Implementation of JIT to increase productivity in sewing section of a garment industry

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Abstract

On time delivery with quality and quantity is important for any manufacturing industry, especially in garment sectors. At present, in RMG industries, lead time is decreasing day by day and customer requirements also continuously changing. The primary objective of this study is to identify the defects in sewing sections that hinders the overall productivity of garments industry in Bangladesh and find out the ways how to reduce those defects in sewing line by implementing Just-in-Time (JIT) techniques. Three different product lines (Jacket, Polo shirt, and T-shirt) have been considered to implement this study. The sample respondents were selected from a reputed textile industry in Bangladesh. Purposive sampling technique is followed by data collection from sewing section and indication of major problems. After indication, improvement proposal is given to the industry from which the productivity as well as line efficiency has compared before and after applying the techniques. The output of the study includes the production capacity, line target, line efficiency, line performance of the respective sewing section that has been increased far well than before within the time duration of three months. It is also suggested that, different techniques like process integration, job sharing, multitasking etc. can also be implemented if responsible authorities of garments industry try to improve the current state situation.

Keywords
Just-in-Time (JIT), Lean manufacturing, Operation layout, Line efficiency, Productivity.

1. Introduction

As the labor wage is increasing in developing countries, the apparel manufacturing has been migrating from the high wage developed country to low wage developing countries. Even the labor cost is cheaper than in developed countries due to the specific market nature of the garment industries. For example, the short production of life cycle, high volatility, low predictability, high level of impulse purchase, the quick market response: garment industries are facing the greatest challenges these days (Lucy Daly and Towers, 2004).
Nowadays industries are getting more volumes (orders), but number of styles they have to handle has increased drastically. In recent day, due to small order quantities and complex designs, the garments industry has to produce multiple styles even within a day; this needs higher flexibility in volume and style change over.

In Bangladesh industries have been running in a traditional way for years and rigid to change. Industry owners are happy as long as the business is sustainable. Now the time has come to struggle with global market in garment industries if the owners want to run it further. The best way to cope with all these challenges is the implementation of lean manufacturing. Its implementation has contributed to the success of many organizations and is used by companies worldwide. JIT is an all-encompassing philosophy that is founded on the concept of eliminating waste. The word waste might make one think of garbage, or paper, or inventory. The broad view of JIT is now often termed lean production or lean systems. If this concept is properly maintained, they will serve the purpose of flexibility and save a lot of money by reducing production lead time, reducing inventory, increasing productivity, training operators multiple works and by rework.

2. Methodology

2.1 Management idea that attempts to eliminate wastes

It is a management idea that attempts to eliminate sources of manufacturing waste by producing the right part in the right place at the right. In the manufacturing process size of batches are related to potential errors in part/production, i.e., smaller batches such as used in JIT systems will potentially reduce the average error per part/production population.

