Design of a Lean Manufacturing model to reduce order delivery in a Textile Mype.

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Abstract*— This Mype has as its main problem the delay time in the delivery of its security clothing orders. Faced with the problem, it is intended to present a solution whose objective is the elaboration of a model design applying Lean Manufacturing tools that allows the reduction of times in the production processes, in the same way to increase the productivity indicator in safety vest garments and rompers Consequently, tools will be applied, such as: A value stream map (VSM) as a diagnostic tool, and the 5s, SMED, Poka Yoke and Kanban as an opportunity to improve process management. The main result of improvement when implementing this model based on lean manufacturing was the reduction of order delivery time by 10%. On the other hand, an improvement in the production process of the sewing area was perceived by 50.37% and a reduction in tool change time of a single digit of minutes in 22.05 minutes.

Keywords—Lean Manufacturing, 5s, VSM, SMED, delays.

I. INTRODUCTION

Companies in the textile industry have shown great growth both in Peru and in the international market, this growth has been based on competitive advantages, among which we can mention high quality. prestige of Peruvian fibers and the high level of integration of the sector throughout the production process [5]. According to the Central Directory of Companies and Establishments prepared by the INEI, it has registered as of 2018, 188 thousand 650 companies that carry out economic activity and manufacturing. Microenterprises represent 93.9%, which is equivalent to 177,650 microenterprises [21]. The Industrial Production Index (IPI) for the sector began in 2020 with a year-on-year decline of 7.5%, compared to the 5.2% drop in the same month a year ago, according to data from the National Institute of Statistics (INE) [10]. The manufacturing sector groups the economic activities that carry out the physical or chemical transformation of materials, substances or components into new products and is one of the most important economic sectors of the country's economy [17]. The study company belongs to the non-primary manufacturing category, therefore its evolution in Peru will be analyzed. The global textile industry involves almost every human being on the planet. The industry has a current value of almostUS$3billion and includes the production, refinement and sale of synthetic and natural fibers used in thousands of industries [19]. It is estimated that between 20 and 60 million people are employed in the textile industry worldwide. Employment in the garment industry is particularly important in developing economies such as India. Pakistan and Vietnam. The textile industrial sector has been in a process of economic reactivation since May 2020 and throughout these last few months. As is known, it has been one of the most affected sectors because of the COVID-19 health emergency, whose recovery has been slow throughout the world and our country has been affected. Companies have been adapting to the new commercial reality and joining the market, to remain competitive and, in addition, to offer a quality product and in the right time.

Faced with this previously mentioned problem, we as a team feel motivated to put into practice prior knowledge acquired at the university to forge us as future industrial engineers, and that is why we decided to analyze the case of Confections DUANYS, a workshop in charge of making sports garments since 2004, which offered polo shirts, socks, shorts, jumpsuits, among other garments, however, after the crisis in which we find ourselves, the company began to make overalls and safety vests.

On the other hand, it is known that for the elaboration of the garments, it is necessary to go through various productive processes, where the transformation occurs and give value to the final product and evaluate how efficient the processes are. In this research project we diagnose a textile manufacturing company and with the support of the Lean Manufacturing methodology such as: Poka Yoke, Kaizen, JIT, 5s, SMED, to achieve an impact of continuous improvement and to be able to counteract certain problems in the production process, what are the possible causes of delays in delivery of order to customers.

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This article begins by explaining, based on statistical sources, the development of the textile sector in our country and in the global environment. Then, it proceeds to summarize according to the literature, review what the authors express about the main problem and apply tools or methodologies that can be used for its subsequent solution. For this, the contribution of each author is important to achieve a novel solution proposal applying the tools together. The solution proposal will be evidenced in each area of the company that the study is applied. Subsequently, the validation is carried out to conclude and recommend as a proposal for similar problems.

II. STATE OF ART

Various authors have evidenced the problems that organizations have due to delays in the delivery of orders in the manufacturing sector and for this reason various companies are forced to implement the different tools to operate effectively and analyze the methodologies based on various proposals for solve the problem.

