

STRATING THE LEAN JOURNEY WITH VALUE STREAM MAPPING IN THE GARMENTS INDUSTRY OF BANGLADESH

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ABSTRACT

Recently, Bangladesh readymade garments sector has started the trend of implementing 'lean manufacturing'. To remain competitive in the global market the most important task for garments industry is to reduce the lead time which is also important for long-term stable development. A headlong rush to reduce lead time by becoming lean has created urgency for researchers and practitioners to apply new tools and techniques for dictating wastages. This research addresses the application of value stream mapping in garments industry to implement lean manufacturing. Value stream mapping is different than conventional recording approaches as it helps in the visualization of Material Flow, Information Flow, cycle times and utilization of resources. With the assurance of effective integration and communication, lean systems can be achieved with better efficiency. This research will stand as a benchmark to implement lean for other garment industries in Bangladesh.

Keywords: Value Stream Mapping, Lean, Garments.

1. BACKGROUND OF THE STUDY

"Readymade garment industry started in the late 1970s, expanded heavily in the 1980s and boomed in the 1990s". Bangladesh garments goes to marks and Spencer. The quick expansion of the industry was possible because of the following unique nature of the industry such as the less complicated (easy to transfer) technology, cheap and easily operating machineries (sewing machines) and a large cheap female labor. In global apparel business, Bangladesh contributes less than 5% which consist 75% of total export earnings in our country (BGMEA, 2007). By the coming years, China will lose their competitive advantage so it's high time to tap the undiscovered destinations of potentials. Global Competitiveness such as the conversion of GATT into WTO has changed the global trading environment remarkably. Particularly, the phasing out of the Multi-fiber Arrangement (MFA) and abolition of GSP is a serious challenge to many developing countries. With the abolition of quota and GSP, the trading environment has become fiercely competitive. Bangladesh, whose economy is heavily dependent on this sub-sector, will now have to compete against textile giants like China and India. Analysis of the internal and external environment suggests eliminating inefficiencies and irregularities distinctively lessening production lead time and wastages from the country's apparel production and exporting processes. Under the highly competitive environment, the garment industry has numerous

opportunities for improvement using lean principles (Mercado, 2007). This is mainly because of the nature of operation of the export-oriented RMG firms. The improvement of deep-level competitiveness through a reduction in total "production and distribution" time will improve surface-level competitiveness by reducing lead time.

This study analyzes several aspects of a garments manufacturing system as either normal mass production model (mass production) or as lean. The article highlights the following aspects:

- The first activity of the research project team was to gain a better understanding of the overall process flow of garments industry.
- To visualize the implementation of value stream mapping as an identification tool for the common value added and non value added activities in apparel production line
- To analyze the issues of processing time, retention time, product family identification, production lead time as a part of value stream mapping.

2. VALUE STREAM MAPPING

Wikipedia says "Lean is the set of tools that assist in the identification and steady elimination of waste (*muda*), the improvement of quality, and production time and cost reduction. The Japanese terms from Toyota are quite strongly represented in lean which has a number of tools to solve the trouble of waste disposal. The tools include

continuous process improvement (kaizen), the '5 Whys' and mistake-proofing (*poka-yoke*), Just in Time (JIT) etc. The majority purpose is process improvement at the system level. Effective business strategy and

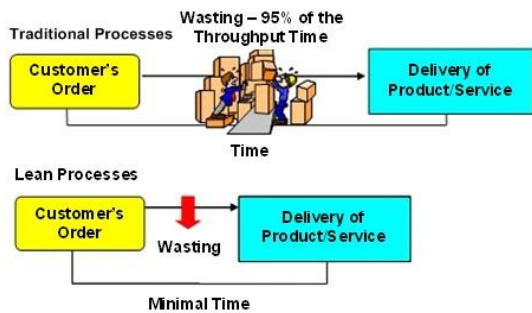


Fig 1. Traditional process versus lean process

management information systems are required for instilling proper mapping and continuous wastes dictation programs.

