

# IMPROVEMENT OF PRODUCTIVITY THROUGH IMPLEMENTATION OF LEAN MANUFACTURING TOOLS IN RMG INDUSTRY

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**Abstract:** LEAN manufacturing techniques are a potential approach for improvement of productivity and automatically reduce of wastage as well as non- value added time. But our main approach of this research is to improve our productivity through lean manufacturing techniques; it is very much effective way to improve productivity. In our traditional production system, productivity is very low beside it consumed more time, workforces etc. But the output is comparatively very poor. In our traditional system, some problems are faced by our many RMG industries, like as poor line balancing, low productivity, longer production lead time, low flexibility of style changeover, high rework, and rejection, etc. By the implementation of lean manufacturing tools, those problems could be addressed. Lean tools like 5S, value stream mapping, Kanban, Kaizen, cellular layout, just in time etc. compare with traditional line and lean line for productivity analyzing as like as improving sewing line efficiency. After applying lean technique in a sewing line, we observed a tremendous appreciated result. Some of the main points of benefit entail number of worker reduced by about 22%, productivity increased about 14%, Line efficiency increased about 32%, capacity/hr increased to 155 from 130 out of 180, SMV target fulfillment increased about 23%, SMV reduction reduced about 21%.

**Keywords:** lean tools, SMV, productivity comparison, capacity analysis.

## I. INTRODUCTION

In Bangladesh, Ready-Made Garments (RMG) sector plays a significant role for the economic and social development of the country. This RMG sector has been contributed to export earnings, foreign exchange earnings, employment creation, poverty alleviation and creation of women empowerment. Around 82.2 % of total foreign earning comes from this sector. And it also contributes GDP Around 16% which was only around 3% in 1991. Around 5.5 million people are working in this sector, about 50 percent of them are women from rural areas. Now they become self-dependent. Starting from the early 1980s, Bangladesh has built a strong reputation centered on price advantage via low-cost labor and investment invigoration; production receptivity and satisfactory quality levels, especially in value and mid-market price point segments. But with the annihilation of quota and GSP, now this sector has been passing very crucial time. The business environment has become very competitive. Bangladesh, whose economy is mostly dependent on this RMG sector. Now we have to compete against garments giants like China and India. However to maintain this growth in positive direction it is urgent to ensure perfect utilization of every resource. In today's competitive world, the most important Tranter for success is time. The company which delivers best quality products with the shortest possible time required for production and shorter lead time is the market winner. Financial growth of any organization also depends upon waste reduction and mainly on productivity improvement.

So to achieve profit from scarce time and to Improve productivity, it is badly needed to use lean manufacturing tools after defining waste as well as adopting new manufacturing concepts, ideas and technology in every sector of the RMG industry and new business initiatives should be taken in this sector in order to be alive in the new competitive market. After World War II, Japanese manufacturers were faced with the dilemma of huge shortages of material, financial and human resources. The problems that Japanese manufacturers were faced with differed from those of their Western counterparts. These conditions resulted in the birth of the “lean” manufacturing concept. Lean manufacturing is a set of tools and methodologies that aims for the continuous reduction of all wastes in the production process which is a process for improving productivity and product quality. Logically more value with less work. Lean manufacturing is a manufacturing philosophy that Reduced the time between the customer order and the product make or shipment by improving productivity. Another explanation of lean is that it targets to gain the same output with less input less time, less space, less human effort, less machinery, less material, fewer costs. Lean principle is broadly implemented among various industries all over the world. But In Bangladesh, most of the industries run in a traditional way. Some industries are trying to implement but can’t implement lean correctly in their industries. So the prime issue of this study is to implementation of lean manufacturing techniques and data analysis in a particular section in selected garments industry to find out the improvement of productivity by. The main purposes of the use of lean production are to increase productivity, improve product quality and reduce manufacturing cycle time, reduce inventory, and decrease lead time. To gain these, the lean production philosophy uses various concepts such as one-piece flow, kaizen, cellular manufacturing, synchronous manufacturing, inventory management, poka-yoke, standardized work, workplace organization, (Russell and Taylor, 1999). In lean production systems, attempts are made to reduce waste through continuous improvement of processes of the entire value chain in the organization. Having nurtured a lean manufacturing mindset among the workers and employees, it facilitates acquirement of continuous production flow through physical rearrangement and control mechanisms.

## II. PURPOSES

1. To improve productivity through lean manufacturing tools
2. To find out the advantage of lean manufacturing tool perspective in our RMG industry.
3. Compare between lean production line and Non lean production line in a specific garment factory.
4. Implement of lean and its result.
5. To show the core difference between lean flowed factory and the other factory where lean didn’t follow.

