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Productivity Improvement of Cutting and Sewing Section by Implementation of Value Steam Method in a Garments Industry

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Abstract

Delivery with quality and quantity is important for any manufacturing industry. At present, lead time is decreasing day by day and customer requirements also continuously changing. To complete customer demand whole production system should be more capable and efficient. For this reason, productivity is important for manufacturing industries. Productivity can be defined as a ratio between input and output. Garment industries are always having lots of production processes for desired products. Out of these processes some are not essential and do not add any value to the product. Most of the time, management is not quite aware of the non-value-adding processes. If we observe a garments production line, we will see that there were lots of In-process inventories and waiting time between almost every sequential operation. No strict and precise work distribution was followed by many workers. Material's used to travel large distance from input receiving to needle check and cartooning. Many of these movements and handlings are totally unnecessary. Sometimes reworks are increasing the total completion time. As a result, the productivity was hampered. So, a smooth, streamlined and continuous flow is really necessary to avoid all such unexpected occurrence. The objective of value stream mapping is to identify value-added activities and non-value-added activities. Value stream maps should reflect what actually happens rather than what is supposed to happen so that opportunities for improvement can be identified. Value Stream Mapping is often used in process cycle-time improvement projects since it demonstrates exactly how a process operates with detailed timing of step-by-step activities. It is also used for process analysis and improvement by identifying and eliminating time spent on non-value-added activities. The present study focuses on improving the overall productivity of cutting and sewing sections through value stream mapping (VSM). Different techniques like process integration, job sharing, multitasking etc. will be implemented to improve the current state situation.

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Three different product lines (Jacket, Polo shirt, and tee shirt) will be considered to implement this study, and the productivity as well as line efficiency will be compared before and after implementing the technique.

Key Words: Productivity; Value stream mapping; Improvement; Implement; Lean Manufacturing.

1. Introduction

"Generally, in an industry more focus is given on profit. Through there are different issues involved in cost reduction internally spent by an industry through finding wastages, preventing and correcting defective work would result in huge savings" [1]. The garments industries in Bangladesh do have the organizational structure but do not have the proper job description of the employees so the problem arises from the mid-level management. Description of rules and responsibilities along with power and authority is essential for smooth production running of any organization. In today's competitive world the manufacturers need to be conscious about time, cost, quality and delivery. To be the champion in business these four components should be given most priority along with good management skill and innovative technological aspects of modern development. "A systematic approach to identify and eliminate waste through continuous improvement by flowing the product at the demand of the customer" [2]. The present situation of the RMG sector is not in a satisfying one and in the last year there was a massive worker agitation because of salary structure, working environment, compliance issues and other human rights. The local garment manufacturers are facing fierce competition in Quota and GSP free market as per WTO agreement and they are well behind from the competing countries like India, Sri Lanka, China, Indonesia and Vietnam etc. In order to face the challenges Bangladeshi manufacturers, have to apply new methods, tools and techniques in different area of production and operation management and in other business areas.

The works addresses the application of lean manufacturing concepts to the mass production sector (RMG) with a focus on the value chain of garment industry including cutting, sewing, finishing. "Lean production is also called lean manufacturing. It is an integrated set of activities designed to achieve high-volume production using minimal inventories of raw materials, work-in-process, and finished goods. Parts arrived at the next workstation "just in time" and are completed and move through the process quickly. Lean is also based on the logic that nothing will be produced until it is needed. Production need is created by actual demand for the product" [3]. The objective of the study is to investigate the present status of the industry, scope of improvement and the benefit gain by the implementation of new tools of lean manufacturing. "Lean enterprise is mainly focused on eliminating waste. In manufacturing, lean principles include zero waiting time, pull instead of push scheduling, smaller batch sizes, line balancing on shorter process time" [4]. The challenges faced by local apparel manufactures can be addressed by the systematic analysis of the manufacturing way and link their problem with the lean tools and techniques to create value for consumers. The application of lean manufacturing concept in RMG sector is totally new in our country. "For companies that have long relied on traditional approaches to their manufacturing systems, it is often difficult to gain from management the commitment required to implement lean manufacturing. Doing so is hard because of differences in a number of aspects including raw material procurement, inventory management, employee management, and production control [5]. The use of lean production is now being practiced by organizations which aim to increase productivity, improve product quality and manufacturing cycle time, reduce inventory, reduce lead time and eliminate manufacturing waste" [6]. So there is an importance to study the chance of implementation and the areas of improvement and the step by step methodology to do it in a positive and learned thinking. The productivity, efficiency and effectiveness are increasingly becoming the burning issue in today's economy. To survive in the hard contest economy, the industry should develop itself with systematic identification and elimination of waste, productivity improvement, cost reduction, employee benefit incentives and social welfare activities. "To sustain global competition, industries strive to reduce wastages, production time and reduce overall product costs using various tools and techniques" [7]. Now a day the buyers are finding market for lower price and they are getting new exporter on their hand with their required lead time. So the profit margin is narrowing and the competition is expanding as a result the production process and new technology is the only way to cope up the crisis. The work tries to find out the common phenomenon to implement lean tools and the barriers to overcome. To identify different types of waste in cutting and sewing sections and also to improve productivity of assembly lines by implementing various process improvement techniques using existing resources.

