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Implementation of 5S in Product Development Section of Apparel Industry in Bangladesh

Uvajanje načel 5S v oddelku za razvoj izdelkov v oblačilni industriji v Bangladešu

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Abstract

Efficient product development is the cornerstone of the garment industry, where customer satisfaction, quality control, cost-effectiveness and technological advancement converge. The product development department ensures the production of high-quality samples to secure order confirmations. This research explores the implementation of the 5S principles within the sample section of Esquire Knit Composite Ltd, Bangladesh. Using a two-phased case study approach, this research identifies inefficiencies and proposes solutions for a cleaner, more assembled and more efficient workstation. By implementing the 5S principles, i.e. Sort, Set in Order, Shine, Standardise and Sustain, the study demonstrates measurable operational improvements, including a reduction in sample-related defects, shortened equipment and material search time, improved workplace cleanliness and safety conditions, and enhanced workflow organisation. The structured reorganisation of storage, labelling systems and cleaning responsibilities further enabled faster sample dispatch and reduced the risk of mixing buyer-specific materials. These outcomes indicate not only qualitative improvements in employee engagement and workplace discipline but also quantifiable gains in efficiency and productivity within the sample development process. Overall, the findings confirm the transformative potential of 5S principles in improving sample section performance and provide practical evidence for lean implementation in garment product development environments.

Keywords: product development, sample section, efficiency improvement, lean manufacturing

Izvleček

Učinkovit razvoj izdelkov predstavlja temelj oblačilne industrije, kjer se prepletajo zadovoljstvo kupcev, nadzor kakovosti, stroškovna učinkovitost in tehnološki napredek. Oddelk za razvoj izdelkov zagotavlja izdelavo visokokakovostnih vzorcev za pridobitev potrditve naročil. Raziskava obravnava uvajanje načel 5S v vzorčnem oddelku podjetja Esquire Knit Composite Ltd v Bangladešu. Z uporabo dvostopenjskega pristopa študije primera raziskava opredeljuje neučinkovitosti in predlaga rešitve za čistejše, bolj urejeno in učinkovitejše delovno okolje. Z uporabo načel 5S, tj. razvrščanje



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(Sort), urejanje (Set in Order), čiščenje (Shine), standardizacija (Standardise) in vzdrževanje (Sustain), raziskava prikazuje merljive izboljšave delovanja, vključno z zmanjšanjem napak, povezanih z vzorci, skrajšanjem časa iskanja opreme in materialov, izboljšanjem čistoče in varnosti na delovnem mestu ter boljšo organizacijo delovnih tokov. Strukturirana reorganizacija skladiščenja, sistemov označevanja in odgovornosti za čiščenje je dodatno omogočila hitrejše pošiljanje vzorcev ter zmanjšala tveganje mešanja materialov, namenjenih posameznim kupcem. Rezultati ne kažejo le kvalitativnih izboljšav v zavzetosti zaposlenih in delovni disciplini, temveč tudi kvantitativne pridobitve na področju učinkovitosti in produktivnosti v procesu razvoja vzorcev. Ugotovitve potrjujejo potencial načel 5S za izboljšanje učinkovitosti vzorčnega oddelka ter ponujajo praktične dokaze za uvajanje vitke proizvodnje v okoljih razvoja oblačilnih izdelkov. Ključne besede: razvoj izdelkov, vzorčni oddelek, izboljšanje učinkovitosti, vitka proizvodnja

1 Introduction

A successful product development in the garment industry hinges on a delicate balance of factors: technological advancement, robust engineering, cost-effectiveness, unwavering commitment to quality control and, most importantly, unwavering customer satisfaction [1]. The core objective of any industry lies in fulfilling both the explicit and implicit needs of its clientele. Within the garment sector, the product development department plays a critical role in ensuring effective sample development and order confirmation [2].

Order confirmations are contingent upon a successful delivery of high-quality samples. This department operates within a dynamic and demanding environment. Each season witnesses an influx of orders from numerous buyers, each typically encompassing 10–15 distinct styles, each with 4–6 variations requiring sample production.

The merchandising team bears the primary responsibility for developing samples for negotiation and subsequent order confirmation [3]. This encompasses a diverse range of samples, including prototypes, fit samples, size sets, photo samples and pre-production samples [4]. Effective communication and feedback with buyers are contingent upon the seamless functioning of the product development department.

The high-pressure nature of this department necessitates efficient management to minimise

errors. Sample-related mistakes necessitate rework, significantly increasing workload and potentially damaging the factory's reputation in the eyes of buyers. Delays in sample submission raise concerns about the factory's professionalism. Timely delivery of high-quality samples is crucial for maintaining strong buyer relationships [5].

To ensure timely delivery and enhance overall productivity, optimising the work environment is paramount. The 5S principles, emphasising organisation, cleanliness and a well-structured workplace, offer a proven approach to achieving these goals. By implementing 5S, the department can minimise defects, prevent accidents, streamline workflows, and improve overall quality and safety [6]. The effective management of the sample section demands a meticulous and efficient approach, leveraging best practices to ensure a smooth and successful execution of all product development activities.

