

IMPROVING WORKING ENVIRONMENT AND PRODUCTIVITY OF A SEWING FLOOR IN RMG INDUSTRY: A CASE STUDY

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Abstract- Kaizen, a continuous improvement of process, is often considered to be the building block of all lean production methods. Kaizen focuses on eliminating waste, improving productivity and achieving sustained continual improvement in targeted activities and processes of an organization. Kaizen is not implemented vastly in garments industries. There is a tremendous scope of using kaizen in garments industries. This paper's objective is to show the effects of using kaizen in garments industries. The aim was to reduce Work In Progress (WIP) and to improve the working environment so as to improve productivity. Kaizen was implemented as a short term project in a sewing floor of a RMG industry and the effects was investigated during implementation. Implementing kaizen in sewing floor, the productivity has been increased while wastes and defects are reduced. The KAIZEN implementation reduced Defects per Hundred Units. This paper emphasizes on the continuous improvement in readymade garments industries.

Keywords: Kaizen, Lean Manufacturing, Non value-added activity, Line Efficiency, 5S score

1. INTRODUCTION

The apparel industry is one of the pillar industries of Bangladesh. Bangladesh is the 3rd largest apparel exporting country in the world [1]. The Readymade Garments (RMG) industry is the largest single economic sector in Bangladesh which contributes to 76% of national exports and 90% of manufacturing goods exports [2]. The garment industry is highly labor-intensive and employs approximately two million workers, out of which 90 per cent are women [3]. Therefore, Bangladesh has around 70 millions of available low cost workers who could be easily trainable and engaged in the apparel sector. [4]

As the garments industries are labor intensive the best utilizing of labors of the industry will assure the highest profit of company. Lean production is founded on the idea of kaizen or continual improvement. This philosophy implies that small incremental changes routinely applied and sustained over a long period result in significant improvements. Using lean, continuous improvement is done dramatically. In addition to this lean production involves, motivates and develop employee skills through education and multi-skilling program [5].

Lean assures the best utilization of labors. Also, information management could be made much simpler and more accurate in the system [6].

2. BACKGROUND

Transforming raw materials and information into parts or products which the customer wants is called

Value-Adding Activities. Which consume resources, but don't directly contribute to the product are called Non-Value-Adding Activities. A major concern of lean manufacturing is to reduce these Non-Value-Adding activities that badly decrease the productivity. Moreover, according to lean principle, there are seven types of wastes in manufacturing such as defective products, overproduction, inventories, excess motion, processing, transportation and waiting. Kaizen acts as a tool that helps reduce these wastes and Non-Value-Adding activities and thus leads to improved productivity. Kaizen Breakthrough is the team-based energy and creativity drives immediate process improvement.

2.1 Shopfloor Kaizen Breakthrough

Kaizen has become a part of the Japanese manufacturing system and has contributed enormously to the manufacturing success [7]. Kaizen Breakthrough is a cross-functional, team-based process for rapid improvement. It is the process of fast change through involvement.

The Kaizen Breakthrough Methodology is a short term like a five-day improvement project conducted on shop floor or office to help identify wastes and reconfigure operations to achieve more streamlined, value added processes. The philosophy of kaizen, which simply means continuous improvement, is the starting place for all lean production improvements. Kaizen events are opportunities to make focused changes in the workplace. Kaizen for the Shop floor takes through the critical steps in conducting a very effective kaizen event

one that is well planned, well implemented, and well documented. Kaizen teams are empowered to make immediate business process changes. At the end of a kaizen breakthrough event these teams typically achieve double-digit reductions in lead time, inventory, defects, and floor space and 25 to 50 percent increases in productivity. The principles of Shopfloor Kaizen Breakthrough (SKB) are-

- Clear objectives
- Team process
- Tight focus on time (one week)
- Quick and simple, action first
- Necessary resources available right away
- Immediate results (new process functioning by end of week)

