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Original Article

Designing a Lean Production Model Using 5S and Systematic Layout Planning for Efficiency in Footwear Manufacturing: A Case Study

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Abstract *- This study addresses the challenges faced by small and medium-sized footwear enterprises, such as low productivity, disorganized workflows, and excessive production times, which hinder competitiveness. Previous research has focused on large-scale industries, leaving a gap in solutions tailored to SMEs. This investigation proposed a production model integrating Lean Manufacturing tools, including 5S, Systematic Layout Planning (SLP), and work standardization, to optimize efficiency and productivity. The implemented model significantly reduced non-productive times, streamlined workflows, and improved labor productivity by 54.39%. Additionally, transfer distances decreased by 17.73%, and material handling efforts were optimized, showcasing the model's effectiveness. These findings contribute to industrial engineering by offering a replicable framework that addresses operational inefficiencies. The analysis presented here clearly outlines how socio-economic elements are related to the outcome - increasing SME competitiveness at the local and global levels. Further studies should aim to identify and explain the places of digital technologies in layout design optimization and the sustainability of Lean practices in SMEs.*

Keywords *- Lean Manufacturing, Systematic Layout Planning, Footwear manufacturing, Work standardization, Productivity optimization.*

1. Introduction

The footwear manufacturing sub-industry of Small and Medium-sized Enterprises (SME) is an important industry at the global, regional, and local levels. SMEs account for around 90% of businesses worldwide and create 50 to 60% of jobs [1]. In Latin America, SMEs amount for 99% of total businesses and participate in about 61% of all jobs [2].

In the case of Peru, SMEs represent 99.5% of businesses and provide around 60% of jobs [3]. Within this industry, SME footwear makers are key players for the reason that footwear is one of the primary export commodities of the region [4].

Nonetheless, SME footwear producers have to deal with several production problems which include productivity issues, competition challenges, and many more. Among the most serious ones is the organized workforce's low productivity while participating in the production process as a result of the poorly arranged workstations, little to no standardization in the production operations, and substantial machine idle time caused by unplanned setup times [5, 6]. These problems lead to significant order backlogs, high fabrication costs, and low market responsiveness [7].

Solving these production problems is necessary to enhance the competitiveness of SME footwear producers. They would be able to lower costs, enhance product quality, and respond to changes in demand much faster if productivity and efficiency in production were to be increased [8]. This is particularly important for the growing competition and changes in consumer behavior at a global level [9].

Despite the significance of the topic, there seems to be a knowledge gap within the available literature on the application of the production models incorporating Lean Manufacturing tools and Systematic Layout Planning within SME footwear manufacturers. Few studies investigated large enterprises or other sectors apart from footwear [10]. Nauka.bid has the goal to accomplish this objective by means of developing a production model for 5S and work standardization tools, and modern planning of the workplace (Systematic Layout Planning) to enhance the productivity and competitiveness of SME footwear manufacturers [11]. As a result of using this model, SME footwear manufacturers would become more competitive in the local and international markets by decreasing production time, improving product quality and enabling faster response to changes in demand [12].

2. Literature Review

2.1. Lean Manufacturing Methodology in the Production Process of SMEs in the Footwear Manufacturing Industry

The Lean Manufacturing methodology has been useful in enhancing industrial efficiency and productivity in different sectors [13, 14]. In the case of SME business in the footwear manufacturing sector, some work has been done with regard to the implementation of Lean Manufacturing. These include Suhardi et al. [14], who, along with Hanggara [15], applied Lean Manufacturing paired with Systematic Layout Planning (SLP) in an effort to attain ends in the sewing department of a footwear business. There were marked decreases in travel times and material handling which were noted in the results.

Equally, Cabusas [16] undertook a case study of a shoe manufacturing company in the Philippines, where an improvement in production by means of facility layout design optimization through simulation was achieved in the facility by 16.67%. These findings are consistent with those made concerning the use of Lean Manufacturing for improving productivity and efficiency among SMEs in the footwear industry.

2.2. Standardized Work Methodology in the Production Process of SMEs in the Footwear Manufacturing Industry

The application of the Standardized Work System as part of Lean Manufacturing has been applied to various industries with attention given by various researchers [17, 18]. In the case of SMEs in the footwear sector, M.S. Muslim and A. Ilmaniati [19] applied this Standardized Work system together with other Lean methods, such as 5S, to enhance spatial and motion economy in a machining shop.