## III. LIMITATIONS

Main limitation was getting proper information and it was really difficult to get practical based information. There is less number of factory available in our country where they are following lean production process. That’s why it was difficult to collect practical information or survey report. We did not get proper scope to discuss or collect data from company’s management.

## IV. LITERATURE REVIEW

In recent years, many literatures have extensively documented the improvement of productivity improvement through lean manufacturing tools into various manufacturing sectors, but very few have addressed the garments environment. In this research paper, we try to focus the lean manufacturing techniques that are being used in a particular section in a garment industry. If lean manufacturing tools implemented in our garments industry properly, productivity will be high as well as others non-value added time will be reduced. There are some studies have been undertaken bearing upon the relationship

between lean practices and manufacturing performance of the firms (Papadopoulo and Ozbayrak, 2005; Bonavia, 2006; Simpson et al., 1998, EPA, 2003; Oliver et al., 1993) and also have exposed the improvement in manufacturing through lean practice. Chihuahua (Society of Manufacturing Engineers, 2007), the producer of world-class power and signal distribution system of Mexico, reviewed its existing manufacturing system and identified the necessary for improvements. The company introduced lean with a view to improving the current performance. It is documented from the study that implementation of lean brought 34% elimination in inventory over a 12 months period and 93.5% uptime. The study exposed that the keys to gaining quality in manufacturing include the flexibility of the production system and involvement and commitment of employees.

It is clear that almost in every firm can adopt lean manufacturing techniques to improve their productivity as well as improve their business. After going through the literature, it is known that Lean Manufacturing is still somewhat new to the world. But it can be seen that usage and implementation of almost of all Lean Tools and techniques have been expanded gradually. As per literature review, it indicates that this is to most of the firms have come to the early implementation stage rather staying in the planning stage. Compare with other industries, some metal related industries are going in implementing Lean tools and techniques. There are some factories are leg behind to implementing lean manufacturing techniques like paper and allied products, stone-clay-glass products, textile mill products, printing, petroleum, metal fabrication etc. But today's textile and garments is one of the best faster-growing sector in our country. That's why this sector is trying to implement lean manufacturing techniques because of reduction all Wastages, non- value added activities and improvement of productivity. According to nature of the industry, the plant size and the technological capabilities, the usage of Lean tools depend upon. Most of the industries want to implement 5S and other visual management tools. US industries conduct six-sigma somewhat heavily than the other countries. Value stream Mapping (VSM) is used by United State of America (USA) and Canadian industries. It is more than the small-scale Indian industries. It is quite astonishing that the Australian companies do not use kaizen, kanban and group technology (GT) as much as another country. Instead of depending on Total Quality Management (TQM). Printing industry in the USA, Kaizen, 5s, Just-In-Time and standardized work are most popular and Advantageous. Furniture industry in United Kingdom (UK) do not use and not very popular Single Minute Exchange of Dies (SMED), Because of they belief that it requires more investment in new machinery or tooling in order to improve changeovers. In china's computer industry sometimes use lean manufacturing tools. Some small companies conducted cellular manufacturing tools become very challenging to implement because they have large number of customers and schedule that change all the time. They do not have sufficient cells to set up.

Reviewing about local context, lean manufacturing is relatively new to Bangladesh. Only some renounce or green factories have implemented lean in Bangladesh. Apart from the other firms, it can be seen that many apparel industries have taken lots of initiatives to implement lean manufacturing in their organization. Because it's future will be bright. If we want to compete in global marker, we have to meet the buyer required product in time. Considering to lead time if we want to ship our product, there is no alternative to implement lean manufacturing concepts and techniques. Because these techniques help to meet buyer's required production in time as well as improve productivity. That's why lean manufacturing techniques are badly needed to implement in our RMG industry in order to sustain in global market.

## V. LEAN MANUFACTURING

Lean manufacturing is a business initiative to reduce waste and improvement of productivity in the manufacturing process. The main target is to eliminate the cost systemically, throughout the product and production process by means of lean manufacturing techniques. "A systematic approach to identify

and eliminating waste (Nonvalue added activities) through continuous improvement by flowing the products at the pull of the customers in pursuit of perfection.”

The main advantage to lean manufacturing are reduce wastage, reduce production cost, reduce production lead time as well as non- value added time and increased output and productivity, higher flexibility of work.