“A value stream is a collection of all actions value added as well as non value added that are required to bring a product or group of products that use the same resources through the main flows, from raw material to the arms of customer” (Rother and Shook, 1999). Value stream mapping originally developed by Toyota is used to first map the current state and then to identify the sources of waste and to identify lean tools to eliminate the waste. Value stream maps show the process in a normal flow format to plan and meet the customer’s normal demands. The typical VSM is called a “stock to dock” or “door to door” value stream map since it normally covers the information and process flow for the value stream at the facility (Wilson, 2010). Diverging from other conventional recording approaches value stream mapping helps to visualize and record cycle times, inventories held, changeover times, modes of transportation, manpower deployment, utilization of resources etc. The key benefit to VSM is its focus on the entire value stream to find system wastes and tries to avoid the pitfall of optimizing some local situation at the expense of the overall optimization of the entire value stream. Specific value stream evaluations and action items include identifying the target product, product family, or service, drawing a current state value stream map which shows the shop floor current steps, delays, and information flows required to deliver the target product or service. This may be a production flow (raw materials to consumer) or a design flow (concept to launch). There are 'standard' symbols and performance measures for representing supply chain entities. VSM also redesigns process to reduce waste and prepare a future state value stream map to work toward the future state condition. As a quantitative tools for analyzing non-value added steps, lead time, the amount of inventory etc., the power of value stream mapping persists to visualize more than just the single-process level, to observe the sources of waste, to offer a common

language for talking about manufacturing processes, to formulate decisions about the flow apparent, to form the basis of an implementation plan, to show the linkage between the information flow and the material flow.

3. METHODOLOGY

The methodology of the research was based on theory and process observation to apply value stream mapping in garments sector and this research used empirical as well as quantitative information from thirteen (13) renowned garments industries as Ananta, IDS, Standard, jamona, Panash, Helicon, Apex, Adury, DBL, Hoplun, PN Composite, Palmal, Radial group of Bangladesh implementing lean. Non value added operations were identified through lead time which was calculated from processing time (where pieces suppose to flow continuously pertaining Value and non value added) and retention time (Materials staging before 1st process or between previous and next processes). The future state mapping or recommendations have been set up discussing with the industries as mentioned.

4. STEPS OF VSM FOR APPAREL INDUSTRY

Lean is not a one-size-fits-all recipe. Instead of trying to apply the original Toyota Production System, the precursor of the lean philosophy, each garment factory attempting to go lean must custom design a lean roadmap. This unique research is designed specifically for guiding garment industry on the lean journey to learn about the application of lean principles and concepts' all elements and tools of the lean approach from value stream mapping are covered.

Lean is about eliminating waste. Before eliminating, wastes must be visualized and identified. Without identification, nothing can be targeted for elimination. Furthermore without proper identification wastes remain and add cost. Composition of Value Stream wastes at three levels such as in the materials and information flow through the processes, in the set up and function of process flow and finally in the operations within each process. The steps in value stream mapping as mentioned earlier is explained below:

4.1 Product Family Identification

The purpose of product family identification is to identify which product family would result in the maximum business impact after improvement. A product family is typically a group of products that share a common processing sequence (cutting, printing, embroidery, sewing, washing and finishing) and, in some cases, the same type of machinery. Product family is identified from the total produced time for all products. The percentage of production time (already produced) for each product is calculated from the given formula as:

$$\text{Produced time for specific product} = \frac{\text{Percentage \% of Produced time}}{\text{Total produced time for all products}} \times 100\%$$

The percentage of produced time (production time of produced products) will be ranked according to the percentage and high percentage products will be the selected product family that will be investigated for value stream mapping. The benefit of product family

identification can be explained by the Pareto principle (also known as the 80-20 rule, the law of the vital few) which states that, for many events, roughly 80% of the effects come from 20% of the causes

4.2 Current State Mapping

Once the target product family was chosen, the next activity will be value stream mapping (VSM) of the factory's current state. Current state follow a product's production (materials) path from beginning to end, then draw a visual representation of every process in the material & information flows including materials retention which will demonstrate the throughput time of first bundle from door to door. The VSM tool allows a visual representation of value streams to help identify and categorize the wastes in the Current State. This map is used to plan actions to eliminate the wastes and obtain the Future State.