2.1. Problem of the delay of the delivery of orders in Mypes

The first typology refers to the research problem that is the delay in the delivery of orders. Compliance with delivery times can be affected by various areas of waste in production, which generate additional costs in overtime and penalties. It was decided through a process evaluation, the 5s, Jidoka and Kanban. These techniques will be applied to reduce or eliminate the main causes analyzed. Defective products were reduced from 18% to 10%, reworked products were reduced from 7% to 3%, and an increase in the catering of raw material was from 65% to 90%, reaching an improvement in compliance with the delivery time from 58% to 95%. [7]. On the other hand, in today's automotive industry, lean manufacturing systems are successfully used to reduce lead times.

The Objective is to develop a roadmap to help decision makers facilitate the successful implementation of integrated Just-in-Time practices. These improvements are confirmed by the percentage of added value, which indicates an improvement of 24.08% compared to the previous data of the VSM, obtaining an added value of 89.87%. [12].

It is important to note that the implementation of lean manufacturing is not always easy in terms of barriers, challenges and applications, efficiency issues, and workplace clutter. As is the case of a furniture industry that, because of inadequate time management and monitoring, does not have a culture of advancement and are limited to the restrictions that the government establishes, and this article will seek to implement this knowledge to various local Mypes.

to improve, which will imply the need to invest time and adapt the workload to new and greater responsibilities. The results of the study will help the government, the furniture association, and wood and furniture companies make more mature and careful decisions regarding lean issues or critical success factors [2].

On the other hand, in the current automotive sector, stands out that lean manufacturing systems are successfully used to reduce the excessive delivery times of a spare part to its national and international distributors and in the second, focus on the Indian manufacturing industry [6], and start root cause analysis and zero-defect production to ensure overall improvement in equipment and facility effectiveness by reducing equipment breakdowns and maintenance downtime. As a result, it was possible to see the effect of JIT and lean manufacturing systems on the performance of manufacturing industries [9]. The proposal for the development of a roadmap to integrate these two concepts and empirically validate them seems to be an encouraging direction for future researchers.

In various investigations, there are limitations to exploring how suppliers can address the following challenges of being able to leverage reliance on garment supplier factories to improve productivity and compliance capacity [6]. The authors are encouraged to do so. the present investigation because when considering the perspectives of both the buyer and the supplier, through the analysis of the problems that currently occur in the textile industry, it is important to investigate the possibilities of the implementation of tools that allow to be of support in the improvement at the plant level to meet market challenges in a developing country context, it also prescribes solutions for suppliers who are concerned about their survival and growth.

2.2. Diagnostic Tool (VSM)

The second typology is based on the Lean Manufacturing Technique “Value Stream Mapping (VSM)”. Productivity is an important parameter for manufacturing industries. This article deals with productivity improvement, the authors focus on the work of the pre-assembly of satellite carriers (PLC) for the gearbox, they focus on the standardization of work and the mapping of the value chain (VSM). Future state value stream mapping shows the improvement in the first step process prior to PLC assembly. Productivity can increase from 7 pieces to 10 pieces in the first assembly step. To meet the daily demand of 10 PLCs, the processing time of the second step has been reduced by about 24% [5]. Reprocessing has been reduced from 9.78% to 5.65% by encoding data. After the implementation of the proper lean tools, label repetition has been reduced by 85.5% [13].

The Mypes require constant continuous improvements in their processes, a clear example in India, there are SMEs that present a constant demand from customers and the same way from competitors to produce quality products at a comfortable cost. LM and Kaizen principles were applied at every opportunity, constantly seeking to reduce waste, variances, system cycle times and improve overall performance. It is important to mitigate the indicated problem, because the recent global competitive world requires customer expectations which are higher with respect to quality and cost of products, the implementation of continuous improvement programs that minimize the cost of the product, reduce the delivery time and improve the quality of the products [12].

All the articles use the VSM tool in order to know the processes, the bottleneck, the problems and causes. In turn, in the three articles they use another tool (Kaizen) that helps to reduce and eliminate the causes [16]. These articles contribute to the research work, since it is confirmed that the VSM tool is of great help to identify the process or processes that generate the most time and the different problems and causes, but they also explain that the tool alone will not To solve these causes, it is necessary to implement other tools according to the difficulty of each cause [3].

