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Service model based on Lean Manufacturing, MRP and MPS to increase the level of service in a MYPE in the textile sector

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***Abstract*—This scientific article focuses on addressing the problems related to the level of service in the textile sector of Mypes. A comprehensive study was carried out based on 40 articles published between 2018 and 2022, using the Scopus database and relevant keywords. The results revealed several problem cases, which were addressed through the implementation of lean manufacturing tools, such as 5S, work standardization and SMED, along with the use of MRP and MPS. These tools will be applied with the objective of improving the level of service, evaluating the percentage of improvement obtained through its implementation. In addition, solutions were proposed to optimize the supply of raw material, strengthen quality controls and properly calibrate the machinery. This study offers a valuable perspective and provides a solid starting point to improve the level of service in the textile sector of Mypes, thus contributing to the advancement and development of the industry.**

***Keywords*—Service Level, Lean Manufacturing, Textile Sector, Service Model, MRP y MPS.**

I. Introduction

At the international level, the textile and clothing sector plays a significant role in the economies of many developing countries. That's why it belongs to the secondary sector, as it allows the transformation of raw materials into consumer products. The research highlights the importance of strengthening operations and improving resources in the sector to achieve economic growth in the country, as is the case in Peru. In the national textile and clothing sector, problems are considered non-priority, which is why the government doesn't promote this industry, despite it generating numerous jobs. It's been recorded that the sector created over 400,000 direct jobs, representing 26% of the manufacturing labor force. However, in 2020, there was a reduction of 67,000 jobs, marking a decrease of 16.7% [1]. This industrial sector saw a 62.2% increase in exports compared to the previous year and the years before the pandemic. It's evident that the value is not only linked to the dynamism of world trade but also to the strengthening of the domestic textile sector [2].

Several improvement articles have been considered, but we highlight two of them. The first one addresses the scenario of enhancing competitiveness in a textile manufacturing industry, which faces issues with order fulfillment and production delays.

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To address this, the use of Engineering tools such as a Just-In-Time model and LM (Lean Manufacturing) tools has been proposed to reduce delayed orders. The 5S tool is also suggested to improve warehouse organization and supplier assessment [3]. This case achieved a 55% reduction in non-compliant orders and a 5.97% efficiency improvement in multiple processes, along with a 40.55% reduction in acquisition costs.

The next case of improvement focuses on a Small and Medium-sized Enterprise (SME) in the textile sector, highlighting their challenges compared to foreign industries, including low productivity and delivery delays. The proposed solution involves warehouse management using LM tools like JIT (Just-In-Time), Kanban, and Standardized Work. This model aims to reduce defective products by 12%, surpassing the sector average by 1.2%. Additionally, it achieved a 32.9% reduction in backlogged orders. The research diagnosis indicated declining productivity, and the use of Kanban led to improved control and productivity analysis, resulting in an increase from 8.34 to 15.85 garments per hour [4].

Therefore, it is advisable to implement improvement tools, including Lean Manufacturing, which identifies and reduces waste, keeps the staff motivated and engaged, and leads to production enhancements. Another tool to address delays is the 5S methodology. For customer specifications, lack of quality control, and poor raw material quality, the standardization tool will be employed. Furthermore, MRP (Material Requirements Planning) and MPS (Master Production Schedule) are being considered to analyze production issues.

This scientific article is divided into five parts: Introduction, State of the Art, Contribution, Validation, and Conclusion.

II. Ease of Use

For this study, scientific articles were reviewed and utilized to define the state of the art.

A. Lean Manufacturing (SMED, Standardized Work, 5S)

The philosophy of Lean Manufacturing encompasses the entire value chain, from raw material acquisition to the delivery of finished products, with the aim of reducing waste and maximizing the value added to the customer. The most significant benefits of this philosophy are related to cost reduction, lead time, improved quality, and the safety and health of workers. It is developed through a set of tools and techniques and can align well with a cost-focused approach or competitive advantage strategies such as cost leadership [5],

[6], [7]. However, maintaining a competitive edge under market circumstances is increasingly challenging with the growth in production volume and product diversity. Therefore, the focus shifts to the trends and implementation challenges of Lean Manufacturing across various manufacturing sectors [8].

