International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Enhancing Sewing Quality in the Apparel Industry of Bangladesh through 5S and PDCA: A Minimization Approach for Defects

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DOI: https://doi.org/10.55248/gengpi.4.823.13401346

ABSTRACT

The RMG sector is a key contributor to Bangladesh's GDP. To ensure its sustained growth and profitability, adopting new tools is essential. This study focuses on implementing 5S, a lean tool, to enhance the quality and productivity of the RMG production system. However, certain limitations hinder the implementation process. This research examines the impact of 5S on reducing lean wastes and improving performance in the sewing line production. The findings provide valuable insights for overcoming implementation challenges and improving productivity in the RMG sector.

Keywords : Implementing 5S & PDCA, Minimization of sewing defects, Reducing lean waste, DHU calculation.

Introduction

The RMG (Ready-Made Garments) sector in Bangladesh is crucial for the country's development, accounting for over 80% of its total export earnings and employing approximately 40% of the manufacturing workforce. In today's competitive market, the key factor is time, and companies that can provide goods with shorter lead times gain a competitive edge [1].

With the rapidly changing economic landscape worldwide, there is an increased focus on profit margins and enhanced productivity. Garment production often faces challenges such as rejected items due to lower quality raw materials, defective techniques, or inappropriate worker attitudes. Unfortunately, there is no ready-made solution to address these issues, which is why increasing the Right First Time percentage is crucial. Re-works in the garments industry disrupt the manufacturing process and hinder the production of standardized products in the first attempt.

Many garment manufacturing firms emphasize minimizing garment wastes to achieve maximum benefits and economic growth by implementing lean tools and techniques. Tennant and Geoff stress the importance of eliminating defective items and improving productivity through continuous improvement processes [2]. Understanding client demand and implementing the appropriate techniques are vital for business success. Pareto analysis is employed to identify the top defect positions, and cause-effect diagrams help to identify and visually display the root causes of quality and functional problems [3].

To meet the demand for shorter lead times, it is essential to implement tools that aid in achieving this goal. Several countries in the world have already embraced such concepts in their garment industry to enhance processing performance. However, in Bangladesh, there is a lack of expert minds to bring these concepts to fruition, as many garment industries prefer conventional methods over innovative strategies.

The major challenges faced by the RMG sector in Bangladesh are productivity and waste. To address these issues, a case study focusing on implementing the concept of 5S in the sewing section to eliminate lean waste, such as defects and unnecessary motion, has been conducted. The research paper explores the sewing segment of a garment industry that produces Knit T-Shirts. Pareto charts and cause-effect diagrams are used to identify and categorize the reasons responsible for defects in the production lines. Subsequently, the 5S methodology and the Plan Do Check Act (PDCA) cycle have been implemented to reduce the garment defect rate.

Literature Review

During the 1980s, a paradigm shift occurred in factories across the US and Europe. Japanese manufacturing companies introduced "Just-in-Time" as a better paradigm, challenging mass production and scientific management techniques from the early 1900s [4]. This Japanese manufacturing concept became known as "lean production." Lean Manufacturing is a systematic approach to identifying and eliminating waste through continuous improvement, flowing the product according to customer demand [5].

Various types of wastes can affect production efficiency and product quality in manufacturing industries. Lean manufacturing categorizes these non-value-adding activities and wastes into seven types, including overproduction, waiting, transportation or conveyance, over processing or incorrect processing, excess inventory, defects, and excess motion [7].

Lean production and its tools such as Just-in-Time (JIT) and Total Quality Management (TQM) were widely implemented in manufacturing industries in the 2000s [8]. Lean tools like 5S, kaizen, Kanban, and PDCA are used to improve production processes. However, these tools are not widely familiar or implemented in Bangladesh compared to countries like China, Japan, and India [9].

5S is a lean method used for process improvement, waste reduction, and increased labor productivity. The 5S components include Sort, Set in Order, Shine, Standardize, and Sustain. These components provide a methodology for organizing, cleaning, developing, and sustaining a productive work environment [10]. Successful implementation of 5S improves work conditions, productivity, and reduces waste and downtime.

