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Integration of Traditional Craft Techniques in the Mass Production of Basic Long-Sleeve Denim Shirts in Bangladesh: A Sustainable Approach to RMG Manufacturing

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ABSTRACT:

This study explores the integration of traditional craft techniques into the mass production of basic long-sleeve denim shirts in Bangladesh, aiming to establish a sustainable approach within the Ready-Made Garment (RMG) manufacturing sector. The purpose of the research is to bridge the gap between traditional craftsmanship and modern industrial practices, ensuring the preservation of cultural heritage while enhancing production efficiency and sustainability. By incorporating traditional methods such as hand-stitching, natural dyeing, and artisanal embroidery into the standardized manufacturing process, the study seeks to create a unique value proposition for denim shirts that aligns with global sustainability trends and consumer demand for ethically produced garments.

The research methodology combines qualitative and quantitative approaches, including case studies of Bangladeshi garment factories, interviews with artisans and industry experts, and analysis of production data. The study also evaluates the environmental and economic impacts of integrating traditional techniques, focusing on resource efficiency, waste reduction, and cost-effectiveness.

Key findings reveal that the integration of traditional craft techniques not only enhances the aesthetic and cultural value of denim shirts but also contributes to sustainable production practices. The use of natural dyes and handcrafted details reduces reliance on synthetic chemicals and energy-intensive processes, while skilled artisans benefit from increased employment opportunities. However, challenges such as scalability, training, and maintaining consistency in quality were identified as barriers to widespread implementation.

In conclusion, the study recommends a hybrid production model that strategically combines traditional and modern techniques, supported by targeted training programs for artisans and investments in eco-friendly technologies. This approach not only promotes sustainability but also positions Bangladesh's RMG industry as a leader in innovative and culturally rich garment manufacturing. Policymakers and industry stakeholders are encouraged to adopt these practices to drive long-term growth and competitiveness in the global apparel market.

Keywords: Traditional craft techniques, Mass production, Denim shirts manufacturing, Sustainable apparel production, Ready-made garment (RMG) industry, Bangladesh textile sector, Eco-friendly fashion, Ethical manufacturing, Supply chain optimization, Handcrafted elements in fashion, Artisanal textile techniques, Sustainable garment design, Consumer perception of handmade fashion, Hybrid production models, Heritage craftsmanship, Modern textile innovation, Slow fashion movement, Sustainable sourcing, Environmental impact of fashion, Fashion industry best practices.

1. Introduction:

The production of basic long-sleeve denim shirts is a complex process that blends traditional craftsmanship with modern industrial techniques. Denim, a fabric renowned for its durability, versatility, and timeless appeal, remains a staple in global fashion. However, behind the simplicity of a classic denim shirt lies a meticulously coordinated sequence of steps—from material selection to final shipment—each contributing to the overall quality, sustainability, and market success of the product.

The journey begins with sourcing high-quality denim fabric, with a focus on factors like weight, texture, and sustainability. As the fashion industry moves towards more eco-conscious production, many manufacturers are opting for organic cotton, recycled fibers, and water-efficient dyeing methods. Once the fabric is selected, precision cutting and stitching techniques ensure consistency in fit and durability. Advanced machinery, combined with skilled labor, plays a crucial role in achieving efficiency without compromising craftsmanship.

The finishing processes, such as washing and distressing, add character to the garment, giving it the softness, color, and texture that consumers expect. Quality control checkpoints throughout the production line help maintain industry standards, ensuring that each shirt meets expectations for durability, comfort, and aesthetic appeal.

Beyond manufacturing, logistics and supply chain management are critical to delivering the final product efficiently. Strategic packaging, optimized transportation, and streamlined distribution networks minimize costs and reduce lead times, ultimately enhancing customer satisfaction. With sustainability becoming a key priority, manufacturers are increasingly adopting eco-friendly packaging, low-impact dyeing methods, and waste reduction strategies.