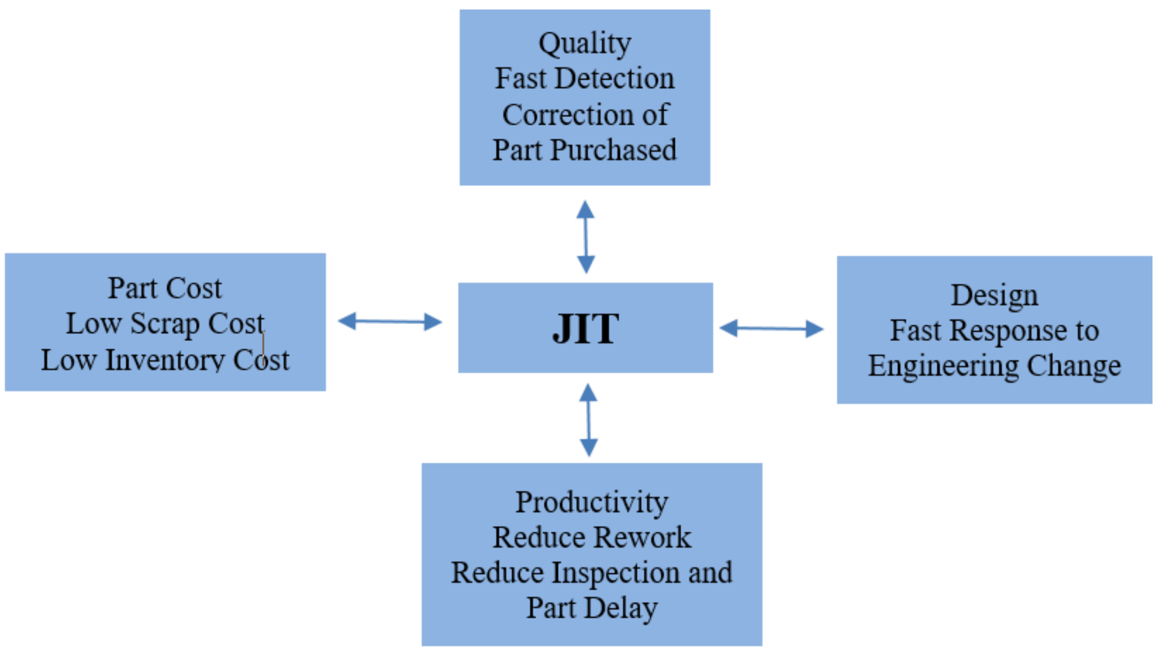

Figure 2.1: Management ideas to eliminate waste

2.2 JIT Distribution

JIT's effectiveness depends heavily on having a strategy alliance between buyers and suppliers. JITD requires the exchange of frequent, small lots of items between suppliers and customers, and must have an effective transportation management system, because inbound and outbound material can have a great effect on production when there is no buffer inventory.

2.3 JIT Purchasing: The Idea of JITP runs counter to the traditional purchasing practices where materials are brought well in advance before their use. Under this, the supplier selection, product development and production lot sizing become very critical. Implementation of JIT in sewing line basically explains (a) Reduction of waste of motion; (b) Reduction of waste in waiting time; (c) Reduction of waste of inventory; (d) Reduction of waste of defects

2.4 Way to reduce waste of motion

Whilst there will always be some form of motion within process it should be minimized as much as possible, both to reduce overburden and to improve efficiencies; this is a benefit to employees as it is making their work easier.
The simplest and most powerful tool eliminate the waste of motion within work cells is that of 5S; 5S challenges team to review each and every step of operation and eliminate the symptoms of the wastes. These changes will on the whole cost nothing other than the time of team but will result in efficiency gains in the order of 10% to 30% in most cases as well as making work area safer preventing accidents (and the law suit that follows.)
5S also starts the ball rolling with regard to standardized operations; it should lead to develop standard operating procedures (SOP) for your processes defining the best way to conduct a specific operation.
The tool of single minute exchange of Die (SMED) will also remove many wasteful motions from setup process, using similar principles to 5S; they are applied to the setup process of work and will often reduce setups from hours to single minutes.
Motion is a significant factor within the seven wastes and every effort should be made to remove it from processes to both increase efficiencies as well as make work easier for all those involved.

2.5 Way to reduce waste in waiting time

- Balancing of production processes using Takt time and Yamazumi boards will help ensure that the processes are better matched with regards to cycle times.
- Improving machine reliability and quality using Total Productive Maintenance (TPM) and quality tools.
- Reducing overproduction and inventory to minimize transport and movement between and within cells.
- Implement Standard Operating Procedures to ensure that standards and methods are clear.
- Use visual methods of planning combined with daily cell meetings to ensure that everyone is clear what is required for the day.

2.6 Way to reduce waste of inventory

The first thing is to work to the main principles of making value flow at the pull of the customer, the idea of Just in Time (JIT) production. This will cause to remove the main cause of inventory that of overproduction.
Factory and cell layout should be followed and then balancing production processes to ensure that work in progress does not build up between processes, it is not important to run every machine as fast as it can be run, at the end of the day it is important to make things as quickly as the customer wants them, no faster; talk time (the time interval between customer call off) and Kanban can be used to help ensure that we balance our processes and prevent the buildup of inventory.

2.7 Way to reduce waste of Defects

This prevention of defects is achieved by a number of different techniques from automation /Jidoka (Machines with "human" intelligence that are able to detect when a non-standard event has occurred) through to Pokayoke devices that detect if a product is defective, either preventing the process from running or highlighting the defect for action.
In this project work, standard operations procedures (SOP) implemented and training provided to ensure that the correct methods are undertaken and standards achieved. The most important factor however is the empowerment of teams to solve and prevent their own problems. By harnessing the talents of employees it would be able to quickly and efficiently prevent the occurrence of defects.