**Figure 1 : Advantage of Lean**

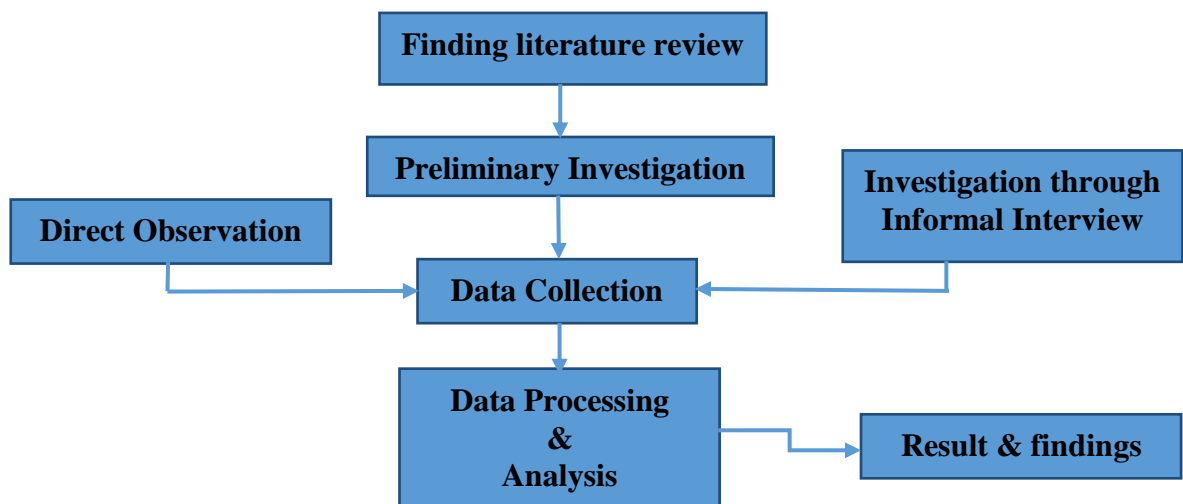


## VI. METHODOLOGY

In this research paper, we try to carry a selected garment industry’s specific section which is following lean manufacturing technique or not. This analysis helps to find out the core value of lean manufacturing production and improvement of productivity through using lean manufacturing tools.

For productivity of this company, we accumulated data from **Alim Knit (BD) Limited** sewing floor. We preferred two line (traditional & lean line) and tried to differentiate between them. The traditional line we choose is the past form of present lean line we chosen too, the working condition and all other condition like as, style, space all were about same. The factory’s floor is used to calculate standard time during conducting time study. The standard task top is selected to do this as a base time because procedure varies from style to style and it is complex correlate all these operations of individual styles. To achieve better result, at least 10 cycles are given for each operation time. For individual operation, actual time is calculated by accumulating raw data the performance rating is given to each operator when time study is made. Finally, the component of personal fatigue and delay is added to the calculated time where the operation time is standardized. Data collection sheet is given below. And also mention the format. Some parameters are kept fixed during conducting time study. (for example, stitches per inch, machine speed, type of machine used etc) to get consistent results.

**Figure 2 : Action plan**



## VII. RESULT & FINDINGS

**Table 1 : Traditional line operational breakdown**

**Style: Men's long sleeve shirt**

S/L No.	Operations	No. of workers	Machine	Std. SMV	Actual time in second	Allowance 20% (s)	Std. time sec.	Capacity
1	Front part Folding	1	Table	0.19	10	2	12	300
2	Front part placket making	1	Table	0.20	7	1.4	8.4	450
3	Placket rulling	1	Lock stitch	0.30	14	2.8	16.8	212
4	Placket marking	1	Table	0.40	13	2.6	15.6	225
5	Placket attaching	1	Plain m/c	0.27	18	3.6	21.6	164
6	Loose tuck	1	Plain m/c	0.19	10	2	12	300
7	Front bach matching	1	Table	0.20	11	2.2	13.2	277
8	Shoulder matching	1	Over lock	0.30	10	2	12	300
9	Label joining	1	Plain m/c	0.29	20	4	24	150
10	Collar marking	1	table	0.26	10	2	12	300
11	Collar joining	1	Plain m/c	0.31	27	5.4	32.4	113
12	Collar scissoring	1	Over lock	0.25	3	0.6	3.6	900
13	Collar joining	1	Plain m/c	0.16	24	4.8	28.8	124
14	Sleeve match	1	table	0.26	8	1.6	9.6	360
15	Sleeve join	1	Over lock	0.23	8	1.6	9.6	360
16	Collar shining	1	Cutter	0.26	16	3.2	19.2	190
17	Collar binding	1	Plain m/c	0.24	10	2	12	300
18	Collar top stitching	1	Plain m/c	0.36	12	2.4	14.4	257
19	Placket close	1	Plain m/c	0.11	11	2.2	13.2	277
20	Placket close	1	Plain m/c	0.15	12	2.4	14.4	257
21	Placket box	1	Plain m/c	0.38	20	4	24	150
22	Placket box stitch	1	Plain m/c	0.48	13	2.6	15.6	225
23	Placket box stitch	1	Plain m/c	0.31	35	7	42	86
24	Collar top stitch	1	Plain m/c	0.31	20	4	24	150