In any organisation, quality and productivity are paramount, and directly influenced by factors such as product defects, accidents, production downtime, working conditions and housekeeping. 5S emerges as a foundational tool for continuous improvement, embodying a five-step transformation towards achieving maximum efficiency and minimising waste within the workplace [7]. Concurrently, the 5S methodologies enhance quality, significantly reduce costs by eliminating waste and provide a robust

framework for organisational progress [8]. Furthermore, 5S actively engages all employees in elevating organisational performance. It drives improvements in both workplace efficiency and effectiveness, ultimately contributing to operational excellence [9].

The 5S principles are fundamentally an approach to minimise waste within the workplace. It serves as a cornerstone for organisations adopting Six Sigma, Lean principles and Total Quality Management methodologies. Recognising the inherent difficulty in establishing favourable operational techniques, improving the work environment and consistently producing high-quality items without a robust 5S foundation, organisations increasingly embrace its implementation [10, 11]. This study specifically investigates the implementation of 5S within a product development department. By implementing 5S, the department aimed to enhance its work environment, improve safety, reduce equipment search time and ultimately increase overall efficiency.

Developed in Japan, 5S emerged as a cornerstone of lean manufacturing practices [12]. While the exact origin remains debated, Hirano (1995) [13] is widely credited for structuring the 5S principles into a series of well-defined steps. Hirano emphasised the importance of removing unnecessary items before establishing layouts and workflows, a distinction often overlooked [13]. Notably, Toyota adopted a modified 4S approach, combining Seiton and Seiso [14, 15]. Hirano defines 5S as the foundation for a visual workplace, fostering waste elimination and process improvement [13]. Kaushik et al. (2015) [16] present 5S as a methodology encompassing standardisation, improved working conditions and quality, waste reduction, worker safety, workplace cleanliness and cultural adoption within an organisation. The 5S principles comprise five primary phases. Hirano (1995) [13] translated the Japanese acronym of 5S into English equivalents: Sort, Set in Order, Shine, Standardise and Sustain. Additionally, some organisations incorporate the sixth phase, i.e. Safety. 5S focuses on five fundamental management techniques that may serve as the foundation for any organisation [13].

(i) Sort (Seiri): This initial phase involves systematically identifying and discarding unnecessary items from the workplace. As outlined by Hutchins (2007) [17], Seiri focuses on eliminating unwanted or redundant materials. The core philosophy behind this phase is to establish order within an organisation. The benefits of Seiri include improved tool search efficiency, reduced operational downtime and a cleaner, more organised workspace [18].

(ii) Set in Order (Seiton): This phase focuses on arranging necessary items in a neat and organised manner, ensuring easy retrieval and subsequent return. Seiton emphasises the creation of a “visual workplace” – a system where every item has a designated place and everything is in its designated place. This enhances workflow efficiency, improves workplace ergonomics, minimises unnecessary movement and reinforces the orderliness achieved during the Seiri phase [18].

(iii) Shine (Seiso): This phase involves thorough cleaning and inspection of the workplace to ensure the absence of dirt, dust and debris on floors, machines and equipment. Seiso aligns with the principles of TPM (Total Productive Maintenance), which relates regular equipment inspections and cleaning to minimise instrument breakdowns. This phase contributes to improved safety and a more conducive work environment, and ensures efficient equipment operation [19].

(iv) Standardise (Seiketsu): This phase defines standardised procedures and processes to facilitate continuous improvement within the workplace [20]. Seiketsu is considered the “discipline” phase of 5S. As outlined by Bharambe et al. (2020) [21], this phase necessitates adherence to established workplace standards by all employees. To maintain these standards, regular audits are conducted to ensure consistent implementation of standardised procedures and processes.

(v) Sustain (Shitsuke): The final phase, Sustain, focuses on cultivating habits that ensure the long-term maintenance of the preceding 4S principles [20]. At this stage, 5S becomes a significant part

of the institutional culture, driving continuous improvement. This continuous improvement aligns with the Kaizen philosophy, which emphasises improvements with time [22]. To maintain this momentum, management, supervisors and employees actively participate in regular reviews (daily, weekly or bi-weekly) of the 5S implementation. Continuous audits, effective communication and ongoing training are essential for sustaining the 5S culture [22,23].

Previous research on the 5S implementation has primarily focused on production lines, assembly operations and general manufacturing environments, where workflows are repetitive and volume-driven. In contrast, limited attention has been given to product development departments or sample rooms within the apparel industry, despite their critical role in order confirmation and buyer communication. This imbalance in the literature highlights a clear research gap regarding the applicability and effectiveness of 5S in non-repetitive, development-oriented operational settings.

Although 5S is a well-established lean management tool, its application has been mainly reported in production lines and general manufacturing environments. The originality of this study lies in the context-specific implementation of 5S in the product development (sample) section of a garment industry, an area characterised by high style variability, frequent buyer changes and strict time constraints, and which has received limited attention in prior studies.

The research uniquely addresses sample-section-specific problems such as weak file management, buyer-wise inventory mixing, dust-related defects and delays in sample dispatch. It further proposes customised physical and organisational solutions, supported by root-cause analysis tools and before-and-after validation. This study, therefore, provides original practical insights into adapting 5S for sample-room operations, bridging the gap between lean theory and apparel product development practice.

2 Experimental

To implement 5S for this study, the procedures as described in the continuation were undertaken. The study was conducted in a two-phase approach with the collection of data from primary and secondary sources. In the first phase, the administration personnel collect data on any previous lean application, manpower involvement, level of automation and potential research area.