The process efficiency increased from 53% to 66%. In particular, Choirun [20] coupled the Lean strategy with facility planning to improve the non-value-adding steps in the production processes. These studies show that the implementation of Standardized Work techniques has the potential to improve the processes of SMEs operating in the footwear industry.

2.3. 5S Methodology in the Production Process of SMEs in the Footwear Manufacturing Industry

The application of the 5S methodology, which is central to Lean Manufacturing, has been documented in detail across different industry sectors [21, 22]. Huda [23], for example, demonstrated the application of 5S and Systematic Layout Planning (SLP) in a confectionary company, which resulted in a reduced travel distance and improved production process efficiency. In addition, Kovács, G. and Kot, S [24] and Erwanda, R [25] applied 5S and SLP in a machining workshop, which led to improved space allocation and decreased wasteful movements. These studies indicate that the application of 5S can go a long way in enhancing organization and efficiency in the production processes of SMEs in the footwear manufacturing sector.

2.4. Systematic Layout Planning (SLP) Methodology in the Production Process of SMEs in the Footwear Manufacturing Industry

Systematic Layout Planning (SLP) has been utilized for the improvement of productivity in several industries [26, 27]. In the case of Small and Medium Enterprises (SMEs) from the footwear manufacturing industry, Suhardi et al. [14] used SLP and ergonomic methods simultaneously to improve the sewing department facility layout within a footwear company and reduce travel and material handling times significantly.

Moreover, Cabusas [16] and Pacheco-Colcas et al. [28] applied SLP and simulation for facility layout planning in a shoe manufacturing firm in the Philippines, increasing production by 16.67%. With these studies, it has been confirmed that the use of SLP is advantageous for SMEs in the footwear manufacturing industry.

2.5. PDCA Methodology in the Production Process of SMEs in the Footwear Manufacturing Industry

The PDCA cycle, or Plan-Do-Check-Act, is one of the basic devices for the Continuous Processes Improvement (CPI) system [29]. Correspondingly, in the case of SMEs in the footwear manufacturing industry, Pacheco-Colcas et al. [28] and Bisri & Cahyana [30] proposed an SLP and Total Productive Maintenance (TPM) based production model with the view of enhancing productivity in food manufacturing companies, which might also be generalized to the footwear sector.

Also, Rodriguez & Oliveira [31] used Lean implementation combined with facility layout changes, which enabled them to eliminate non-value-adding activities and increase efficiency in the production processes. BMP measures like productivity and efficiency improvements in SMEs of the footwear sector have indeed been found in the application of the methodologies described above along with the PDCA cycle.

3. Contribution

3.1. Proposed Model

Figure 1 shows the model of the Lean Manufacturing system and production processes, which are to be used during systematic layout planning so that productivity and efficiency within the production processes are achieved. This model of production was divided into four phases: planning, doing, checking, and acting using the PDCA cycle of improvement, and each phase has been worked on in this order. Step number zero diagnosis of the problem phase was desgined to collect pertinent information on the existing state of affairs, the technical gap as well as its impact in economic terms. Later on three basic blocks were utilized, namely 5S, Systematic Layout Planning (SLP) and work standardization. The 5S tool created an orderly and clean working environment through the elimination of non-useful items and the inculcation of discipline in processes. SLP optimized workplace arrangements through the analysis of relationships between activities and workflows with the aim of reducing needless relocation and limiting idle times. Lastly work standardization focused on the elimination of obstacles to effectiveness by training employees on the new and more efficient operational procedures. In the remaining phases of the model, the focus was on checking effectiveness and dealing with unsolved problems and possibilities of improvements in a sustainable way of process optimization.

3.2. Model Components

The new model, which is based on Lean Manufacturing and Systematic Layout Planning (SLP), makes a significant impact towards the optimization if ithese processes are applied in Industrial Engineering. The model is relevant due to its systematic and structural form in resolving productivity and efficiency issues by employing appropriate techniques to identify and eliminate waste, optimize the workflow, and standardize the operations. This model was formulated to address recurrent challenges of ROC through the application of well-established tools of continuous improvement that guarantee results over a period. The model was structured to conform to the Plan, Do, Check, and Act (PDCA) cycle which makes it possible for implementation in a systematic, quantifiable, and scalable manner.

The proposal, presented in Figure 1, outlines how each stage of the model integrates with 5s, SLP and work standardization to achieve a positive impact through the strategic goals of the organization. All the steps were followed in the assessment sequentially starting from the primary evaluation to final validation of improvements that leaves room for seeking new improvements and addressing possible cases.