S/L No.	Operations	No. of workers	Machine	Std. SMV	Actual time in second	Allowance 20% (s)	Std. time sec.	Capacity
25	Side joining	1	Over lock	0.12	26	5.2	31.2	116
26	Side joining	1	Over lock	0.26	20	4	24	150
27	Collar tuck	1	Plain m/c	0.12	12	2.4	14.4	257
28	Thread cut	1	table	0.24	2	0.4	2.4	1800
29	Bottom hem	1	Flat lock	0.16	9	1.8	10.8	327
30	Sleeve hem	1	Flat lock	0.28	13	2.6	15.6	225
31	Button holing	1	Button holing m/c	0.15	8	1.6	9.6	360
32	Button attaching (5)	1	Button Attaching machine	0.3	13	2.6	15.6	225
33	Thread cutting	4	table	0.3	35	7	42	86
<b>Total =</b>		<b>36</b>		<b>8.42</b>			<b>552</b>	

### Calculation # 1

**Input = 180 pcs, Output = 130 pcs**

$$(i) \text{ Productivity} = \frac{\text{Output}}{\text{Input}} \times 100\% = \left( \frac{130}{180} \times 100\% \right) = 72.20\%$$

$$(ii) \text{ SMV} = \frac{552}{60} = 9.20$$

$$(iii) \text{ SMV increased} = \left( \frac{9.2 - 8.42}{8.42} \right) \times 100\% = 9.26\%$$

$$(iv) \text{ Efficiency of line (\%)} = \left( \frac{\text{Total Production} \times \text{SMV} \times 100}{\text{No. of workers} \times \text{Working Hours} \times 60} \right)$$

$$= \left( \frac{130 \times 9.2 \times 100}{36 \times 1 \times 60} \right) = 55.37\%$$

$$(v) \text{ SMV Target Fulfillment} = 100\% - \left\{ \left( \frac{180-130}{180} \right) \times 100\% \right\}$$

$$= 100\% - 27.78\% = 72.22\%$$

**Table 2 : Lean line operational breakdown**

S/L No.	Operations	No of workers	Machine	Actual time in second	Allowance 20% (s)	Std. time sec.	Capacity
1	Placket mark	1	Table	10	2	12	300
2	Placket rull +body match	1	Over lock m/c	12	2.4	14.4	257
3	Attach placket	1	Plain m/c	14	2.8	16.8	212
4	Placket fold tuck	1	Plain m/c	9	1.8	10.8	327
5	Front back matching	1	table	9	1.8	10.8	327
6	Shoulder join +cut	1	table	15	3	18	200
7	Care label attach	1	Plain m/c	19	3.8	22.8	157
8	Collar marking	1	table	17	3.4	20.4	180
9	Collar join	1	Plain m/c	19	3.8	22.8	157
10	Sleeve match	1	table	4	0.8	4.8	720
11	Sleeve join With body	1	Over lock	34	6.8	40.8	88
12	Sleeve joint	1	Over lock	22	4.4	26.4	138
13	Collar binding	1	Plain m/c	15	3	18	200
14	Binding cut+ over	1	table	12	2.4	14.4	257
15	Collar top stitch	1	Plain m/c	13	2.6	15.6	211
16	Placket close(r)	1	Plain m/c	16	3.2	19.2	189
17	Placket close(l)	1	Plain m/c	15	3	18	200
18	Make placket box	1	Plain m/c	41	8.2	49.2	73
19	Make placket box	1	Plain m/c	28	5.6	33.6	106
20	Arm hole join	1	Flat lock m/c	16	3.2	19.2	189
21	Side join	1	Over lock m/c	38	7.6	45.6	78
22	Side join	1	Over lock m/c	32	6.4	38.6	92
23	Placket tuck	1	Plain m/c	18	3.6	21.6	164
24	Body hem	1	Flat lock	13	2.6	15.6	225
25	Sleeve hem	1	Flat lock	19	3.8	22.8	157
26	Button holing	1	Button holing m/c	17	3.4	20.4	180
27	Button attaching	1	Button attaching m/c	5	1	6	600
28	Thread cutting	1	cutter	42	8.4	50.4	72
<b>Total =</b>		<b>28</b>				<b>618.2</b>	