The PDCA (Plan-Do-Check-Act) cycle is a central process for continuous improvement. It involves comparing actual results with targets, identifying disparities, and taking corrective measures. PDCA is often referred to as the Deming cycle and is essential for quality management. Another variation is the PDSA (Plan-Do-Study-Act) cycle.

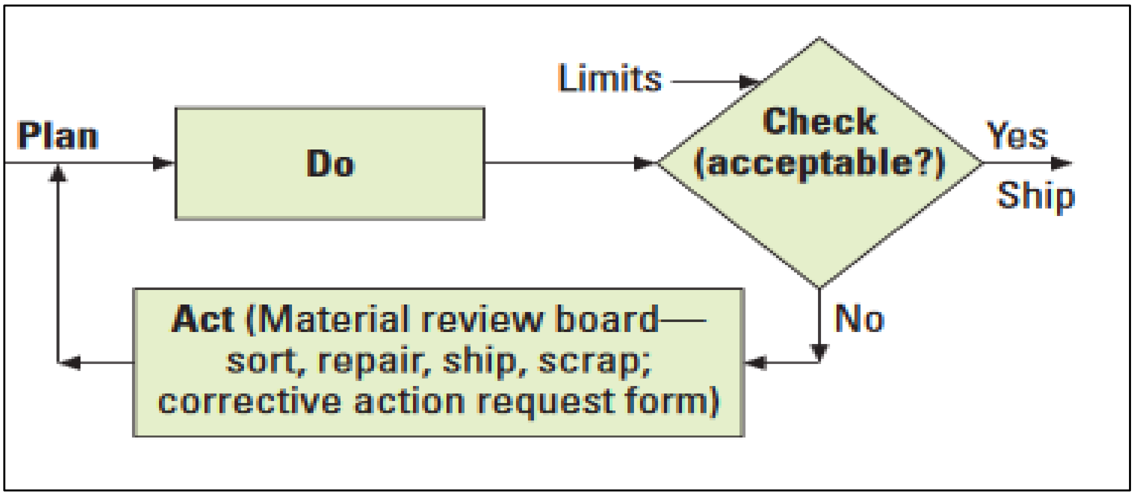

Figure 1 - PDCA Cycle for Product Management

The PDCA cycle is also incorporated in the ISO 9001 quality management system. It involves planning, implementing, monitoring, measuring, and taking actions to continually improve processes [8].

According to lean concepts there are 7 types of wastes.

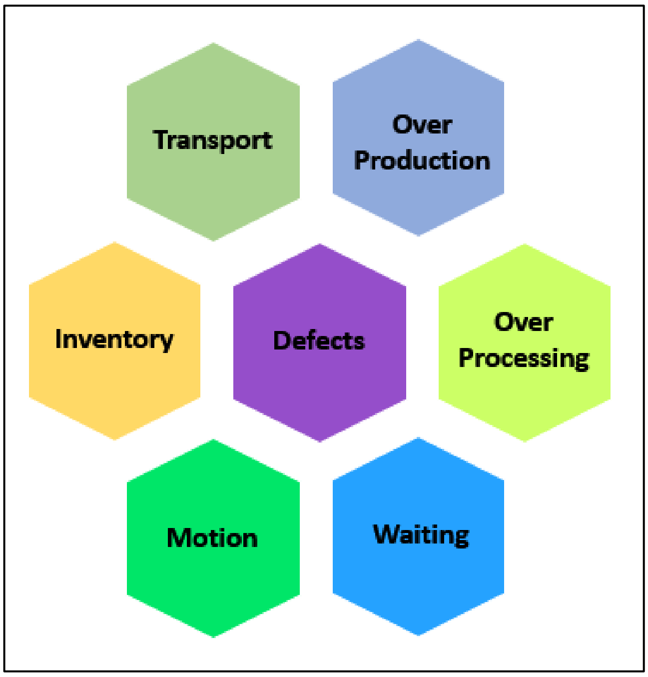

Figure 2 - 7 Types of Wastes in Lean Concept

The measurement of 5S is based on five criteria:

S1 Seiri (Sort): Sorting and minimizing waste of time while improving process performance by ensuring materials availability [11]. This involves identifying and sorting necessary and unnecessary items in the workplace for further processing [12].