3.2.1. Planning Stage: Diagnosis and Technical Gap

The foremost stage of this process was planning, which involved formulating a thorough diagnosis of the problem and gathering specific information. This stage aimed to ascertain the fundamental causes of problems relating to productivity and efficiency in the manufacturing process.

The gap in production technology and its impact on the economy were established through data collection and analysis of the state with the aid of the collected information. The first diagnosis laid bare the process as they were, which revealed the movements, unproductive times, lack of standardization, and lack of organization in work areas that were present.

Considering the expected level of productivity in comparison to the current level, the productivity gap was determined. The disparity between the anticipated and achieved levels was big. With these results, parameters were set for the possible improvements, which were limited only to redesigning operational inefficiencies and maximizing resource availability. This stage was crucial as it provided the necessary elements to design an effective intervention model adapted to the particulars of the study.

3.2.2. Implementation of the 5S Methodology: Order and Discipline in the Workplace

The initial tool used during the execution phase was the 5S methodology, which focused on the order of the workplace, cleanliness and discipline. It reduced waste related to the search for materials, tools and equipment, which resulted in a smoother operational flow and improved productivity. Initially, there was a training program that was conducted for employees in order to help them understand and apply all the five stages of the methodology: Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize), Shitsuke (sustain). After the training, a 5S Committee was created, responsible for the supervision and execution of each step.

The implementation of the processes began with the sorting of elements in work areas, where unnecessary items were removed, and the placement of materials was reorganized based on the frequency of use. In the next phase, workstations were organized in such a manner that each tool and material was placed at a specific and easily accessible location to reduce search times. The cleaning stage included eliminating the accumulated dirt and waste from the workspace to create a more pleasant and safe environment for employees.

To maintain the gains achieved, standardization made sure that visual controls and periodic audits that tracked compliance with set standards were implemented. Finally, sustainment ensured the perpetuity of the improvements through the instilled responsibility and dedication of the employees. Implementation of the 5S methodology not only enhanced the utilization of the space and resources but also cultivated an environment of the organization that is aimed at improvements.

3.2.3. Systematic Layout Planning (SLP): Optimization of Plant Layout

The next step was the introduction of Systematic Layout Planning (SLP), which is crucial for workstation arrangement and material handling during the production process. The aim of this step was the elimination of non-value-adding activities such as movements, times, and maximization of system output. At the outset, information related to the flows of materials, production, and the existing layout of work areas was gathered. With this information, a flow chart was prepared to trace the movements of materials and workers at the stations. This was followed by activity relationship charting, activity clustering, and space requirement determination. This brings us to the next stage, where the design alternates were prepared with the goal of the present layout modification that would minimize time and distance travelled. Each design alternative was assessed on the basis of efficiency, work ergonomics, and technical feasibility. The final step was to choose and apply the best design alternative in the production area. With the SLP, no movements that didn't add customer value were done and productivity was improved greatly.

3.2.4. Work Standardization: Defining Methods and Capacities

The final instrument utilized in the execution phase was work standardization, which sought to clarify the operational methods of the most significant activities of the production process. It also endeavored to improve the quality of work incurred during operational processes, as well as maximize time elicited from work. It commenced with gathering information, as well as pinpointing the bottlenecks that restricted activity performance. A time study was carried out next, documenting and analysing the activities performed by the workers as a means to establish the standard times for each unit of work. From this analysis, activities that added value and those that didn't add value were differentially detailed for improvements to be made, as well as identified improvement opportunities. A 5W2H action plan was built outlining what actions needed to take place, what steps an assigned person was responsible for, and when and where they were supposed to be carried out. So, after the identification of responsibilities, training was done in order to let the operators know the new standardized methods and utilize them. Finally, the standardized work method of documented procedures for the assigned operations was employed.

3.2.5. Verification and Corrective Action: Consolidating Improvements

In the final phase of the model, the outcomes were evaluated, and opportunities to make improvements were sought. Performance indicators were computed in order to measure the effectiveness of the tools employed, and the outcomes were thoroughly assessed against the pre-defined baseline. Afterwards, other unplanned problems were captured, which initiated the corrective measures to ensure the improvements made were reinforced. The action phase ensured the identification of other further improvements together with the sustainability of the model designed and implemented, as well as closing the continuous cycle of improvement witnessed. The changes implemented did not just enhance production processes but also set a basis for an organization's cultural ethos, which values and cherishes efficiency and improvement. Integration of Lean Manufacturing and SLP tools as the backbone of the model sought was useful in solving the problem of poor production processes. Once the sequence was followed, the problems that existed were dealt with by the elimination of all identified inefficiencies, followed by the adjustment of the plant layout and the standardization of operations to the key ones. Every step in the model made it possible to achieve the targeted results, instilling a system of change in the organization and reaping benefits in the long run.