In a case study, authors Chon and Perumal evaluated the maturity level of Lean Manufacturing implementation in machinery and equipment (M&E) Small and Medium-sized Enterprises (SMEs). The closed-ended survey questionnaire method was adopted across three countries in Malaysia, targeting manufacturing SMEs in the M&E sector, and data were collected for descriptive analysis. The findings indicated that these companies generally fall within a low to moderate level of understanding of this philosophy. Hence, understanding, implementing, and succeeding in Lean Manufacturing are crucial for organizational transformation [9].

B. *Material Requirements Planning (MRP)*

MRP, or Material Requirements Planning, is a system that aims to effectively manage inventory, perform accurate production scheduling, and thereby deliver the right product on time and at optimal cost. Additionally, it serves as a tool to organize the production system, as it helps determine the required amount of raw materials and inputs, as well as calculates the time each product should be produced [10]

Some of the problems that can be addressed with this system include over-inventory, insufficient demand coverage, and production stoppages. On the other hand, in a study conducted in the sewing department of a textile company, it was identified that low productivity was a significant issue. Factors causing this were evaluated, leading to the development of a model that incorporates Lean Manufacturing and MRP tools, with a focus on the Kaizen philosophy. The implementation of this model resulted in an increase in productivity to 0.13 units/soles, representing a 20% increment from the main objective [11], [12], [13].

C. *Master Production Schedule (MPS)*

The Master Production Schedule is a tool that determines which finished products need to be manufactured and by what deadline, based on customer orders and demand forecasts. The aim of this tool is to schedule the production of finished products and avoid overloads. Some of the benefits it offers include cost reduction, optimal inventory management, and meeting delivery deadlines. A study was proposed to demonstrate the strengths of these tools as decision-making support, optimizing the allocation of resources in production processes with a certain level of complexity, ensuring a well-functioning system. For this purpose, the Flexsim software was applied as a discrete event simulator. Solution 92 was selected as the best alternative for the planned week, with a minimum total cost of $34,941.52, a plan fulfillment of 99.48%, and a performance of 1.52 dozen/minute. Accompanied by utilization rates of 73.25%, 73.45%, and 86.84% for threaders, turners, and machines, respectively [12], [14], [15], [16].

III. CONTRIBUTION

A. *Fundament*

Currently, companies in the textile sector have a significant market presence and play an important role in the Peruvian economy. However, they have been negatively impacted by the low level of service provided by some sector companies, which is linked to issues such as productivity, delayed deliveries, and low quality. This led to the development of a value proposition based on a literature review, aiming to identify models, tools, and methodologies to enhance the level of service. As a result of this search and based on the identified problem, Lean Manufacturing, Material Requirements Planning (MRP), and Master Production Schedule (MPS) were determined as proposed tools to implement in the current study.

Table I is presented below, specifying the methodologies to be used and the most relevant articles considered in relation to their objectives.

B. *Proposed Model*

The proposed model is developed based on Lean Manufacturing (SMED, 5S, Standardized Work), MRP, and MPS, which must be worked together to achieve an increase in the level of service. Therefore, it is necessary to identify the appropriate inputs for the present study. First, the measurement of production times for each process is conducted, along with the quantity of defective products, the number of delayed orders, and the number of operators working in each process. Next, the main problem and its root causes are identified, followed by an evaluation of the case in comparison to sector standards. With these collected data, the implementation of standardized work, MRP, and MPS will be carried out. These tools, based on the Lean Manufacturing philosophy, are used to reduce production delays, address shortages of raw materials, and improve material quality issues.

