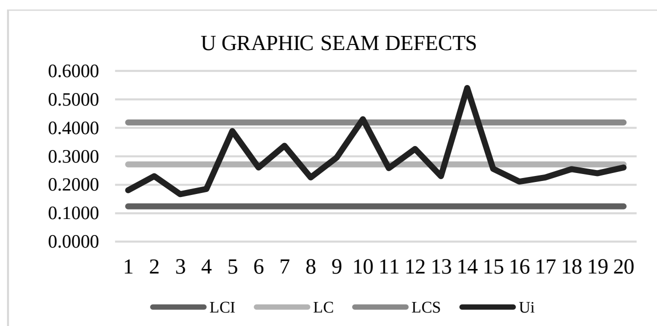

Fig. 3 U graphic

In this case, the samples submitted are expected to be between 0.124 and 0.418 defects per jacket with an average of 0.271. However, when examining lot 10 and 14 it is found that the process is out of control, as both samples describe peaks outside the limit.

IV. CONTRIBUTION

A. Fundament

During the year 2021, textile sector companies, mostly SMEs, contributed 7.9% of the national GDP. [31] Thus becoming the third most influential activity in the generation of employment and economic contribution. As a result, the sector's companies should be made more competitive in the market, since their activities are of great importance to Peru's economy. Among the limitations of these organizations are the high percentage of reprocessing, low efficiency, shortages, and high costs. [32] For this reason, this research work was carried out in a company in this area, in which the problems and causes were determined. Based on the literature consulted and considering the factors related to the problem found, our contribution is based on providing a solution model integrated by the 5S tools. SMED and Standardized Work and ECRS. These techniques have been proposed based on studies that have demonstrated their validity, achieving great results that are expected to be obtained in the company under study.

B. Design of the proposed solution model

The model that provides a solution to the causes of low efficiency in the sewing area was designed with the support of the literature review detailed in the state of the art. It consists of 2 components developed under the Lean Manufacturing philosophy as detailed in Figure 4. The first component aims to reduce unproductive times and the second seeks to standardize the sewing process, the fusion of the fulfillment of both objectives is projected to achieve an increase in the efficiency of the company under study.

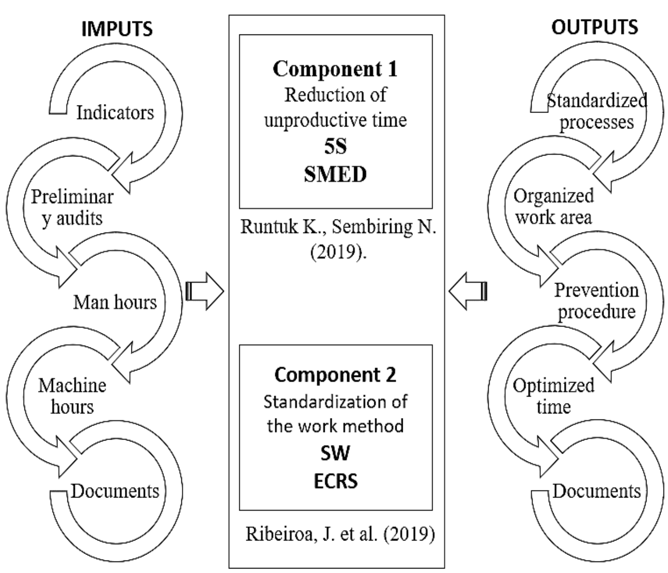

Fig. 4 Proposal model

C. Proposal Specific Model

Component 1: SMED and 5S

The first component began with the application of SMED, which was developed in four stages, as detailed below:

STAGE 1: Identification of activities, in this stage a three-level VSM was created, which showed us the activities, tasks and the sewing process with times, in order to know in depth, the activities that compose it. Then we proceeded to capture the information in a DAP, to classify and detail the activities.

STAGE 2: Separation of external activities, after knowing the activities that make up the sewing process, we separated the internal activities from the external ones, considering that the internal tasks are those that are performed when the machine is turned off, and the external ones are the opposite, since they are performed when the equipment is turned on. In this step, we detected that there are 20 external and 12 internal activities, which were specified in a register.

STAGE 3: Convert internal to external activities, to execute this phase, three key factors are considered, which are substitute (S), eliminate (E) and combine (C).
Based on this information, proposals for change are recorded for each of the internal activities:

STAGE 4: Standardize internal and external activities. In this last stage, the implementation of SMED was verified through the execution of a SMED implementation procedure, which provides the necessary considerations to maintain the changes in the long term.

