Implementation of Lean Manufacturing Tools in Garment Industry

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Abstract **- For any Company's economy, the industry cost, production time, total quality management and waste reduction have great impact. The investments consumed by the company by eradicating non value added production work and time are very important. Focusing on these points Lean Manufacturing tools, a Japanese strategy, is implemented in this work. An apparel industry was studied and the bottleneck areas were identified through Value Stream Mapping (VSM). The bottleneck areas were identified and eliminated by implementing line balancing and parallel working section. The implementation of kaizen resulted in reduction of cycle time by 48.7%.**

Keywords **– Lean Manufacturing, Value Stream Mapping, Kaizen, Line Balancing, Garment.**

I. INTRODUCTION

Lean often referred as Lean Manufacturing or Production which is the systematic method to eliminate waste in any manufacturing unit. From the customer's perspective "value" is the process for which the client would be willing to pay for any product or service. Lean manufacturing is a philosophy which has been derived from Toyota Production System in 1990s and identified as "Lean". Toyota Production System is mainly focused on reduction of seven wastes to improve customer's overall value. Lean is an essential tool for which it adds value by reducing everything else.Lean is a tool which helps to identify and eliminate waste. By eliminating the waste it improves the quality while the cost and production time are reduced.

A list of such tools includes: 5S,SMED,Multi-process handling, Rank order clustering, Poka-yoke, Value Stream Mapping, Redesigning working cells,Kaizen,Kanban, Elimination of time batching, Single point scheduling, Mix model processing, Total Productive Maintenance and Control Charts. Lean principles can be applicable to any manufacturing sector like Apparel Industry, Machinery manufacturers, Computer chip makers and Helicopter manufacturers. Lean is also used in Logistics, Healthcare, and Software development areas.

II. BACKGROUND

In India, the textile field has always been considered as backbone of the country as equal to agriculture. It is a land of opportunities for textile and apparel industries. It is remarked that, this textile and apparel sectors are ancestral business, lacking to implement new technologies, pioneering skills, in the evolution of time. Implementing innovation and flexibility in production methods, combine together help us to sustain this flourished field now and in mere future. It also leads a diversion to old traditional methods.

The main motive of any investment in industrial sectors is always expected with an output, resulting in profit and wastage reductions. Factors such as industry cost, production time, quality management, elimination of non-productive works makes the company economically safe. Focusing these points, steps have been taken to implement "LEAN MANUFACTURING", a Japanese strategy, which can be a solution to the problem we face in today's apparel industries. The concept of lean and its tools help us to identify and rectify the problems we face in industry production methods, time utilization and wastages. In this work, an apparel industry, study the various problems faced in that industry, through lean tool techniques and find a solution in such a way their productivity is not affected, time is saved by elimination of wastes.

III. LITERATURE REVIEW

Rajenthirakumar et al (2011) studied that Lean manufacturing is an applied methodology of scientific, objective techniques where a process of minimum non-value adding activities are obtained. This paper described an application of value stream mapping (VSM), where present and future states of value stream maps are constructed to improve the production process. A noticeable reduction in cycle time and increase in cycle efficiency is confirmed. The production flow was optimized thus minimizing several non-value added activities like bottlenecking time, waiting time, material handling time, etc. Preetinder Singh Gill (2012) studied that Value Stream Mapping (VSM) in a research effort involves a review of existing literature pertaining to application of the VSM tool in hospital emergency rooms/departments. Seyed Mohammadali Motavallian et al (2013) studied that how Value Stream Mapping (VSM) can help in identifying key specific objectives. Based on the findings a step by step procedure provided that helps organizations to apply VSM in Product development environment. Murugananthan et al (2014) studied that

implementing VSM in a casting foundry with current state maps and future state maps. With a case study in one of the casting industry, the production process path is visualized After tracking the entire process, wastage affecting the cycle time are identified and its causes analyzed. A future state value stream map is developed and improvement ideas are suggested. VSM is proved as a useful technique to minimize the cycle time and increase the productivity.