Flow Chart of Current Traditional line layout

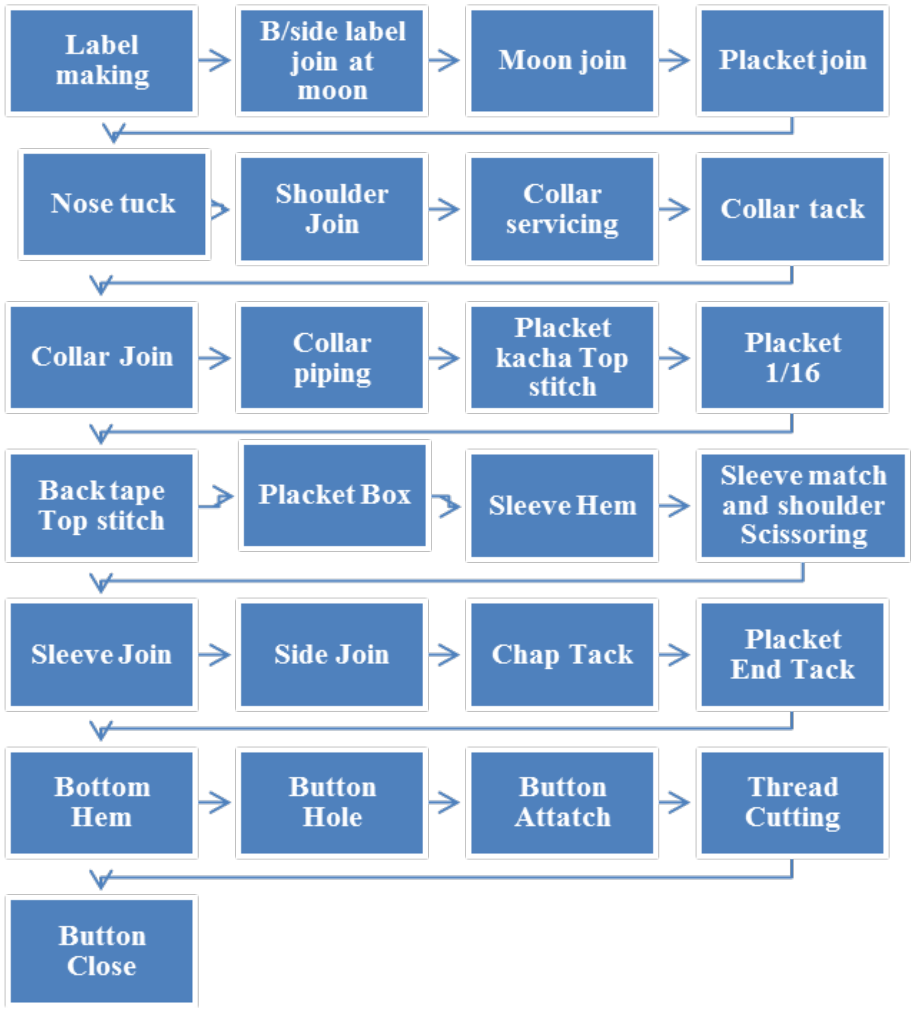

Figure 2.2: Flow Chart of Current Traditional line layout

Improvement areas of JIT in Sewing Section

- Not multi-tasking practices
- Using helper for front and back match
- Using helper for body with sleeve match
- Surging of cuff and collar
- Don't thread trimming by operator
- No bundle wise flow in sewing line from beginning to ending
- Less use of guide, folder and attachment
- Bundle pickup, dispatch and arranging system is not proper way i.e. disorganized way
- Not to use laser for marking
- Less Job sharing practices
- Not multi-machine operating by one worker
- There is a transportation and waiting time from sewing to fusing section.