3. METHODOLOGIES

The implementation of Kaizen is that it works on a small area and works on a small change to improve the overall productivity. The Kaizen implementation event was a five days activity. A sewing line named YHT-02(B) of Youngone Sportswear Hi-tech Company Limited, DEPZ, Savar, Dhaka had been selected for implementation. The style no. 376819 ordered by NIKE was sewing on that line. Total summarizations of Kaizen implementation are given below-

- Lean training to the operator, line supervisor and other relevant persons.
- Existing data collection and finalizing objectives.
- Audit of 5S of existing layout and taking corrective action plan. Auditing 5S after taking these corrective actions.
- Taking quality actions by identifying top 5 defects of current sewing line. Identifying root causes of these defects and take corrective action plan to reduce these top 5 defects.
- Taking some maintenance actions such as daily checklists for operators & mechanics to reduce uncertain breakdown and bad quality.
- Visualizing hour & hour chart of the sewing line.

3.1 Details of Kaizen Implementation

On the first day, the first task of implementing Kaizen was to train the operator, line supervisor and other relevant persons about Lean, Kaizen and other necessary information.

5S is a process and method for creating and maintaining a safe, organized, clean and high-performance workplace. It is a conditioning discipline for kaizen. 5S works on the working environment of the garments. The name of factors and their descriptions are listed in table 1. The 5S score evaluation & scoring criteria are that five or more than five problems are considered as zero score. Four problems are considered as one score. Similarly three problems, two problems, one problem and zero problems are considered as two score, three score, four score and five score respectively.

Work In Progress (WIP) is one of the fundamentals in building a 'Lean' environment in a business. It is often an overlooked part of the practice to reduce lead times and increase factory performance. WIP is one of the key

performance indicators which directly influence various areas of production. WIP costs money (material, labor and overheads) to produce and excess WIP means an excess of working capital tied up in a resource that is not adding any value. Work in Progress (WIP) of garments can be expressed in the number of pieces by simply recording daily production figures between each process and accumulating the difference between sequential processes. For example, if 10,000 pieces are be cut but only 6,000 pieces are sewed then WIP in sewing will have to be reduced by 4,000 pieces on that day. On the first day, the observed existing WIP of the line was 152 pieces of garments.

Table 1: 5S score sheet before kaizen implementation

Sl. No.	Factors	Score	Note for the next level of improvement
1	Unnecessary Items	1	1. Found previous defective Garments 2. Found unnecessary yarn 3. Defective yarns were there 4. Unnecessary fabrics were present
2	Safety	3	1. Boxes were not in their position. 2. Large items were stored incorrectly
3	Material Storage	2	1. Defective garments were stored in the tray 2. Previously other items of defective garments were present 3. Unnecessary fabrics were stored
4	Tools & Gages	3	1. No specific place for tools 2. Tools were not standardized
5	Cleaning Equipment & Materials	3	1. Brooms were stored in the tray 2. No specific place for brooms
6	Emergency Equipment	1	1. No specific point for emergency equipment 2. Emergency equipments were not colored 3. Not sufficient equipment 4. Emergency equipments were not maintained properly.
7	Aisles	3	1. Trays were

			present in aisles 2. Fabrics were present in the aisles
8	Floor (Cleaning)	2	1. Fabrics were present in the floor 2. Shoes were also present 3. Unnecessary yarns were found
9	Equipment (Cleanliness)	2	1. Dust in equipment 2. Unnecessary oil were always in the equipment 3. Work surface were not clean
10	Equipment (maintenance)	2	1. Dust in the equipment 2. Oil leakage in equipment 3. Dust in light code
11	Visual Management	0	No visual management
12	5S Control (Posted)	0	No 5S
Total		22	
5S Score		22/12 = 1.83	

The main objective of lean is to reduce wastes. In sewing floor defective garments are regarded as wastes. Defects are very common in sewing floor. So if defects are reduced wastes are also reduced. It also improves quality garments. There are different types of defects that can occur in sewing floor. But defects which occur frequently and respectively are to be given priority. So reduction in these defects will result in reduction of total defects of sewing floor and so efficiency, productivity, and quality will increase dramatically. Data have been gathered of the previous week of Kaizen implementation from line YHT-2 B of Youngone Sportswear. Figure 1 shows the defects occurred in last one week. Here the defects broken stitch, wrong stitch, run off stitch, ironing, needle pick, pleat, skip stitch occur most times.

