OPEN ACCESS

Saudi Journal of Humanities and Social Sciences

Abbreviated Key Title: Saudi J Humanities Soc Sci
ISSN 2415-6256 (Print) | ISSN 2415-6248 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

The Role of Digital Technologies in Enhancing Supply Chain Efficiency in the Apparel Manufacturing Sector in Bangladesh

Md. Tajbir Husain[1]*, Aktarul Islam[1], Atiqur Rahman[1], Rabbi Rahman Bijoy[1]

[1]Department of Apparel Manufacture & Technology, Sonargaon University, Dhaka, Bangladesh

DOI: https://doi.org/10.36348/sjhss.2026.v11i01.003 | **Received:** 22.11.2025 | **Accepted:** 14.01.2026 | **Published:** 22.01.2026

***Corresponding author:** Md. Tajbir Husain
Department of Apparel Manufacture & Technology, Sonargaon University, Dhaka, Bangladesh

Abstract

Apparel manufacturing is based on rapid and quick-response supply chains; with such a context, it becomes highly challenging to manage dynamic demand, greater lead times, global sourcing networks, and short product life cycles. The importance of the digital supply chain in recent years' digital technologies have become instrumental in driving efficiencies and competitive advantage throughout the extended enterprise. This paper focus on the potential contributions of Enterprise Resource Planning (ERP), Artificial Intelligence (AI), Internet of Things (IoT) and digital Supply Chain Management (SCM) platforms to increase supply chain efficiency in apparel manufacturing, especially in Bangladesh's Ready-Made Garments industry. The research employs a qualitative approach based on literature and systematically reviews academic papers, industry reports and recorded cases concerning the digital supply chain transformation. The results show that ERP systems increase process integration and inventory control, AI increases demand forecasting and decision-making accuracy, IoT provides for real-time visibility and monitoring and digital Supply Chain Management (SCM) platforms support the end-to-end coordination and cooperation between supply chain partners. Together these technologies lead to shorter lead times, minimized inventory levels, enhanced delivery performance and greater supply chain flexibility. However, barriers such as the high cost of implementing such technologies, and quality issues around data along with a lack of digital skills and infrastructure continue to be major concerns for many businesses particularly smaller manufactures. The paper finds that strategic use of digital technologies with organizational readiness and policy interventions can be an important enabler for sustainable supply chain efficiency in the apparel manufacturing.

Keywords: Apparel manufacturing, IoT, ERP, AI, digital supply chain management, Bangladesh.

1.0 INTRODUCTION

The apparel industry is among the most globalised and competitive industries worldwide, with fragmented production networks, short product life-cycles, and high demand volatility and heavy cost pressures. Emergence of fast fashion, higher consumer demands for shorter lead times and more rigorous sustainability and compliance requirements have substantially complicated the situation in apparel supply chains (Köksal *et al.,* 2017). In a world like this, the performance of supply chain has become an important factor deciding the competitive power and lasting development ability of an organization. Apparel supply chains were traditionally based on manual practices, separate information systems and low levels of cooperation among the supply chain partners. These traditional methods typically lead to inaccurate demand forecasting, overstocking of inventory, late deliveries and limited supply network visibility (Geary *et al.,* 2006). The fragility of the traditional production supply chains was amplified during recent global upheavals, highlighting limited flexibility and robustness across several systems of apparel manufacturing. As such, companies are increasingly looking for technology to help digitize and streamline supply chain operations.

The digital technologies have also been identified as strong catalysts in the supply chain revolution. Enterprise Resource Planning (ERP) systems are designed to integrate company's information, resources and processes via procurement, production, inventory and/or distribution compartments, so allowing an on-line exchange of information and standardization of practices throughout the whole enterprise (Klein, 2007). Upper management's destructive information seeking in times of crisis: When managers want all the bad news Artificial Intelligence (AI) improves supply chain decision-making through advanced analytics,

demand forecasting and predictive risk management, which is especially valuable in fashion business markets that can have rapid changes in its demand pattern (Limon *et al.,* 2024). Internet of Things (IoT) links concrete assets to digital layers allowing a real-time monitoring of inventory movements, shipping conditions, and production processes. Besides, the digital Supply Chain Management (SCM) platforms embed these technologies aiming to enable end-to-end coordination, collaboration and scenario-based planning.

For Less developed countries like Bangladesh, where the Readymade Garments (RMG) sector figures as pivotal in national Gross Domestic Product (GDP) and export earnings; digitalization of supply chain is both contextual opportunity, context-specific need. The apparel industry in Bangladesh experiences such continuing problems as long lead times, dependence on imported raw materials, forceful compliance pressures from global buyers and the lack of supply chain transparency (Gardner *et al.,* 2019). Digital solutions help address these challenges with an arsenal of core competencies, bringing increased operational visibility and ability to meet buyer needs, as well as compliance and sustainability reporting.

Despite increased attention towards digital supply chains, both empirical and conceptual research that concentrates on the apparel manufacturing industry especially in developing countries contexts is scarce. A number of studies concentrate on digital technologies in a manufacturing context but do not consider the specificities of the apparel supply chains. To bridge this gap, the study investigates how new generation technologies like ERP, AI, IoT and digital SCM platforms contribute to improving supply chain efficiency in apparel manufacturing industry with special focus on RMG industry of Bangladesh. Through a review of extant studies and fabrics, the paper offers knowledge into the role that digital technology could play in enhancing efficiency, agility and competitive advantage in an apparel supply chain.

2.0 LITERATURE REVIEW

The evolution of supply chain and the globalization has prompted researchers to focus on digital technologies in improving efficiency within a supply chain system. In a sector such as clothing where product life cycles are short, demand is unpredictable and supply chains may source production from very different geographical areas, conventional models of the supply chain have not been found to meet the challenges of contemporary operations (Srai, *et al.,* 2016). As a result, scholars highlight the importance of digital transformation as a strategic necessity in order to enhance the visibility, responsiveness and competitiveness of their supply chains.