2.3. Single Minute Exchange of Die (SMED)

The authors [14] and [11] state that today's manufacturers may need to present and demonstrate the success of products not only faster, but also deliver them to end users at the right time. This was achieved with the main goal being to reduce the change over time from the current setup time. After implementing the SMED, the total change over time was reduced [11]. Likewise, production losses were reduced, and productivity increased.

"Lean Manufacturing model of production management under a change management approach to improve productivity in a company dedicated to manufacturing" [18]. The authors confirm that, in companies, the improvement of production processes aims to optimize production and productivity. However, the reasons that cause low productivity may be mechanical problems, inadequate work method, high time for preparing machines, preparing supplies, etc.
The authors implemented the tools SMED, 5'S, change management and work study to reduce the time of preparation of machines (SET UP) to increase productivity by reducing the time of Set Up due to the SMED implementation. In addition, it is expected to solve the disorder in the work area, through the 5'S tool and finally with a work study it is expected to solve the delay regarding the preparation of supplies.

In a state of the art entitled "Textile management enabled by lean thinking: a case study of textile SMEs" [17]. The author in his report concludes that some of the main operational problems that are evident in MSMEs that cause their exit from the labor market are non-compliance with delivery times, inappropriate quality, and market fluctuations. The author analyzes a textile company.

That shows that in recent months there has been a persistent breach of production deadlines, which presented an impact on the penalties provided by the different clients. Which leads to a decrease in economic profitability by 19% with respect to income. Equally, productivity revealed a decrease of 5% in the last 4 years compared to the Peruvian sector,

In the articles [19] and [20], presented by the authors Saravanan,V., et al (2018) and Monteiro,C., et al.(2019) used the SMED tool with the aim of reducing delivery times , both in the first N°19, whose purpose was to present a lean approach to the manufacturing system of injection molding facilities by reducing change over time. A lean One Minute Die Exchange (SMED) tool has proven to be an effective tool to eliminate wasted time.

Later, in the final stage of the SMED implementation, the following three alternative clamps were proposed, functional clamps, hydraulic clamp, and pneumatic clamp, which allowed reduction of production losses and increased productivity, the total time necessary to carry out the configuration activities in the selected manufacturing system, it was possible to reduce it in approximately 1623 seconds and the reduction percentage in the total configuration time achieved was 67.72%.

In the second case study in a metalworking company, in the same way it was carried out in stages, it began with the mapping of VSM flows, then the ABC analysis, then they identified the processes, then they carried out the SMED balance, finally, the creation of shelves, minimizing movement times. It was achieved with the purpose of eliminating waste and increasing productivity in the machining sector, reducing the average time required for the configuration of the vertical milling machine by approximately 40%, the initial average of 9 minutes and 51 seconds. decreased to the current average of 5 minutes and 52 seconds. In articles [2] and [20], presented by the authors who used the SMED tool with the aim of reducing delivery times, whose purpose was to present a lean approach to the manufacturing system of injection molding facilities by reducing change over time. A lean one-minute die exchange tool has proven to be an effective tool to eliminate wasted time.

2.4. 5S checking tool

The article [6] and [15] demonstrate that the application of 5S, work study and Muda elimination techniques can be applied in small-scale industry. It should be noted that these tools involve the Toyota Production System, which highlights the interaction of all categories of employees in the asset, with the aim of a small but continuous development. The author recommends carrying out a Japanese Management and Production System Toyota. The techniques to be used will require a top-down technique that becomes part of the corporate fabric [15].

In the articles [4] and [8] presented by the authors, the 5S technique was implemented under different approaches, but with the same purpose of reducing production cycle times. This allows the research project to know the impact of 5S with respect to operational performance, the need to have organized areas and the importance of delivering orders on time. In addition to this, articles [12] and [14] present similarities when implementing the 5S tool with the aim of eliminating waste from the organization, since this waste causes overtime and no added value. In this way, thanks to the implementation, an improvement in the performance of operations is also achieved.