In the first phase, the administration personnel in any previous lean application data, manpower involvement, level of automation and potential research area. In the second phase, all additional information was collected directly from the product development floor of Esquire Knit Composite Ltd, Narayanganj, Bangladesh. The workflow of the study is outlined in Figure 1.

2.1 Case study methodology

This work utilised a case study technique to investigate the implementation of the 5S principles. The specific case study focused on “Esquire Knit Composite Limited” located in Narayanganj, Bangladesh. During the study period, multiple employees from cutting, sewing, finishing, inspection and sample coordination units participated in the 5S implementation process. Training, awareness sessions and supervised workplace reorganisation were conducted to ensure consistent adoption of the 5S principles across the sample section.

Observation of the product development section: The company has a product development section that is very crowded and always busy with making a variety of knit fabric samples. This section has different kinds of subsections like office room, CAD & counter sample storing room, sewing section, cutting section, inline inspection, final inspection, ironing, packaging section, accessories & thread storage section, needle delivery room & garments cut panel storing section. The section is not clean nor well-organised. As different types of buyers’ orders are coming, there is always the possibility of mixing

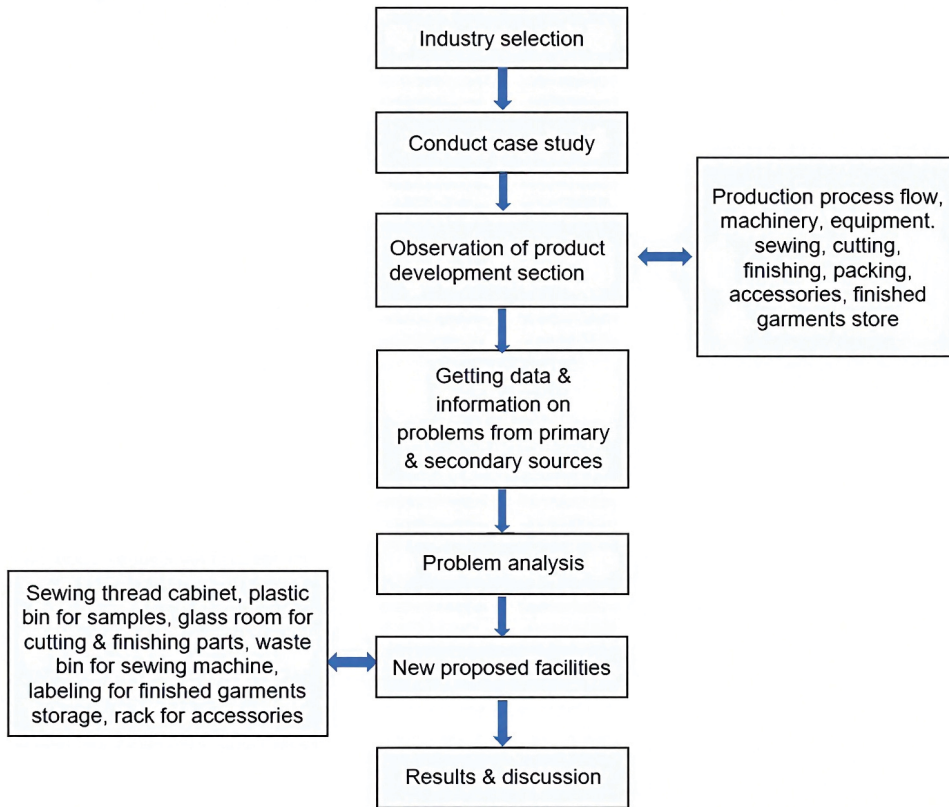


Figure 1: Study workflow

up the samples. We found some specific points that hamper the smooth dispatching and quality of the

samples. Figure 2 shows the layout of the product development section.

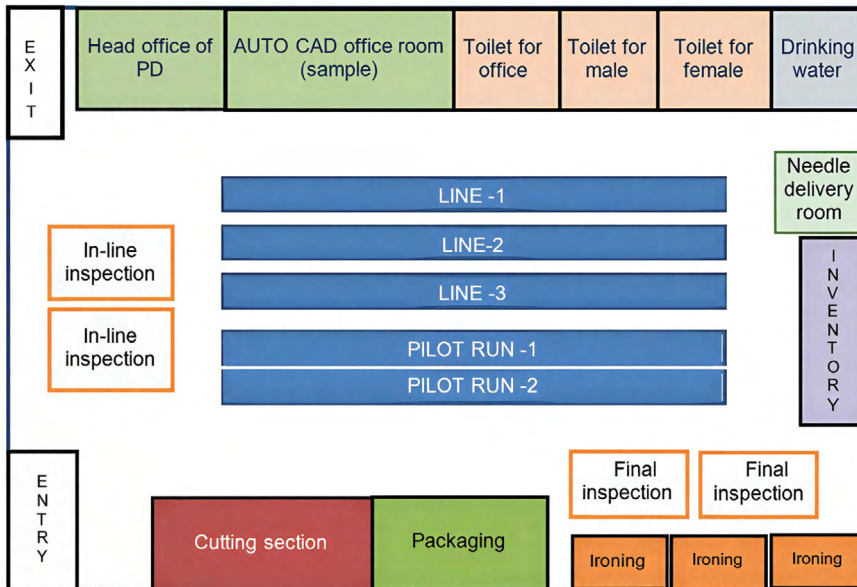


Figure 2: Layout of product development section

2.2 Data collection

Data collection involved a mixed-methods approach, incorporating both secondary and primary sources.

