



Application of Lean Manufacturing Tools in Garment Industry

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ABSTRACT

The main challenges which the garment industry is facing are labor cost for production processes, small quantities with few repetitions, frequently changing styles and short delivery times. Textile exports must get special focus in view of its immense importance in the economy of country. More than 90 million people of India are directly and indirectly engaged in textiles or textiles related sectors. It is the largest employment generating segment of the economy, next to agriculture. The fashion industry is highly volatile and if the orders are not fulfilled on time, the fear for losing business is real. Today, industries are getting the same or more volumes, but the number of styles they have to handle has increased drastically. These problems were addressed in this work by the implementation of lean tools like cellular manufacturing, Value stream mapping, single piece flow, work standardization, 5S etc. Lean manufacturing is an integrative concept use for identification and elimination of wastes related to production. The main purpose of implementing lean tool is to increase productivity, reduce lead time, improve poor line balancing, reduce WIP, improve quality, increase flexibility in design, reducing cost, etc. Under the highly competitive pressure the garment industry has a good scope for improvement using lean principles. Lean concept must be implemented in the fashion industry as companies always need to be prepared to respond to unexpected changes. This work will focus on the implementation of lean tools and the conversion of traditional batch production into single piece flow and long assembly line into small work cells.

Key Words: *Lean manufacturing, Value stream mapping, Cellular manufacturing, 5S, Single Piece Flow*

1. INTRODUCTION

The lean manufacturing or lean production uses lean word as it uses less of everything in comparison to mass Production. Lean describe a system that produces what the customer wants and when they want it, with minimum waste - it is based on the Toyota production system. The concept of lean arises when company want to make the process more efficient, without delays and with less capital. The term lean implies the identification and elimination of waste in all the process involved in manufacturing. Lean manufacturing can be applied to any process and it brings a great result for sure. Lean manufacturing is a management philosophy

that focuses on continuously improving all the processes involved in a manufacturing firm, irrespective of what type of product are being produced. It can be used in automobile, garment, aerospace, chemical engineering or any other type of manufacturing. Lean manufacture has a comprehensive set of rule, elements and tools which focus on the elimination of waste and the creation of value. Any non-value added activity or process is called waste.

1.1 Types Of Wastage

Overproduction – manufacturing product more than the customer demands.

Waiting – waiting implies waiting for material, information, equipment, tools, etc

Transportation –carrying of work in process (WIP) for long distance, insufficient transport, moving material from one place to another place is known as the unnecessary transport.

Over Processing – working on a product more than the actual requirements is termed as over processing.

Excess Inventory –this includes excess raw material, work in process, finished goods, obsolescence, damaged goods, transportation and storage costs.

Defects – defects in the processed parts is known as waste. repairing of the defective parts, producing defective parts or replacing the parts due to its poor quality etc. is the waste of effort and time.

Excess Motion – unnecessary motion is caused by poor workflow, housekeeping, poor layout and inconsistent or undocumented work methods. value stream mapping is also used to identify this type of waste.

Underutilized People – this includes underutilization of the mental, creative, and physical skills and abilities

1.2 Principle Of Lean Implementation

The first step for implementing the lean concept in any manufacturing company is to define the value from the perspective of the final customer first. Then identify the value stream by creating a map of the Current State and the future State of the value stream. Identify and categorize waste in the Current State, and eliminate it. Eliminating this waste ensures the flows of product to the customer without any interruption, detour or waiting. Return to the first step and begin the next lean transformation, offering a product that is ever more nearly what the customer wants.

1.3 Lean Manufacturing Tools

5S: 5S is a systematic method for organizing and standardizing the workplace. It's one of the simplest Lean tools to implement

TPM: TPM is important for smooth running of a production facility and gives the best utilization of machines with least disruption of production

CM: CM is an integral part of lean manufacturing systems. Cellular Manufacturing is based upon the principles of Group Technology.

VSM: VSM is used to find waste in the value stream of a product. Once waste is identified, then it is easier to make plan to eliminate it

KAIZEN: A strategy where employees work together proactively to achieve regular, incremental improvements in the manufacturing process.

Pareto Chart: The Pareto diagram is a graphical overview of the process problems, in ranking order from the most frequent, down to the least frequent, in descending order from left to right.

POKA YOKE: Design error detection and prevention into production processes with the goal of achieving zero defects. This method makes sure that the operator does not make any mistake while in operation.

