

Optimizing Apparel Supply Chains to Strengthen E-Commerce Operations

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Abstract— The rapid growth of e-commerce has significantly transformed the operational landscape of the apparel industry, emphasizing the need for efficient and responsive supply chain systems. Apparel manufacturers, particularly in developing countries such as Bangladesh, face increasing challenges due to rising labor costs, regulatory pressures, and unreliable access to essential resources like electricity and natural gas. These constraints have intensified the need for cost-effective and sustainable operational strategies. This study examines the impact of supply chain optimization on enhancing e-commerce performance in the apparel sector. It highlights how inefficiencies in traditional supply chain processes—especially those caused by poor information flow—lead to increased operational costs and delays. The research explores the integration of e-commerce technologies, particularly a centralized database system (CDS), as a solution to improve coordination among supply chain stakeholders, including manufacturers, suppliers, and retailers. The findings suggest that adopting a digital, e-commerce-based supply chain system significantly improves order processing speed, reduces lead times, and enhances overall transparency. By replacing manual, email-based communication with real-time data sharing, organizations can achieve greater agility and responsiveness. The study concludes that supply chain optimization through e-commerce integration is essential for improving efficiency, reducing costs, and maintaining competitiveness in the global apparel market.

Keywords— E-commerce, optimization, Apparel supply chain, management.

I. INTRODUCTION

E-commerce is no longer limited to online buying and selling; it represents a broader transformation toward operational efficiency across business functions. Apparel manufacturers are under increasing pressure to remain competitive, especially as labor costs continue to rise. For instance, in Bangladesh, government regulations mandate a wage increase for garment workers every five years, with the most recent adjustment raising wages by 51%.

While this policy supports worker welfare, it significantly increases production costs without offering industry-specific relief.

Although manufacturers may explore options such as cheaper energy sources or tax incentives, they still face high operational expenses, particularly due to unreliable access to electricity and natural gas. As a result, many companies invest in alternative energy solutions to maintain production continuity—an approach that is both expensive and unsustainable over time.

To address these challenges, firms are increasingly turning to supply chain optimization as a cost-reduction strategy. Inefficiencies—often caused by poor information flow—lead to higher expenses, such as reliance on costly air freight for urgent deliveries. Integrating e-commerce into the apparel supply chain helps improve visibility and coordination. By digitizing information flows, companies can enhance supply chain management, reduce lead times, and lower logistical costs.

II. LITERATURE REVIEW

Optimizing the apparel supply chain in Bangladesh involves distinct challenges, primarily driven by political and bureaucratic complexities that raise operational costs. Effective supply chain management (SCM) plays a vital role in coordinating procurement, production, inventory, and distribution activities, all of which are essential for the success of the e-commerce sector. SCM is widely recognized as the backbone of e-commerce, enabling organizations to achieve greater agility and responsiveness.

Ganeshan and Harrison [1] describe SCM as a network of facilities and distribution systems responsible for material sourcing, production processes, and the delivery of finished goods to customers. Similarly, Lee and Corey [2] explain that SCM integrates activities across multiple facilities, from raw material acquisition to product transformation and final distribution through established channels.

Christopher [3] defines SCM as a network connecting upstream and downstream organizations that contribute value through the transformation of products and services, ultimately delivering them to end consumers.

Effective SCM goes beyond individual organizations, requiring strategic alignment of business functions both within firms and across the entire supply chain to improve short- and long-term performance [4]. Supply chains that focus on delivering best value demonstrate superior performance in key areas such as speed, quality, cost efficiency, and flexibility [5]. Despite its importance, there remains limited clarity regarding the theoretical factors that differentiate highly successful supply chains.

Over time, SCM has evolved in response to changing business priorities. During the 1970s, the primary focus was on reducing manufacturing costs; in the 1980s, attention shifted to quality and delivery performance; the early 1990s emphasized customer service; and by the late 1990s, environmental sustainability became a key concern. Today, SCM extends beyond individual firms to encompass the entire supply chain, promoting collaboration in a knowledge-driven economy [6,7,8].

In the modern, fast-changing business environment, adaptability is critical. For e-business, agility in software infrastructure is essential to respond quickly to evolving market conditions. Zhang Shensheng emphasizes that e-business solutions, such as the HuiQing Agile Supply Management System, are developed using agile methodologies to support dynamic and flexible operations [9]. The influence of e-commerce on supply chains has been widely observed and validated in apparel manufacturing organizations [10], with additional impacts also identified across various supply chain functions [11].

Upon confirming the purchase and providing shipping and billing details, the buyer receives an invoice confirming their order.

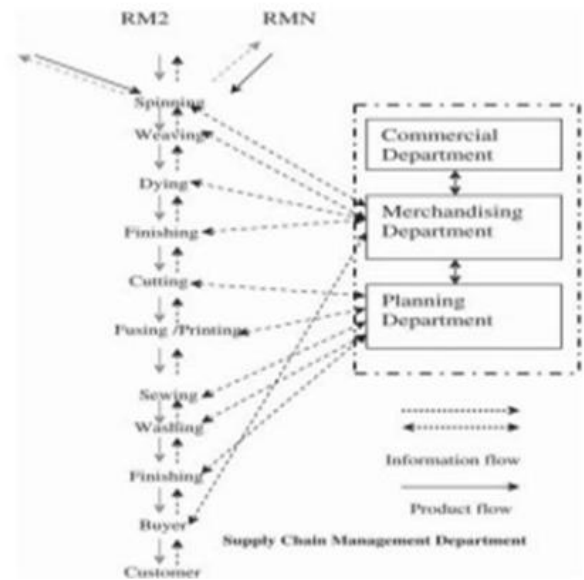


FIGURE 1: GARMENTS SUPPLY CHAIN



FIGURE 2: CENTRALIZED DATABASE SYSTEM



FIGURE 3: DATABASE SYSTEM FOR RETAILER

III. RESULTS & DISCUSSIONS

E-commerce offers a streamlined experience for buyers through enhanced product visibility and simplified purchasing processes. When a buyer navigates an e-commerce website, they can browse product options, access detailed specifications, and view pricing and categorization information, allowing them to make informed purchasing decisions. Once a customer selects a product, the system provides a summary and initiates the checkout process.