- **Primary data:** Data was collected from the “Esquire Knit Composite Limited” through observations, interviews with key personnel and document reviews (e.g. production records, quality control reports).
- **Secondary data:** Relevant literature on the 5S implementation methodologies, best practices and case studies was reviewed to provide a broader context for the research.

This approach ensured a comprehensive understanding of the existing challenges and opportunities within the sample section of the chosen organisation. The study was conducted over a defined implementation period consisting of baseline observation and post-implementation evaluation phases. The 5S activities involved product development personnel, supervisory staff and management representatives working collaboratively with the research team. Workplace improvements were executed under managerial supervision, while the monitoring and documenting were performed by the researchers. The 5S implementation effectiveness was assessed using structured workplace observations, checklist-based 5S audit practices and key operational performance indicators such as defect occurrence, material searching time, workplace cleanliness and sample dispatch efficiency. These methodological details provide transparency regarding the duration, responsible participants and measurement approach of the intervention.

2.3 Problem analysis

The sewing machinery continuously produces waste and makes the floor dirty. Again, broken chairs are lying in the sewing section. In the office room, there is weak file management, which causes failure in sample submission or rejection due to mistakes. Moreover, weak inventory management like mixing up fabrics (GSM/yarn count/colour/pattern no.), ac-

cessories and trims like buttons (colour/size/shape), zipper (length/colour), sewing threads (ticket no./colour), cut pattern etc. of each sample with others. The sewing thread is kept haphazardly and gets dirty, which produces different sewing defects and quality problems. In the counter sample storage room, there are racks for storing the counter sample; however, the label is missing according to the buyer’s name. The sample packing section adheres to the cutting section, which continuously produces dust and gets the final sample dirty, causing quality problems. The cut patterns of different buyers are not labelled.

2.4 New proposed facilities

After the analysis, a plan will be proposed for implementing some facilities, showing a cleaner and well-organised product development section. In the proposed plan, the facilities are a plastic waste bin for a sewing machine, cabinet system racks for sewing thread, racks for accessories (button, tape, zipper etc.), racks for storing inventory, a plastic bin for storing samples used in future as record and final sample, labelling for counter sample storage racks, cut panel storage racks, pattern storage racks, raw fabric storage racks and accessories storage racks. By ensuring a cleaner and well-organised product development section, the productivity and efficiency can be increased. Hence, the proposed plan will significantly contribute to a better and improved production process.

3 Results and discussion

The work starts with the understanding and analysis of the current scenario, ensuring that all machinery, equipment and inventory are arranged according to the 5S principles. The current arrangement is observed and identifies things in 5S that have to be implemented. The workings include sorting things into necessary and unnecessary items, putting things in order, and proposing some facilities with cleaner and less time-consuming thus getting organised, cleaning work areas, maintaining them properly and

establishing procedures for a safe work environment. The product development section usually deals with different types of samples, e.g. developed samples, counter samples, photo samples, pre-production samples, fit samples, size set samples, prototype samples etc. Unlike mass-production sewing lines characterised by stable processes and repetitive operations, the investigated sample section operates under a high-mix, low-volume structure requiring rapid switching between styles, trims and buyer specifications. This operational complexity increases the risk of material mixing, documentation errors and dispatch delays, thereby reinforcing the necessity of structured workplace organisation through the 5S implementation.

Sample section problems

Improper arrangement of the product development section includes weak file management, weak inventory management like thread, accessories, cut panel, raw fabrics, counter samples, dirty sample section and unskilled personnel. Table 1 presents the problems in the product development section.

Table 1: Problems in Product Development Section

Causes	Problems
Weak file handling	Providing incorrect details to washing, printing or embroidery units regarding their respective standards
	Errors in measuring garment panels
	Inability to prioritise sample completion based on urgency
Poor inventory control	Mixing up fabrics (e.g. colour, yarn count, pattern), trims and accessories (e.g. buttons, sewing threads).
Dustysample area (section)	Exposure to dust particles causes respiratory health risks for workers
	Slippery floor due to uncleaned oil spills poses a risk of injuries
	Garment components or panels are getting soiled due to contact with unclean or oily surfaces
Lack of skilled workforce	Technical errors such as mismatched panels, misaligned checks or stripes, and poorly constructed seams.

Implementation of 5S: By implementing the 5S principles, organisations can streamline processes, reduce waste and enhance the overall work environment.

Step 1: Seiri (Sort)

Seiri, the first step of 5S, focuses on “sorting” through all items within the workspace. It involves identifying and removing unnecessary items, such as clutter, obsolete materials and unused equipment. This initial phase establishes order within the organisation and directly contributes to improved operational efficiency, reduced downtime and a cleaner, more organised workspace.

In the context of Esquire’s Product Development Section, the Seiri phase involved a thorough evaluation of all materials and equipment within the department. As illustrated in Figure 3, multiple sources of disorder, e.g. such as unlabelled files, mixed cut patterns, dusty sewing threads, broken chairs, and haphazard accessory storage, were identified during this initial sorting stage and categorised as unnecessary or improperly managed items requiring corrective action.

During the sorting phase, the sewing defects were identified and sorted out, as illustrated in Table 2 and Figure 4.