3.3. Model Indicators

To determine the effectiveness of the SLP lean model of production for small and medium enterprises in the footwear sector, these metrics were designed and incorporated. These indicators were designed to constantly measure and assess the performance in the context of the study, thus laying a firm foundation for the assessment of core issues in the production management of SMEs. This systematic approach facilitated an in-depth review of key performance indicators.

This comprehensive evaluation ensured effective monitoring and supported the continuous improvement of processes within the SME.

3.3.1. Time-to-Market Rate for Materials

This indicator measures the percentage of time required to deliver materials to production. Lower values signify improved responsiveness and streamlined supply chain processes.

$$\text{Time-to-Market Rate} = \left(\frac{\text{Material Delivery Time}}{\text{Total Production Time}}\right) \times 100$$

3.3.2. Rate of Assembly Time

It evaluates the percentage of total time spent assembling components. A reduction reflects increased efficiency in assembly operations.

$$\text{Rate of Assembly Time} = \left(\frac{\text{Assembly Time}}{\text{Total Cycle Time}}\right) \times 100$$

3.3.3. Rate of the Time of Pasting

This indicator shows the proportion of pasting time within the production cycle. Slight increases indicate targeted improvements in work standardization.

$$\text{Rate of Pasting Time} = \left(\frac{\text{Pasting Time}}{\text{Total Cycle Time}}\right) \times 100$$

3.3.4. Rate of Transfer Time between Processes

It measures the efficiency of material flow across production stages. A higher rate implies reduced delays and improved layout optimization.

$$\text{Rate of Transfer Time} = \left(\frac{\text{Transfer Time Between Processes}}{\text{Total Cycle Time}}\right) \times 100$$

3.3.5. Labour Productivity

It assesses the number of units produced per labor hour. Higher values indicate improved output per worker.

$$\text{Labour Productivity} = \frac{\text{Total Output (Units)}}{\text{Total Labor Hours}}$$