We then proceed to develop the 5S tool, which is composed of six stages, as explained below:

PHASE 1: It is proposed to develop an internal audit and 5S training. Also, in this preliminary stage, the functions of the 5S committee will be formed and established.

PHASE 2: Seiri, for this stage green, yellow and green cards will be used, which are classified according to the need of the tools in the workstation. Those that are used daily and are of vital importance to the process will be green. Those, which are necessary, but infrequently, will belong to the yellow color and those, which are necessary, will belong to the red color.

PHASE 3: Seiton, small boxes will be used to place the tools based on the colors indicated in the previous step, in order to keep the work space tidy.

PHASE 4: Seizo, a cleaning program and sewing area cleaning procedure will be incorporated.

PHASE 5: Seiketsu, we propose the use of check sheets and a procedure to ensure compliance with the previous stages, with the support of the 5S committee.

PHASE 6: Shitsuke, the final audit will be carried out to know the progress of the application of this tool and which are the points that need to be improved.

By way of summary, we proceed to present a systematic graph of the phases comprising component 1.

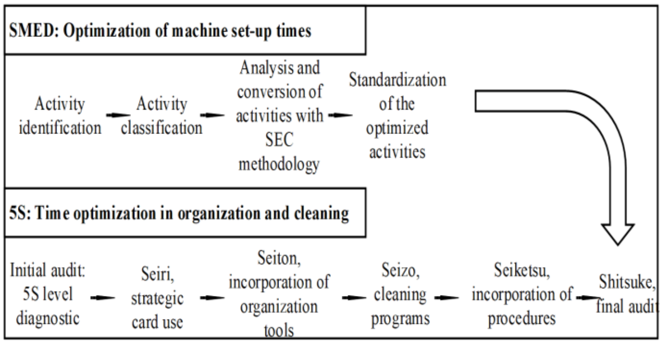

Fig. 5 Schematization of component 1

Component 2: SW and ECRS

The component is developed in 3 stages as shown in Figure 6. The processes of each stage are executed with the objective of standardizing the sewing process in order to reduce the percentage of reprocesses that occur in this area.

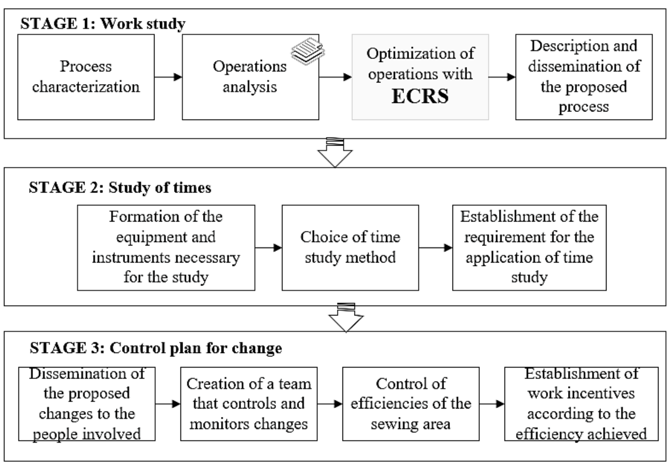

Fig. 6 Component 2 stages

STAGE 1: The steps to be developed in stage 1 are aimed at creating a procedure with optimized process activities, for which we began with the characterization of the process using the SIPOC diagram, which allowed us to identify that the sewing process has high reprocessing indicators and does not have control mechanisms despite having critical factors such as method, material and machine. Then we proceeded to analyze the operations that comprise the sewing process of the jackets, a representative line of the company, in order to eliminate the activities that do not add value, prioritize the activities that add value and analyze the suspicious activities with the use of an AVA matrix. The creation of a new optimized sewing procedure was developed after the application of the ECRS tool, which allowed the evaluation and optimization of suspicious activities as shown in Figure 7. The final activity of this first stage consisted of the creation of fabric cutting inspection procedures, instructions for the verification of machine calibration and the dissemination of the proposed work method process.

	ACTIVITIES	REMOVE	COMBINE	REORG.	SIMPLIFY	IMPLEMENTATION ACTIONS
1	Select Hood Colo Thread		X			The activity of selecting thread can be carried out by the facilitator and not by the seam stress
2	Put thread and thread in the sewing machine					
3	Cut out hood elastic	X				This activity can be perfomed by the enabler
4	Switch to the straight machine			X		The space to change to the machine can be seduced by placing closer to the overlock machine
5	Elastic overlocking to the hood				X	The activity can be carried out in a single operation
6	Elastic stitching on hood					

Fig. 7 ECRS tool application

STAGE 2: In stage 2, the objective was to establish time standards for each of the operations described in the procedure previously created. This will contribute to the control and measurement of the sewing process and also to the calculation of the area's efficiency, for which the time study technique will be developed. The team in charge will be composed of the head of the sewing area, an analyst and the production assistant. Each of them will receive training on the technique and then develop the operational and tactical activities necessary for the study. Then, we should proceed with the choice of the time taking method, for which the repetitive timing method will be used, and for the qualification of the work, the Westinghouse method will be used. Likewise, the work supplements to be considered for the calculation of the standard time are established. The last activity corresponding to the stage consists of developing meetings with the area to make them aware of the need to collaborate with the study to be developed.