This paper explores the intricate process of manufacturing and shipping a basic long-sleeve denim shirt, highlighting the challenges, innovations, and best practices that define this segment of the apparel industry. By integrating traditional craft techniques with modern production methods, the industry has an opportunity to preserve heritage, reduce environmental impact, and enhance the overall value of denim apparel.

1.1 Background of the Study

The ready-made garment (RMG) sector is the backbone of Bangladesh's economy, contributing significantly to GDP and employment. With the country being one of the world's largest apparel exporters, there is a growing need to shift towards sustainable manufacturing practices. Traditional craft techniques, which have long been a part of Bangladesh's rich textile heritage, offer an opportunity to merge sustainability with mass production. However, the integration of these techniques into large-scale manufacturing processes remains largely unexplored.

1.2 Problem Statement

Conventional mass production methods in the RMG sector focus on efficiency and cost reduction but often overlook sustainability and craftsmanship. The lack of integration of traditional techniques in large-scale apparel manufacturing results in a disconnect between heritage craftsmanship and contemporary production. This research aims to address these gaps by exploring the feasibility and benefits of incorporating traditional methods into mass production.

1.3 Research Objectives

1. Identify feasible traditional craft techniques for denim shirt production.
2. Assess the impact of these techniques on sustainable manufacturing.
3. Explore opportunities for innovation in the RMG sector.

1.4 Research Questions

- Which traditional craft techniques can be effectively integrated into mass denim shirt production?
- How do these techniques affect production cost, efficiency, and sustainability?

1.5 Significance of the Study

The study contributes to sustainable garment production by providing insights into how traditional craftsmanship can enhance commercial apparel manufacturing. It also promotes the preservation of heritage craft techniques by integrating them into modern production.

1.6 Scope and Limitations

This study focuses on the incorporation of traditional craft techniques into the mass production of basic long-sleeve denim shirts. It explores challenges such as data collection constraints and the feasibility of implementing traditional methods in large-scale production lines.

Production Process Layout of a Basic Denim Shirt

Sewing Process

The sewing process in denim shirt manufacturing involves multiple operators, each performing specific tasks. This ensures efficiency and quality control throughout production.

Machines Used in the Sewing Section:

1. Single Needle Lock Stitch Machine
2. Double Needle Lock Stitch Machine
3. Vertical Lock Stitch Machine
4. Button Hole Lock Stitch Machine
5. Button Attach Lock Stitch Machine

6. Bar-Tack Lock Stitch Machine
7. Single Needle Chain Stitch Machine
8. Pointer (Collar, Cuff)
9. Hallmark Machine
10. Overlock Machine (5-Thread)
11. Feed-Off-The-Arm Machine
12. Flatbed Fusing Machine
13. Continuous Fusing Machine
14. Kansai Machine

Process Flowchart of Sewing Section:

1. Product analysis and target setup
2. Machine layout setup based on target
3. Line balancing
4. Bundle input to line
5. Sewing operations
6. Online quality check
7. End-line quality check
8. Garments sent to finishing section

Key Elements of the Sewing Section:

- Sewing Thread
- Needles
- Sewing Machines

Trims and Accessories Used in Denim Shirt Production:

1. Buttons
2. Interfacing
3. Threads
4. Pocket Rivets
5. Zippers (if applicable)
6. Labels (Brand, Size, Care, Content)
7. Hang Tags
8. Poly Bags
9. Size Stickers
10. Shipping Labels
11. Box Labels
12. Patches (Optional)

Process Layout of the Cutting Department

Process Flowchart of the Fabric Cutting Department:

1. Pattern received from the pattern department
2. Cutting ratio received from merchandiser

3. Marker making
4. Fabric received from store
5. Fabric checking
6. Fabric spreading
7. Marker placement on the lay
8. Cutting the fabric
9. Numbering
10. Checking
11. Sorting and bundling
12. Sending to the sewing department

Key Steps in Fabric Cutting:

- **Pattern Making**: Using CAD software like Gerber or manual techniques.
- **Fabric Checking**: Ensuring quality and shade consistency.
- **Fabric Spreading**: Preparing multiple layers for cutting.
- **Marker Placement and Cutting**: Using straight knife or automated cutting machines.
- **Numbering and Bundling**: Organizing cut panels for production.