The 5S are quality practices, which refer to an integral maintenance of the company, receiving this name from the initials of the 5 words that symbolize actions or principles of expression for the productivity of the company (UTEC, 2019). Definition of 5S techniques:

- Seiri (classification and discard): It means eliminating everything that will be unnecessary in the places where activities or work are carried out.
- Seiton (order): It consists of organizing the elements classified in the previous step, so that they can be easily found.
- Seiso (clean): Consists of removing dust and dirt from the elements of a factory.
- Seiketsu (standardize): What has been achieved in the first 3s is maintained, so as to prevent the workplace from returning to its original state.
- Shitsuke (disciplinary): By ensuring the culture of self-control within the company, the proper development of the daily activities of each member of the company is achieved. The 5S tool is used, because it serves efficiently in the establishment of order in the workstations and the change in the perception of quality by the workers.

In the articles presented by the authors Shukla, HM, and Ganvir, KD (2018), Kumar, DV, Mohan, GM, and Mohanasundaram, KM (2019) and Jayachitra, R. and Parthasarathy, S. (2020), the technique 5S was implemented under different approaches, but with the same purpose of reducing production cycle times. This allows the research project to know the impact of 5S with respect to operational performance, the need to have organized areas and the importance of delivering orders on time.

The articles by the authors Pombal, T., et al. (2019) and Burawat, P. (2019) present similarities when implementing the 5S tool with the aim of eliminating waste from the organization, since this waste causes overtime and no added value. In this way, thanks to the implementation, an improvement in the performance of operations is also achieved. This article serves the research project because it provides information about the possible causes that cause the main problem and how with the 5S tool it is possible to eliminate or reduce them.

III. INPUT

The proposed model is developed based on the article where the authors implement the SMED, 5'S, change management and work study tools to reduce machine preparation time (SET UP) in order to increase productivity through the reduction of Set Up times due to the implementation of SMED. In addition, it is expected to solve the disorder in the work area, through the 5'S tool and finally with a work study. hopes to resolve the delay regarding the preparation of supplies. Likewise, the model in which the author indicates that the simulation and modeling of small industrial systems has become essential in decision-making processes, since it allows micro-enterprises to base their production decisions [16]. Similarly, they state that an analysis was carried out of a company that manufactures outerwear for men with an average weekly production of 490 garments. The company studied as an SME in the textile-clothing sector and a leader in its field for its line of safety clothing products. This is in search of positioning itself in the market and improving its competitiveness, so it is important to identify the main problem.

The tools applied in this improvement plan are the LM model and the first to be implemented are the 5's, it intervenes for continuous improvement and within its sequence, the application of the SMED tool (methodological tool for reduce time) and Poka Yoke (tool to avoid errors in the product manufacturing process) that serve as support to effectively implement the improvement plan process. Likewise, they state that an analysis of a company dedicated to the manufacture of clothing with an average weekly production of 490 garments was carried out.

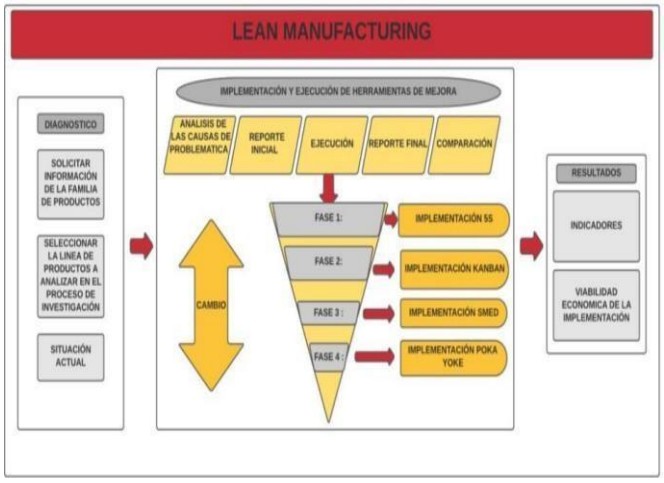

Fig. #1: Design of the proposed model

Source: self-made

The study analysis yielded real system simulation results and a comparison with an improvement scenario that showed an increase in weekly productivity with an improvement greater than 10%.

First, the analysis of the main problem of the company was carried out and the reasons and causes that originated it were determined. Second, the Value Stream Mapping is used as a diagnostic tool to calculate the cycle time and observe in which area of the production process the bottleneck occurs. It is important to highlight that the company presents problems during its safety clothing production process. Indicators of efficiency and productivity of the company in recent periods were used, with the aim of evaluating and conducting a market study in which other companies in the textile sector are found. The contribution of using this tool is the reduction of the cycle time for the manufacture of a garment from the safety clothing line. In this way, the weekly demand of 46 units per week is satisfied.