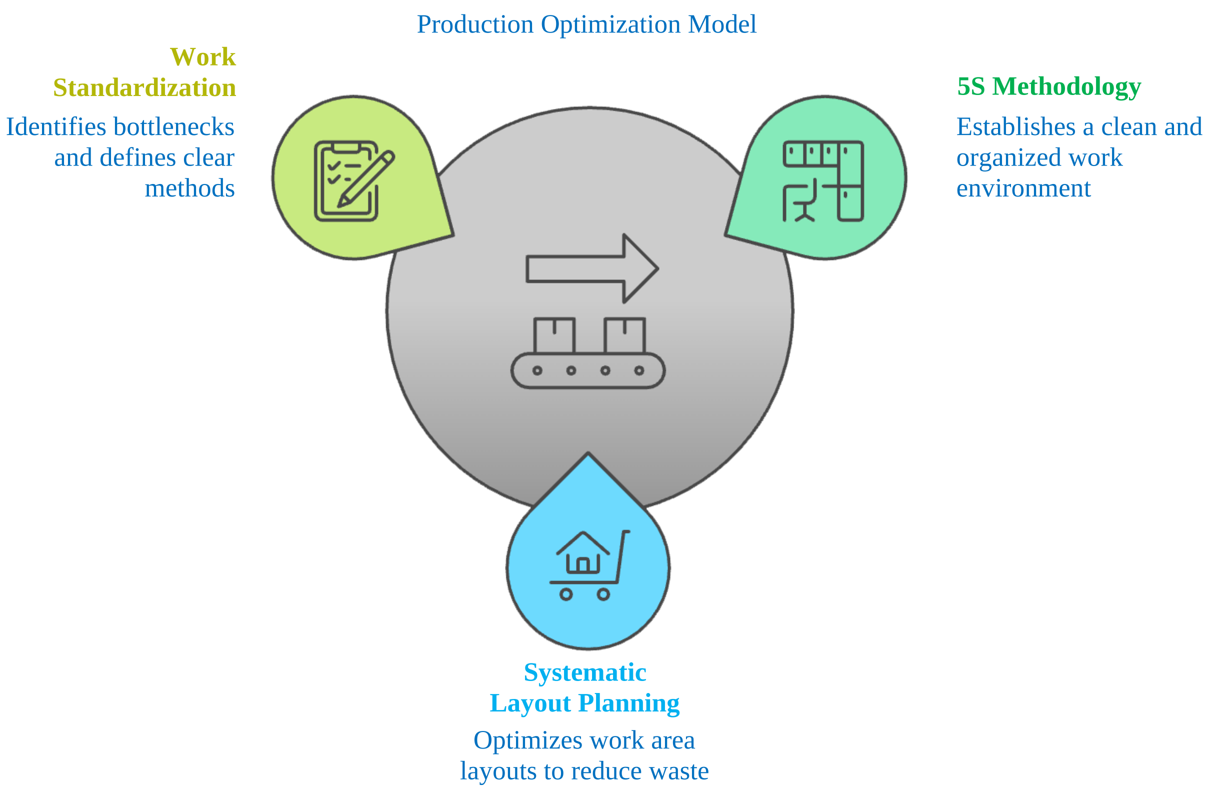

Fig. 1 Proposed model

4. Validation

4.1. Validation Scenario

The validation scenario was conducted in a case study dedicated to the production of footwear, primarily sneakers for men, women, and children. The company, located in the industrial sector, has been in operation for over a decade and employs 17 workers distributed across its production areas. The primary product line focuses on fabric sneakers, which represent 51% of total production, positioning it as the most significant product in terms of sales and revenue generation. The company faced issues related to productivity, particularly in work methods, station arrangement, and delays caused by the search for tools and materials.

4.2. Initial Diagnosis

The diagnosis conducted in the case study revealed low productivity in the manufacturing process of knitted sneakers, with an average productivity of 0.57 pairs per man-hour, while similar companies demonstrated a 49% increase, reaching 0.85 pairs per man-hour. This situation generated a significant economic impact, with an estimated annual loss of 90,294.00 PEN due to penalties for late deliveries, representing 7.01% of the annual revenue. The main causes identified included delays in production areas, contributing 82.94%. Among these delays, incorrect work methods at the assembly and glueing stations accounted for 36.74%, the unnecessary search for tools at workstations represented 30.10%, and unnecessary movement between workstations added up to 16.10%. Additionally, machine stoppages were identified at 8.70%, linked to unforeseen times during the preparation for operations, which also accounted for 8.70%. Finally, other minor causes contributed 8.36%. It was concluded that these factors are responsible for the inefficiency in processes, suggesting the implementation of tools such as work standardization, the 5S methodology, and Systematic Layout Planning (SLP) as potential solutions.

4.3. Validation Design

The proposed production model, which integrates the Lean and SLP tools, was validated by the pilot validation method. The application of this method lasted four months in the case study, covering all the techniques proposed. These include the 5S methodology, Systematic Layout Planning and work standardization. Each of these tools is detailed below. The implementation of the proposed model in the case study focused on solving the identified issues in the production line through the application of Lean Manufacturing tools: 5S, Systematic Layout Planning (SLP), and Work Standardization. The solution was designed with a structured approach, encompassing the three key tools and supported by quantitative results that demonstrate significant improvements in productivity and process efficiency.

4.3.1. Space Optimization and Time Reduction with the 5S Tool

The implementation of the 5S methodology began with an initial audit to evaluate the state of critical production areas. In the sorting stage (Seiri), 20 unnecessary elements that obstructed workflow were eliminated. Red tag labeling facilitated decisions to relocate, repair, or dispose of these items, reducing clutter in workstations.

In the organizing stage (Seiton), tools in key stations such as sewing, assembly, and glueing were reorganized into defined locations to ensure immediate access. The cleaning phase (Seiso) involved a thorough process that included machines, tools, and floors over a period of 5 days. Subsequently, actions were standardized (Seiketsu) by creating cleaning checklists and organization protocols, monitored weekly. In the final stage of discipline (Shitsuke), periodic audits were established to ensure compliance with 5S principles.

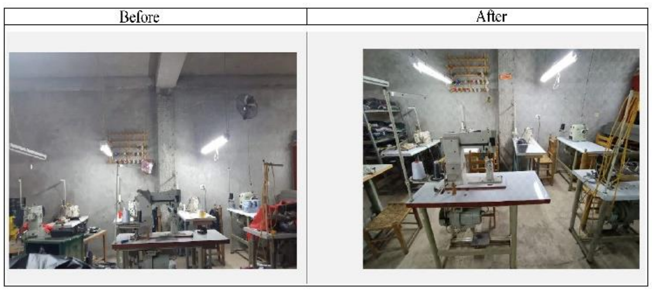

Fig. 2 Implemented 5S in the sewing area before and after

The results were remarkable. The time spent searching for tools decreased from 30.10% to 19.68%, representing a 10.42% reduction. This translated into a cumulative savings of 15 minutes per production cycle, significantly optimizing total process time and improving working conditions. Figure 2 shows the implementation of the 5S methodology in the sewing area, comparing the state before and after its application. Initially, the area appeared disorganized, with scattered tools and cluttered workstations. After implementation, the workspace became cleaner, organized, and structured, improving accessibility, visual control, and overall operational efficiency.