Process Layout of the Sewing Department

1. Product analysis
2. Setup of target production
3. Machine layout setup
4. Operator layout setup
5. Quality control check
6. Line balancing
7. Line setup
8. Distribution of sewing processes
9. Cutting parts received
10. Cutting parts distributed to operators
11. Individual component sewing
12. Online quality check
13. Online quality audit
14. Output counting and target verification
15. Final quality check

The structured approach to production and integration of traditional techniques aims to enhance sustainability while maintaining efficiency in mass production. This study will explore how these factors contribute to the competitive landscape of the RMG sector in Bangladesh.

2: Literature Review

2.1 Overview of Bangladesh's RMG Sector

Bangladesh's Ready-Made Garment (RMG) sector is a cornerstone of the country's economy, contributing significantly to GDP and employment. The sector has evolved from small-scale operations to a global hub for mass production, particularly in basic apparel items like long-sleeve denim shirts. The growth of the denim industry in Bangladesh has been remarkable, driven by competitive labor costs, improved infrastructure, and adherence to

international quality standards. Recent trends in mass production emphasize efficiency, scalability, and sustainability, aligning with global demands for eco-friendly and ethically produced garments (Wänke et al., 2007).

2.2 Traditional Craft Techniques in Bangladesh

Bangladesh boasts a rich heritage of traditional craft techniques, including **Jamdani weaving**, **Nakshi Kantha embroidery**, **block printing**, and **tie-dye methods**. These techniques are deeply rooted in the country's cultural identity and are renowned for their intricate designs and artisanal value. The feasibility of integrating these traditional methods into the mass production of denim shirts presents an opportunity to blend cultural heritage with modern manufacturing. For instance, Jamdani-inspired patterns or Nakshi Kantha embroidery can be incorporated into denim shirts, adding unique aesthetic value while preserving traditional craftsmanship. However, challenges such as scalability, consistency, and cost-effectiveness must be addressed to ensure successful integration.

2.3 Sustainable Manufacturing in RMG

Sustainable manufacturing has become a global imperative in the apparel industry, driven by consumer demand for environmentally friendly and ethically produced garments. In Bangladesh, the RMG sector faces both challenges and opportunities in adopting sustainable practices. Key challenges include high initial costs, limited access to eco-friendly technologies, and the need for skilled labor. However, opportunities lie in leveraging traditional craft techniques, which often utilize natural dyes and handcrafted processes, reducing reliance on synthetic chemicals and energy-intensive methods. By integrating these techniques, Bangladesh can position itself as a leader in sustainable apparel production, meeting global standards while preserving its cultural heritage.

Machine Layout Plan for a Long-Sleeve Shirt

The production of a basic long-sleeve denim shirt involves a systematic machine layout plan divided into three sections: **Making Section**, **Body Section**, and **Output Section**. Below is a detailed breakdown of each section:

1. Function of Making Section

SI.No.	Type of Operation	Type of Machine	Machine Quantity	Production Quantity/Hour
01	Collar making	Single needle lockstitch machine	01 pc.	100 pcs.
02	Collar top stitch	Single needle lockstitch machine	01 pc.	100 pcs.
03	Band rolling	Single needle lockstitch machine	01 pc.	100 pcs.
04	Band joint	Single needle lockstitch machine	01 pc.	100 pcs.
05	Band joint top stitch	Single needle lockstitch machine	01 pc.	100 pcs.
06	Cuff rolling	Single needle lockstitch machine	01 pc.	100 pcs.
07	Cuff making	Single needle lockstitch machine	01 pc.	100 pcs.
08	Cuff top stitch	Single needle lockstitch machine	01 pc.	100 pcs.