Nor Azian Abdul Rahman et al (2013) studied that in Japan, Kanban system is one of the manufacturing strategies for lean production with minimal inventory and reduced costs. Findings of the study suggest that top management commitment, vendor participation, inventory management and quality improvement are important for Kanban deployment and towards lean manufacturing. Geoff Miller et al (2013) studied that a small furniture production company has integrated lean tools and sustainability concepts. It was aided by the use of discrete event simulation and optimization to overcome deficits in lean's traditional implementation strategies. Sameh Mohamed Fahmi et al (2012) studied that the steel industry has many challenges for the implementation of lean manufacturing due to some constraints. They described the application of lean principles in the production planning of a flat steel plant. Pull Production, Mixed Model Production, elimination of waste, and creating flow are among the lean manufacturing principles that were applied in this case. The results showed more than 40% reduction in work in process and cycle time, reduction in cycle time variability and less chaos. Md. Mazedul Islam et al (2013) studied that for any industry cost and time related to production and quality management or wastages reduction have important impact on overall factory economy. The research was administered with two leading apparel manufacturers in Bangladesh using personal interviews, secondary data and observations. The outcome of this observation reflected that an industry may gain higher productivity and profitability by proper application of lean manufacturing.

IV. PROBLEM STATEMENT

In India due to lower skill levels and traditional manufacturing systems, the garment industries are able to achieve 50% to 60% productivity level .This project is done in an apparel industry in Salem, Tamil Nadu, India. They are manufacturers of men formal and casual shirts. The company has been facing problem with unbalanced productivity among various operations in sewing department.

V. OBJECTIVES

- The primary objective of the present study is to investigate the garment manufacturing processes to identify the bottle-neck operations through lean diagnostic tools, preferably value stream mapping (VSM).
- Appropriate lean tools are to be implemented until the productivity is improved by eliminating the waste operations

VI. DIAGNOSIS OF THE PROBLEM

The factory consisted of 60 high speed industrial lock stitch sewing machines to manufacture formal woven shirts. The shirt components like collar, cuff, sleeve, front and back are produced in separate sewing lines and the final garment is produced in assembly line by attaching these prepared components with other components. The customer demand is 725 shirts per shift of 8 hours. With the study on the production data of components and main assembly line it is found that cuff line production was around 550 pieces in a shift. It showed a shortage of 175 cuff pieces to assembly line in every shift. The manufacturing of cuff involved 8 operations.

To understand the real bottle neck area, the operations analysis for cuff production line and current state of value stream mapping are created and shown in Table 1and Fig 2, respectively.

Table 1Current State Operation

Steps	Activity	Time (Sec)
1	Shift a pair of cuff from the bench to ironing table using left hand	2
2	Pick one cuff and place in the work area	1
3	Fold the raw edges of the cuff to the inner side using both hands	3
4	Hold the cuff in left hand and press using the iron box with right hand	12
5	Place the ironed cuff aside	1
6	Pick the second cuff to the work area	1
7	Fold the raw edge of the cuff to the inner side using both hands	7
8	Hold the cuff in left hand and press using the iron box with right hand	11
9	Place the ironed cuff aside	3
TOTAL		41