KANBAN: Kanban is a Japanese word that means instruction card. A Kanban can be any visual indication used to order the requirement of part or component. It is a manual pull device that allows an efficient means to transfer part from one shop to other.

SMED: It focuses on simplifying machine setups. Reduce setup or changeover time to less than 10 minutes and it focuses on increase production flexibility

JIT: Pull parts through production based on customer demand instead of pushing parts through production based on projected demand. It involves having the right items with the right quality and quantity in the right place at the right time

Visual Inspection: Makes the state and condition of manufacturing processes easily accessible and very clear – to everyone.

1.4 Lean Manufacturing In Garment Industry

Textile exports must get special focus in view of its immense importance in the economy of country. More than 95 million people of India are directly

and indirectly engaged in textiles or textiles related sectors. It is the largest employment generating segment of the economy, next to agriculture. This sector contributed 12.5 per cent of country's export earnings in 2009-10. Besides some selective big textile enterprises, this industry basically consists of medium, small and numerous micro enterprises scattered all over the country. The textile sector is the most labor-intensive, and has a rich heritage and tradition of thousands of years. The industry earned world-wide name and fame prior to the industrial revolution. In view of the labor-intensive nature and de-centralized character Indian textile industry is also in a position to make positive and meaningful contribution towards achieving the cherished objective of 'inclusive' growth Indian textile industry requires to be competitive and cost effective by improving its productivity, product diversification and enhancing operational scale. The fashion industry is highly volatile and if the orders are not fulfilled on time, the fear for losing business is real. Today, industries are getting the same or more volumes, but the number of styles they have to handle has increased drastically. Earlier industries were getting bulk order so there is no need to worry; if the production line was set for the first time it would run for a month or at least a week or two. But nowadays due to small order quantities and complex designs, the garment industry has to produce multiple styles even within a day; this needs higher flexibility in volume and style change over. This volatility of styles can be addressed only by flexibility in manufacturing. The best way to cope with all these challenges is the implementation of lean manufacturing. This will serve our purpose of flexibility and save a lot of money by reducing production lead time, reducing the inventory, increasing productivity, training operators for multiple works, and by reducing rework.

2. MOTIVATION

The main challenges in the garment industry are labor efforts for production processes, small quantities with few repetitions, frequently changing styles and short delivery times. Additionally,

customer requirements influence the aesthetic design and the functional requirements of the garment in terms of its usefulness and lifespan. This is especially the case in the fashion industry, in which companies must always be prepared to respond to unexpected. Now more than ever, garment companies must be able to quickly adapt to customer requirements. The improvement of production processes is critical in order to overcome these challenges.

The competitive pressure of globalization is causing textile and garment manufacturers to lower production costs and increase their efficiency. The Indian garment industries have witnessed substantial improvements in recent years. But the unnecessary capital investment is not going to solve the problem entirely; moderately this will turn out the waste in long run. The implementation of lean manufacturing is greatly recommended, in order to identify the waste and to eliminate them.

The Progressive Bundle System is a traditional method of manufacturing which has been widely adopted in the garment Industry for the past three decades. The parts of various components after being cut in the Cutting Room are tied up in bundles and distributed out to the Sewing Section. This is called the Progressive Bundle System (PBS). This method requires bundle to be transported to individual sewing operators. In this production system bundles of cut pieces (bundle of 5, 10, 20 or 30 pieces) are moved manually to feed the line. Then inside the line an operator himself drag the bundle from side table and transfer the bundle to the next operator after completion of the work.

With the advancement of the technology batch processing is converted into single piece movement by the implication of new layout (cellular manufacturing). This will help to increase operator skill. Cellular Manufacturing as UPS (Unit Production System) transports cut pieces hanged in hangers i.e. one hanger for one piece by automated mechanical transport system. It reduces manual transportation and it has many other benefits against PBS. The unit production system transports all the pieces of one complete product through the

manufacturing process. An addressable product carrier takes all the pieces of one entire unit through the different steps of production. Operations are performed at individual workstations. Cellular Manufacturing has become now an integral part of lean manufacturing systems. Finally, flexibility in production is achieved by reduced WIP and multi-skilled operators, who can work on multiple styles immediately.