C. *Equations*

The proposed model is developed based on Lean Manufacturing (SMED, 5S, Standardized Work), MRP, and MPS, which must be worked together to achieve an increase in the level of service. Therefore, it is necessary to identify the appropriate inputs for the present study. First, the measurement of production times for each process is conducted, along with the quantity of defective products, the number of delayed orders, and the number of operators working in each process. Next, the main problem and its root causes are identified, followed by an evaluation of the case in comparison to sector standards. With these collected data, the implementation of standardized work, MRP, and MPS will be carried out. These tools, based on the Lean Manufacturing philosophy, are used to reduce production delays, address shortages of raw materials, and improve material quality issues.

In addition, the SMED tool will be applied to poorly calibrated machinery to reduce downtime and enhance efficiency. Finally, the obtained indicators will be evaluated post-implementation and compared to the initial indicators to assess whether the established objectives have been achieved.

TABLE I. COMPARATIVE MATRIX OF PROBLEMS IN THE PROPOSAL VS STATE OF THE ART

Goals/ Articles	Increase the level of service	Reduce delays in the production	Achieve with the amount established	Improve the quality of product	Reduce the stops by machinery to bad calibrated
Canales-Jeri, L., Rondinel-Oviedo, V., Flores-Perez, A., Collao-Diaz, M.(2022)		Lean Manufacturing (Estandarización de trabajo,5S)		Lean Manufacturing (Estandarización de trabajo)	
Carrillo-Corzo, A. , Tarazona-Gonzales , E. , Quiroz-Flores, J. , Viacava-Campos, G.(2021)	Lean Manufacturing (Estandarización de trabajo,5S)	Lean Manufacturing (Estandarización de trabajo,5S)		Lean Manufacturing (Estandarización de trabajo)	
Zamora-Gonzales , S. , Galvez-Bazalar, J. , Quiroz-Flores, J.(2021)		Material Requirements Planning (MRP)	Material Requirements Planning (MRP)		
Crespo, E.O., Cossio, N.S., Piarpuezán, R.V.(2018)		Master Production Schedule (MPS)	Master Production Schedule (MPS)		
Dogan, O., Cebeci, U., Oksuz, M.K.					Lean Manufacturing (SMED)
Proposal	Estandarización de trabajo,5S	Estandarización de trabajo,5S, MRP, MPS	MRP, MPS	Estandarización de trabajo	SMED

D. Equations

The proposed model is developed based on Lean Manufacturing (SMED, 5S, Standardized Work), MRP, and MPS, which must be worked together to achieve an increase in the level of service. Therefore, it is necessary to identify the appropriate inputs for the present study. First, the measurement of production times for each process is conducted, along with the quantity of defective products, the number of delayed orders, and the number of operators working in each process. Next, the main problem and its root causes are identified, followed by an evaluation of the case in comparison to sector standards. With these collected data, the implementation of standardized work, MRP, and MPS will be carried out. These tools, based on the Lean Manufacturing philosophy, are used to reduce production delays, address shortages of raw materials, and improve material quality issues.

In addition, the SMED tool will be applied to poorly calibrated machinery to reduce downtime and enhance efficiency. Finally, the obtained indicators will be evaluated post-implementation and compared to the initial indicators to assess whether the established objectives have been achieved.

E. Components of the Model

The proposed model is built upon three components that will be developed below:

Component 1: Lean Manufacturing Implementation

The company will undertake the implementation of Lean Manufacturing in the sewing and transfer printing areas, with the goal of addressing waste excess and inefficiency in processes. To achieve this, the 5S method will be applied, an organization and continuous improvement approach that optimizes processes, enhances efficiency, and improves quality in the workspace. Through thorough classification of elements and materials used, unnecessary or damaged ones will be identified and eliminated. Subsequently, a storage and visual order system will be established to facilitate access to necessary elements, with clear standards for their arrangement and location. Furthermore, a culture of continuous improvement will be fostered among employees through training and regular meetings to reinforce the principles of 5S. In the Fig. 1 "Proposal model" more clearly represents the components of the proposed model.