The main causes of sewing defects were sorted out. Dust in sewing thread is one of them. Due to dust and dirt in the sewing thread, operators face problems in shade matching of the main body and the sewing thread. To remove dirt from the sewing thread, use an air gun that loosens the cone of the sewing thread. As a result, there is a problem in matching the sewing tension. Other causes of sewing defects are oil stains and lack of maintenance. Operators often forget to keep the oil paper under the pressure foot. Figure 5 illustrates the fishbone diagram for sewing defects.

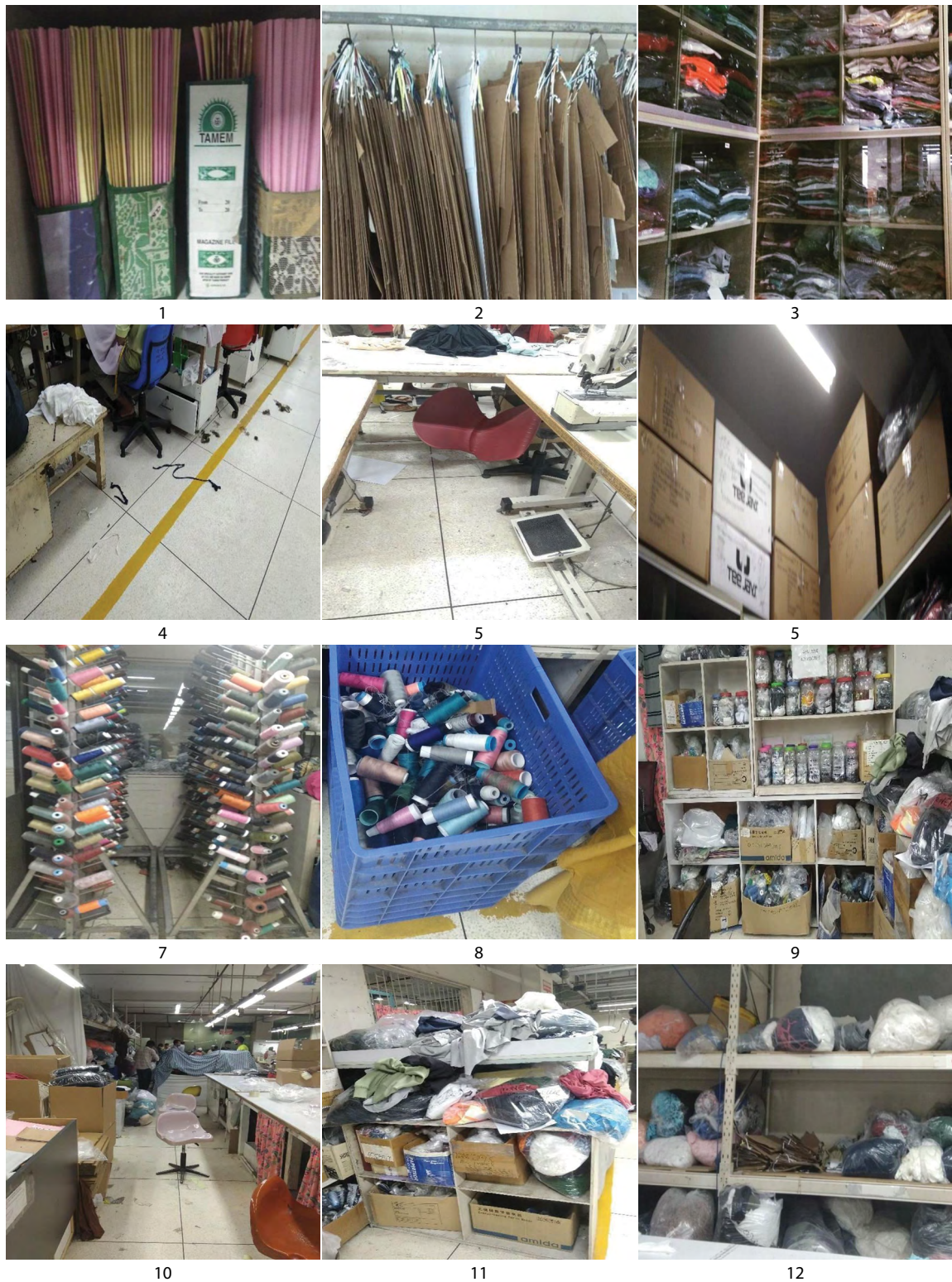


Figure 3: Current scenario of sewing floor of product development section: 1 – unlabelled file management, 2 – unlabelled cut patterns storage, 3 – unlabelled counter samples storage, 4 – dirty sewing floor, 5 – broken chairs in sewing floor, 6 – haphazard past style items storage, 7 & 8 – dirty sewing threads storage, 9 – haphazard accessories storage, 10 – dirty finishing floor, 11 – haphazard garments cut panel storage, 12 – unlabelled raw fabrics storage

Table 2: Sewing defects with percentage

Type of defect	Number of defects	Cumulative	Share (%)
Broken stitch	150	150	20
Oil spot	105	255	34
Dirt spot	78	333	44
Uncut thread trims	45	378	50
Loose thread tension	40	418	55
Uneven shoulder	40	458	61
Uneven point	36	494	66
Needle mark	35	529	70
Skipped stitch	28	557	74
Print defect	25	582	77
Open seam	25	607	81
Tuck missing	22	629	83
Label missing	20	649	86
Puckering	20	669	89
Uneven hem length	18	687	91
Pleat defects	16	703	93
Dropped stitch	15	718	95
Shading error	14	732	97
Missing button	12	744	99
Improper joint stitching	10	754	100