3. LITERATURE REVIEW

The aim of lean manufacturing is the elimination of waste in every area of production including customer relations, product design, supplier networks, and factory management. Its goal is to incorporate less human effort, less inventory, less time to develop products, and less space to become highly responsive to customer demand while producing top quality products in the most efficient and economical manner possible. Cellular Manufacturing is a model for workplace design, and is an integral part of lean manufacturing Systems Properly trained and implemented cells are more flexible and responsive than the traditional mass-production line, and can manage processes, defects, scheduling, equipment maintenance, and other manufacturing issues more efficiently. ^[1]

The ultimate goal of a lean system is to focus on the creation and preservation of value for the customer by eliminating waste in the production system (Dennis, 2007). Value is often defined as any action or process that a customer who uses and consumes the product is willing to pay for. As a means of creating value, lean methods focus on eliminating all waste from the production system. By focusing on the elimination of waste, all actions except the actions the customer is willing to pay for have the potential to be reviewed and eliminated. As a result of the continuous elimination of waste in lean systems, production time and cost are reduced and overall profitability and quality is improved within the manufacturing system ^[2]

Cellular manufacturing leads to reduction in WIP due to its balanced work cell. In case of Progressive Bundle System until the defect is noticed operators

may have piled up bunch of WIP and it is very difficult to clear defective parts. But in case of Cellular layout WIP is reduced and it is easy to observe any defects if present and can be cleared in line also and so help to reduce rework to greater extent. The number of operation and operator needed to complete a job is reduced by eliminating some non value added operations from the process. ^[3]

Discuss about the importance of adopting cellular manufacturing layout over the previous Progressive Bundle System (PBS) and also focus on the various problem related with PBS and how to come over this problem by adopting new layout. Focus on customized implementation of lean tools for minimizing the process waste such as work in progress (WIP), line setting time, which in turn will reduce the cost of production. In batch process the system generate high amount of WIP which in turn increase the rework. PBS system also suffers with the problem of lack of flexibility. ^[4]

Discuss about lean principle..The objective of these lean principles is to create the best possible system, from concept to consumer using the current financial and resource constraints to provide the most value to the customer. Once the value stream is designed, or redesigned, improvements can be made by implementing lean tools and techniques appropriate to the particular situation (Womack & Jones, 1996). ^[5]

Cellular Manufacturing is an alternative approach to enable both, flow production and volume flexibility in machining. Cellular Manufacturing can be a lean and flexible alternative to done-in-one concepts with complex, highly automated machine tools. ^[6]

4. PROBLEM DEFINITION

In garment industry it's high time to adopt cellular manufacturing (Unit Production system), instead of existing Progressive bundle system (PBS) so that company will posses minimum WIP, as high WIP results in increasing the throughput time and as well as the flexibility of manufacturing firm can also be increased in order to meet customer changing need and demand.

OBJECTIVES

- The main objective of implementing this tool is to minimize the work in process inventory and rework.
- Flexibility will be improved and it is the current demand of garment industry due to frequent change in fashion style.
- Labor cost will be reduced as less number of operations and operators will be require for doing the same amount of work.

5. EXISTING SYSTEM

The work is conducted in garment industry which make basically Men's formal shirt in various order size. Shirt manufacturing process consists of series of different steps. These steps are divided into two categories pre-production and production process. The preproduction process includes designing the garment, pattern design, production pattern making, marking. The production process consists of fabric inspection, spreading, cutting, bundling, fusing, sewing, assembly, buttoning, threading, pressing, packaging and different quality checking points. The present manufacturing system uses batch system which is also called progressive bundle system (PBS). In PBS the parts of various garment components after being cut in cutting room are tied up in bundle and distributed finally to the sewing section. These bundles of parts are moved sequentially from one operation to other and the gradually assembly process takes place through successive sub assembly and main assembly operation in bundle form. In this system the sewing operations are aligned in a one continuous single line following the sequence of operation sequence order. Once the operation at one work station completed the WIP is pushed to next work station manually or by using trolley. After final sewing operation the work piece is send to quality checking point before sending in assembly section.

6 RESEARCH METHODOLOGY

Value stream mapping is a lean-management method for analyzing the current state and designing a future state for the series of events that take a

product or service from its beginning through to the customer. At Toyota, it is known as "material and information flow mapping".