2. Literature Review

Lean manufacturing is a set of tools and methodologies that aims for the continuous elimination of all waste in the production process i.e. a system for improving productivity & product quality. Laconically more value with less work. Ford starting time in 1910, Ford and Charles E. Sorensen, fashioned the first comprehensive Manufacturing Strategy. We are using ford system in cutting and sewing section, first of all that is continuous process so that we gone the systematic wise we took all the elements of a manufacturing system- people, machines, tooling, and products and arranged them in a continuous system for manufacturing the Model T automobile. Ford is considered by many to be the first practitioner of Just in Time and Lean Manufacturing. Incorporate Ford production, Statistical Process Control and other techniques into an approach called Toyota Production System or Just in Time. We are recognized that the Ford system had contradictions and shortcomings, particularly with respect to employees. After post-war of japan Toyota soon discovered that factory workers had far more to contribute than just muscle power, but we did not saw that spirit in our performed worker. After that we finally get ensure that the worker do not has any brought things to their family and country. So result came out that for this reason productivity not improve like japan "Lean manufacturing, pioneered by Toyota, involves inventory and quality control, industrial relations, labor management, and supplier-manufacturer practices that differ fundamentally from traditional American business practices" [8]. In spite of these differences between Japan and the United States, "lean" as "a philosophy of manufacturing that focuses on delivering the highest-quality product at the lowest cost and on time" [9]. It is a system of production that also takes a value stream focus. The 'value stream' consists of all the steps in the process needed to convert raw material into the product the customer desires. "Although lean manufacturing has its origins in the automobile manufacturing sector, other industries have adopted the practices to improve their own operations" [10]. Several case studies of firms making radically different products, including stretch-wrapping machines, wire management systems and power protection devices, and aircraft engines, among others Lean thinking focuses on value- added flow and the efficiency of the overall system. A part sitting in a pile of inventory is waste and the goal is to keep product flowing and add value as much as possible. The focus is on the overall system and synchronizing operations so that they be aligned and produced products at a steady pace.

3. Principle of Lean Manufacturing

Key principles behind Lean Manufacturing can be summarized as follows:

1. Recognition of waste.
2. Standard processes.
3. Continuous flow.
4. Pull-production- Also called Just-in- Time (JIT).
5. Quality at the Source.
6. Continuous improvement
7. Customer focus.
8. Perfection.

3.1 Value & Waste

Waste is anything that does not contribute to transforming a part to the customer's needs. 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. Essentially, a "waste" is anything that the customer is not willing to pay.

3.2 Types of waste

"There are five types of waste which are following" [11]

3.2.1 Overproduction

Overproduction means making more than is required by the next process, making earlier than is required by the next process, or making faster than is required by the next process. The corresponding Lean principle is to manufacture based upon a pull system, or producing products just as customers order them. It is visible as storage of material. It is the result of producing to speculative demand. Causes of overproduction time include.

Just in case logic

Lack of feedback from downstream process lack of balance between misuses of automation.