3. Data analysis and findings

Before implementation layout data

Table 1: Previous layout data

Style No		BSS-0378								Buyer	Brand Machine Group		
Current Production										S.M.V.	6.29		
Observer										Line	8		
Sl No	Operation Description	M/C Name	Cycle Time (in sec)					AVG. Time (Sec)	AVG.Time (Min)	AVG. Time with 15% allowance	Rating%	SMV	Capacity /Hour
			1	2	3	4	5						
1	Label Making	SN	11	12	17	13	13	13	0.22	0.253	80%	0.2	300
2	Back Side Label Join at Moon	SN	12	17	16	11	13	14	0.23	0.2645	80%	0.21	286
3	Moon Join	SN	16	15	15	14	15	15	0.25	0.2875	80%	0.23	261
4	Placket Join	SN	16	17	18	17	14	16	0.27	0.3105	80%	0.25	240
5	Nose Tack	SN	11	13	12	11	12	12	0.2	0.23	80%	0.18	333
6	Shoulder Join	O/L	18	17	21	16	19	18	0.3	0.345	80%	0.28	214
7	Collar Servicing	O/L	4	4	3	4	6	4	0.07	0.0805	80%	0.06	1000
8	Collar Tack	SN	14	15	14	13	14	14	0.23	0.2645	80%	0.21	286
9	Collar Join	O/L	13	16	17	16	14	15	0.25	0.2875	80%	0.23	261
10	Collar Piping	PIPING	10	12	12	13	16	13	0.22	0.253	80%	0.2	300
11	Placket Kacha Topstitch	SN	23	17	15	15	17	17	0.28	0.322	80%	0.26	231
12	Placket 1/16	SN	13	16	19	17	18	17	0.28	0.322	80%	0.26	231
13	Back Neck Tape Topstitch	SN	15	13	16	14	13	14	0.23	0.2645	80%	0.2	300
14	Placket Box	SN	15	17	15	17	16	16	0.27	0.3105	80%	0.25	240
15	Sleeve Hem	F/L	7	7	8	9	8	8	0.13	0.1495	80%	0.12	500
16	Sleeve Match & Shoulder Scissoring	H	21	16	23	19	21	20	0.33	0.3795	80%	0.3	200
17	Sleeve Join	O/L	23	23	30	33	30	28	0.47	0.5405	80%	0.43	140
18	Side Join	O/L	33	38	39	42	36	38	0.63	0.7245	80%	0.58	103
19	Chap Tack	SN	20	21	23	18	22	21	0.35	0.4025	80%	0.32	188
20	Placket End Tack	SN	15	17	20	23	14	18	0.3	0.345	80%	0.28	214
21	Bottom Hem	F/L	10	13	14	15	16	14	0.23	0.2645	80%	0.21	286
22	Button Hole	Button Hole	15	14	15	17	17	16	0.27	0.3105	80%	0.25	240
23	Button Attach	Button Attach	15	18	21	20	20	19	0.32	0.368	80%	0.29	207
24	Thread Cutting	H	25	20	20	18	21	21	0.35	0.4025	80%	0.32	186
25	Button Close	H	10	8	12	13	14	11	0.19	0.2185	80%	0.17	353