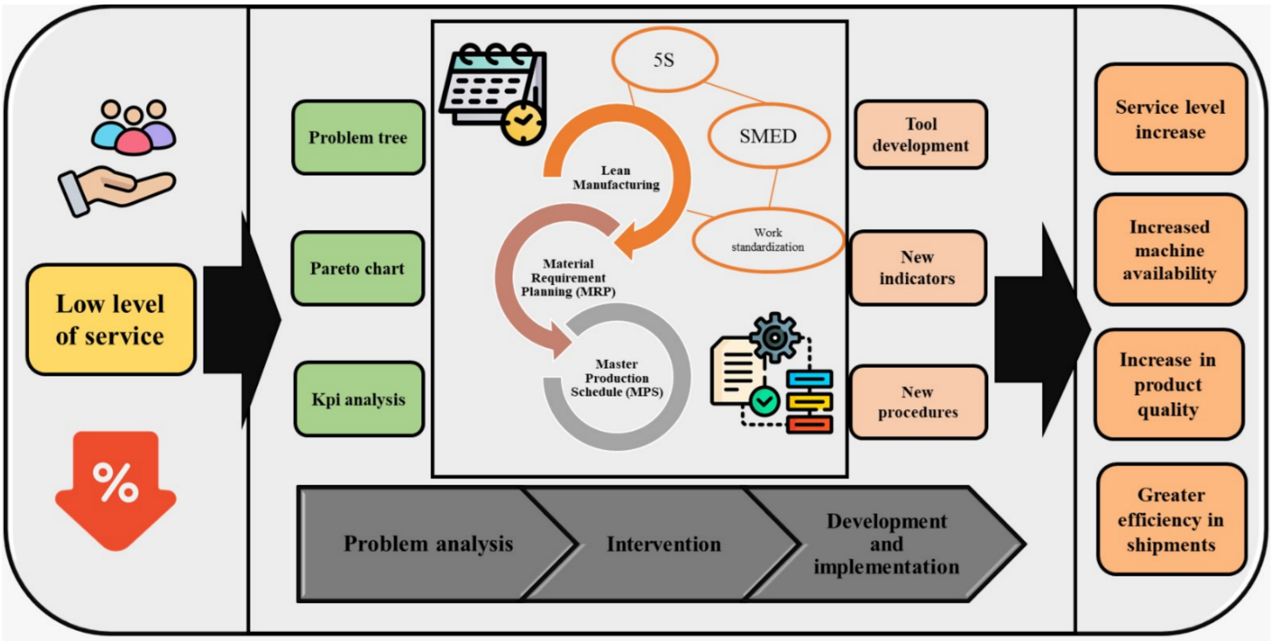

Fig 1. Proposed model

In figure 1 of the proposed model shows how the entire implementation will work, so additionally, SMED will be implemented in the transfer printing area, a methodology focused on reducing the time needed for tool and configuration changes in the production process. Through a detailed analysis of each process stage, internal and external activities will be simplified and optimized, minimizing machine downtime. Standard procedures for tool changes will be established, and personnel will be trained to ensure compliance. Control and monitoring measures will also be implemented, along with regular audits to ensure adherence to established standards and make necessary corrections. With these implementations, the company aims to achieve a higher level of service, increased productivity, waste reduction, improved safety, and a more efficient and pleasant work environment for its employees.

Component 2: MPS Implementation

The Master Production Schedule (MPS) will be implemented in the company, considering crucial aspects such as safety stock, lot size, and a work horizon of less than 3 months. Relevant data for MPS, including a safety stock of 0, a lot size of 1, and a 1-month horizon, has been summarized in a table.

After defining these aspects, the estimated weekly demand for the most demanded product, which in this case is shirts, is identified. Finally, the Master Production Schedule is carried out to calculate the necessary quantity of shirts to produce each week and the available quantity for promise. Weekly demand forecasts, customer orders, current inventory, and desired final inventory are considered to calculate the quantity to be produced (MPS) and the production forecast for each week (DPP). With this implementation, the company will be able to efficiently plan and adjust its shirt production to meet market demand.

Component 3: MRP Implementation

The implementation of Material Requirements Planning (MRP) will allow for optimal purchase and production orders, requiring certain preliminary data. This includes the MPS obtained in a previous component, the Bill of Materials (BOM) listing materials and their required quantities, pending purchase orders, and lead time indicating the waiting period for obtaining materials.