3.2.2 Waiting

Material waiting is not material flowing through value-added operations. This includes waiting for material, information, equipment, tools, etc. Lean demands that all resources are provided on a just-in-time (JIT) basis- not too soon, not too late. Waiting for a machine to process should be eliminated. The principle is to maximize the utilization or efficiency of the worker instead of maximizing the utilization of the machines. Causes of waiting time include:

Long set up times

Lack of balance between processes namely engineering, workload, automation, scheduling etc.

Unplanned maintenance Lack of redundancy wherever possible Quality problems in upstream process.

3.2.3 Work in process

Work in Process (WIP) Inventory is material between operations due to large lot production or processes with long cycle times. Material sits taking up space, costing money, and potentially being damaged. Related to Overproduction, inventory beyond that needed to meet customer demands negatively impacts cash flow and uses valuable floor space. Causes of work in process time include:

Poor communication

Inadequate market research Just in case between misuses of automation.

3.2.4 Transportation

Transportation includes any movement of materials that does not add any value to the product, such as carrying work in process (WIP) long distances, creating inefficient transport, or moving materials, parts, or finished goods into or out of storage or between processes. Transportation between processing stages results in prolonging production cycle times, the inefficient use of labor and space and can also be a source of minor production stoppages. Causes of transportation time include: Poor plant layout, Poor understanding of the process flow for production, Large batch sizes, long lead times and large storage areas.

3.2.5 Unnecessary Motion

Any wasted motion employees have to perform during the course of their work, such as looking for, reaching for, or stacking parts, tools, difficult physical movements due to poorly designed ergonomics, which slow down the workers. Also, walking is waste. Causes of motion waste include: Unskilled people and machine ineffectiveness inconsistent work methods. unfavorable facility or cell layout. Poor workplace organization and housekeeping Extra “busy” movements while waiting.

3.3 Push System

In a push system, the demand (often forecast because the lead times are so long) is converted to a schedule for each operation. The material is released to the first operation, as dictated by the schedule, and it is progressed ("pushed") through the subsequent operations.

3.4 Pull System

In a pull system, the demand (often customer demand as lead times are usually short) is the production schedule of the last operation. This operation asks the previous operation for work only when it needs it to fulfill the customer demand. The previous operation then asks the one before it and so on. The fundamental rule is that material is only worked on if the customer demands it. In this way material is "pulled" through the previous operations

3.5 Workplace Organization

The Five S's are some rules for workplace organization which aim to organize each worker's work area for maximum efficiency.

3.5.1 First pillar: Short (Seiri)

Sort what is needed and what is not needed so that the things that are frequently needed are available nearby and as easy to find as possible. Things which are less often used or not needed should be relocated or discarded.

3.5.2 Second Pillar: (Seiton)

Arrange essential things in order for easy access. The objective is to minimize the amount of motion required in order for workers to do their jobs. For example, a tool box can be used by an operator or a maintenance staff who must use various tools. In the tool box, every tool is placed at a fixed spot that the user can quickly pick it up without spending time looking for it. This way of arrangement can also help the user be immediately aware of any missing tools.

3.5.3 Third Pillar: Shine (Seiso)

Shine means keep machines and work areas clean so as to eliminate problems associated with in-cleanliness. In some industries, airborne dust is among the causes of poor product surface or color contamination. To be more aware of dust, some companies paint their working places in light colors and use a high level of lighting.

3.5.4 Fourth Pillar: Standardize (Seiketsu)

Standardize is make the first 3S's a routine practice by implementing clear procedures for sorting, straightening and scrubbing.

3.5.5 Fifth pillar: Sustain (Shitsuke)

Sustain – Promote, communicate and train in the 5 S's to ensure that it is part of the company's corporate culture. This might include assigning a team to be responsible for supervising compliance with the 5 S's.

3.5.6 The Benefits of 5S

¾ Improves safety

¾ Better working environment
¾ 5S can significantly improve space utilization space
¾ Easy retrieval of material, information, tools etc.
¾ Reduce quality problems
¾ Lower costs
¾ Increased customer satisfaction and
¾ Discipline in workplace etc.