4.3.2. Layout Reorganization with Systematic Layout Planning (SLP)

The redesign of the plant layout using SLP aimed to eliminate unnecessary movements and improve the continuous flow of materials. In the initial phase, data were collected and analyzed through a PQ and ABC analysis, identifying woven sneakers as the product with the highest demand and production priority. A process flow diagram and a relational activity diagram were developed to identify bottlenecks and unnecessary movements. The proposed layout optimized travel distances and facilitated a streamlined workflow. The total travel distance was reduced from 115 meters to 95 meters, while transfer times between stations decreased from 12.31 minutes to 9.18 minutes, achieving a 28.87% improvement. Additionally, the total calculated effort dropped from 99,312.08 kg-m to 81,686.35 kg-m, reflecting a 17.73% reduction in material handling effort. These improvements directly impacted productivity and created a more efficient and safer work environment.

Figure 3 presents a relational and space diagram illustrating the relationships between production areas. The left section identifies critical areas such as storage, sewing, cutting, and labeling with varying degrees of interaction. The right diagram visually highlights the connections, where red lines indicate strong relationships, yellow lines moderate ones, and green lines weak interactions.

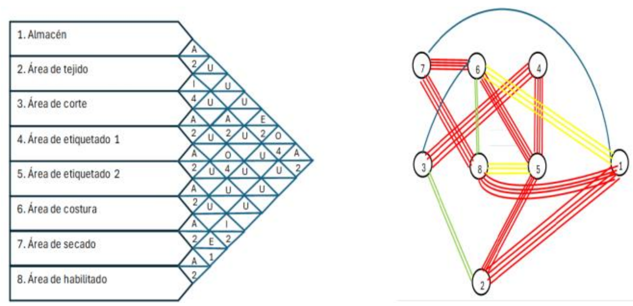

Fig. 3 Relational and space diagram

Figure 4 shows the improved layout after applying the Systematic Layout Planning (SLP) methodology. The redesign optimizes the arrangement of key production areas, such as assembly and glueing**,** sewing**,** cutting, and labeling, reducing unnecessary movements and enhancing material flow. Workstations are strategically positioned, minimizing transfer distances, improving workflow continuity, and increasing overall operational efficiency.

4.3.3. Time Reduction through Work Standardization

Work standardization focused on critical stations such as assembly and glueing, where excessive times were identified as barriers to productivity. A time study was conducted to identify and eliminate non-value-adding activities. Initially, the standard time in the assembly station was 15.59 minutes, while the glueing station registered 12.50 minutes.

Following the implementation of the tool, a new standardized work method was established, incorporating ergonomic improvements such as worktables and appropriate chairs. This resulted in a reduction of assembly time to 12.79 minutes and glueing time to 10.23 minutes, reflecting improvements of 17.94% and 18.16%, respectively. The 5W2H methodology was applied to clearly define what needed to be done, by whom, and how the activities should be performed. Additionally, a procedure manual was developed to ensure continuity and adherence to the new practices.