FIGURE 4: DATABASE SYSTEM FOR SUPPLIER



Figure 9: Adding Into Cart And Billing Address



FIGURE 5: DATABASE SYSTEM FOR MANUFACTURER



Figure 10: Check And Invoice For Orders

Item	Item Name	Quantity	Price	Total
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

FIGURE 6: CDS

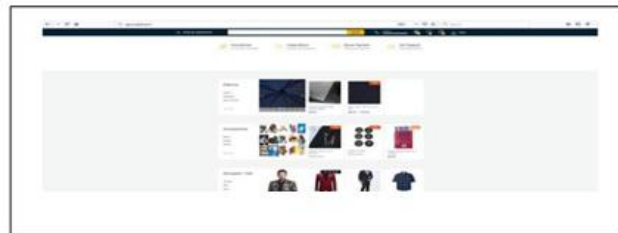


Figure 7: E-Commerce Website



Figure 8: User Login And Product Selection

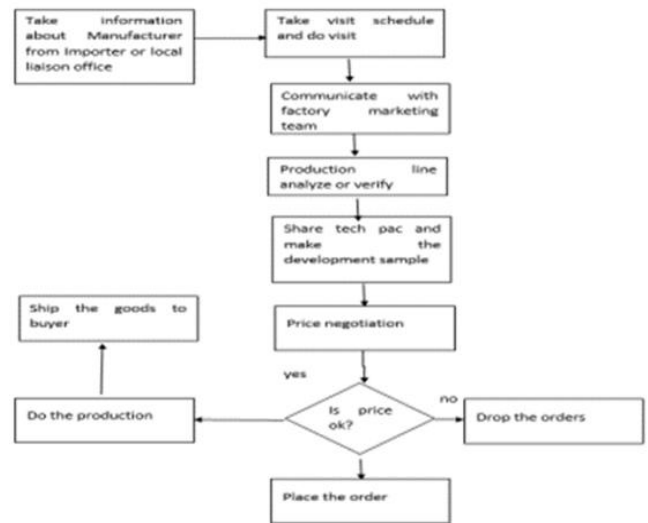


Figure 11 : Current Flow Diagram Of Order Placing Method

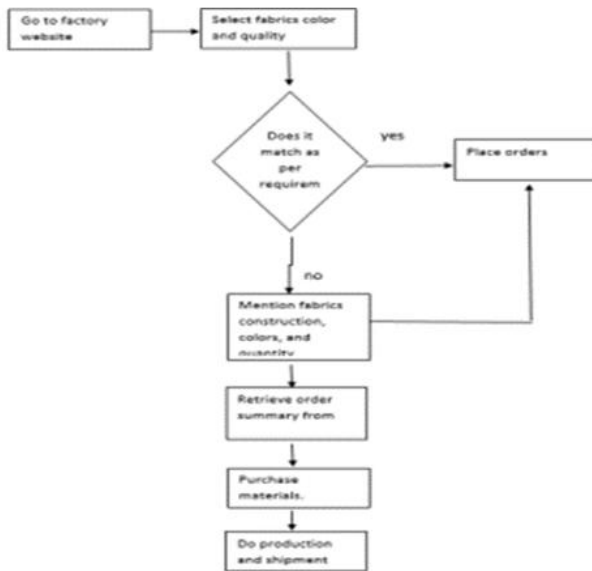


Figure 12: Proposed Flow Diagram Of Order Placing Method

The current order-placing system, compared to the proposed e-commerce-enhanced system, demonstrates marked differences in efficiency. Traditional ordering often relies on manual email confirmations, causing delays. The proposed centralized database system (CDS) addresses this by allowing all supply chain stakeholders—manufacturers, suppliers, and retailers—access to a shared online ordering platform. By adopting this approach, order placements can be confirmed faster, reducing lead times and improving the overall responsiveness of the supply chain. This improvement is visualized through Figures 11 and 12, which compare the existing and proposed ordering methods, highlighting the benefits of a digital, e-commerce-based approach.

IV. CONCLUSIONS

The study highlights the effectiveness of a centralized database system (CDS) in improving the efficiency of the apparel supply chain, particularly when implemented using platforms such as WordPress. As illustrated in Figures 2 and 3, the CDS simplifies the order processing system by allowing customers to place orders directly through an online platform. Unlike conventional email-based confirmation methods, the CDS offers real-time updates and maintains comprehensive records of all transactions within a single, accessible database for all supply chain stakeholders.

By integrating an online ordering system with the CDS, the apparel industry can establish a more streamlined and transparent supply chain. This digital approach enables manufacturers and suppliers to efficiently input, share, and retrieve critical information, thereby enhancing visibility and minimizing delays. The adoption of an e-commerce-driven platform is strongly recommended for apparel manufacturers seeking to improve operational efficiency. Such a system promotes agility and responsiveness, helping organizations manage rising costs while maintaining competitiveness in the global market.

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