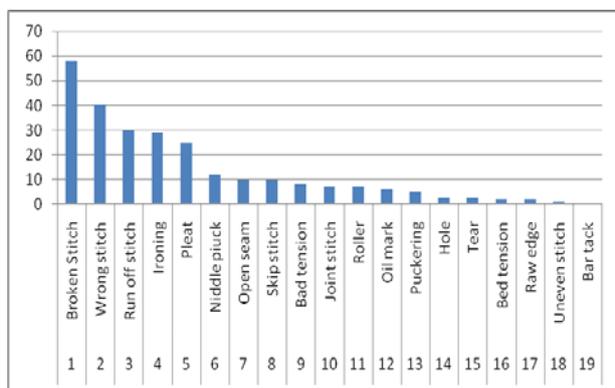


Fig.1: Defect frequency of last one week in line YHT-2 B of Youngone Sportswear

The root cause analysis has been carried out for mostly occurring defects. Figure 2 exhibits the fish bone diagram of a defective garment. This fish bone diagram identifies the causes of top five defects. To reduce these defects some corrective action plans are taken. Those corrective actions are listed in table 2.

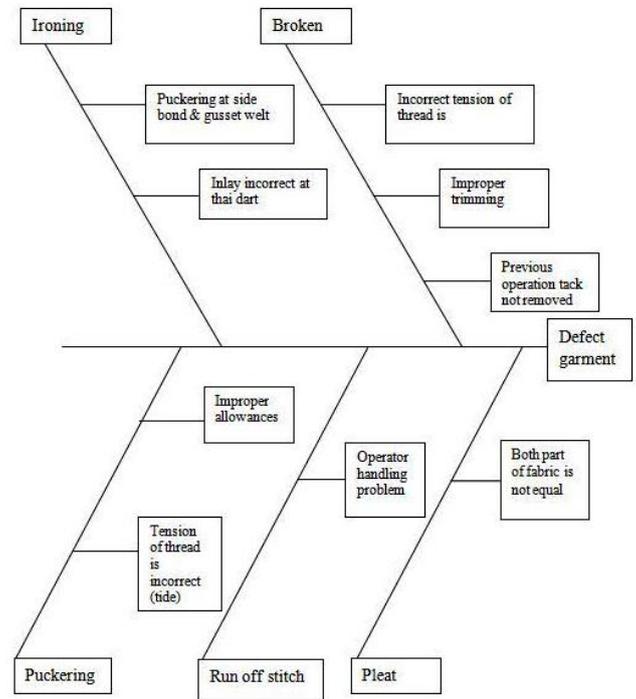


Fig.2: Fish bone diagram for defective garments

Table 2: Top 5 defects and action plan

Quality issue	Actions taken
Ironing	1. Bond needs to keep tide from top while sewing. 2. Added gauge and made the operation easy for the operator by following gauge properly.
Broken	1. Tension of bobbin case & needle thread is adjusted 2. Made work easy for the operators & advice to trim attentively.
Puckering	1. Tension of bobbin cage & needle thread is adjusted 2. Made work easy for the operator by using gauge & advice to give 1cm allowance properly
Run off stitch	1. Operators are advised to follow the rules properly
Pleat	1. Previous operation is made correct by giving 1 cm allowance. 2. Made the operation easy for the operator by using cut mark.

The existing 5S score of the sewing floor was 1.83. To increase the working environment as well as 5S score some corrective actions were taken. These corrective actions are listed below-

1. Removal of unnecessary items
2. Displaying MSDS and SOP
3. Material storage review
4. Stretcher not to be blocked
5. Easy access to first aid box
6. Checking trays coming way
7. Proper Operator movement
8. Floor cleaning
9. Cleaning Machines
10. 5S audit

4. DATA ANALYSIS

DHU is the total no. of defects found in all the inspected garments in hundred units. DHU is considered as the total no of defect points of all defect garments. DHU is an important quality indicator.

$$DHU = \frac{\text{Total no. of defects of inspected products}}{\text{No. of inspected products}} \quad (1)$$

On the first day, the total no. of inspected garments was 259 and the total no. of defect points was 347. By using Eq. (1), DHU can be found to be 134.