3.6 Kanban

Kanban is one of most popular tools in lean manufacturing. This is a simple concept, but very effective. Kanban mainly focus on the reduction of overproduction. There are mainly two types of Kanban's. A Kanban uses a designated workspace between operations to balance supply with demand. It means a visible record. Kanban triggers mechanism to make or move material.

3.7 Kaizen

It is a Japanese term for "continuous improvement", with an emphasis on small incremental improvements. A main theme of Kaizen is to create a culture of continuous improvement, largely by assigning responsibility to workers, and encouraging them, to identify opportunities for improvement. A company can never be perfectly efficient. Lean Manufacturing requires a commitment to continuous improvement, and preferably a systematic process for ensuring continuous improvement, whereby the company constantly searches for non-value-added activities and ways to eliminate those. The focus of continuous improvement should be on identifying the root causes of non-value-added activities and eliminating those by improving the production process.

Two main opportunities for improvement are:

1. The elimination of Muda (waste) from processes
2. The correction of any issues/problems within processes in addition to Muda

Organized and 'visual' workplace, Lower space/facility requirements, Improved use of floor space, Allows more strategic management focus, Improved knowledge retention, New employees fit in more quickly with less training, Cross-trained employees, Flexible work cells with flexible people, Small batch operations more cost effective, Productivity / Capacity increase, Inventory reduction, Cost reduction, Improved efficiency, Improved communication, Improved profit margins, Improved customer relations, Quality improvement, Improved vendor support and quality, Higher labor efficiency and quality, Reduced scrap and waste, Reduced cycle time, Reduced obsolescence, High quality and reliability, Lower overall costs, Self-directed work teams, Lead time reduction, Fast market response, Longer machine life, Improved flexibility in reacting to changes, Increased shipping and billing frequencies.

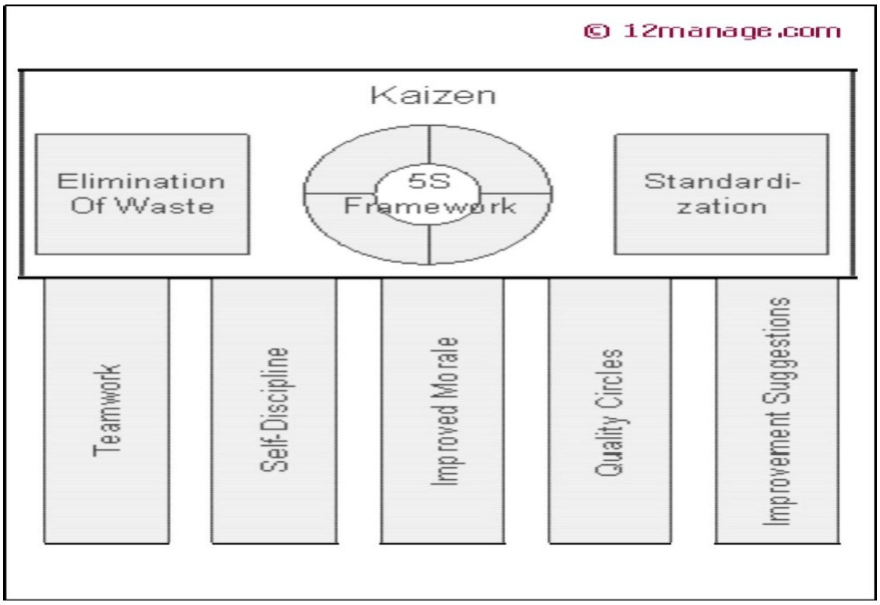

Figure 1: Building Kaizen Quality Management Team

4. Future State Mapping and Implementation

Value stream mapping is important to identify non value adding task and time. Waste being any activity that does not add value to the final product, often used to demonstrate and decrease the amount of 'waste' in a manufacturing system. VSM can thus serve as a starting point to help management, engineers, production associates, schedulers, suppliers, and customers recognize waste and identify its causes. As a result, Value Stream Mapping is primarily a communication tool, but is also used as a strategic planning tool, and a change management tool [12]. We can reduce non value adding activities by increase value adding activities through a future state mapping. "Most of the garments followed DMAIC approach elimination of their defects and attaining excellence of the product. In many manufacturing industries adapted to structured DMAIC concept for their continuous improvement and attaining for more profit. DMAIC (Define, Measure, Analyze, Improve and Control) of six sigma methodology is one of analytical tool to root cause for existing manufacturing scenario for eliminating the maximum percentage of defectives. All the activities which we will implement in future all are given in future state map" [13].