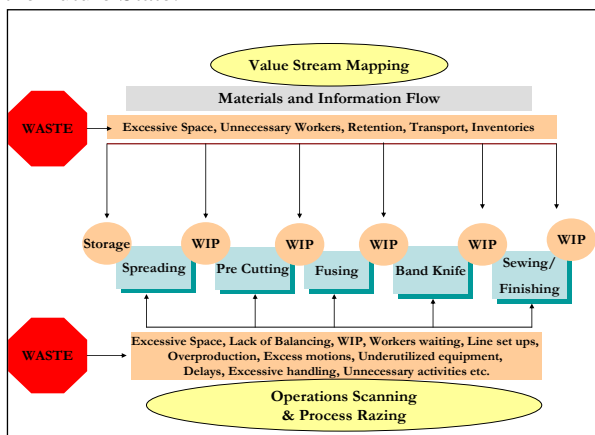


Fig 1. Garments production process and VSM
Source: DCG-ASDA/GEORGE Lean Project, 2011

Figure 1 explains an ongoing process of garments industry which clarifies standardized production process and application of VSM to detect the types of wastes. Process Razing is the most comprehensible method for reducing manpower on production lines. Operation Scanning is used to reduce cycle time and overstaffing through the elimination of wasteful motions or through the combination and simplification of targeted operations within a given process. Also, it serves to eliminate motions between team members to synchronize cycle time. It's an elemental or micro-motion analysis of one single operation-one worker such as Sewing operator or group of workers on one single operation.

4.3 Future State Mapping

After drawing the current VSM it is necessary to draw (using icons) a future state map of how value should flow thinking lean or applying the lean tools. It also shows the materials and information flow without seven deadly manufacturing wastes. To achieve the future state mapping KPI results create some Kaizen (continuous improvement) Milestones and monitor the result periodically.

5. FINDINGS AND ANALYSIS

5.1 Current State Mapping, Lead Time

Time-line is used to identify the value-adding steps, as well as wastes, in the current system. The comparison between the processing times and the retention time (calculated as Available Capacity/Customer Demand) is a preliminary measure of the value and waste. This retention time is mostly used as an ideal time for each operation to achieve. Based on the analysis of the Current State Map, one then develops a Future State Map by improving the value-adding steps and eliminating the non-value adding steps (waste).

$$\text{Lead Time} = \text{Processing time} + \text{Retention Time}$$

Percentage of processing time or retention time=

$$\frac{\text{Total Processing time or Total Retention time}}{\text{Total Lead Time}} \times 100\%$$

Table 1: Current State Mapping, Summary of processing time and retention time, lead Time

Factory	Industry Type	Processing time (days)	Retention time (days)	Lead time (days)
1	Woven	2.69	3.35	6.04
2	Woven	1.4	6.9	8.3
3	Woven	1.9	4.15	6.05
4	Woven	0.69	29.9	30.59
5	Sweater	2.47	5.25	7.72
6	Sweater	1.58	3.8	5.38
7	Knit	0.6	8.27	8.87
8	Knit	0.4	36.24	36.64
9	Knit	1.46	12.46	13.92
10	Knit	6.03	7.74	13.77
11	Knit	1.15	2.23	3.38
12	Knit	0.727	2.38	3.107
13	Knit	3.4	8.7	12.1
Total		24.49	131.38	155.87
Percentage		15.71%	84.29%	

Source: DCG-ASDA/GEORGE Lean Project, 2011

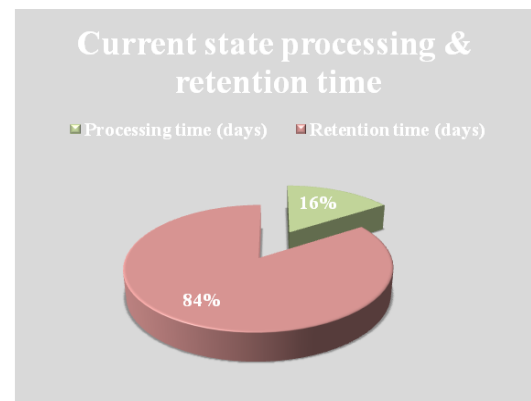


Fig 2. Current State Processing and Retention Time

Figure represents 15.71% activities as value added activities to the final product of the garment industries and other 84.29% activities are non value added activities. The value added activities are those activities which create more customers value (Michael Porter) and which change the material state with right first time.