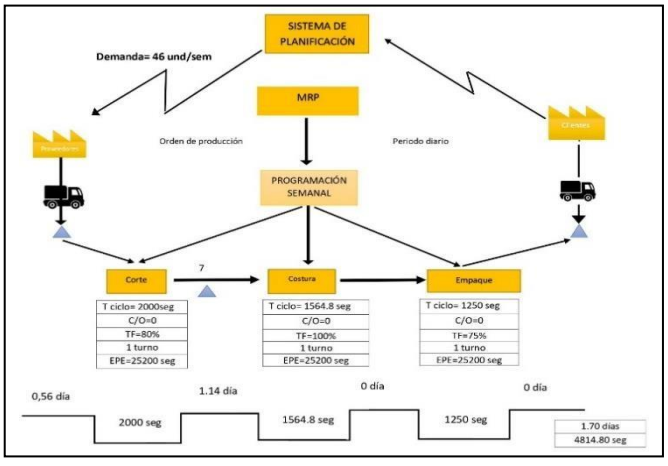

Fig. #2: Future VSM of Confections Duany

Source: self-made

To begin the implementation stage, the 5S methodology will be designed, in which the current state of the company will be analyzed and the improvement of the execution of each of the phases will be detailed:

Phase 1: Seiri “Classify”

Fig. #3: Cut area before and after implementing the first S

Source: self-made

Phase 2: Seiton "Organize", once the application of the first phase has been carried out, the Facilitator and the 5S team will have the task of starting with the implementation of Phase 2. In this stage, the to properly organize the activities to be carried out, in such a way that only the essential elements for the process to be carried out in the area will be found, placing them in specific places so that they can be properly identified, as well as the delimitation of the space that will be occupied in the cutting area; this with the purpose that the tool used or the material used is returned to its same place.

The delimitation of the zones within the cutting area is necessary, because it will help to organize the area and avoid accidents, it will improve the safety of the workers, it will also allow a pleasant work environment, and reduce loss of time due to possible accidents. The members that make up the work area must take it into account and respect the work areas, as well as become visual inspectors of compliance with the standards declared by the 5S team.

In the third Seiso phase "Clean", it is suggested that the 5S committee should generate the idea of creating a new habit based on visual inspection for the identification of defects. It will consist of carrying out daily cleaning in the work area, looking for the conservation of the place of each element or tool at the end of its use. This is the first inspection that the 5S Committee together with the 5S Facilitator must carry out in the cutting area, inspecting the proper functioning of each tool, cutting machines, generation of fabric scraps, among others.

ACTIVIDAD	MATERIAL EPPS	DESCRIPCIÓN DEL MATERIAL LIMPIADO	Fecha	ENCARGADO	ÁREA
LIMPIEZA	ESCOBA Y MASCARILLA	RETAZOS DE HILOS	06/09/2021	LUZ ROMERO	CORTE
LIMPIEZA	GUANTES	TIJERAS	06/09/2021	LUZ ROMERO	CORTE
LIMPIEZA	GUANTES	REGLAS	06/09/2021	LUZ ROMERO	CORTE
LIMPIEZA	ESCOBA Y MASCARILLA	RETAZOS DE TELAS	06/09/2021	LUZ ROMERO	CORTE

Fig. #4: Registration documents of cleaning activities by area

Source: self-made

It will be considered to implement registration documents of cleaning activities, indicating the PPE used to carry it out, describing the materials cleaned, the date, the person in charge and placing the area where the activity will be carried out, all with the in order to maintain a clean and safe work area so that the work space can be optimized to the maximum and in the same way better manage the movement of materials used in the process of manufacturing overalls and safety vests.

Phase 4: Seiketsu "Standardize", in the penultimate phase, the 5S committee together with senior management must commit to achieving the consolidation of the conservation of the previous phases and ensuring its persistence by standardizing the processes. Unnecessary objects are assigned an ID for quick identification and relocation out of the product development area.