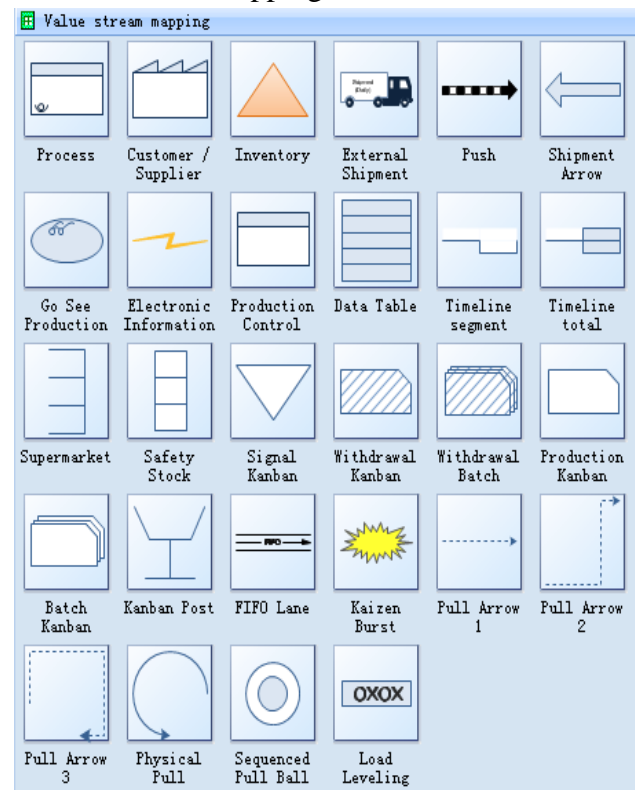


Figure 6.1 Symbol Used In Value Stream Mapping
Reference-<http://www.edrawsoft.com>

VSM is one of the most powerful tools which guide the management to implement most effective lean manufacturing tool in garment industry to make company more efficient. Value stream mapping is a tool used to visually indicate all actions required to bring a product or service in logical steps from start to finish.

It show all the action both value added and non-value added currently required to complete a product or service through to the customer. The information flow and the product flow can be visualized. A product or product family should be selected for which map is to be prepared. The value stream map should be drawn for the entire operation or multiple product lines. For drawing the current state map, the first step is to gather information from the production floor or office area. The map should reflect everything from start to finish. Both the material flow and information flow should be mapped. After drawing the map the next step is to

analyze the map. Identify first the value added and non value added activities. Next step is to understand the customer requirement, recognize supplier capabilities and constraints. After that the current WIP is calculate. If possible make the production single piece flow, balance the line. After analyzing the current state VSM, the new VSM is drawn by keeping in mind that non value added activity should be reduced or eliminated. For drawing VSM some symbol is used this is shown in figure (3.4). With the help of this symbol the detailed mapping is done either using pencil or software. The data collected with reference to the existing system and new revised system should be tabulated in proper way so that comparison can be done easily and effectively. In this work the VSM tool as a table and map will help us to understand and compare both the system the existing as well as proposed system.

After analyzing existing value stream mapping, Cellular Manufacturing prove to be best tool to be implemented to overcome existing problem. So, the batch processing process will be replaced by new layout, called cellular layout which focus on unit production system. By doing this the firm will be able to reduce WIP to greater extent and flexibility will be also improved due to reduced WIP. Cellular layout is one of the most effective tools of lean manufacturing concept; in fact it is an integral part of lean manufacturing system.

6. PROPOSED SYSTEM

Some operation from the existing system will be removed. From the preparatory section the quality checking points will be removed as the operator will be aware of quality standards and will work according to that only. The creation of cells will be as per the operations needed to complete individual parts. The first step in creating new cellular layout is to finalize the operation require to produce garments. To implement new cellular layout it is not necessary to install new equipment rather same equipment should be re-arranged as per the need as buying new equipment and installation is very costly. A Specialized training should also be conducted for

the system to understand each and every aspect of this new layout. There is different section use in making shirt like front body section, back body section etc. For example suppose five operations needed to make the complete front body section then all these operation related to front body section will be grouped together in one cell. So, basically in this new layout total six cells will be formed, five of them will be for preparatory section and rest one is for assembly section where all the other four section will meet and complete the making of shirt. It will be good to take help of expert to guide in determining and demonstrating the attributes before implementing new system. Most of the companies have tried to implement cellular manufacturing concept in their company but they faced a big problem and that is about mobilizing people