5.2 Steps to improve current state:

The basic steps to improve the current state mapping includes

1. Identifying the Process Loops
2. Prioritizing the Process Loops
3. Tying Priority to Key Performance Indicators
4. Establishing the Criteria for Prioritization
5. Prioritizing the Work within Each Loop
6. Presenting the Maps to the Workforce
7. Presenting the Maps to the Steering Committee
8. Assigning a Value Stream Manager
9. Attacking the Action Plan

5.3 Improvement of current state by prioritizing KPIs in garments industry

If inefficient process is allowed to continue, it results in the accumulation of no-value-added work, which is not covered in the price the customer pays for the product, and therefore increases production costs. To identify the wastages through VSM, the current state of the following measures will be considered for future state development as key performance indicators (KPI).

Overproduction is probably the most common form of waste in a garments environment. The fear of absenteeism, potential machine breakdowns, anticipated rework and scrap, and ‘not looking busy’ will generally cause operators to overproduce. Line supervisors and managers cannot always control **absenteeism and employee turnover**, and build product ahead of schedule just in case they are short on employees the following day.

Machine breakdown occurs because many companies either have a poor preventive maintenance program or continually purchase equipment that is cheap and unreliable. Rather than fixing the equipment issues, operators prepare for possible equipment malfunctions by producing more product than is required, “just in case.” Typically, the same unreliable machines are unable to yield the required tolerances for fit, form, and function, so rework and scrap become standard procedures.

Lead time or waiting occurs when all manufacturing processes are out of synchronization, causing an operator to be idle. Lack of parts, work content imbalances, inaccurate standards and methods, long setup times, bad equipment, poor communication, and rejects all create wait time.

In any and all cases, **reducing work in process and inventory** will lower costs tremendously. Inventory on the assembly line should be kept at a minimum. After identifying the parts necessary for specific workstations, proper quantities should be set. Every company has different volumes with multiple part configurations. Part quantities should be established based on organization’s

needs.

Wasted motion is any movement that does not add value to the product. **Wasted motion** does not only apply to the production line; moving equipment, unnecessary reaching, looking for parts and tools, confusing standards, walking to and from maintenance, poor visual management, floor layout, and improper work content order are all wasted motions.

Defects are often hidden in stacks of WIP generated by overproduction. Product defects are caused by a lack of 5S, poor line flow and layout, overproduction, insufficient training, inaccurate standards and instructions, and the inability to hold people accountable for continuous mistakes. Rejects can cause line stoppages, requiring operators to rework product that should have been manufactured correctly the first time. Lastly, one major flaw in today’s management is the inability to identify **individual employee skill sets** and then properly utilize those skills to effectively balance their workloads. Not utilizing individual employee potential or placing employees in positions where they feel uncomfortable and are likely to make errors are wasteful decisions, both of which impact quality and productivity, creating waste issues that will lead to additional waste: the domino effect.

Table 2: List of Performance Measures “Metrics” (Deliverables Drivers) in Garments

Key performance Indicator	Performance Measures	Production Area	Unit of measure
Product Flow	Lead Time	Sewing , cutting, finishing	Minutes
	Inventories & WIP	Store, Sewing , cutting, finishing, Finished Good	Pieces
	Stock Turnover Ratio	Factory	Days
	Cut to Ship Ratio	Factory	Percentage of quantity shipped vs. Cut
Labor Utilization	Machine Breakdowns	Sewing	Plant Overall in Monthly Minutes
	Other off-standard	Sewing	Daily average Minutes per Worker
	Changeover	Sewing	Daily average Minutes per Worker
	Lack of Balancing Only the time related to idle workers “Waiting”	Sewing, cutting, finishing	Daily average Minutes per Worker
	Unnecessary Activities	Sewing, cutting, finishing	Min/pc
Key performance Indicator	Performance Measures	Production Area	Unit of measure

Cycle Time	Wasteful motions	Spreading , sewing, finishing	Minutes of studied style vs. Cycle Time
	Over processing	Handling in Sewing	
Space Utilization	Underutilized Space	Factory Overall	Total SQFT
Labor Issues	Absenteeism	Factory	Percentage
	Labor Turnover	Factory	Percentage

Source: DCG-ASDA/GEORGE Lean Project, 2011

5.4 Future State mapping, Lead Time

Using the chart of deliverables, the ratio of potential improvement is calculated by identifying the value added and the elimination of waste at 100%. The future state is mapped and the table value is achievable if the waste is properly handled.