Once all this data is collected, material and product planning will be carried out, taking into account orders and demand for each week. With MRP in operation, the company can efficiently manage materials and production, ensuring an optimal supply flow and avoiding shortages or unnecessary inventory excess.

F. Indicators

The following indicators are presented for the research, which will allow evaluating the obtained results to contrast progress and verify improvements.

1) Customer Satisfaction-Related Service Level: This indicator assesses the ability to maintain the appropriate stock for customer requests.

Objective: Increase the current value from 71%.

Service Level (SL) = (Total Perfect Orders / Total Orders Requested) x 100%

Explanation of Use: This indicator is measured against a standard value where the Service Level target is typically 95%.

2) Machine Quality Rate: This calculates the percentage value of operational machinery.

Objective: To measure this indicator, the optimal value according to Nakajima, which is 90%, is taken into consideration. This value is derived from Overall Equipment Effectiveness (OEE).

Machine Availability = (Operating Time / (Available Time - Planned Downtime)) x 100%

3) Employee Absenteeism Evaluation: Measures the level of worker absenteeism.

Objective: A lower value is expected since the goal is to maximize the utilization of workers and operators during their work hours.

Absenteeism Rate (%) = (Number of Absences / Number of Employees) x 100%

Explanation of Use: Calculate the worker's attendance ratio over a specified period, whether by days or averages of days absent or by work area.

4) Delivery Date Compliance Rate: Measures the efficiency in delivering orders within a specified period.

Objective: A value close to 99.8% is expected, as the goal is to have the maximum number of orders prepared on time.

Delivery Date Compliance (%) = (Orders Delivered on Time / Total Orders) x 100%

Explanation of Use: Calculate the effectiveness of processes that enable orders to be prepared on time.

IV. VALIDATION

4.1 Scenario Description

To enhance the company's level of service and address the identified issues, two strategies were implemented. Firstly, a pilot plan was executed using Lean Manufacturing tools such as 5S, SMED, and Work Standardization to tackle the root causes of the low service level, including untimely orders, customer specifications, and lack of raw materials.

4.2 Initial Diagnosis

The company is facing serious service level problems, with a low performance of 71%. These problems stem from three main causes: untimely orders, changing customer specifications, and lack of raw materials. Specifically, untimely orders are the primary reason negatively impacting the company's ability to deliver products within the agreed-upon timeframe. Additionally, the low product quality, accounting for 25% of the service level, is attributed to lack of quality control, subpar raw materials, and improperly calibrated machinery, resulting in finished products with transfer stamp imperfections, excess threads, and occasional inadequate packaging.

The company also encounters challenges in its planning program as it inadequately considers difficulties in order processing, availability of raw materials according to required specifications, and processing time. Customer-initiated specification changes lead to additional delays of about a week in processing time.

Based on a comprehensive assessment, the company's audit team identifies specific areas that require significant improvements. Key indicators for order, cleanliness, and organization exhibit low results within the company: machinery availability at 81%, busy operators at 87%, and on-time delivery compliance at 65%, all contributing to inefficiencies in the production area.

4.3 Application of the Model in the Case Study

A simulation will be conducted using Arena software to verify and validate the results obtained during the literature review. This simulation will allow for an in-depth exploration of the implemented model and its effectiveness. Additionally, a pilot test will be carried out in the selected company to apply the pilot plan and assess its performance.

During this phase, the procedures and strategies employed for executing the pilot plan within the company will be described. The objective is to analyze the feasibility and effectiveness of implementing Lean Manufacturing tools.

4.3.1 Pilot Plan: Lean Manufacturing

The pilot plan implemented in the textile company focuses on the application of the 5S methodology to improve efficiency and organization in the different areas of the company, as shown in Fig. 2, Area of Sewing and Printing by Thermal Transfer. The first phase involved a comprehensive initial audit carried out by a multidisciplinary team that exhaustively evaluated all areas of the company to identify opportunities for improvement in terms of order, cleanliness and organization.