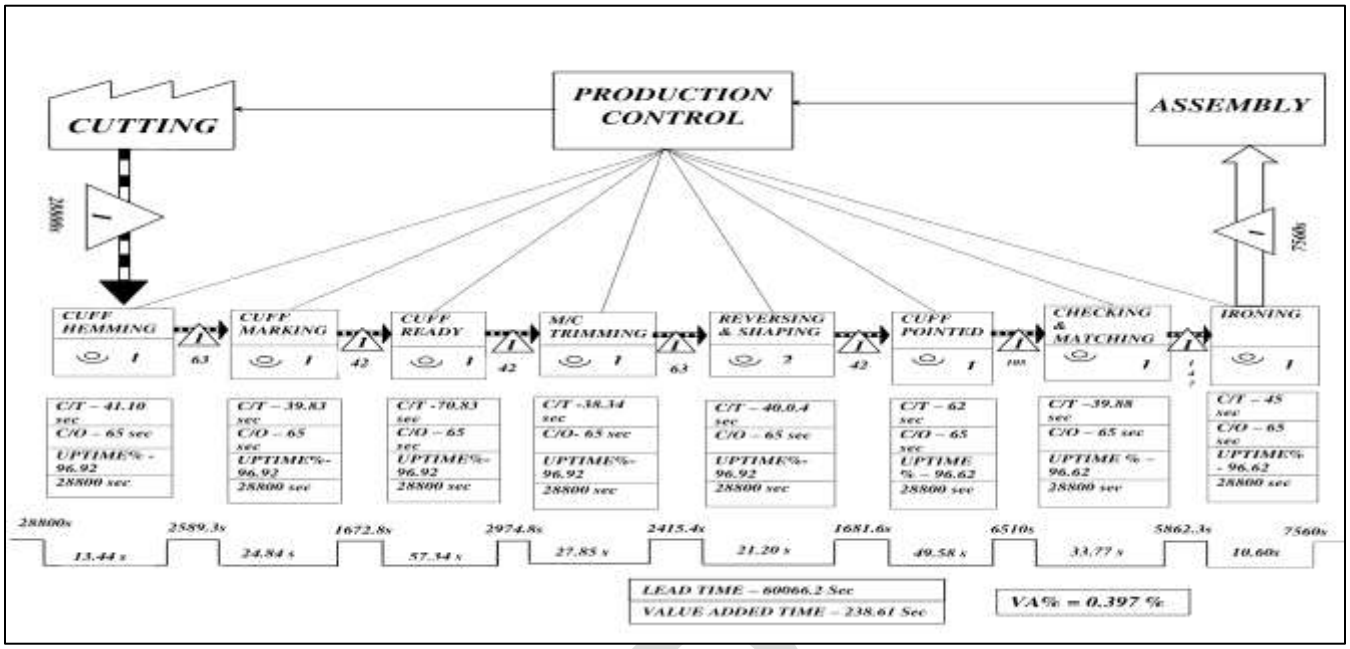

Fig 2: Current State Value Stream Map

The takt time is estimated for the current data as follows

Takt time = Available time / Customer Demand = 480 / 725 = 0.66 Min or 39.72 Sec.

So, the production activity of any operation must be equal to or below 39.72 sec to maintain smooth flow of production. The analysis of VSM data revealed three bottle neck areas in the cuff production line which is shown in Fig 3.

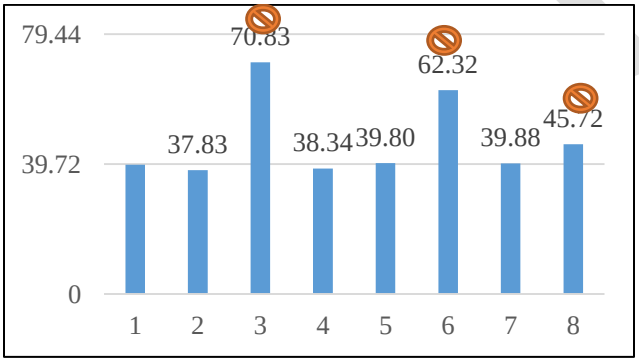

Fig 3. Identification of bottle-neck operations

The Fig 3 clearly showed that the cycle time of the operations cuff ready, cuff top stitch and cuff pressing are 31.11 sec (78.3%), 22.6 sec (56.8%) and 6.00 sec (15.1%) respectively higher than the takt time.