4.1 Drawing Future State VSM

For designing a future, a state map, we have to prepare and begin actively using an implementation plan that describes, on one page, how to achieve the future state plan. The propose Future State VSM is drawn by showing different types of Lean concept of kaizen, process merging, job sharing, multitasking, multi-machine operating and operation change, reduce transportation on the improvement areas of Current State VSM. The Production unit needs to work with the required rate of production and to maintain the quality and efficiency also. Figure 6.1, 6.2, 6.3 is showing the future state mapping.

4.2 Future VSM implementation project team

After designing the future state map and implement the Kaizen Event and other improvements project teams has been formed and also design their regular task. Planning and controlling and follow up the communication with group member regular basis implement new good ideas. Create benchmarking for project products. Execution the new layout according to team leader direction Communication with production team regularly Motivation workers, Logistics support (Guide, Folder arrangement) regularly time study Skill matrix creation Productivity analysis daily basis Layout design and comparison Measure improvement daily basis.

4.3 Company profile

The selected apparel manufacturing plant is DEBONAIR GROUP is an export oriented woven garment manufacturing unit established in May 2001. Now it is the ISO, Accord certified knit garments in Bangladesh. Main products are, denim pant, Jacket and Fancy products etc. Currently it has 72 sewing lines in which most of the machines has auto trimmer and mostly oil-free dry head machine with the capacity of 2-2.5 million pieces. It is located at Sataish Road, Gazipura, ujarpara, Bangladesh. Debonair Ltd. has backward and forward linkage sister companies.

Table 1: Company Profile

Factory name:	Debonair Group
Factory name:	Debonair Group
Factory address:	Ujarpara , National university, Gazipur
Total direct labor:	5000 persons (Cutting, Sewing and finishing)
Product range:	Jacket, Denim pant, Fancy product, Kids wear etc.
Sewing lines:	72 lines
Sewing operators per line:	
Helpers per line:	Basic-8, Semi Critical-10, Critical-12
Daily working hours:	8
Selected product for mapping:	Polo shirt (Cutting, Sewing and Finishing)
Absenteeism:	5.5%
Days for order changeover:	23

4.4 Kaizen Events/Blitz

Traditionally, kaizen has meant making small, incremental improvements over a long period of time. A blitz is an intense and lightning-quick version of the kaizen process used to implement a variety of Lean techniques in a hurry, usually three to eight days in length. It is also sometimes called a Kaizen Event. It’s easy to understand why lean manufacturers are embracing the kaizen blitz. Improvement in a Lean organization must be an ongoing process and the structure of a kaizen blitz is one of the surest ways to augment continual change, increase efficiency and generate savings.

Following are the improvement ideas and implemented in Future state VSM.

4.4.1 Cutting Implementation

“The cutting section of apparel manufacturing industry supplies the cut panels required in the sewing section for the production modules [14].” For doing a good chain, Team building is important to achieve a goal. It is quiet impossible for one or two person to overcome and follow up a lots of process perfectly and nicely. As a result, many people are engaged here to accomplish the task properly. So for team work need training and team building session that will help the people work together. Training is important to make the people knowledgeable about their task and responsibilities. By training we can easily adopt new concept and implement it.

a. Starting ten pieces bundling system

Traditional bundling system is more than twenty to thirty pieces in a one bundle. But our new concept is bundle is no more than ten pieces for tee shirt, polo shirt and five pieces for jacket product. If the bundle is small, it will easy to handling and can easily arrange it.

b. Maintaining serial in all ten pieces bundle to eliminate front with back and body with sleeve matching

In traditional system we can see that all time one or two person is engage for match front with back and body with sleeve. Now to reduce the helper we have to maintain serial in one bundle than we can easily match front, back and sleeve without any problem.

c. Start all parts in one bundle together such as front, back, and sleeve cut panel