**Calculation # 2**

**Input = 180 pcs, Output = 155 pcs, Standard SMV= 12.56**



$$(i) \text{ Productivity} = \frac{\text{Output}}{\text{Input}} \times 100\% = \left( \frac{155}{180} \times 100\% \right) = 86.11\%$$

$$(ii) \text{ SMV} = \frac{618.20}{60} = 10.30$$

$$(iii) \text{ SMV decreased} = \left( \frac{12.56 - 10.30}{10.30} \right) \times 100\% = 21.94\%$$

$$(iv) \text{ Efficiency of line (\%)} = \left( \frac{\text{Total Production} \times \text{SMV} \times 100}{\text{No. of OP} \times \text{Working Hours} \times 60} \right)$$

$$= \left( \frac{155 \times 10.30 \times 100}{28 \times 1 \times 60} \right) = 87.50\%$$

$$(v) \text{ SMV Target Fulfillment} = 100\% - \left\{ \left( \frac{160-140}{160} \right) \times 100\% \right\}$$

$$= 100\% - 12.50\% = 95.03\%$$

### VIII. DATA ANALYSIS

Table 3 : Productivity Analysis

Topic	Traditional time	Lean time
Productivity	72.2%	86.11%
Line efficiency	55.37%	87.05%
SMV reduction	-9.26%	21.94%
SMV target Fulfillment	72.22%	95.03%
No of worker	36	28
Capacity/hr utilization	130out of 180	155 out of 180

### IX. KEY PRODUCTIVITY COMPARING

Value is the critical starting point for lean thinking. Value can only be defined by the ultimate customer, and it is only meaningful when expressed in terms of a specific product which meets the customer's needs at a specific price at a specific time. Producer is created value. From the consumer's point of view, this is why producers exist. There something arises that does not add value to the product is waste, and the customer is not willing to pay for this something.

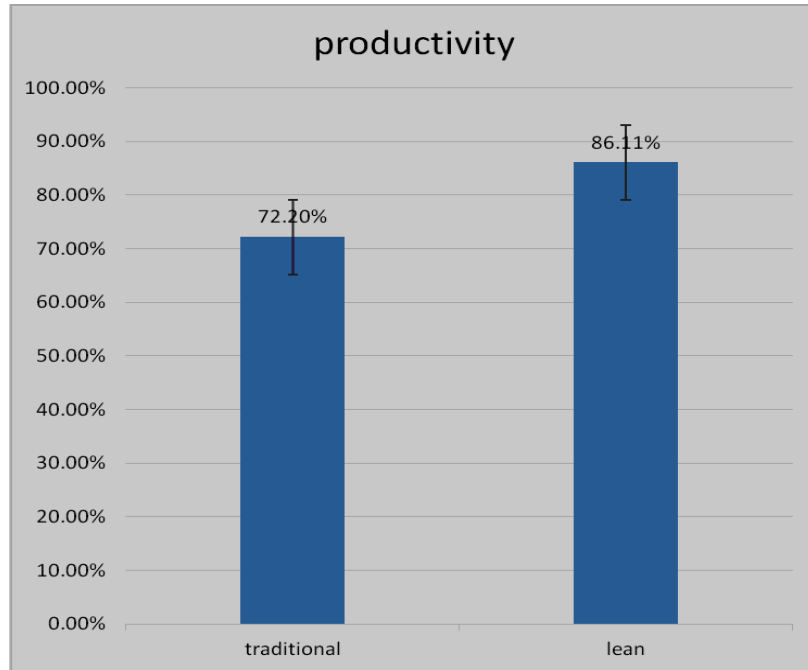
Table 4 : Productivity comparison

Traditional line	Lean line	Improvement
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72.2%	86.11%	13.91%
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**Figure 3 : Productivity comparison between traditional and lean line**