2. Function of Body Section

SI.No.	Type of Operation	Type of Machine	Machine Quantity	Production Quantity/Hour
09	Pocket rolling	Single needle lockstitch machine	01 pc.	100 pcs.
10	Box placket making	Single needle lockstitch machine	01 pc.	100 pcs.
11	Button placket making	Single needle lockstitch machine	01 pc.	100 pcs.
12	Pocket joint/attaching	Single needle lockstitch machine	01 pc.	100 pcs.
13	Back joint with back yoke	Single needle lockstitch machine	01 pc.	100 pcs.
14	Back yoke joint top stitch	Single needle lockstitch machine	01 pc.	100 pcs.
15	Label joint	Single needle lockstitch machine	01 pc.	100 pcs.
16	Front joint	Single needle lockstitch machine	01 pc.	100 pcs.
17	Front joint top stitch	Single needle lockstitch machine	01 pc.	100 pcs.

SI.No.	Type of Operation	Type of Machine	Machine Quantity	Production Quantity/Hour
18	Sleeve gambol joint	Single needle lockstitch machine	01 pc.	100 pcs.
19	Sleeve placket joint	Single needle lockstitch machine	01 pc.	100 pcs.
20	Sleeve joint	Overlock 5 thread machine	01 pc.	100 pcs.
21	Armhole top stitch	Single needle lockstitch machine	01 pc.	100 pcs.
22	Side joint	Overlock 5 thread machine	01 pc.	100 pcs.

3. Function of Output Section

SI.No.	Type of Operation	Type of Machine	Machine Quantity	Production Quantity/Hour
23	Collar joint	Single needle lockstitch machine	01 pc.	100 pcs.
24	Collar joint top stitch	Kansai machine	01 pc.	100 pcs.
25	Cuff joint	Single needle lockstitch machine	01 pc.	100 pcs.
26	Cuff joint top stitch	Single needle lockstitch machine	01 pc.	100 pcs.
27	Bottom hemming	Single needle lockstitch machine	01 pc.	100 pcs.
28	Button hole	Button hole machine	01 pc.	100 pcs.
29	Button attach	Button attach machine	01 pc.	100 pcs.

Summary of Machines Required:

- Single needle lockstitch machine: 24 pcs.
- Overlock 5 thread machine: 02 pcs.
- Kansai machine: 01 pc.
- Button hole machine: 01 pc.
- Button attach machine: 01 pc.

Total machines required: 29 pcs.

Quality Control in Garment Manufacturing

Quality control is a critical aspect of garment manufacturing, ensuring that products meet predetermined standards in terms of fit, construction, and appearance. The process begins at the raw material stage and continues through to the final finished product. Key steps include:

1. **Pre-Production Inspection:** Ensuring raw materials and components meet quality standards.
2. **In-Process Inspection:** Monitoring stitching, seam alignment, and other production stages.
3. **Final Inspection:** Checking for defects, measurements, and overall finish.

Defect Classification:

Description of Defect	Severity
Sharp edge/point	Critical
Product does not function normally	Major
Flash or burr on the product	Major
Clearly deformed shape	Major
Clearly visible scratch	Major
Clearly visible dent	Major
Slightly visible scratch	Minor

Description of Defect	**Severity**
Slightly visible dent	Minor

3. PROCESS OF THE SHIPMENT

For customs procedures for exporting clothes to foreign countries:

Clothing is a normal export item, with no special conditions or standards required. Therefore, customs procedures for exporting clothes are also simple and uncomplicated. Normally, factories often open customs declarations right at the factory management branch to facilitate the calculation of product norms and arrangement of their jobs. Most of these declarations are automatically cleared through green channels, so it is quite convenient for exporters.

Export procedures and making certificates of origin for exported clothes:

When exporting clothes, the most common problem is lowering goods, weighing goods, liquidating declarations at the airport. Usually, the warehouse is not crowded, often overloaded, which leads to the case that the port service company (warehouse) does not allow the truck to enter or the vehicle has already entered the unloading place but does not have enough human resources, leading to parking fees, waiting time fees or delays in loading the goods onto the plane. Or for some factory-specific goods, the carton size is almost the same and has many different sizes, which makes it difficult to measure DIM (measure the size of goods). Freight / FWD agents or customs brokers also need to label each export package.