In traditional system all parts are delivered as a separate bundle. As a result, operator cannot find it easily and not interest to match it. So our new concept is we will deliver all parts suppose front, back and sleeve together also maintain serial from cutting.

d. Utilization of band knife machine for small parts cutting to keep dimensional accuracy

In current conditions people are not using band knife machine for small parts cutting. As a result, the shape of the cut panel is not good. So our new concept for small piece cutting we cannot use normal straight knife cutter we will use band knife machine to keep small parts shape accuracy.

e. Start without numbering bundling system by implementing roll wise cutting system

Our new idea is from now we will not use sticker attach on cut panel we will cut the fabrics according to role wise and cannot amalgamate one role to another role if there are no shading issue may come. Because sticker is use only for shading purpose.

f. Maintain on time input of all parts

To reduce changeover and through time also non production time we will ensure that all parts are provided together and at a time.

g. Use same table for laying, cutting, checking and bundling to reduce transportation

To reduce transportation time on cutting section we will use same table for cutting numbering also check and bundling.

h. Elimination of bundle card writing helper by bundle card automation

Previously six to seven helper is engaged for bundle card writing and sometimes they cannot supply it quickly as urgent requirement. Now new concept, we will make it automation of paper printing (see Appendix-L). As a result, no need extra four to five helper.

4.4.2 Sewing Implementation

Different types of improvement activities have been done in sewing section which are following:

4.4.2.1 Operator Reduction

a. Two machine operating by one operator

Normally one operator operates one machines but now one operator will operate two machines at a time. So we can easily reduce one operator from one machines, by process scanning.

b. Multi-tasking by one operator

Previously one person doing one task suppose operator is only operating machine but not thread cutting. Now our new concept is all worker will do two or three task at a time. For example, each operator will be thread trimming after sewing and some operator will be marking and sewing at a time.

c. Job sharing

Previously operator cannot share the job. But now our target is one operator will share two process each hour, suppose half hour will do collar joint and another half hour will do another process collar top stitch.

4.4.2.2 Helper Reduction

Helper can be reduced by different ways following are some procedure.

a. Marking and thread trimming by operator

In our project team we started new concept that every operator will be trimming their extra thread end after sewing, if we no need use extra helper for thread trimmings.

b. Elimination of matching through nicely arrange cut panel and all parts keep together in bundle

To reduce helper for front with back and body with sleeve, we will arrange the bundle serially and together and flow them together so for this reason we have no need extra two helpers for front back match and body with sleeve match.

5. Data Analysis and Result

5.1 Data analysis

After implementation of different kaizen on current state following is the comparison between current and implemented future state, and for line balancing graph

Table 2: Comparison between traditional line and model line summary

Comparison Criteria	Traditional line	Model line
No of Machine	31	28
No of Operator	31	27
No of Helper	11	2
No of QI	6	3
No of Iron	2	2
No of Packing worker	8	6
Total worker	58	40
Quantity Output	1040	960
Avg. Working Hour	8	8
Avg. Hourly Production	130	120
Output Min	8840	8160
Input Min	20160	13920
Average sewing Efficiency	43.85%	58.62%
Productivity	2.24	3.00

5.2 Summary after Implementation of Future State map

After implementation of future state map following are the data and result analysis

5.2.1 Future State of Cutting

Table 3: Future state Cutting summary

Cycle time (min)	271.26
Actual time (min)	42.13
Workers	20
Quantity Outputs (pcs)	1100
Batch size	1100
Waste	
Transportations (feet)	135
Defects	
Waiting time (min)	991

Total value added time = 42.13 min

Total non-value added time = 991.00 min

Total unavoidable time = 229.13 min

Total time = VA time + NVA time + UNVA time = 42.13 + 991.00 + 229.13 min

= 1262.26 min

Total Lead time = 1262.26 min % of value added time = 3.34%

% of non-value added time = 78.51%

% of unavoidable non value added time = 18.15%

5.2.2 Future State of Sewing

Total value added time = 0.04 min

Total non-value added time = 123 min

Total unavoidable time = 5.26 min

Total time = VA time + NVA time + UNVA time = 0.04 + 123.00 + 5.26 min

= 128.30 min

Total Lead time = 128.30 min % of value added time = 0.03%

% of non-value added time = 95.87%

% of unavoidable non value added time = 4.10%

Table 4: Future state Sewing summary

Cycle time (min)	14.34
Actual time (min)	2.50
Workers	29
Quality outputs (pcs)	960
No of activities	62
Batch size (size)	10
Available time	480
Waste	
Transportations	53
Defects	
Waiting time (min)	123
Up time	100%