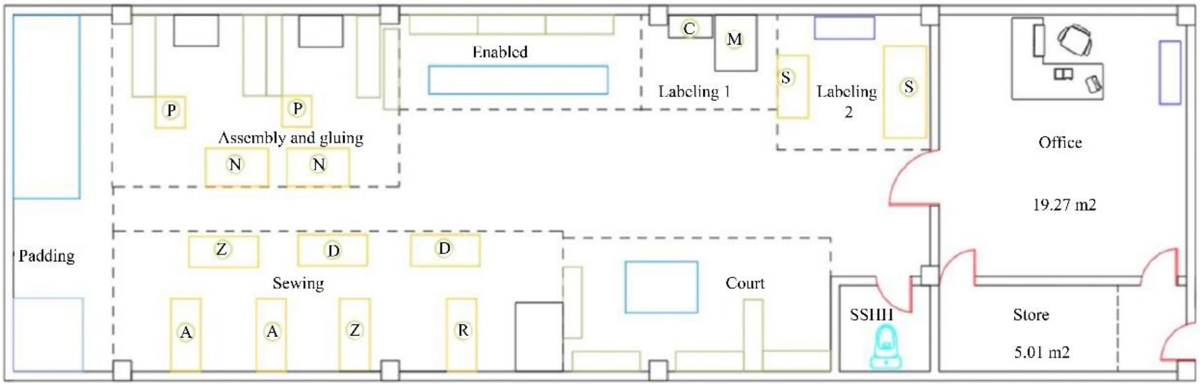

Fig. 4 Improved layout after applying the SLP

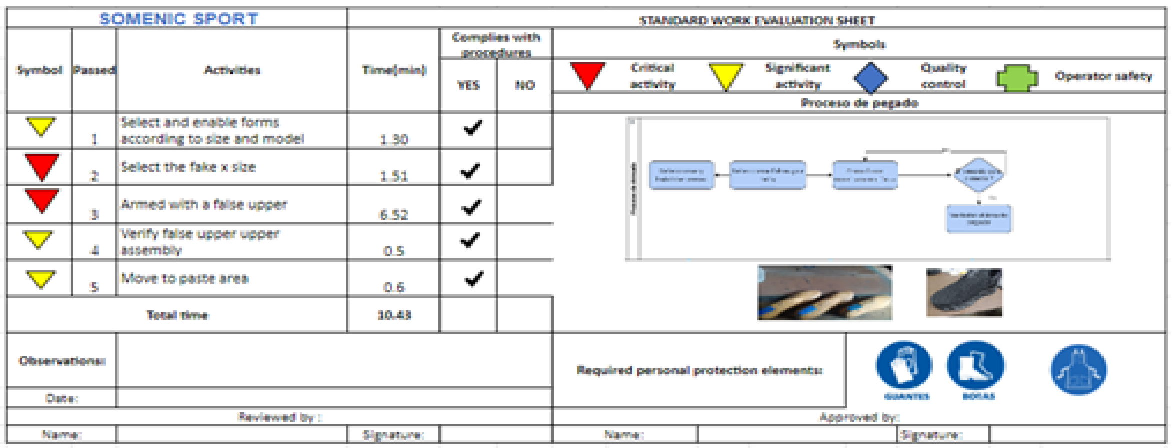

Fig. 5 Standard worksheet

The Figure 5 presents a standard work evaluation sheet for the glueing process at SOMENIC SPORT. It outlines five key activities with their respective times, totaling 10.43 minutes. Activities 2 and 3 are marked as critical (red triangles), while activities 1, 4, and 5 are significant (yellow triangles), reflecting their importance. The diagram includes a visual process flowchart and images illustrating the tasks. Additionally, compliance with procedures is indicated with checkmarks, ensuring adherence to standards. Personal protective equipment, such as gloves and safety boots**,** is mandatory to guarantee operator safety.

4.3.4. Global Results and Visual Proposals

The integration of these tools led to an increase in labour productivity from 0.57 pairs/H-H to 0.88 pairs/H-H, representing a 54.39% improvement in overall productivity. These achievements translated into significant reductions in non-productive times, optimization of material flow, and the standardization of key processes.

4.4. Results

In Table 1, the comparison between the initial values (As-Is), the proposed targets (To-Be), and the results obtained after implementing the Lean and SLP models is presented. Significant improvements were observed, highlighting a 34.62% reduction in the Time-to-Market Rate for Materials and a 54.39% increase in labour productivity.

Additionally, there was a 12.06% decrease in the Rate of Assembly Time and a 79.94% increase in the Rate of Transfer Time between Processes, reflecting greater flow and efficiency in production. These variations validated the effectiveness of the proposed model by optimizing critical times and improving the overall productivity of the process.

Table 1. Results of the pilot

Indicator	Unit	As-Is	To-Be	Results	Variation (%)
Time-to-Market Rate for Materials	%	30.10%	20.44%	19.68%	-34.62%
Rate of assembly time	%	20.39%	18.44%	17.93%	-12.06%
Rate of the time of pasting	%	16.35%	18.44%	18.16%	11.07%
Rate of transfer time between processes	%	16.10%	33.00%	28.97%	79.94%
Labour productivity	pairs/H-H	0.57	0.85	0.88	54.39%