S2 Seiton (Set in order): Settling things in the right order to facilitate easy retrieval and disposal [12]. It helps eliminate waste in various manufacturing operations.

S3 Seiso (Shine/Clean): Daily cleaning practices, essential for eliminating lean wastes such as defective garments and unnecessary drawings in garment manufacturing [2]. A clean workplace ensures effectiveness, reduces untidiness, indiscipline, inefficiency, faulty production, and work accidents. The Seiso process focuses on renovating the workplace [11].

S4 Seiketsu (Standardize): Establishing the highest standard to maintain overall work efficiency and quality in the manufacturing system.

S5 Shitsuke (Sustain): Ensuring the sustainability of the established standard to prevent underutilization of facilities and maintaining a clean workplace for smooth workflow [5]. Before implementing 5S, we identified the types of waste present on the sewing floor and the factors responsible for them.

Research Methodology

A garment factory, Epyllion Styles Ltd., (Epyllion Knitex Ltd.), located in Rajendropur, Gazipur, Dhaka, Bangladesh was selected for the research. Research work was conducted within the selected factory. Data was collected on sewing defects provided by the management of the factory's sewing section.

It was identified that various lean wastes present in the sewing section based on the observations. The 5S methodology were implemented and analyzed the current state of the sewing section. Guidelines were provided for the further implementation of 5S and improving the production system.

Data Collection and Analysis Method

This research is a case study based on an exploratory and descriptive approach. Primary and secondary data were collected using appropriate methods.

Table-1: Sources and Methods of Data Collection

Steps	Methods	Sources
Primary Data Collection	Interview, Email	Executives, Industrial Engineering
Secondary Data Collection	Literature Review	Books, Journals
Analysis of Data	Qualitative & Quantitative	Data from questionnaire and interview

Results & Discussion

Table-2: Profile – waste of time in sewing section

Types	Reason/ Result	Which/Who is Responsible?			
		Man	Machine	Material	Others
Over production	Produce more than order	✓	✓	✓	
Non value added processing	More process step	✓	✓		
	Rework	✓	✓	✓	
	Inspection	✓			
Waiting	Stock out	✓			
	Lot processing delays	✓	✓	✓	✓
	Equipment down time	✓	✓		
	Capacity bottleneck	✓	✓		
Defect	Replace production	✓	✓		✓

Excess motion	Poor work flow	✓			
	Undocumented work method	✓			
Unnecessary transportation	Transporting WIP long distance	✓			

Table-3: 5S and Waste elimination matrix

7 wastages of sewing line	Identified problems	Stores	Stitching	Finishing	Office Area	Action Required
1. Transportation	Floor marking	No	No	No	No	Seiton
	Path ways defined	No	No	No	No	Seiton
2. Inventory	File arrangement	No	No	No	No	Seiton
	Different type of thread of same style	No	Yes	No	No	Seiton
	Unnecessary items in locker	No	Yes	No	Yes	Seiri
3. Motion	Unnecessary activities	No	Yes	No	Yes	Seiri
	Thread mistake	Yes	Yes	No	No	Seiri
4. Waiting	Left over present	Yes	Yes	Yes	No	Seiri
5. Over processing	Oil spot	No	Yes	No	No	Seiri
	Bottle neck	No	Yes	No	No	Seiri
6. Over Production	Failure in balancing efficient operator	No	Yes	Yes	No	Seiton
7. Defects	Sharpe tools	Yes	Yes	No	Yes	Seiri
	Holes while cutting thread by operator	No	Yes	Yes	No	Seiri
	Uneven stitching	No	Yes	No	No	Seiri

DHU Calculation

Efficiency refers to the evaluation of actual production or performance in relation to its maximum potential. In simpler terms, efficiency is calculated as the percentage of output achieved relative to the input. When it comes to the sewing floor, the efficiency equation can be expressed as follows:

$$Efficiency = \frac{Total\ output\ per\ day\ per\ line * SMV}{\text{Total manpower per line} * \text{Total operating minute}}\ X\ 100$$