6.29

After implementing layout plan & data

Table 2: After Implementation layout plan and data

Style No		BSS-0378								Buyer	Brand Machine Group		
Current Production										S.M.V.	5.75		
Observer										Line	8		
Sl No	Operation Description	M/C Name	Cycle Time (in sec)					AVG. Time (Sec)	AVG.Time (Min)	AVG. Time with 15% allowance	Rating%	SMV	Capacity /Hour
			1	2	3	4	5						
1	Label Making	SN	12	10	11	12	11	11	0.18	0.207	80%	0.17	353
2	Back Side Label Join at Moon	SN	13	15	11	12	14	13	0.22	0.253	80%	0.2	300
3	Moon Join	SN	14	11	15	11	12	13	0.22	0.253	80%	0.2	300
4	Placket Join	SN	17	15	14	16	13	15	0.25	0.2875	80%	0.23	261
5	Nose Tack	SN	10	12	11	10	11	11	0.18	0.207	80%	0.17	353
6	Shoulder Join	O/L	16	14	17	14	15	15	0.25	0.2875	80%	0.23	261
7	Collar Servicing	O/L	5	4	3	3	4	4	0.07	0.0805	80%	0.06	1000
8	Collar Tack	SN	14	12	11	13	12	12	0.2	0.23	80%	0.18	333
9	Collar Join	O/L	13	14	16	14	13	14	0.23	0.2645	80%	0.21	286
10	Collar Piping	PIPING	10	12	11	13	12	12	0.2	0.23	80%	0.18	333
11	Placket Kacha Topstitch	SN	21	16	14	15	15	16	0.27	0.3105	80%	0.25	240
12	Placket 1/16	SN	13	16	15	14	18	15	0.25	0.2875	80%	0.3	200
13	Back Neck Tape Topstitch	SN	14	15	12	13	12	13	0.22	0.253	80%	0.2	300
14	Placket Box	SN	15	14	16	15	14	15	0.25	0.2875	80%	0.23	261
15	Sleeve Hem	F/L	7	7	6	8	7	7	0.12	0.138	80%	0.11	545
16	Sleeve Match & Shoulder Scissoring	H	18	15	17	15	16	16	0.27	0.3105	80%	0.25	240
17	Sleeve Join	O/L	25	24	23	23	24	24	0.4	0.46	80%	0.37	162
18	Side Join	O/L	33	32	31	32	32	32	0.53	0.6095	80%	0.49	122
19	Chap Tack	SN	20	19	21	18	22	20	0.33	0.3795	80%	0.3	200
20	Placket End Tack	SN	15	18	15	16	16	16	0.27	0.3105	80%	0.25	240
21	Bottom Hem	F/L	11	13	14	13	15	13	0.22	0.253	80%	0.2	300
22	Button Hole	Button Hole	15	14	15	16	16	15	0.25	0.2875	80%	0.23	261
23	Button Attach	Button Attach	17	18	20	17	18	18	0.3	0.345	80%	0.28	214
24	Thread Cutting	H	22	20	18	19	21	20	0.33	0.3795	80%	0.3	200
25	Button Close	H	11	10	8	9	12	10	0.17	0.1955	80%	0.16	375
												5.75	

3.1 Ways of reducing WIP

Proper job distribution and line balancing

To reduce WIP it is important properly work distribution. Without proper work balance & line balance there will be a bottleneck and it will create the WIP.

Keep 10 pieces bundling system

If 25 or more pieces are kept in one bundle, it will create WIP in lines. Lean concept is a single piece flow in assembly line and if it cannot be done then it is needed to keep it as much as low quantity. In most of the knit factory in Bangladesh, production quantity is generally higher than others. For this reason, small quantity bundle is difficult. So in that case, target should be to keep the bundle size minimum 10 pieces, which will be helpful for maintaining WIP minimum quantity level.

Maintaining two bundle flows

In traditional system there is no control of bundle flow. In this project work, there was maintained two bundle flow from the starting to ending. So that, controlling of line WIP, identifying the bottleneck process, balancing the line would be easy.

Implementation of traffic light system

It is a quality system designed to identify problems and get help from management to solve those problems. The purpose of this system is to identify quality problems within the needlepoint and to immediately give remedies to stop it from recurring. The chart always starts with YELLOW and moves to either RED or GREEN but will never directly between RED and GREEN. In other words RED and GREEN are always separated by YELLOW.

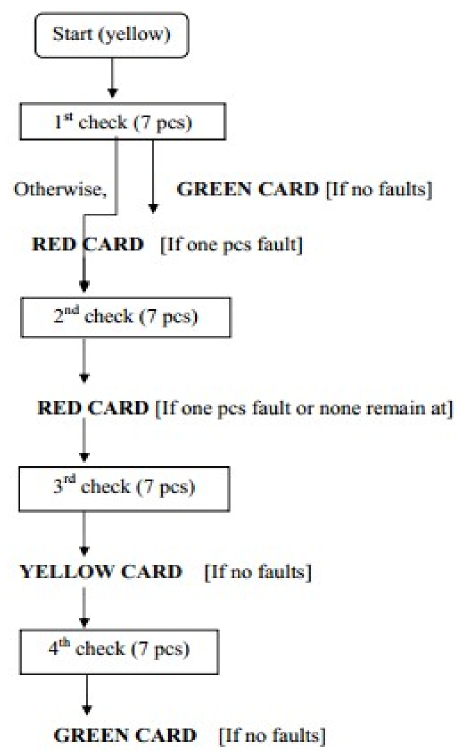

Figure 3.1: SOP of Traffic Light System for maintaining quality

4. Results and discussion

SMV calculation is used for determining workers efficiency, line capacity of a factory unit. It can determine the efficiency of production line, production cost. What should be the production target for the specific operation & for the production line of a specific style can also be measured by using SMV.