In Unit Production System an overhead conveyor system is used in which the carrier is loaded to move all the components of one garment from one work station to another work station. The carrier itself is divided into section and each section will be having a quick release clamp attached with it, which will prevent the components from falling out during movement from one work station to other work station. In this system the garment components are automatically transported from one workstation to other work station according to a pre-determined sequence. When the components of garment will be loaded into carrier, some mechanical or electronic device will be attached with it, which will keep track of the number of carrier and will addresses it to its destination. The carrier will be addressed with the entire destination it will pass through for completion of work. The main line containing the loaded carrier will be connected to each work station by means of junction which will open automatically when carrier will reach to its target workstation for which it is addressed. when the work will be completed on carrier a push button kept at the side of sewing machine need to be pressed and will direct it to move to next work station for which it has been addressed. The empty product carrier will returns to the loading station for next steps. The work stations are designed very

smartly so that the amount of movement required to grasp and position by the operator will be reduced by large amount.

7. Result and discussion

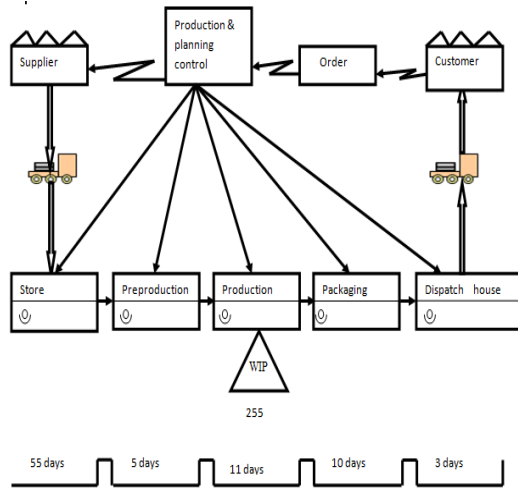


Figure 7.1 Current VSM of Existing System

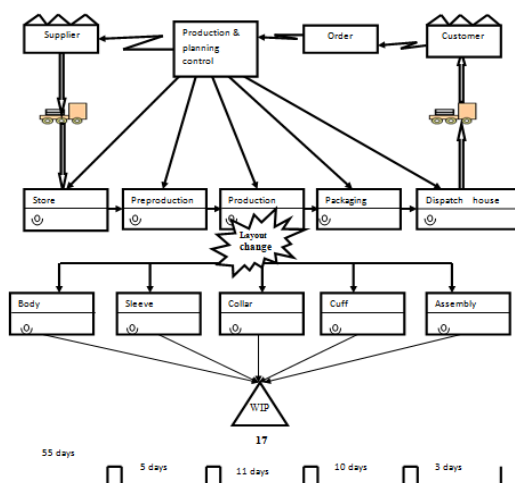


Figure 7.2 Revised VSM of New System

8. CONCLUSION

- More than 80% Work in Process inventory reduction as the new work cell will be arranged with the application of Value stream mapping tool in way to provide a balanced flow from machine to machine.
- Flexibility will be improved by Cellular manufacturing as the line can be changed immediately whenever needed.

- The number of operation required to complete the work will be reduced to greater extent by eliminating non adding value operation.
- Number of operator or labor will be reduced as there will be no need of quality check after each section as used to be in existing system and also due to elimination of the non value adding operation. Thus labor cost will be reduced.

REFERENCES

1. Ripon Kumar Chakroborty^a, Sanjay kumar paul^{b*}, "Study and implementation of lean manufacturing in Garment manufacturing company", Journal of optimization in industrial engineering, 7(2011) 11-22.
2. Alanna. G. Kennedy, "An introduction to the relational theory of continuous improvement and the seven waste of lean research", Research method in lean manufacturing environment. July 2011.
3. Naresh Paneru, "Implementation of Lean Manufacturing Tools in Garment Manufacturing Process Focusing Sewing Section of Men's Shirt", Degree Programme in Industrial Management, 2011
4. B.Senthil kumar*, Dr. V.R.Sampath, "Garment Manufacturing through lean initiative- An empirical study on WIP fluctuation in T-Shirt production unit", International journal of lean thinking, Vol.3, Issue 2, 2012.
5. Goforth Kelly Ann, Dr. George Hodge, Dr. Jeffrey A. Jolnes, "Adopting Lean manufacturing to textile industry", North Carolina State University, 2007.
6. Joachim Metternich, Seven Bechtloff*, Stefan Seifermann, "Efficiency and economic evaluation of cellular manufacturing to enable lean manufacturing", Procedia CIRP, 7(2013) 592-597.