After taking the corrective actions defects are reduced. Here it is noticed that DHU is reduced by taking the corrective actions of defects. The DHU for that week is given in table 3.

Table 3: DHU chart of the week

Day	23-Nov	24-Nov	25-Nov	26-Nov	27-Nov
DHU	134	118	143	92	51
No. of Defect points	347	330	386	271	159
No. of inspected products	259	280	270	295	312

The existing 5S score of the sewing floor was 1.83. The details of 5S score after Kaizen implementation are listed in table 4. After taking corrective actions, 5S score has been increased from 1.83 to 3.17.

Table 4: 5S score sheet after kaizen implementation

Sl. No.	Factors	Score	Note for the next level of improvement
1	Unnecessary Items	3	1. Unnecessary fabrics are present 2. Unnecessary yarns are present
2	Safety	4	1. Large items are stored incorrectly
3	Material Storage	3	1. Defective garments are stored in the tray 2. Unnecessary fabrics are stored

4	Tools & Gages	4	1. Tools are not standardized
5	Cleaning Equipment & Materials	4	1. No specific color code for brooms
6	Emergency Equipment	3	1. Emergency equipments are not colored 2. Not sufficient equipment
7	Aisles	3	1. Unnecessary yarns are present in the aisles 2. Fabrics are present in the aisles
8	Floor (Cleaning)	3	1. Fabrics are present in the floor 2. Unnecessary yarns are found
9	Equipment (Cleanliness)	1	1. Unnecessary oil is always in the equipment 2. Work surfaces are not clean
10	Equipment (maintenance)	5	–
11	Visual Management	2	1. Not correctly specific 2. Is not updated Hourly 3. Congested area, tough to visualize
12	5S Control (Posted)	3	1. Counter measures implemented 2. Results are not graphed
Total		38	
5S Score		38/12 = 3.17	

During implementing kaizen, the observed Work In Progresses are given in table 5. The WIP has lessened gradually. This happened because of total productive maintenance of operators and equipments. Mentoring, control and improvement in processes have resulted in this reduction of WIP.

Table 5: Observed WIP during implementing Kaizen

Day	23-Nov	24-Nov	25-Nov	26-Nov	27-Nov
WIP	152	145	133	121	106

5. RESULTS AND DISCUSSIONS

Before implementing Kaizen 5S score was 1.83. Here the 5S score was based on twelve important factors of garment environment. A new approach named visualization system has been introduced there. The present condition of output hour by hour is visualized. The number of defects and most defects are also visualized. So the result is that the competition among

worker increased. If there is also a system for extra incentive for good performance, operator will also be motivated. Actually the performance of output highly depends on the working environment. Improving the working environment by making it clean and worker friendly, the operators have become self motivated to concentrate to the work. So the output of the operators has been increased automatically. In other word productivity depends on operators psychological factors. Before implementing Kaizen the 5S score was 1.83 but after implementing, monitoring, and controlling 5S approach the 5S score gets 3.17.

Bangladeshi garments are usually hundred percent exports oriented. Buyer requirement is to have the hundred percent quality products. But defects are common in sewing floors and it cannot be fully eliminated. After analyzing cause and effect diagram, it is found that few defects are common and occur maximum time. The root causes of those defects have been identified and corrective actions have been taken. Then the DHU has reduced rapidly. Before implementing Kaizen the DHU was 134 but after implementing Kaizen the DHU has turned to 51. Figure 3 exhibits the day by day reduction in DHU with the implementation of Kaizen.