4.1 Production capacity calculation

Before JIT implementation,

Production capacity per hour (in pcs) $= \frac{\text{Total man power} \times \text{working hour} \times 60}{\text{SMV}} \times$ Line efficiency%

$= \frac{25 \times 1 \times 60}{6.29} \times 61\%$

= 145.4689 Pcs

≈ 146 Pcs

∴ Production Capacity per shift (in pcs) = (146 × 8) Pcs

= 1168 Pcs

After JIT implementation,

Production capacity per hour (in pcs) $= \frac{\text{Total man power} \times \text{working hour} \times 60}{\text{SMV}} \times$ Line efficiency%

$= \frac{25 \times 1 \times 60}{5.75} \times 61\%$

= 159.1304 Pcs

≈ 160 Pcs

∴ Production Capacity per shift (in pcs) = (160 × 8) Pcs

= 1280 Pcs

∴ Increased production per shift (in pcs) = (1280 – 1168) Pcs

= 112 Pcs

After calculation, Production capacity per shift 1168 pcs and after JIT implementation production capacity per shift is 1280 Pcs and production per shift increased by 112 Pcs.

4.2 Line target calculation

Before JIT implementation:

Line Target per hour $= \frac{Total\ man\ power \times Working\ hour \times 60}{SMV}$

$= \frac{25 \times 1 \times 60}{6.29}$

= 238.4738 Pcs

≈ 239 Pcs

Line Target per shift = (239 × 8) Pcs

= 1912 Pcs

After JIT implementation:

Line Target per hour $= \frac{Total\ man\ power \times Working\ hour \times 60}{SMV}$

$= \frac{25 \times 1 \times 60}{5.75}$

= 260.8696

≈ 261 Pcs

Line Target per shift = (261 × 8) Pcs

= 2088 Pcs

∴ Increased line target per shift = (2088 – 1912) Pcs

= 176 Pcs

Before JIT implementation the line target was 1912 Pcs and after JIT implementation the line target become 2088 pcs. Line target per shift increases by 176 Pcs.

4.3 Line efficiency calculation

Before JIT implementation-

$$\text{Line Efficiency per hour (\%)} = \frac{Total\ production \times SMV}{Total\ man\ power \times Working\ hour \times 60} \times 100$$
$$= \frac{146 \times 6.29}{25 \times 1 \times 60} \times 100$$
$$= 61.22\%$$

After JIT implementation-

$$\text{Line Efficiency per hour (\%)} = \frac{Total\ production \times SMV}{Total\ man\ power \times Working\ hour \times 60} \times 100$$
$$= \frac{160 \times 5.75}{25 \times 1 \times 60} \times 100$$
$$= 61.33\%$$

∴ Increased Line Efficiency per hour (%) = (61.33-61.22) %
= 0.11%

Before JIT implementation the Line efficiency per hour was 61.22% and after JIT implementation the line efficiency become 61.33 %. Line efficiency per hour increased by 0.11%.

4.4 Line performance calculation

Before JIT implementation-

$$\text{Line Performance per hour (\%)} = \frac{\text{Line Output} \times 100}{\text{Line Target}}$$
$$= \frac{146 \times 100}{239}$$
$$= 61.0878$$
$$\approx 61.09\%$$

After JIT implementation-

$$\text{Line Performance per hour (\%)} = \frac{\text{Line Output} \times 100}{\text{Line Target}}$$
$$= \frac{160 \times 100}{261}$$
$$= 61.3027$$
$$\approx 61.30\%$$

∴ Increased Line Performance per hour (%) = (61.30 – 61.09) %
= 0.21%

Before JIT implementation Line Performance was 61.09% and after JIT implementation Line Performance become 61.30%. The increased Line Performance per hour was 0.21%.