(Equation -1)

Table-4: Day by day observed output of the line

Day	1	2	3	4	5
Output	165	172	195	200	225

Table-5: Comparison of efficiency before and after implementing 5s:

Parameters	Before implementing 5s	After implementing 5s
Total output per line per day	165	312
SMV	54	54
Total manpower	32	32
Total working minute	8 hrs (480 minutes)	8 hrs (480 minutes)
Efficiency (by using equation – 1)	58%	79%

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

$$\text{DHU} = \frac{Total\ number\ of\ defects\ in\ inspected\ products}{\text{Number of inspected products}}\ X\ 100$$

(Equation -2)

On the initial day, a total of 165 garments were inspected, revealing a combined count of 347 defect points. Utilizing Equation [2], DHU was calculated and determined to be 134. Following the implementation of corrective measures, defects were reduced. Notably, it was observed that DHU decreased as a result of these corrective actions. The DHU values for the entire week are presented in Table 5.

Table-5: DHU chart of the week

Day	**1**	**2**	**3**	**4**	**5**
DHU	127	119	102	90	67
No. of Defect points	210	205	199	180	150
No. of inspected products	165	172	195	200	225

Once the profile waste elimination matrix is completed, the workplace checklist is conducted [1]. This checklist helps assess the current state of the sewing lines and determine their 5S level.

Table-6: 5s workplace checklist for sewing section

Rating Level	**Number of Problems**	
Level 4	4 or More	Waste is anything other than the minimum amount of equipment, materials, parts, space, and workers time which are absolutely essential to add value to the product.
Level 3	3	
Level 2	2	
Level 1	1	
Level 0	No Problem	

Category	**Item**	**Level**
Sort (When in doubt, Sort it out!)	**Eliminate the clutter; sort out what is not needed.**	
	Excess/unneeded machine, table, basket, trolley are in area.	3
	Items are present in aisle ways, corners etc.	2
	Excess/unneeded inventory, supplies, materials are in area.	3
	Safety hazard existing in the floor is dust of fabrics.	1
Set In Order (A place for everything and everything in its place!)	**Organize and level, set boundaries and limits.**	
	Correct places for items are not clearly marked or labeled.	2
	Items such as trolley, basket for thread and scrap are not marked with “return addresses”.	2
	Aisle ways, unused machines, inventory locations are not marked.	2
	Height and quantity limits are not clearly marked.	2
Shine (Inspection through cleaning!)	**Clean everything inside and out.**	
	Machines are not properly cleaned.	1
	Floors, walls and stairs are not properly cleaned.	2
	Shortage of appropriate cleaning materials	1
	Lines, safety signs are hard to see.	2

Visual evidence showcasing the successful implementation of the 5S methodology within the chosen sewing line