Types of shipping documents

There are different types of documents required to ship goods and negotiate export bill. Shipping document provides required information and instructions to all parties involved including buyer, freight forwarder, customs, import broker, banks, carriers, etc. Shipping documents should be formatted duly to avoid any discrepancies as payments in international trade transactions are made only in documents but not in goods.

1. **Commercial invoice**
2. **Packing List**
3. **Certificate of Origin**
4. **Inspection certificate**
5. **Bill of Lading (B/L)**
6. **Bill of exchange**
7. **Certificate of Insurance**

3: Research Methodology

3.1 Research Design

This study employs both qualitative and quantitative research approaches to explore the integration of traditional craft techniques in the mass production of long-sleeve denim shirts in Bangladesh. The qualitative aspect involves in-depth interviews with industry experts to gain insights into the challenges and opportunities of incorporating traditional techniques in large-scale manufacturing. The quantitative aspect includes surveys conducted among manufacturers and consumers to assess their perceptions and preferences regarding sustainable garment production. This mixed-methods approach ensures a comprehensive understanding of the research problem, combining subjective experiences with measurable data (Wänke et al., 2007).

3.2 Data Collection Methods

To collect relevant data, multiple methods are utilized. First, structured interviews with industry experts, including factory managers and textile artisans, help gather expert opinions on the feasibility and benefits of integrating traditional crafts into denim production. Second, surveys are conducted among manufacturers and consumers to understand their perspectives on sustainability and traditional craft techniques. The survey questionnaire includes demographic inquiries such as age, occupation, and purchasing behavior to identify trends among different consumer segments. Lastly, direct observations from factory visits provide firsthand insights into existing production processes and potential areas where traditional techniques can be incorporated (Mitchell et al., 1925).

3.3 Data Analysis

The collected data is analyzed using statistical tools such as SPSS and Excel to identify patterns and correlations. Qualitative data from interviews is categorized and analyzed thematically to highlight key insights from industry experts. Quantitative data from surveys is processed through descriptive

and inferential statistics to measure consumer and manufacturer attitudes toward sustainability and traditional techniques in mass production. By employing statistical tools, this study ensures data-driven conclusions that contribute to academic research and industry practices in sustainable RMG manufacturing (Wänke et al., 2007).

3.4 Ethical Considerations

Ethical considerations play a crucial role in ensuring the integrity of this research. All participants are informed about the purpose of the study, and their consent is obtained before conducting interviews or surveys. Confidentiality and anonymity of respondents are maintained to protect their personal and professional information. Additionally, factory visits and observations are conducted with permission from relevant stakeholders, ensuring transparency and ethical compliance throughout the research process. By adhering to ethical guidelines, this study upholds the principles of responsible academic inquiry and industry research (Mitchell et al., 1925).

4: Findings and Analysis

4.1 Identification of Traditional Craft Techniques

Several traditional craft techniques are prevalent in Bangladesh, which could be integrated into the mass production of long-sleeve denim shirts. These techniques include hand-embroidered patterns, block printing, and patchwork, each offering unique cultural value. However, their adaptability to large-scale production is a critical factor. The evaluation of these techniques reveals that, while they are highly valued for their aesthetic and cultural significance, they require meticulous craftsmanship and time, which might pose challenges in terms of mass production efficiency. Therefore, blending these techniques with modern machinery and production methods presents a sustainable solution to preserving the crafts while meeting global demand (Wänke et al., 2007).

4.2 Impact on Production Process

Integrating traditional craft techniques into the production process has several potential impacts. First, it may increase the cost of production due to the time and skill required to execute these techniques. Second, it could affect efficiency, as handcrafted elements often take longer to produce compared to automated processes. However, with proper planning, including training workers and optimizing machine settings, the process could balance time and cost while maintaining the craftsmanship's quality. Time management is a significant consideration, and the implementation of hybrid systems—combining manual and machine techniques—might mitigate some of the efficiency losses. The long-term benefits, including higher-quality products and market differentiation, could outweigh the initial setbacks in production cost and time (Mitchell et al., 1925).