5.3 Result analysis of implemented future state map

Total value added time = 44.67 min

Total non-value added time = 1432 min

Total unavoidable time = 246.26 min

Total time = VA time + NVA time + UNVA time

= 44.67 + 1432 + 246.26 min

= 1722.93 min

Total Lead time = 1722.93 min

% of value added time = 2.59%

% of non-value added time = 83.11%

% of unavoidable non value added time = 14.29%

Following are the implemented future state map value adding, non-value adding and unavoidable non value adding time summary:

Table 5: Summary of implemented future state map

Criteria	Implement Future State Map	
	Time	Percentage
Lead time (min)	1722.93	
Non Value adding time	1432.00	83.11%
Value adding time	44.67	2.59%
Unavoidable non value adding time	246.26	14.29%

6. Results and discussion

Following are the final comparison between traditional line vs model line-

Table 6: Comparison between traditional and model line

Performance measure	Unite of Measurement	Traditional line	Model line	Improvement %
Line efficiency	Percentages	43.85%	58.62%	33.68%
Line productivity	Labor per hour	2.24	3.00	33.92%
WIP reduction	Pcs	2184	420	80.76%
Lead time reduction	%	4401.93	1722.93	60.85%
Value adding time Inc.	%	1.02%	2.59%	153.92%
Non VA time Reduce	%	93.16%	83.11%	10.78%

Following are the traditional and model line efficiency, productivity, WIP, lead time, value adding, and non-value adding time comparison graph:

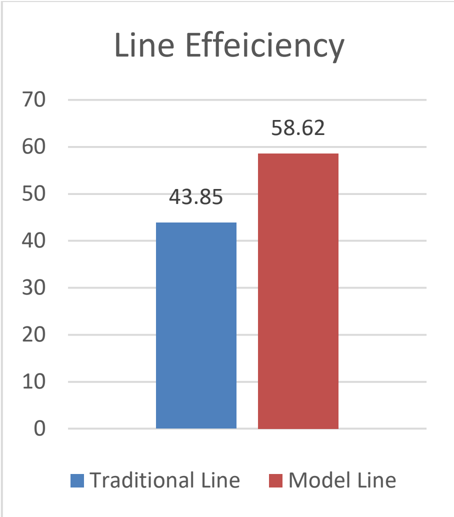

Figure 2: Comparison of line Efficiency

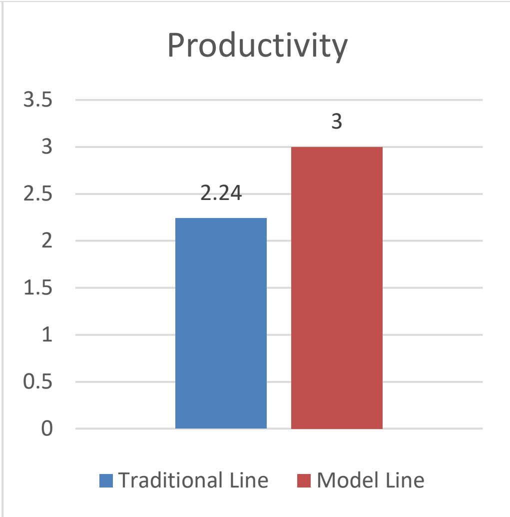

Figure 3: Comparison of Productivity

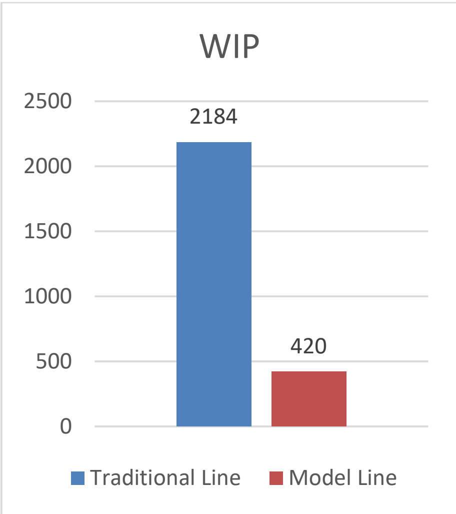

Figure 4: Comparison of line WIP

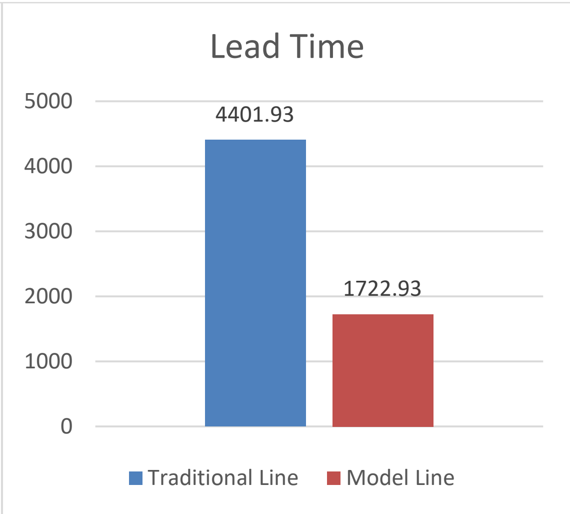

Figure 5: Comparison of Lead time

Figure 6: Comparison of Value adding

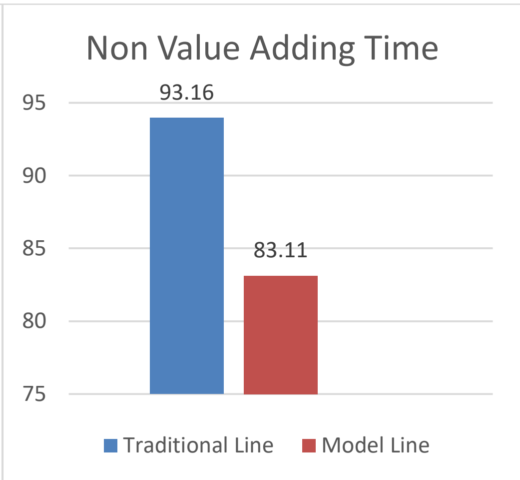

Figure 7: Comparison of Non-Value adding

7. Conclusions

The value stream mapping method (VSM) is a visualization tool oriented to the Toyota Production System. It helps to understand and streamline work process using the tools and technique of lean manufacturing. The goal of VSM is to identify, demonstrate and elimination of waste in the process. Before eliminating waste, we must be able to see it. If we can identify waste, we can target it for elimination. "The real power of the Concept of 'lean production 'as we intended the term to be used and as we use it in [the] Machine was that all five elements were combined" [15] But if we cannot see it, it will remain and add cost. Without VSM problem cannot be identified easily and cannot reduced. VSM can serve as a starting point to help management, engineers, production associates, schedulers, suppliers, and customers, recognize waste and identify its causes. As a result, value stream mapping is primarily a communication tool, but is also used as a strategic planning tool and a change management tool.

If we look back of current state assessment. It is found that value adding time is 1.02%, waiting time is 93.16%, line efficiency 57.29% and productivity 2.37 per person per hour. The line is not properly balanced and lots of transportation also needs more space. The helper, operator ratio was 1:2.81. This shows huge opportunities for improvement in those areas.

After implementation of team work, different kaizen blitz, process integration, job sharing, multi machine operating and balancing the task also eliminating unnecessary activities, team achieved 58.62%-line efficiency, productivity achieved 3 per person per hour, lead time reduction 60.85%, and value adding time increased 153.92% also non value adding time reduction is 10.78%. Besides defects, WIP, transportation, and helper also reduced than previous traditional systems.

8. Recommendations

The study was done with a limited scope. The future works may include super market pull between cuttings and sewing section also implementation of JIT and Kanban system to keep WIP at minimum level. The future works may also include helper less Zero defect line where each operator will be the quality at the source and creation of standard operating procedure (SOP) for each sections and for Incentive policy also.

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