Based on the audit findings, detailed in Fig. 3. Initial Audit Results, an implementation plan for the 5S methodology was established. This plan outlined the specific roles and responsibilities of each team member.

Fig. 2 Sewing and Heat Transfer Printing Area

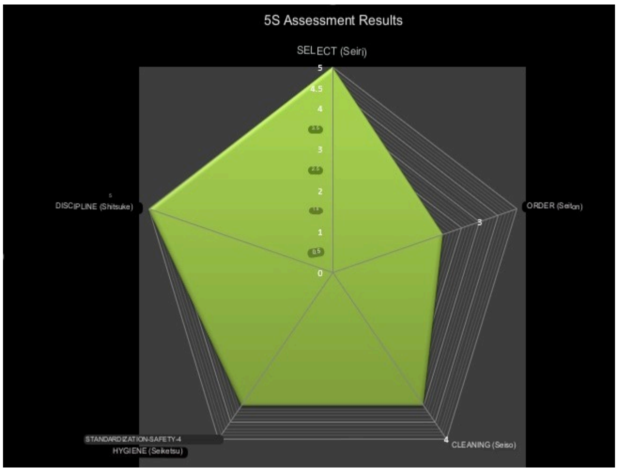

Fig. 3. Initial Audit Results

In the second phase, the 5S methodology was implemented in the company, starting with the "Classification" stage, where all the materials, equipment and tools in each work area were reviewed and organized. Subsequently, the “Put in order” stage was executed, which involved designating specific locations for each item and implementing clear and visible labeling systems. The "Shine" stage focused on establishing regular cleaning procedures and encouraging individual responsibility to maintain a clean and organized environment, as shown in fig. 4 Area after implementation

Fig. 4. Area after Implementation

In the final phase, additional Lean Manufacturing tools such as SMED (Single-Minute Exchange of Die) and work standardization in the area of heat transfer printing were applied. A substantial reduction in the time required for tool changes and setups was achieved, improving efficiency and minimizing downtime as detailed in Table II. Additionally, clear procedures were put in place and communicated to operators to standardize the process and improve product quality.

TABLE II. TIMES FOR HEAD TRANSFER ACTIVITIES

Activity	Standard time (Seconds)	Target time (Seconds)
A1	1,717	1,5
A2	9,566	8,0
A3	6,015	5,7
A4	4,779	4,0

The pilot plan yielded positive results in terms of efficiency, organization and quality within the textile company. The implementation of Lean Manufacturing tools created a more organized and safe work environment, which led to an improvement in the overall performance of the company, as detailed in Fig. 4 Final Audit Results.

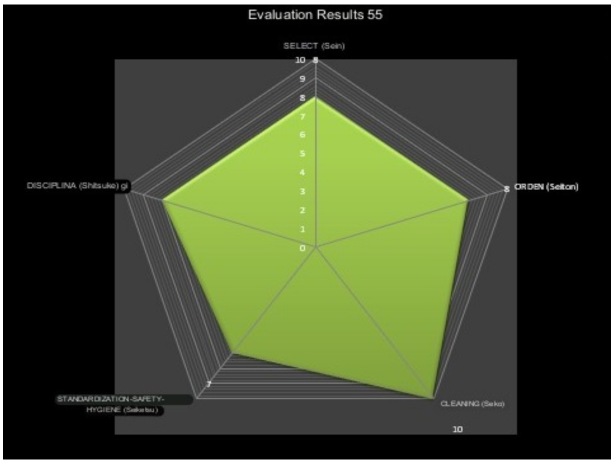

Fig. 5. Final Audit Results

4.3.2 *Simulation of Tools*

As part of the validation process, a simulation will be carried out using the Arena software to evaluate the proposed improvements in the area of sewing and heat transfer printing of a Micro and Small Textile Company (MYPE). To carry out the simulation, specific conditions must be specified to guide its development. These conditions include the scope of the system, the input variables, the calculation of the optimal sample size, the entities and elements of the system, the test period, and the optimal run size.