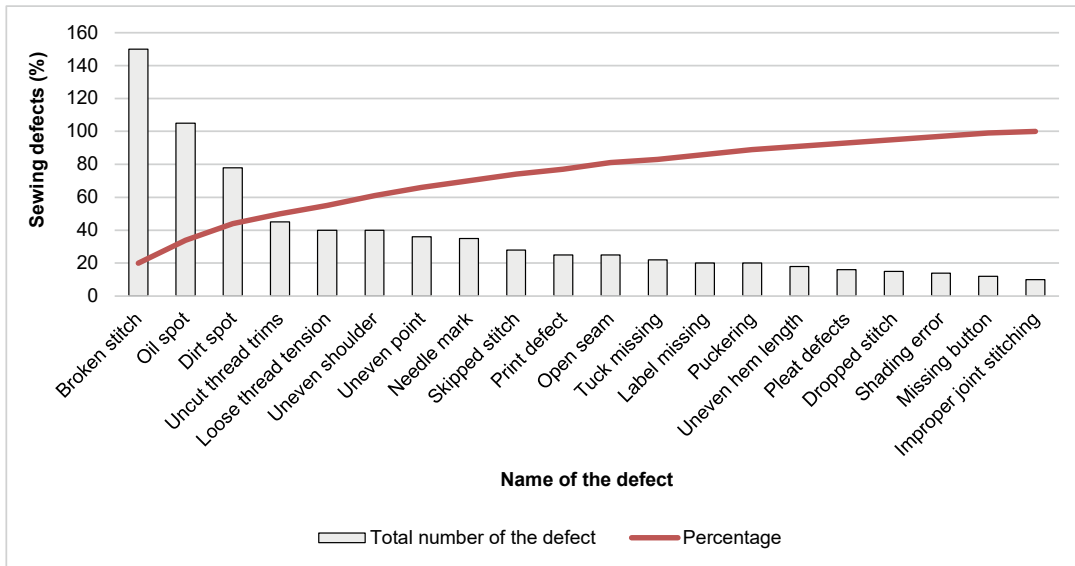


Figure 4: Pareto chart for sewing defects

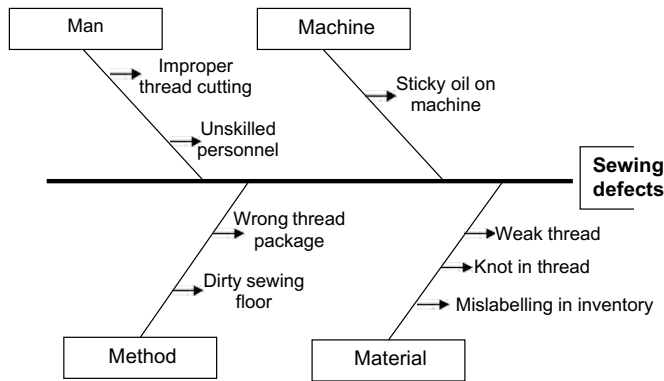


Figure 5: Fishbone diagram for sewing defects [24]

Step 2: Seiton (Set in Order)

Seiton, the second phase of 5S, focuses on “setting in order” all necessary items within the workspace. This involves arranging items systematically and logically so that they can be easily located and returned to their designated place after use. This step enhances

efficiency by minimising search times and improves safety by minimising the risk of contributions and accidents in a more organised and visually appealing work environment. Figure 6 illustrates the newly ordered sewing floor of the product development section.



Figure 6: Newly ordered sewing floor of product development section: a) labelling of cut patterns, b) labelling of files, c) labelling of counter samples storage, d) plastic bin with labelling of past style items

Step 3: Seiso (Shine)

Seiso, the third phase of 5S, emphasises “shine” or maintaining a consistently clean workspace. This

is not merely a superficial cleaning but a proactive approach to determine the root causes of dirt and disorganisation. In this phase, data is collected

and analysed to pinpoint the underlying factors contributing to waste and inefficiency. Tools such as fishbone diagrams can be utilised to visually map out potential root causes of these issues within the

Product Development Section. Figure 7 illustrates the fishbone diagram for the inefficiency of sample dispatching.

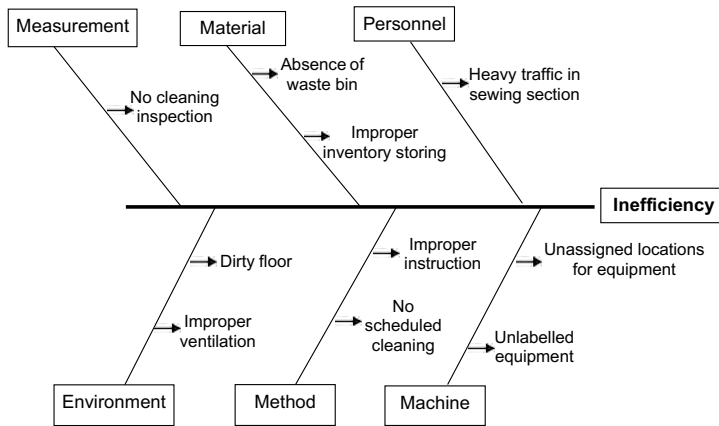


Figure 7: Fishbone diagram for inefficiency of sample dispatching [24]

The Seiso phase emphasises the importance of consistent cleaning and maintenance to ensure long-term efficiency gains. Regular cleaning not only improves the aesthetic appeal of the workspace but also protects against the accumulation of dust and debris that can inhibit productivity and potentially pose safety hazards. In the context of the Product Development Section, the Seiso phase can be implemented through the following practices:

- Assigning cleaning responsibilities: Designating specific individuals or teams

responsible for maintaining the cleanliness of designated areas within the section.