Fig. #5: Implementation of stickers in order deliveries
Source: self-made

Phase 5: Shitsuke "Discipline" The last phase is intended to generate, in the workers and throughout the company, habits of standardized methods and procedures in the previous phase, the 5S manager and the members of the committee, will lead them to carry out unexpected audits in the cutting area to verify compliance with each phase.

Fig. # 6: Order and cleanliness at workstations

Source: self-made

In the second execution phase, the SMED tool is applied with the priority of reducing times between machines. The implementation of this tool requires a sequence of steps which is to identify and separate your internal activities from external ones. In this way, it seeks to eliminate external activities that add valuable time during the production process.

Operaciones internas del set-up	Internas	Externas
Enchufar máquina de coser	40	
Recepcionar moldes de tela		45
Separarar cada molde de tela según prenda		75
Colocar la bobina en la maquina	22	
Insertar el rollo de hilo en el porta cono	30	
Seguir instrucciones para la pasada de hilo	75	
Poner aguja en la máquina	25	
Prender máquina de costura	65	
Ubicar moldes de tela en la máquina	87	
Unir moldes de tela		45
Armar el producto de ropa de seguridad	500	
Presionar palanca para producir transmisión de movimiento	5,8	
Formar el producto de ropa de seguridad		250
Colocar en el estante por tipo de producto		55
Retirar hilo sobrante de la máquina	45	
Calibrar la máquina	200	

Fig. #7: Internal and external set-up operations
Source: self-made

It is important to mention that this will be developed with a constant evaluation and with the help of indicators such as the number of products delivered outside the agreed date, production time and set-up time. The incentive with bonuses to the operators is essential so that they can effectively develop the implementation of these tools. After that, it will be necessary to use the Poka Yoke tool to control and monitor the results obtained by the implementation of the new design of Lean Manufacturing tools. In this way, the company seeks to achieve with the implementation of this tool, and thus reduce set-up times by 65% for the sewing process. which is beneficial for the company since it generates higher income and the fulfillment of order delivery in the time agreed with the client.

Indicators

At this stage, the indicators that were used throughout the research work will be established and it should be noted that for the implementation of the improvements it is necessary to consider the main metrics that will support the management of the progress of the project. It is important to measure the results of each tool separately, that is why metrics will be used for both setup time, transport time and waiting time, in this the difference that it has had with the initial diagnostic value will be measured to perceive the progress that it would bring to carry out this implementation.

INDICADOR	OBJETIVO	FORMULA PARA EL CALCULO	CONTROL	RESPONSABLE
MERMA	Medir rastros aquellos en los almacenes que están en alerta y que deben ser intervenidos por el área de prevención perdidas.	%m= (Metros de merma)/(Metros totales usados en la producción) ×100	merma<0.10	Jefe de producción
EFICIENCIA	Medir el nivel de ejecución del proceso, se concentran en el Cómo se hicieron las cosas y miden el rendimiento de los recursos utilizados por un proceso.	Eficiencia= (Producción real)/(Capacidad efectiva)×100	Deficiente<1 Normal=1 Muy eficiente >1	Jefe de producción
PRODUCTIVIDAD	Medir el desempeño, disponibilidad, rendimiento y calidad del proceso productivo de las empresas	Productividad=(Tiempo real)/(Tiempo disponible)×(Unidades producidas)/(Unidades planificadas)	Product>0	Jefe de producción
TIEMPO DE PRODUCCIÓN	Medir el tiempo en el que el material fluye desde su recepción hasta que está listo para su envío.	TP=(Tiempo real)/(Tiempo disponible)×(Unidades producidas)/(Unidades planificadas)	TP> 1.00 1.00 < TP < 1.15 TP< 1.15	Jefe de producción
TIEMPO DE ESPERA (TE)	Medir la mejora en los tiempo de espera por proceso	TE= TE inicial- TE final	Positivo 0 Negativo	Jefe de producción
REDUCCIÓN DEL TIEMPO	Medir la reducción del tiempo que se reduce después de la implementación de la mejora	RT=(TP inicial-TP real)/TP inicial	RT> 23% 10% < RT < 23% CP< 10%	Jefe de producción
VAN	Medir monetariamente la viabilidad del proyecto	$VAN = -I_0 + \sum_{t=1}^{n} \frac{F_t}{(1+k)^t}$	VAN>S/. 10 000 S/. 0 < VAN< S/. 10 000 VAN < S/. 0	Gerencia de contabilidad