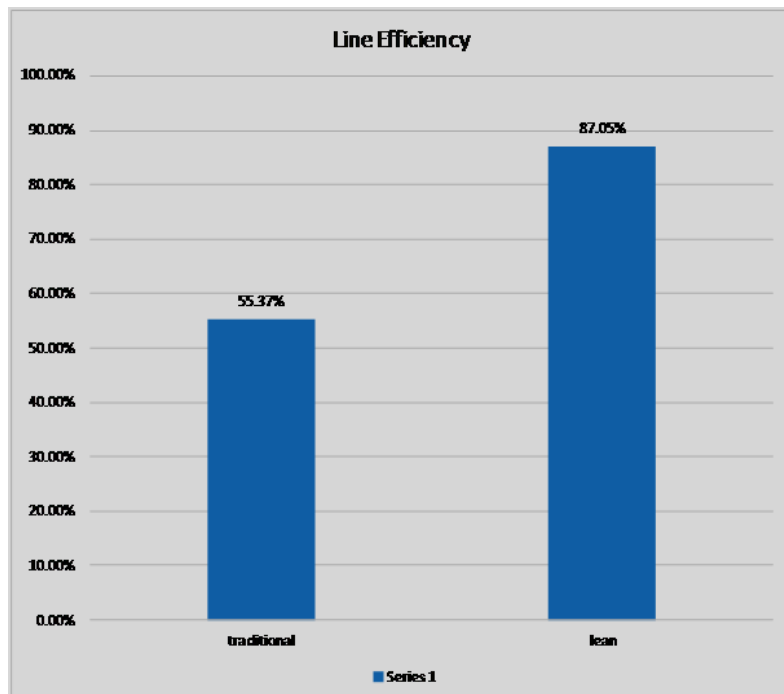


Above graph shows that lean line productivity is higher than traditional line. in traditional line productivity was 72.20% and after apply of lean in this particular section, this productivity has improved 86.11%.Improvement rate 13.91%.

**Table 5 : Line efficiency comparison**

Traditional line	Lean line	Improvement
55.37%	87.05%	31.68%

**Figure 4 : Line efficiency comparison**

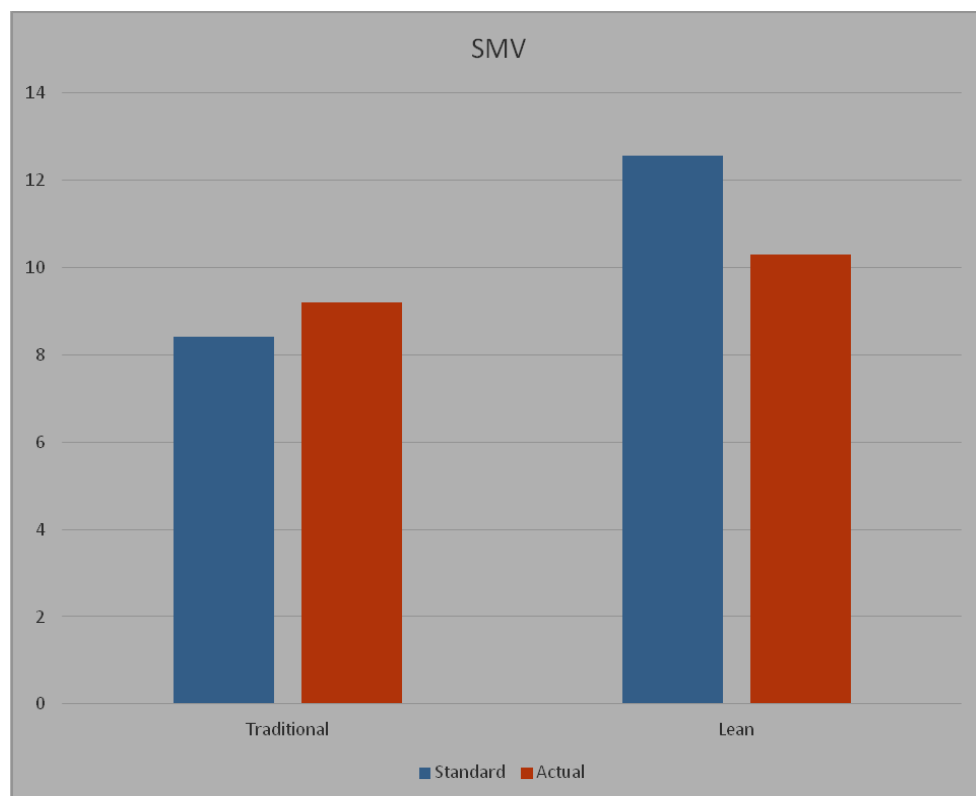


Graph of Figure 4 shows that line efficiency of that particular section has improved 31.68%. We considered 2 lines in this particular section traditional and lean line. In lean line efficiency is 87.05% and traditional line efficiency was 55.37%.