Strategy 1: Line Balancing

Since the operation 3 (Cuff ready) and 6 (Top Stitch Cuff) require more than 50% of the takt time, it warranted a parallel production operation which can potentially reduce the cycle time. In order to facilitate continuous flow the line balancing technique was to be used. Two sewing operations were introduced in parallel with operation 3 and 5. The line got changed from 8 operations and 9 operators to 8 operations and 11 operators. This strategy eliminated the bottle neck and the cycle time was brought down to takt time. The Fig 4 clearly shows that the bottleneck has been cleared at operations 3 and 6.

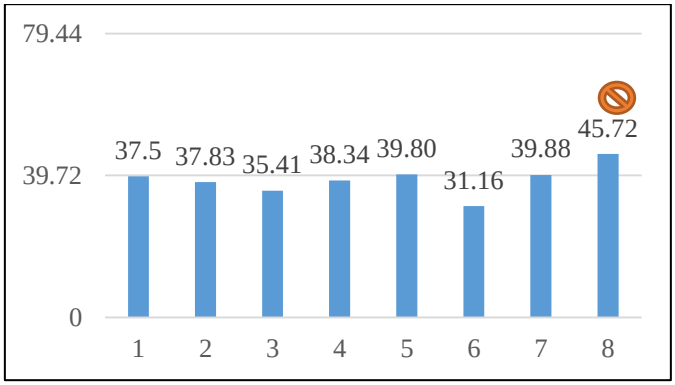

Fig 4 Improvement after line balancing

Strategy 2: Reduce cycle time by KAIZEN (Operation 8 - Ironing)

As the cycle time of ironing is few seconds above the takt time, introduction of another extra ironing table will cause a greater pull and the cuffs may start to pile up at the iron station. So, Kaizen was experimented and the results are shown in Table 2, Table 3 and Figure 5, as follows.

Table 2: KAIZEN 1 – Top and Bottom Extension

Steps	Activity	Time (Sec)
1	Pick both cuffs and place it simultaneously in top and bottom manner on the working table	4
2	Hold the edges of the top cuff and extend it slightly so that it gets folded and place a ruler over it	6
3	Similarly hold the edges of the top cuff and extend it slightly so that it gets folded	6
4	Now holding the bottom cuff iron both cuffs together	11
5	Pair both the cuffs and place it aside	1
TOTAL		28

Table 3: KAIZEN 2 – Top and Bottom Extend Overlap

Steps	Activity	Time (Sec)
1	Pick both cuffs and place it simultaneously in top and bottom manner on the working table	2
2	Fold the top cuff by extending its edges and place it in such a way that it overlaps the bottom cuff	4
3	Similarly fold the bottom cuff by holding the top cuff too	5
4	Hold both the cuffs and iron it together	7
5	Place the ironed cuff aside	2
TOTAL		20

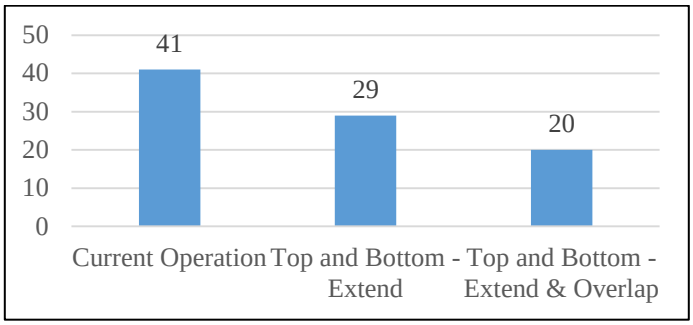

Fig 5: Outcomes of KAIZEN

The timing has been reduced to 50% by KAIZEN. Now all the operations in the cuff line are under control and a smooth flow is achieved. The improved takt time details are shown in Fig 6.