Table 3: Future State mapping, Lead Time

Factory	Industry Type	Processing time(days)	Retention time(days)	Lead Time (days)
1	Woven	1.961	0.669	2.63
2	Woven	1.82	0.48	2.3
3	Woven	1.877	0.633	2.51
4	Woven	3.458	1.482	4.94
5	Sweter	1.981	0.849	2.83
6	Sweter	2.45	1.05	3.5
7	Knit	1.092	0.468	1.56
8	Knit	1.386	0.594	1.98
9	Knit	1.709	1.161	2.87
10	Knit	1.89	0.81	2.7
11	Knit	0.91	0.39	1.3
12	Knit	0.994	0.426	1.42
13	Knit	1.674	1.146	2.82
Total		23.202	10.158	33.36
Percentage		69.55%	30.45%	

Source: DCG-ASDA/GEORGE Lean Project, 2011

Comparing current state and future state mapping from Table 1 and 3, we can easily visualize that the value addition increases from 15.71 % to 69.55 % approximately and a significant reduction of no value added activity by retention time which has been represented through a pie chart. Still after value stream mapping a few unavoidable retention times is observed this can be minimized through introducing the high end technology and infrastructure.

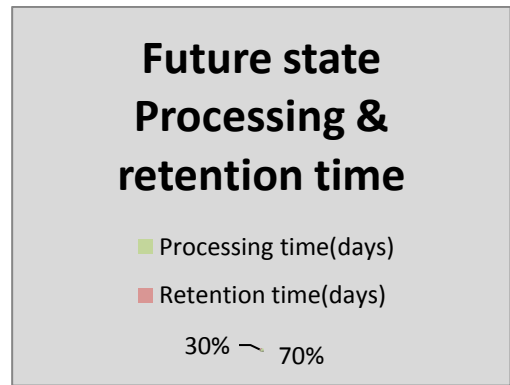


Fig 3. Future State Processing and Retention Time

5.5 Future State mapping, Deliverable Drivers

Similar to lead time VSM has been used to identify the current state and future state mapping of the key performance indicators or deliverable drivers of the garments industry. The below summarized data of table 4 gives a general view of the key performance indicator, current and future state calculated from the information of renowned garments factories.

Table 4: Future State mapping, Deliverable Drivers

KPI	Unit of Measure	Current State	Future State
Labor Utilization	Percentage	45%	64%
Space Utilization	Pieces/SQFT/Day	0.34	1.20
Productivity	Daily Pieces	27998	37769
Right First Time	Percentage	88%	96%
Stock turnover ratio	Days	26.80	13.57
Cut/knit to Ship Ratio	Percentage	96%	99%
Lead Time	Minutes	7102	2457
WIP & Inventory	Piece	1253574	858461
Efficiency	Percentage	45%	66%
Balancing ratio	Percentage	62%	84%

Source: DCG-ASDA/GEORGE Lean Project, 2011

6. CONCLUSION

The benefits of value stream mapping do not come solely from the creation of a map but from the interaction of the people making the maps, with the process and making the observations on the floor, which are necessary to gather the information for the value stream maps. The prioritization and action must follow the VSM. In short, there needs to be a management presence in the value stream map construction process. However, beyond the advantages, VSM fails to handle multiple products that do not have identical maps and tends to bias a factory designer to consider only continuous flow, assembly line layouts, *kanban*-based Pull scheduling, etc. that are suitable mainly for high volume and low variety manufacturing systems. VSM lacks the capability, due to the manual process of creation, for rapid development

and evaluation of multiple “what if” analyses required to prioritize different alternatives for improving a Current State Map when time and/or budget constraints exist. Finally, this research has the proof of advantages, feasibility and applicability of value stream mapping which will stand as a benchmark to implement lean for other garment industries in Bangladesh. We hope that this paper contains its worth for practitioners in the garment industries.

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