Fig. #8: Management indicators used in the research

work Source: self-made

IV. VALIDATION

For the present investigation, the Pilot Test will be carried out, since it is part of the methodological framework of the projects, which will serve to make real approximations of the research projects before establishing the final test. The Pilot Test verifies if the research subjects understand the instrument, if the items or questions are truly sufficient and clear, in addition to having the opportunity to evaluate the congruence of the language, writing or cultural adaptation (if necessary).

Remarks cutting area

- The variety of products generates ignorance of the manufacturing process in some operators, and this can result in poor quality products, reprocessing or dissatisfied customers.
- The process of the activities that are required to produce the garments is disorganized, it does not have an orderly record of document management. These procedures are transmitted orally to the workers.

Sewing area remarks:

- It is the area considered the bottleneck compared to the other production areas.
- There is not a good organization between the distribution of materials in the respective area.

Economic validation:

In the investment flow, the implementation costs of the new design proposal will be considered. We identify that the net present value is S/118,554.80, which is a positive and beneficial value for the entity. The cost of this implementation of the proposal represents approximately one third of the net present value.

According to the information provided by the company and based on the item to which it belongs, the cost of implementing the proposal amounts to 13%, the latter being the interest that shareholders demand for returns for the investment cost and/or a banking investment. To economically evaluate the implementation of the design, it is necessary to have knowledge of the Net Present Value (NPV), to determine if the project is feasible or not to execute it.

Net Present Value (NPV)

According to the projection, the flow period is 5 years with a discount rate of 13%. (WACC). The following calculations are carried out.
The application of the NPV formula is important to determine the feasibility of the project. For your calculations, you proceed to replace the data in the following formula:

Where:

Io: Project initial investment
FEL: Free cash flow (FEL)
I: Discount rate (WACC)

$$VAN = -Io + (1+i)_n$$

$$VAN = 16013.83 \quad (1)$$

Indeed, the NPV value turns out to be greater than 0, which means that investing in the project is viable. Considering, the acceptance criteria of the research proposal are shown. Likewise, the NPV is positive greater than 0, for which it is feasible to accept the project proposal.

Internal Rate of Return (IRR)

The Internal Rate of Return is the minimum rate of return that must be obtained from the project that you want to implement in the proposal in such a way that the value does not decrease.

$$VPN = -Co + \sum (1+r)_t$$

$$r = 0{,}5471 = 54.71\% \ (2)$$

After having made the calculations, the following indicators must be considered to evaluate the feasibility of the project. It can be concluded that the project that is required to be implemented if it turns out to be viable for the company Confections Duany.

VI. CONCLUSIONS

- The main tool in this research project is 5S since it is the first to act within the company's production process.

- The second crucial tool for bottleneck detection is the VSM, the sewing area of the overalls production process represented an improvement of 50.37%, and hand in hand with the SMED, since it served as a method of reducing costs. waste in 22.05 minutes.

- The application of Lean tools is advantageous since in the company they only had a few workers, which made it much more feasible to work on the training and orientation of the activities to be carried out in the implementation. They managed to capture successfully and are much better organized.
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- The economic flow analysis shows us as a result that the research project is viable and beneficial. Indeed, the Net Present Value shows a result of S/.118554.80.
- Improvement of time reduction in the cutting area by 39.81%, after applying the pilot test in the company, and after the evaluation of the time study, a reduction of 49.11 minutes was obtained after the implementation of 5S, SMED, Poka Yoke, which in percentage would be a 40,28% improvement.

V. GRATITUDE

A cordial thanks to the teachers of our alma mater Peruvian University of Applied Sciences for transmitting their knowledge to us throughout these 5 years of studies, and especially to our dear advisers, Engineer Juan Carlos Eyzaguirre, who from heaven is observing our achievement of graduating and soon becoming industrial engineers, as well as our current advisor Engineer Ernesto Altamirano, who with his patience, wisdom and knowledge has forged us to successfully complete this great stage and for his valuable contribution to this work .

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