- Maintaining a clean and organised workspace: Ensuring that all work surfaces, equipment and storage areas are kept clean and free from clutter.
- Addressing oil spills and stains: Promptly removing oil spills and stains from floors and machinery to prevent accidents and ensure a safe work environment.
- Strategic placement of trash bins: Providing

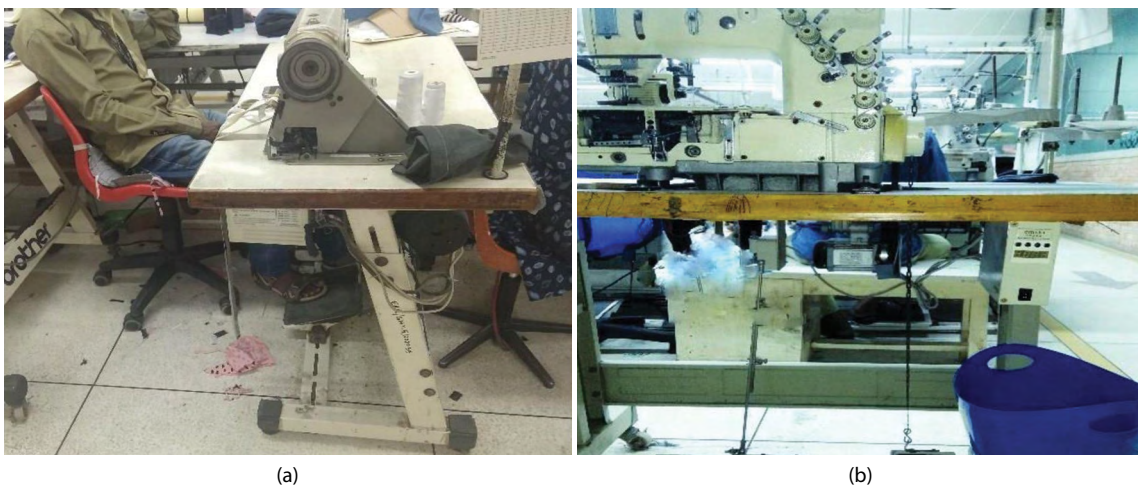


Figure 8: 5S implementation in sewing floor: a) before implementing 5S, b) after implementing 5S

convenient access to trash bins at strategic locations throughout the sample room, including near cutting and finishing tables.

By implementing these practices, the Product Development Section can maintain a consistently clean and organised environment, enhancing safety, efficiency, and overall productivity. Figure 8 illustrates the sewing floor status before and after implementing 5S.

Step 4: Seiketsu (Standardise)

Seiketsu emphasises the importance of standardising the practices established in the previous three steps (Seiri, Seiton and Seiso). This involves documenting and implementing standardised procedures to ensure the consistent maintenance of a clean, organised and efficient workspace.

Standardisation is a crucial aspect of lean manufacturing, ensuring that best practices are consistently followed across all areas of the organisation. In the context of the Product Development Section, this can be achieved through:

- Establishing clear work instructions: Providing all staff with clear and concise instructions regarding cleanliness and organisational standards.
- Implementing regular maintenance schedules: Establishing and adhering to a regular maintenance schedule for all equipment and utilities within the sample section.

Step 5: Shitsuke (Sustain)

Shitsuke focuses on sustaining 5S as an ongoing practice within an organisation. It involves cultivating a culture of continuous improvement where 5S principles are ingrained in the daily routines of all employees.

To confirm the sustainability of 5S, the following measures are crucial:

- Regular audits and inspections: Conduct regular audits and inspections to monitor adherence to the 5S standards and identify areas for improvement.

- Employee training and development: Providing ongoing training to all persons on the principles and benefits of 5S.

Leadership commitment: Demonstrating strong leadership commitment to 5S by actively participating in the implementation and promoting its importance within an organisation. By fostering a practice of continuous development and emphasising the importance of the 5S principles, organisations can generate a more efficient and safer environment for people. The Shitsuke phase emphasises the continuous improvement and long-term maintenance of the 5S principles within the Product Development Section. To achieve this, the following strategies can be implemented:

- Regular practice of the 5S principles: Encourage consistent adherence to the first four steps of 5S (Seiri, Seiton, Seiso and Seiketsu) as part of daily routines.
- Establishing 5S as a discipline: Integrate the 5S principles into the departmental culture, emphasising their importance and encouraging employee ownership.
- Conducting regular training sessions: Organise dedicated training sessions (at least 1–2 hours per week) to educate employees about the significance of 5S in enhancing workplace efficiency, safety and overall productivity.