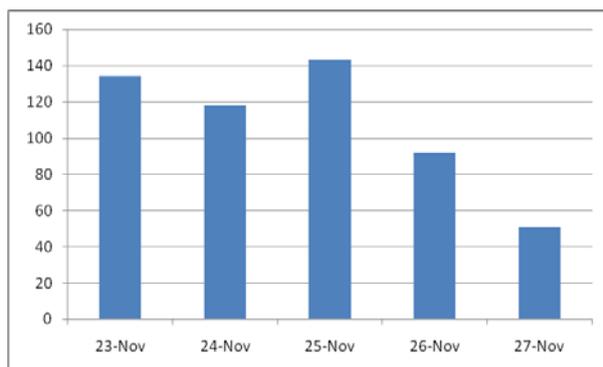


Fig. 3: Reduction in DHU day by day

The visualization system was introduced in the line. The hour by hour output, the total numbers of defects, top five defective operators, and the defect quantity have been showed in the visualization system. So the line supervisor could easily identify the problems and could take corrective actions to reduce those problems. If the visualization system is monitored properly, the DHU will also reduce more in future operations.

Before implementing Kaizen work in progress (WIP) of garments was 152. After implementing Kaizen work in progress (WIP) garments were reduced to 106. This WIP has reduced because of improvement in working environment and processes and so as efficiency, reduction in defects, and total productive maintenance (TPM) introduced for both machine and operators. All the works for the line were distributed equally such as line supervisor, water spider and operators. So monitoring in line has been better than pre Kaizen and WIP thus has been reduced. Figure 4 exhibits the day by day reduction in WIP with the implementation of Kaizen and table 6 summarizes the overall results of Kaizen implementation.

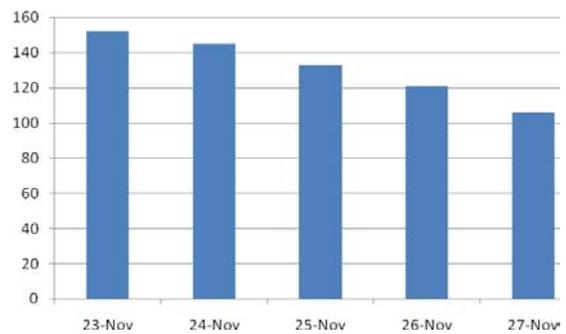


Fig. 4: Day by day WIP reduction while implementing kaizen

Table 6: Results

Sl.	Objectives	Before KAIZEN implemen tation	After KAIZEN implemen tation	Result
1	DHU	134	51	62% reduced
2	5S Score	1.83	3.17	Increase by 1.34
3	WIP	152	106	30% down

6. CONCLUSIONS

The power of teamwork and collaboration is explored in shop floor kaizen break through (SKB) approach. The SKB was a 5 days activity which started from a small area to improve the overall productivity, efficiency and quality. The results of before Kaizen implementation and after Kaizen implementation are surprisingly fruitful. After implementing Kaizen DHU reduces from 134 pieces to 51 pieces, 5S score improves from 1.83 to 3.17, and WIP reduces from 152 to 106. The working environment has been tremendously improved as well. At the end of the week, dramatic operational improvements have been achieved. But it is a matter of great concern that most of the industries in Bangladesh are not conscious and even they don't know the techniques about implementing Kaizen and its benefits. Bangladeshi garments industries have the low cost labor, but they could not make the highest profit because of not implementing new techniques such as lean, kaizen, 5S. Some apparel industries using these techniques are in the leading position. In modern competitive market implementation of Kaizen or continuous improvement is badly needed.

7. RECOMMENDATIONS

A 30-days action for future improvements has been identified to implement for the line. Some recommendations can be made for further improvements. Motivating plans (incentives, prizes, training etc.) could be prepared to increase operators' performance. Operators training plan could be prepared to provide adequate training on lean manufacturing and Kaizen. The training plan must be reviewed. For team based working team leaders could be introduced.

8. REFERENCES

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9. NOMENCLATURE

Symbol	Meaning	Unit
<i>SKB</i>	Shopfloor Kaizen Breakthrough	Dimensionless
<i>DHU</i>	Defect per Hundred Unit	„
<i>WIP</i>	Work in Progress	„
<i>MSDS</i>	Material Safety Data Sheet	„
<i>SOP</i>	Standard Operating Procedure	„
<i>TPM</i>	Total Productive Maintenance	„