**Table 6 : SMV reduction comparison**

Type	Standard SMV	Actual SMV	Remark
Traditional line	8.42	9.2	-9.26%
Lean line	12.56	10.30	21.94%

**Figure 5 : SMV reduction comparison**



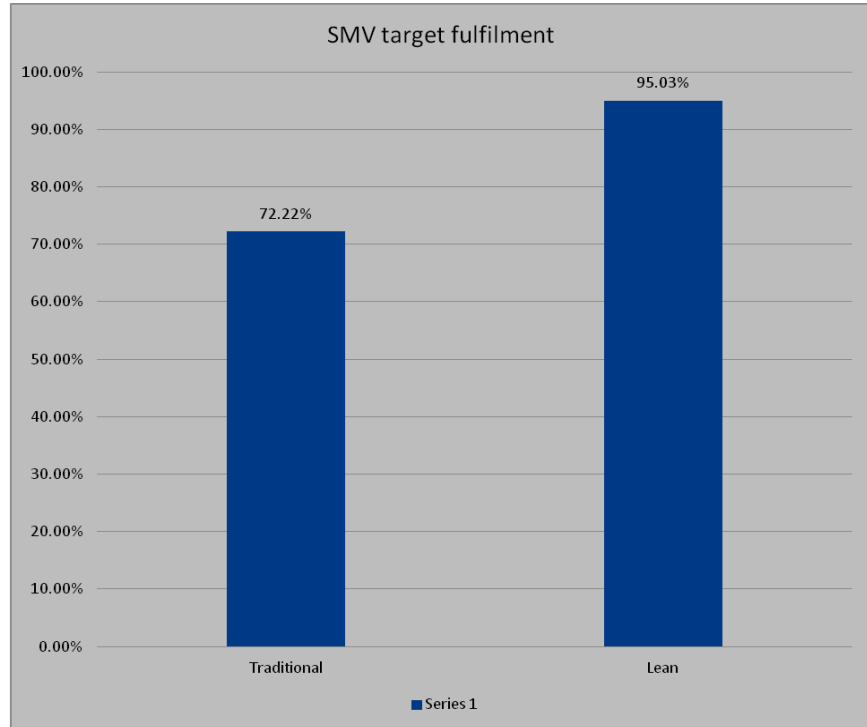
In this graph, we try to show the reduction of SMV consider to standard SMV using lean techniques in this particular section. In traditional line, standard SMV was 8.42 and actual was 9.2. That means it is required to more SMV in actual production process. But in lean line standard SMV is higher than Actual SMV. That's means need less time in actual production process.

**Table 7 : SMV Target fulfillment comparison**

Traditional line	Lean line	Improvement
72.22%	95.03%	22.81%

In graph of Figure 6 shows that SMV fulfillment in lean line is 95.03% where traditional line was 72.22% of SMV fulfillment. Improvement 22.81% than traditional line.

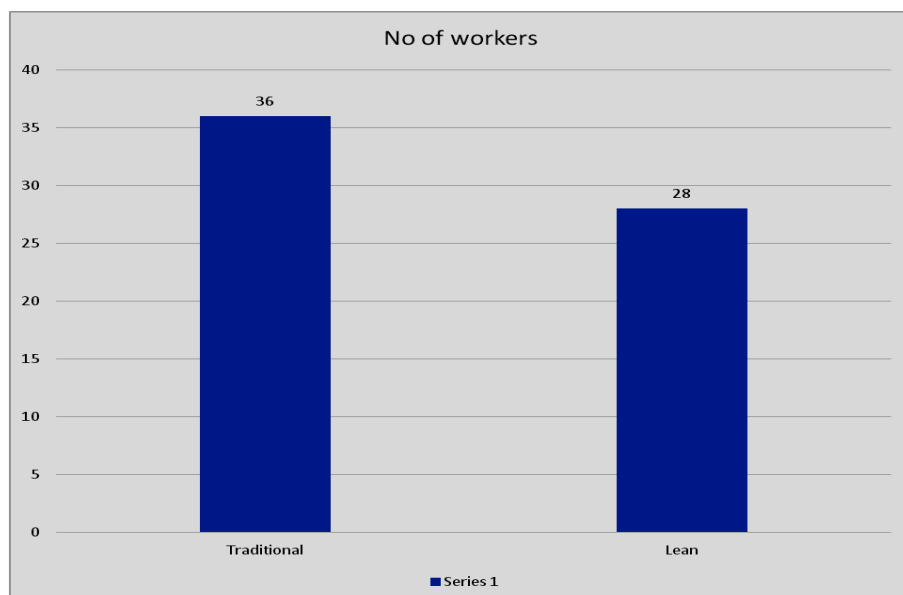
**Figure 6 : SMV Target fulfillment comparison**