STAGE 3: Finally, the application of stage 3 aims to establish a plan to control the changes established, for which it is necessary that the operators are informed of the changes to be implemented, then the time recording team must be trained to implement the calculation of area efficiencies to finally establish incentives to operators according to the efficiency indicator.

V. VALIDATION PROPOSAL

The validation of the application of the model to be implemented is carried out through the application of a pilot plan and discrete data simulation, for which the Arena software was used.

A. Pilot Plan

To carry out the validation of 5S, a Pilot Plan was chosen, since this tool has visual components and records that allow verifying its functionality.

This type of validation will have a duration of 7 weeks, time established based on the organization's disposition. It is also limited to only part of the sewing area, since it is the sample area of this study.

B. Simulation – Discrete events

The validation of the SMED and SW - ECRS tools of the model to be implemented in the study will be performed by simulation using the ARENA discrete event simulation software, since making investments without first making sure of the results to be achieved is not within the scope of this study. Furthermore, the data analysis involved in the development of the aforementioned tools is of stochastic origin, so according to [33], when dealing with this type of data it is advisable to use simulations to validate the changes generated. The development of the validation is structured in 6 phases:

Phase 1: Construction of the model, which should represent the operating system of the sewing process.
Phase 2: Data collection, for which the observation method will be used.
Phase 3: Validation of the number of observations using the Imput Analyzer and the data obtained in phase 2.
Phase 4: Verification of the model performance, with the objective that it represents the behavior of the AS-IS state production.
Phase 5: Implementation of proposed improvement tools.
Phase 6: Verification of the detailed results in SAP Crystal Reports.

VI. RESULTS

After performing the simulations of each tool, it is observed that all of them contribute to improve the main indicator of this work. However, it is important to know what changes would be achieved by implementing all the tools together to the simulated system, for this purpose the result of the 5S pilot test is incorporated to the simulation system, this provides results presented in table IV.

TABLE IV
PILOT TEST DURATION

TOOL	Indicator	As Is	To Be
All tools	% Efficiency	64.71%	80%
SMED	Set up time	21.51 min	11.54 min
5S	Organizing and cleaning time	30.32 min	16.32 min
SW, ECRS	Production time variation	12%	6%
SW, ECRS	% Reprocesses in sewing	11%	5%

The table shows that the objective of increasing efficiency to 80% is met, as well as standardizing the sewing process, since the variation of production times was reduced to 6%, the quality control systems were improved because the percentage of reprocesses was reduced to 6% and the unproductive times of both machine configuration and cleaning organization were reduced to 11.54 minutes and 16.32 minutes respectively.

VII. CONCLUSIONS

The use of 5S, SMED and SW tools contribute to the increase in the efficiency of the sewing area by 16.5 percentage points, converting the indicator from 64.71% to 80%.

The application of 5s and SMED tools reduced the high organization and cleaning time by 14 minutes and the machine configuration by 9.97 minutes respectively. This allows a 4.35-minute reduction in the cycle time to produce a jacket, directly influencing the increase in production of 294 garments in one month.

The SW and ECRS tools, after their application, make it possible to standardize the sewing process, since they reduce the coefficient of variation of production times to 6%, and also allow the incorporation of inspection methods to anticipate frequent sewing errors, thus reducing the percentage of rework to 5%. These changes reduce the cycle time by 5.62 minutes, thus increasing production by 302 garments in one month.

The application of all the aforementioned tools together allows reducing the cycle time by 7.35 minutes and increasing the monthly production of jackets by 790 garments per month.

VIII. RECOMMENDATIONS

It is recommended that a training plan be designed for each of the tools, which should be adapted to the company's environment. One point to consider is that the company's workers had difficulty in applying the techniques in detail, since they do not have adequate training in this technique adequate training in these techniques.

It is advisable to apply the three tools together to achieve better results.

The investment required to carry out the project does not involve a significant amount not involve a significant amount, so it is recommended that it can be replicable in all production lines and main areas such as cutting and embroidery.

IX. GRATITUDE

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