By implementing these strategies, the Product Development Section can cultivate a practice of continuous development and ensure the long-term sustainability of the 5S initiative.

New proposed facilities

This research has proposed the design shown in Figures 9, 10 and 11 for the implementation of 5S in the Product Development section:

- a) Cabinet for sewing thread: This research has proposed a cabinet for sewing thread for several reasons, i.e. getting clean sewing thread, easy-to-identify required colour

thread, maintaining proper tension, getting rid of knotting problems, thus reducing sewing defects, increasing work efficiency and helping in improving the quality of various types of samples.

- b) Cabinet for accessories: This research has also proposed a cabinet for accessories with labelling according to the buyer, for the operators to easily identify the required

accessories. This reduces the time to search required labels for different buyers, and also reduces mislabelling as well as sewing defects.

- c) Rack for garments cut panel: This research has proposed a cabinet for garments cut panel storage, which is arranged according to buyers to reduce the possibility of making faulty garments.



(a)



(b)

Figure 9: Thread cabinet: a) before implementing 5S, b) for implementation of 5S



(a)



(b)

Figure 10: Accessories storage: a) before implementing 5S, b) for implementation of 5S



Figure 11: Rack for garments cut panel: a) before implementing 5S, b) for implementation of 5S

This investigation aimed to identify the root causes hindering the timely dispatch of high-quality samples. By analysing the challenges faced by the sample section, it became evident that implementing and effectively utilising the 5S principles could significantly mitigate these issues.

The successful application of the 5S methodologies can lead to several positive outcomes, including:

- Increase efficiency and productivity within the sample section.
- Improved workplace organisation and a more conducive work environment.
- Reduced equipment search time, minimising delays in the sample development process.
- Enhanced workplace safety for all personnel.

By addressing the identified challenges through the systematic application of the 5S principles, the

sample section can achieve smoother and more efficient sample dispatch, ultimately contributing to improved customer satisfaction and overall business performance. To address the lack of numerical clarity, before-and-after comparisons were conducted using observational productivity indicators and defect occurrence records within the sample section. The implementation of 5S resulted in measurable reductions in material searching time, sample handling errors and dust-related quality defects, alongside observable improvements in workplace safety and organisation. These quantified operational indicators validate that the reported efficiency gains and defect reductions are supported by performance-based evidence rather than qualitative judgment alone. Table 3 presents the new facilities of the product development section with an impact.

Table 3: New facilities with impacts

New facilities	Impacts
Waste bin for an individual sewing machine	The sewing machine and floor become clean, and health hazards and sewing defects, e.g. oil stains, are reduced.
Labelling for counter samples storage racks	Reduced time loss for searching in storage racks.
Cabinet for sewing thread storage	The thread remains clean and the possibility of knotting and weakening is reduced.
Plastic bin for keeping past-style items	Reduced time loss for searching.
Labelling for cut patterns storage	Reduced possibility of making faulty products.
Removing broken chairs from the sewing floor and putting new ones	Increased sewing production and clean floor.
Labelling of dyed or finished fabrics in the cutting section	Reduced possibility of mixing different buyers' samples.
A separate glass room for the cutting and packing section	Dust from the cutting room is not coming to the packing section and quality is not hampered.
Labelling files	Reduced possibility of passing wrong information to washing, printing, embroidery and cutting panel measurements.
Cabinet with a label for garments, cutpanel	Reduced possibility of shading as well as mixing of cut panels of garments.
Cabinet with a label for accessories	Reduced possibility of making sewing faults as well as faulty garments.
Training facility for personnel	Reduced technical problems like mismatching of cut panels, poor seam assembly and poor shading.

4 Conclusion

This work highlights the pivotal role of the 5S principles in transforming the product development section of a garment manufacturing facility. By systematically addressing inefficiencies such as poor inventory management, disorganised workflow and unclean environment, implementing the 5S principles has significantly improved operational efficiency, sample quality and workplace safety. The newly proposed facilities, including labelled storage solutions, designated cleaning responsibilities and dedicated training sessions, have effectively minimised delays and errors while fostering a practice of continuous improvement. The findings underscore the importance of a clean and organised workspace in enhancing productivity and maintaining strong buyer relationships. By integrating 5S into daily routines, Esquire Knit Composite Ltd. has set a benchmark for operational excellence within the garment industry. This case study demonstrates that with leadership commitment, employee engagement

and sustained efforts, 5S can serve as a cornerstone for achieving a long-term organisational success. Future research may explore the scalability of the 5S implementation across other departments and industries to validate its effectiveness further.

To sustain these gains and ensure long-term effectiveness, several key measures are recommended:

- Regular audits: Conducting periodic audits to monitor adherence to the 5S principles and identify areas for further improvement.
- Resource allocation: Allocating adequate resources and budget to support the ongoing maintenance and improvement of the 5S practices.
- Employee engagement: Actively engaging all employees through comprehensive training programmes and awareness campaigns to cultivate a strong understanding and appreciation of the 5S principles.
- Continuous improvement initiatives: Implementing a continuous improvement framework to identify and address areas

for a further optimisation within the 5S system.

- Incentive programmes: Introducing a system of rewards and recognition for employees who actively participate in and contribute to the 5S implementation.

A successful implementation of the 5S principles not only enhances operational effectiveness and reduces waste but also fosters a positive and productive work environment.

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