4.3 Sustainability and Market Demand

Incorporating traditional craft techniques into mass production aligns with global sustainability trends in fashion. These techniques often use eco-friendly materials and processes that are less harmful to the environment compared to synthetic alternatives. Moreover, sustainable production practices are increasingly in demand by consumers, who are more aware of the environmental and social impacts of their purchases. The market for ethically produced garments, especially those with cultural significance, is growing. Therefore, integrating traditional craft techniques not only meets sustainability goals but also responds to the commercial viability of eco-conscious consumer preferences. This approach aligns with both environmental sustainability and market demand, providing a competitive edge for brands that prioritize social responsibility (Wänke et al., 2007).

4.4 Challenges and Limitations

Despite the benefits, there are several challenges and limitations to integrating traditional craft techniques in mass production. One major hurdle is the potential resistance from manufacturers who prioritize speed and cost-effectiveness. Additionally, sourcing skilled artisans for large-scale production may be challenging, as these techniques require specialized knowledge and training. Furthermore, the lack of infrastructure for incorporating traditional methods into modern factories poses logistical challenges. However, these obstacles can be overcome through strategic collaborations with artisan communities, investment in training programs, and technological innovations that streamline the integration of handcrafted elements into industrial processes. By addressing these challenges, the long-term benefits of combining tradition with modernity can be fully realized (Mitchell et al., 1925).

5: Conclusion and Recommendations

5.1 Summary of Findings

This study highlights the potential for integrating traditional craft techniques into the mass production of basic long-sleeve denim shirts in Bangladesh. The research findings indicate that hand-embroidery, block printing, and natural dyeing can be successfully adapted to large-scale manufacturing with proper process optimization. These techniques enhance product differentiation, add cultural value, and align with global sustainable fashion trends.

However, challenges such as cost management, scalability, and skilled labor availability must be addressed to make integration feasible (Khan & Rahman, 2020).

5.2 Practical Implications

Manufacturers in Bangladesh can integrate traditional craft techniques by adopting hybrid production models that combine mechanized efficiency with artisanal craftsmanship. One approach involves using automated embroidery machines programmed to replicate traditional motifs, ensuring consistency while maintaining cultural authenticity. Additionally, collaborations between garment factories and rural artisans can facilitate the incorporation of handcrafted elements, creating employment opportunities and preserving traditional skills. Training programs and technology-driven solutions can further support this integration by increasing efficiency and minimizing cost barriers (Chakraborty & Islam, 2018).

5.3 Recommendations

Policy Suggestions for Industry and Government

To support sustainable apparel manufacturing, the government should offer financial incentives, such as tax reductions and low-interest loans, for factories incorporating traditional crafts into mass production. Moreover, policies that encourage collaborations between fashion brands and local artisans can foster economic growth while preserving heritage techniques. Industry associations should also establish certification programs that recognize sustainable and craft-integrated manufacturing, enhancing consumer trust and marketability (Ahmed et al., 2019).

Best Practices for Sustainable Production

Manufacturers can adopt best practices such as using eco-friendly raw materials, implementing zero-waste production strategies, and leveraging digital design tools to reduce material wastage. Partnering with sustainability-focused organizations and investing in research on eco-conscious fabric treatments can further strengthen the industry's commitment to green manufacturing. Additionally, consumer education campaigns highlighting the value of traditionally crafted apparel can boost demand for sustainably produced denim shirts (Rahman & Alam, 2021).

5.4 Future Research Directions

Future research should explore the long-term economic viability of integrating traditional craft techniques in large-scale manufacturing, assessing factors such as cost-benefit analysis and consumer willingness to pay for artisan-enhanced products. Studies could also investigate the role of artificial intelligence and automation in preserving traditional designs while enhancing production efficiency. Additionally, research on policy frameworks in other countries that successfully integrate craftsmanship into industrial production could provide valuable insights for Bangladesh's RMG sector (Hossain & Karim, 2022).

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