Regarding the scope of the system, the simulation will cover the entire process from the receipt of garment orders to the final delivery to customers. Visual representations of both the current system and the improved system will be presented. The current system is detailed in Fig. 5 Arena Model of the current system, which will allow a comparison and evaluation of the effectiveness of the implemented proposals. Through this simulation, detailed in Fig. 6 Arena model of the improved system. You can get a detailed perspective on how the proposed improvements will influence the heat transfer printing and sewing process. This will provide valuable information to validate and support the feasibility of the suggested changes.

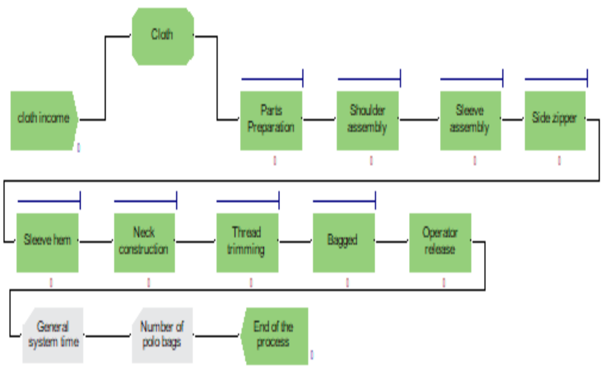

Fig. 6. Arena model of the current system

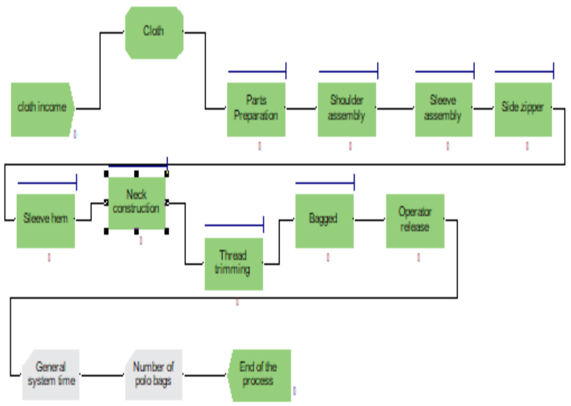

Fig. 7. Arena model of the improved system

4.4 Results

In the table III Results, the outcomes following the implementation of Lean Manufacturing tools (5S, SMED, work standardization), along with MRP and MPS, based on simulation and pilot testing, have showcased significant enhancements across all indicators. Machinery availability rose to 86%, occupied operators decreased to 89%, on-time delivery compliance increased to 96%, and the overall service level improved to 92%. These improvements reflect an upsurge in efficiency, productivity, and the ability to meet customer demands within the sewing and heat transfer printing area of the textile company. The results substantiate the feasibility and effectiveness of the implemented actions to optimize the production and service process, which will ultimately benefit the overall performance of the company.

TABLE III. RESULTS

Cause	Current	Indicator	Improved	Goal
Machinery Availability	Regrinding Machine B.Number Busy	81%	90%	86%
Busy workers	Preparation worker	87%	90%	89%
Compliance with delivery dates	Orders delivered on time	65%	95%	96%
Service level	Service level	71%	95%	92%

V. DISCUSSION

5.1 New Scenarios vs. Results

The study presents three scenarios for the three months following the implementation of improvements in the sewing and heat transfer printing area. In the table IV, in "Scenario 1," corresponding to the second month after the enhancements, the service level remains constant at 92%, while complementary indicators such as the utilization of the serger machine and operator improve slightly. In "Scenario 2," representing the third month after the improvements, an increase in the utilization of the serger machine and operator is evident, but the service level and on-time deliveries remain the same as in the first month. In "Scenario 3," corresponding to the fourth month after the improvements, a 1% increase is observed in both the service level and on-time deliveries, and the improvements in the utilization of the serger machine and operator are sustained.