**Table 8 : No of workers comparison**

Traditional line	Lean line	Remarks
36	28	Less 8 workers needed in lean line

**Figure 7 : No of workers comparison**

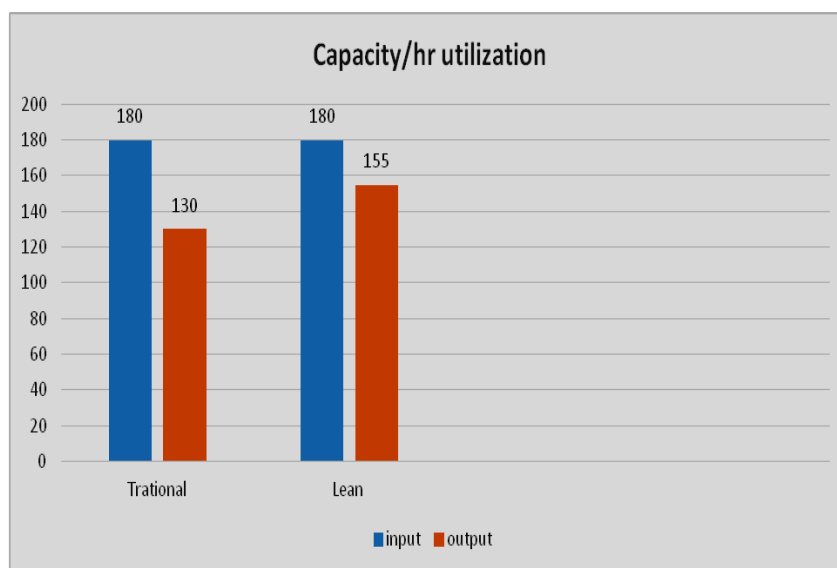


Lean line is a systemic way to layout line and make operational breakdown. That's why less number of workers are needed to produce a particular style of product than traditional system, this graph are shown this clearly. In traditional line workers were 36 and in lean line workers need 28 and get more output.

Table 9 : Capacity/hr utilization comparison

Type	Input	Output	Remarks
Traditional line	180	130	Less output
Lean line	180	155	More output

Figure 8 : Capacity/hr utilization comparison



In the graph of Figure 8, capacity per hour in traditional line was 130pcs per hour where input was 180 pcs per hour. But when we applied lean techniques, it was so effective that output increased 155 pcs per hour.

To balanced sewing line, I used time study. And by using this method, we calculated productivity. According to lean manufacturing techniques, we arranged line. Now we observe the improvement of productivity by using time study.

Time study is a important element of work study, SMV calculation helps to identify the points where production has picked up the standard level and the points where production level has gone down the standard. To improve productivity, it is acted as balance to remove bottle neck. This system was highly helpful.

## X. RECOMMENDATION

Researchers have always tried to give better realization the relationship between lean and traditional manufacturing techniques since 1990's. In both systems tried to focus mainly on the improvement of productivity. Our Bangladeshi RMG sector is one of the main competitors in the global competitive market. And now we are in the 2<sup>nd</sup> position in this global market. Our main competitor countries are China, India, Srilanka, Pakistan, and Vietnam etc. that's why, if we want to sustain or keep our position

in this globally competitive market, there is no alternative way to improve productivity. It is too difficult task for us to compete for those countries because backward linkage industry is our main problem as well as we are no following systemic rules in our manufacturing process. But there is a way to overcome this problem only when we will be able to eliminate waste, improve productivity and try to make the best use of our raw materials, time, equipment, In a systemic or standard way like lean manufacturing techniques. And it can help us to get the higher results as it has some more effective tools and techniques.

## XI. Conclusion

Bangladesh is a developing country; readymade industry is the most important and leading industry in this country. Apparel business is one of the most important businesses in this sub-continent as well as in the whole world. Apparel business is highly fashion oriented business. But in this modern world fashion is changing very rapidly. Sometimes it is changing overnight. So to cope up with this business, we need a very effective system to produce the product. As readymade industry is human resources oriented business so there are so many scopes to reduce time by implementing methods of production system. As we are human being we need some allowance in the work place. But if we can reduce the allowance we can save a huge amount of time as well as we can increase the productivity. The times we required in the workplace as allowance, we called it no value added time. Lean manufacturing tools is the most effective tools to reduce the non-value added time in this industry. Lean tools show us how to reduce non-value added time and how to increase productivity. It also shows us how to balance a line and how to reduce bottle necking in production of the products.

Garments industry is the most efficient business in Bangladesh. In this country most of the factories don't follow lean in their production line. Sometimes some factory management doesn't have enough idea about lean production methods. So our research aim was to inform them about lean production system and let them understand the benefits of using lean in their factory. This research will help the factory management to apply lean in their factory.

As apparel industry is fashion oriented factory, so the apparel industry should follow the lean production system. If the company implements this method of production in their factory they will be able to make high profits by reducing non-value added times, and will be able to shipment their products on time. Perhaps the factory can reduce the lead time and can be able to get more order in the factory. So we can say lean manufacturing is the most important issue for our RMG industry to enhance productivity and make profits.

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