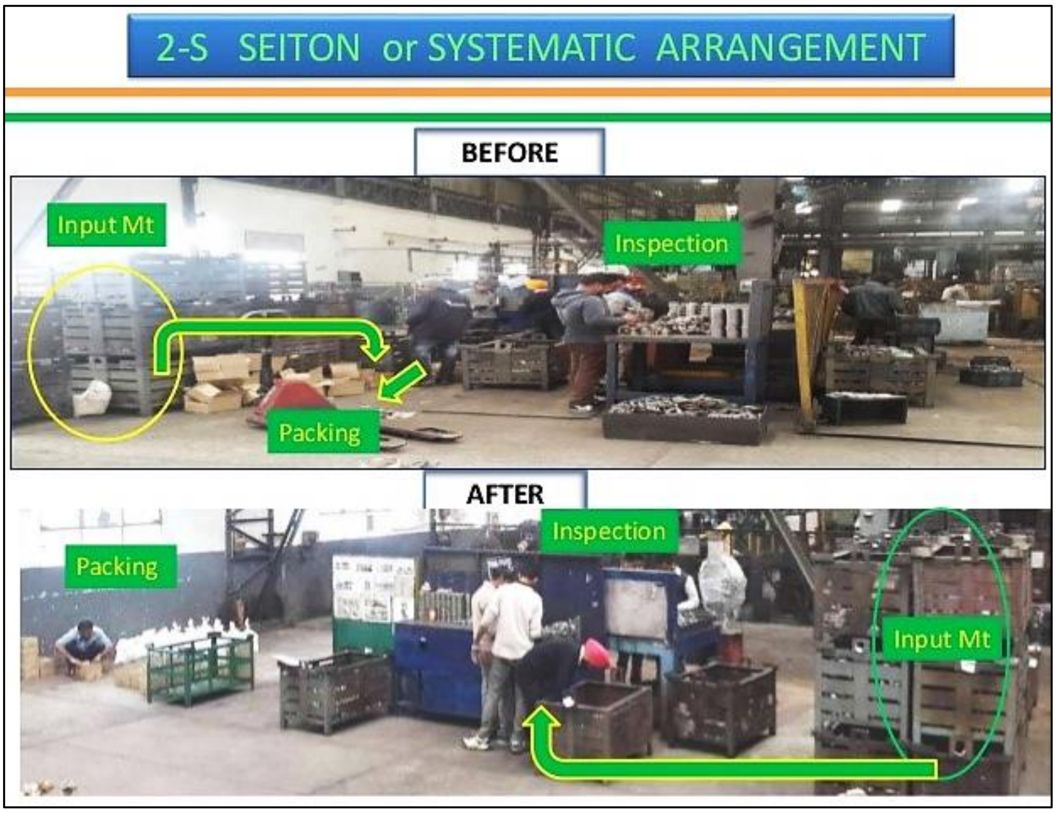

Figure 3 – Gaining more efficiency through systematic arrangement

Figure 4 – Comparison of sewing section before and after implementing 5S

Recommendation

When implementing the 5S methodology, it is important to consider the following cautions:

Begin with a fixed area: Initiate the first three pillars of 5S (Sort, Set in Order, and Shine) by selecting a specific area within the factory. This focused approach allows for a more manageable implementation and helps establish a solid foundation for the methodology.

Gradual expansion to the entire factory: Once the fixed area has successfully undergone the 5S process, gradually extend the implementation to encompass the entire factory. This phased approach ensures a smooth transition and allows for adjustments based on lessons learned during the initial implementation.

Development of standards and checklists: Establish clear standards for each step of the 5S methodology. Create checklists to ensure consistency and provide guidance for employees during the implementation process. Regularly review and update these standards and checklists to adapt to changing needs and improve effectiveness.

Create an educational environment: Foster an educational atmosphere by utilizing visual aids such as pictures and posters. These tools help communicate the principles and benefits of 5S to employees. The 5S team should regularly organize educational activities to reinforce the importance of maintaining a clean and organized workplace, ideally on a monthly basis. By heeding these cautions, organizations can enhance the success of their 5S implementation, promoting a culture of continuous improvement and ensuring the sustained benefits of a well-organized and efficient workplace.

Conclusion

In conclusion, this study has provided an overview of the sewing section in the selected garments industry, focusing on productivity, quality, and waste. Through the application of the 5S analysis, it has been observed that numerous unnecessary items, redundant tools, unwanted equipment, and inefficient motions exist within the sewing section. Additionally, the presence of defects indicates a need for improvement in the working process.

To enhance the overall performance of the sewing section, several recommendations are proposed. Firstly, providing proper and adequate training for inexperienced sewing operators is essential to improve their skills and efficiency. Furthermore, implementing a systematic maintenance system for various sewing machines can contribute to enhanced performance. Additionally, establishing a daily 5S audit system and ensuring its proper maintenance in the sewing section will facilitate continual improvement and optimal performance.

By implementing these recommendations, the sewing section can achieve improved productivity, enhanced quality, and reduced waste, ultimately leading to the overall advancement of the garments industry. Further research and practical implementation of these suggestions are encouraged to validate their effectiveness and maximize the benefits to the organization.

Acknowledgment

None.

Conflict of Interest

No conflict of interest.

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