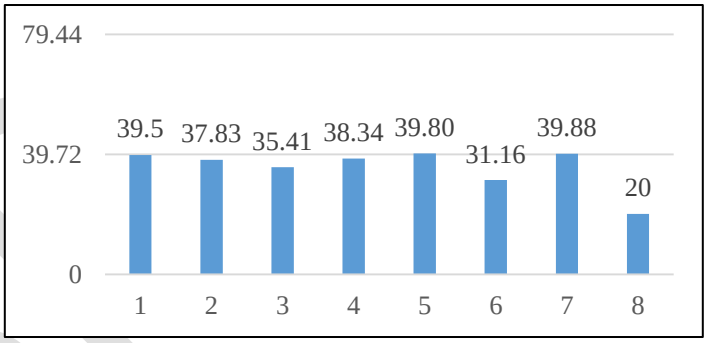

Fig 6: Takt time after implementation

The future state of value stream map (Fig 7) is developed with the reduced cycle time in the three operations. Now, the percentage of value-added activities for the future state is improved from 0.397 to 0.431 which accounts for 8.5% overall improvement in the process.

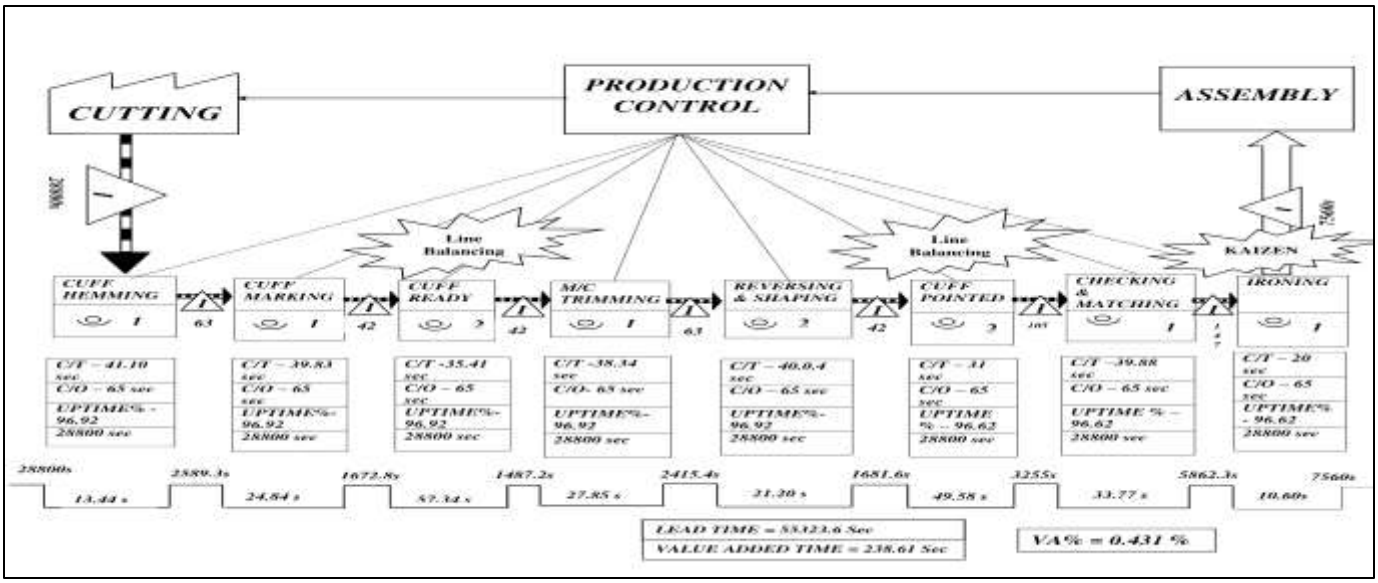

Fig 7: Future State Value Stream Mapping

VII. CONCLUSION

Thus an apparel industry was studied and the bottleneck areas were identified through Value Stream Mapping (VSM). The bottleneck areas were eliminated by implementing line balancing and parallel working section. The implementation of kaizen resulted in reduction of cycle time by 48.7%.The value added percentage got increased from 0.397% to 0.431% which accounts for 8.5% improvement in the processes.

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