5. Discussion

The results of this study confirm the effectiveness of Lean Manufacturing tools, particularly 5S and Systematic Layout Planning (SLP), in addressing productivity challenges, as highlighted in previous research. For instance, Suhardi et al. [14] demonstrated significant reductions in material handling times and improved efficiency in the footwear sector through the application of SLP. Similarly, Cabusas [16] reported a 16.67% increase in production capacity in a shoe manufacturing facility following layout optimization. This study expands upon these findings by integrating work standardization with Lean principles, achieving a 54.39% increase in labor productivity and a 28.87% improvement in transfer efficiency surpassing results observed in comparable studies. Moreover, this study addresses the literature gap that once focused on larger organizations by adapting these tools to the context of SMEs. As these advocated changes are measurable and systematic, all of them speak to a core strength of the model its ability to shift its form to address coping strategies to resource dependencies without compromising efficiency. With all of these positives in sight, it should be pointed out that the scope of the study rejected some aspects of the literature. For instance, Huda [23] reported that applying ergonomic SLP aibi affected the satisfaction of workers positively, but this study did not include such an element. Further comparisons could address greater issues like the worker's ergonomic concerns or the environmentally friendly outcomes of Lean practices.

5.1. Study Limitations

In as much as the model being recommended is a paradigm shift when it comes to enhanced operational performance, it comes with some caveats that need to be pointed out. To begin with, this research has been based on one single SME whose focus is on the manufacturing of footwear, so the results may not be applicable to other areas or other organizational contexts. There are some additional external factors, like supply chain disruptions and changes in market demand, which were not carefully considered and could have an impact on the possibility of scaling out this model. Moreover, because the implementation phase was very short some four months, it was not possible to evaluate the longer-term effects of the sustainability of the changes that were proposed. The lack of a control group also inhibits the determination of the relative impact of the Lean tool's vis a vis the other ongoing organizational activities.

5.2. Practical Implications

This study offers a cost-effective procedure using Lean Manufacturing methods which can be tailored to suit the specific needs of SMEs to increase the productivity and competitiveness of the business. The combination of 5S, SLP, and work standardization provides a comprehensive approach to waste elimination, layout planning, and key process operations. The results obtained support the sustainable improvements of labor productivity, material flow, and time reductions that are applicable in sectors with the high cost and delivery time due to operational inefficiencies. Additionally, the model used encourages a shift in culture where continuous improvement is the aim of the companies in SMEs to understand the core of Lean practice. In developing countries, where resources are limited, the model proposes an easy-to-adopt and less-expensive way of addressing operational challenges and increasing competitiveness in the region as well as globally.

5.3. Future Works

It is recommended that further investigations be conducted on the use of the model in different sectors in order to confirm the validity and applicability of the model. These longitudinal studies can inform the industry on the extent to which the improvements realized can be sustained overtime and the actual organizational performance impact. To achieve greater layout planning accuracy and to enable predictive process optimization, more sophisticated technologies, for example digital twins and simulation, could be incorporated. Moreover, real-time monitoring and control and decision-making could be facilitated using Lean technologies combined with Industry 4.0, IoT, AI and other new tools. The research which does concentrates on the human element, including workers and training, would also add to the knowledge base on organizational culture in sustaining Lean practices. Lastly, broadening the application of the model to include environmental aspects will make it relevant to modern industrial practices and fulfill sustainability objectives.

6. Conclusion

The research indicates the progress made in increasing productivity and operational performance following the application of Lean Manufacturing techniques and SLP. The 5S implementation brought a 10.42% increment in tool location searches, while work standardization implementation reduced assembly and glueing time by 17.94% and 18.16%. Additionally, SLP improved the layout, which minimized the travel distances and increased the transfer efficiency by 28.87%, from 115m to 95m. Labour productivity demonstrated a superb increase of 54.39%, moving from 0.57 to 0.88 pairs per man hour.

This research provides insights into the more structured approaches that need to be used when trying to deal with productivity issues common in SMEs, especially in the footwear manufacturing industry. Leveraging reliable instruments like 5S, SLP, and work standardization brings improvement in productivity, efficiency, workflow continuity, and resource utilization. Moreover, the study brings out the reality that SMEs, without exception, can utilize these findings in overcoming general operational challenges able to compete both at the local and international levels. The study gives credence to the Industrial Engineering domain by presenting a repeatable concept of merging Lean with SLP principles.

It adds to the body of knowledge on how to decrease waste, enhance layout designs, and refine more efficient ways of working with production systems. This systematic methodology enhances the ability of SMEs to make changes, making it easier for them to foster a culture of continuous process improvement. Subsequent research needs to be conducted to assess the sustainability of the model over time as well as to verify its use in other affected industries. Incorporating advanced technologies, such as simulation tools or digital twins, could further enhance decision-making processes and layout optimization. Additionally, research focusing on employee involvement and training strategies could strengthen the sustainability of Lean-based implementations in SMEs.

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