4.5 Column chart for comparison of production capacity

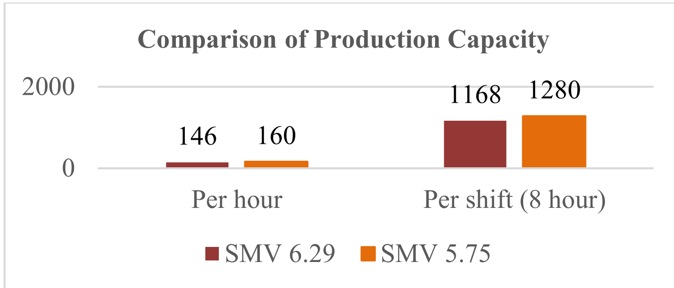

Figure 4.1: Production capacity before and after JIT implementation.

4.6 Column chart for comparison of line target

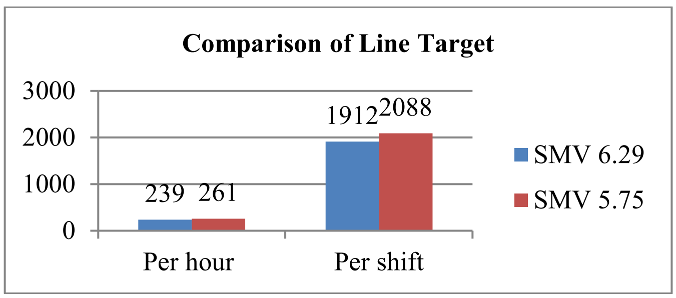

Figure 4.2: Line target before and after JIT implementation.

4.7 Column chart for comparison of line efficiency

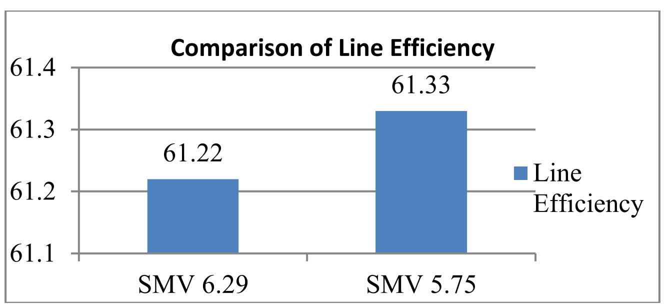

Figure 4.3: Line efficiency before and after JIT implementation.

4.8 Column chart for comparison of line performance

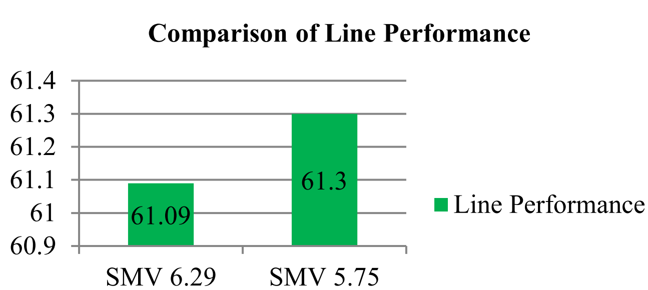

Figure 4.4: Line efficiency before and after JIT implementation.

5. Conclusion

The standard minute value (SMV) is a visualization tool and its goal is to identify, demonstrate and elimination of waste in the process. Before eliminating waste, we must be able to see it. SMV can serve as a starting point to help management, engineers, production associates, schedulers, suppliers, and customers, recognize waste and identify its causes. Before implementation of tools & techniques of JIT training were provided to the people specially supervisor and make them knowledgeable about different types of waste and how to identify waste also reduce waste. Operator also trained on kaizen how small change make work simple and improve visibility of off-standards and they were introduced to changing for better.
In current state assessment it was found that Production Capacity per shift (in pcs) is 1168, line efficiency 61.22% which shows huge opportunities for improvement in those areas. It has started with 5 pieces bundling system in sewing section and then following up the line regularly and capacity study from time to time. After implementation of team work, process integration, job sharing, multi machine operating and balancing the task, eliminating unnecessary activities, team has achieved 61.33%-line efficiency, Production capacity per shift (in pcs) 1280. Besides defects, WIP, transportation also reduced than previous traditional systems.
The study was done with a limited scope as there were limited time and restriction of permission from industrial authority during research work .As industry always go for profit, desired production line allocation were also quite difficult for collecting data. Future work may include super market pull between cuttings and sewing section .Also implementation of SMV and Kanban system to keep WIP at minimum level. The future work may 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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