Upon comparing the results of the three scenarios, it is concluded that the implemented improvements exhibit a positive impact on the performance of the sewing and heat transfer printing area, with additional enhancements becoming more noticeable over time. In economic terms, the analysis demonstrates a reduction in economic losses associated with the low service level in scenarios 1 and 2, while scenario 3 achieves an 87.50% improvement compared to the current situation. These findings support the effectiveness of the implemented actions and suggest that the improvement will continue to generate benefits as it becomes more established over time.

TABLE IV. RESULTS COMPARISION

Indicator	Current Situation	Improved Situation	Scenario 1	Scenario 2	Scenario 3	Average of the scenarios
Service level	71%	92%	92%	92%	93%	92%
Overlocker Busy	81%	86%	88%	89%	89%	89%
Busy worker	87%	89%	90%	90%	91%	90%
Orders delivered on time	65%	96%	96%	96%	97%	96%

TABLE V. ECONOMIC IMPACT BY SCENARIO

Economics losses	Scenario 1	Scenario 2	Scenario 3
Additional costs for low level of service	14,610.81	14,610.81	12,780.63
Improvement compared to current situation	85.71%	85.71%	87.50%

When analyzing the economic results in the table V, it can be observed that only in the fourth month will there be another improvement from an economic perspective, following the first month of implementation of the enhancement.

5.2 Results Analysis

To analyze the results obtained in each scenario simulation, the following table was created, which compares the increase or improvement present in each proposed indicator with respect to the current situation of the company.

TABLE VI. DIFFERENCE BETWEEN SCENARIOS AND CURRENT SITUATION

	GAP		
Indicator	***Scenario 1***	***Scenario 2***	***Scenario 3***
Service level	21%	21%	22%
Overlocker Busy	7%	7%	8%
Busy worker	3%	3%	4%
Orders delivered on time	31%	31%	32%

It is observed in table VI that the implemented improvement will continue to function for the following months in the company, with the improvement gradually increasing as the months go by, surpassing the research objective reflected in the main indicator, which was the service level. It goes from an initial 71% to 97% in the fourth month after implementation, surpassing the initial goal of reaching 95%.

5.3 Future Work

Regarding the continuation of the study, it would be advisable to carry out personnel training to ensure the proposed enhancements are effectively integrated within the company's context. It would be beneficial to observe real-life implementation results to validate the simulation outcomes.

Furthermore, extending the implementation of improvements to all areas of the company and monitoring their performance, not just in polo shirt production, which is the primary source of income, but also across different clothing lines. This could potentially lead to increased sales for various products.

VI. CONCLUSIONS

After the implementation of the 5S methodology in the study company, a significant improvement in organization and cleanliness of the work environment has been observed. The use of tools such as labels and proper storage systems has facilitated material search and availability, leading to increased efficiency and productivity in all areas of the company. Furthermore, the culture of 5S has promoted greater awareness among employees about the importance of maintaining order and cleanliness, creating a safer and more pleasant work environment.

The implemented work standardization in the textile company has yielded significant results in terms of efficiency and quality. The clear definition of procedures and establishment of standards have enabled consistent task execution across all areas. This has contributed to reducing variability and errors, enhancing productivity, and ensuring the delivery of high-quality products. Work standardization has also eased the training of new employees, accelerating their integration and adaptation to the company's processes.

The application of SMED (Single-Minute Exchange of Die) in tool and configuration changes within the textile company has resulted in a substantial reduction in machine downtime. Through the identification and elimination of unnecessary steps, as well as optimization of changeover times, greater flexibility and responsiveness to market demands have been achieved. This has led to a noticeable enhancement in efficiency and productivity, enabling the company to swiftly adapt to order changes and minimize delivery times (31%).

The implementation of MRP (Material Requirements Planning) and MPS (Master Production Scheduling) has enabled more effective resource and production planning and control in the textile company. These tools have provided improved visibility and coordination across the entire supply chain, resulting in more accurate scheduling and timely product delivery. By anticipating demand and efficiently planning resources, the company has managed to minimize waiting times, prevent excess inventory, and maximize the utilization of its production capacity (5%). The use of MRP and MPS has enhanced both internal and external communication, enabling more informed decision-making and efficient management of available resources.

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