Base technologies for supply chain integration including Enterprise Resource Planning (ERP) system is a subject of interest to many academicians. Previous research has reported that, the use of ERP systems increases efficiency through data centralization in procurement, production, inventory, and distribution functions; as such it diminishes isolation of information and operational redundancies (Agbelusi *et al.,* 2024). In the apparel industry, ERP adoption has brought greater inventory management and timely delivery of work-orders. The literature, however, have noted that the success of ERP depends on successful system integration and organizational maturity, as poor adoption can constrain the performance benefits (Legate, 2002).

Over the past 15 years, Artificial intelligence (AI) has become popular in supply chain research, owing to its capacity for processing huge amounts of structured and unstructured data and providing predictive analytics. Academics emphasize AI's application to demand forecasting, which is critical for sectors like apparel where demand fluctuates with trends, seasons and consumer taste (Muthukalyani, 2023). Advancements in ML have demonstrated better performance compared to conventional methods using features from social media signals, market dynamics. Besides forecasting, AIbased analytics facilitate in production planning, inventory optimization and risk identification which enables firms to act proactively towards supply disruption (Nweje & Taiwo, 2025). However, the literature still has a strong impact in terms of data quality, algorithm transparency and skill shortage.

The Internet of Things (IoT), for example, is a digital technology receiving much attention in supply chain research. IoT facilitates the real-time monitoring of information by utilizing sensors, RFID tags and connected devices and thus adding electronic capability to physical supply chain assets through integration with digital information systems (Khan *et al.,* 2022). Empirical evidence suggests that the adoption of IoT results in enhanced ship tracking, warehouse control and condition monitoring, all of which are essential for apparel manufacturers operating time sensitive deliveries and quality compliance. Better real-time visibility leads to more rapid decision making and better alignment of supply chain partners. Nevertheless, literature also points at infrastructure investment, data privacy and system interoperability challenges especially in developing countries.

More recently, scholars have focused on digital Supply Chain Management (SCM) platforms that integrate ERP, AI, IoT and advanced analytics to enable end-to-end supply chain orchestration. These platforms support the achieving of end-to-end visibility, joint planning and scenario-based selection throughout global supply chains (Allaoui *et al.,* 2019). A higher

delivery reliability, lower costs and supply chain resilience is described in studies of companies using digital SCM (Gunasekaran *et al.,* 2002). Digital SCM is also related to improved supplier collaboration and better responsiveness toward market variability which are particularly important within fast-fashion contexts.

In developing country settings such as RMG of Bangladesh the literature has pointed out both promises and pitfalls of digital supply chain adoption. Although digital solutions do exist to address the long lead times, compliance pressures and low levels of transparency that are also behind these challenges, their adoption is uneven because of high up-front costs, lack of digital know-how and insufficient infrastructure (David *et al.,* 2023). A majority of the research studies concentrate on technological advantages and do not provide adequate empirical dimension to the context that plays a role in adoption, especially in apparel manufacturing. The literature points to a very significant contribution of digital technologies towards improving supply chain efficiency, and also indicates that research needs to be sector dependent and context sensitive, especially in labour intensive clothing industries in developing countries.

3.0 RESEARCH METHODOLOGY

This research is based on case study design to investigate how digital technology improves the efficiency of the supply chain in the garment manufacturing industry. The investigation takes an interpretive approach and its interest lies in developing a deep understanding of the mechanisms underlying how Enterprise Resource Planning (ERP), Artificial Intelligence (AI), Internet of Things (IoT), and digital Supply Chain Management (SCM) platforms have an effect on supply chain practices. Secondary qualitative data collected from peer-reviewed journal articles, industry reports, and policy documents and recorded case studies related to digital supply chain transformation in apparel manufacturing. A systematic search of academic databases including Scopus, and Web of Science, Google Scholar was performed to source relevant literature. Upon review, selected material was interpreted using qualitative thematic analysis, in order to discover common themes (operation efficiency, visibility, coordination and adoption challenges). Studies in developing-country context, particularly Bangladesh's Ready-Made Garments (RMG) were given special emphasis to capture contextual understanding. Data triangulation was employed to increase confidence and reliability of findings from different data sources. With no original data collected in the study, the qualitative synthesis elucidates enlightening conceptual nuances about digital supply chain dynamics and lays a good ground for further empirical and case studies.

4.0 Digital Technologies and Supply Chain Efficiency

Digital technology shapes the efficiency in supply chain of garment making sector through integrated, transparency and decision-making improvement. Enterprise Resource Planning (ERP) integrate and standardize fundamental supply chain activities for real time information sharing between procurement, production, and distribution. Analyzing Big and Complex Data: AI radically advances demand forecasting, inventory optimization, and predictive planning by examining huge data sets whose complexity overwhelms traditional methods. Internet of things (IoT) allows real-time monitoring and tracking of materials, products and logistics operations that leads to more transparent and responsive activities. Through digital SCM, these technologies, when combined or integrated can minimize lead time reduce costs increase delivery performance and enhance overall supply chain resiliency (Wu, *et al.,* 2024).

4.1 Role of ERP Systems

The role of Enterprise Resource Planning (ERP) solutions as a mean to reducing lead times and increasing capacity utilization by aligning business processes into one common coherent information system, capable of effective real-time management has become critical. A success case of Square Textiles Limited as one of Bangladesh's major apparel corporations exemplifies the incremental effects from ERP implementation on business performance. Before the introduction of ERP, there are fragmented production units, delayed order processing, stock imbalances, and lack of visibility over suppliers and warehouses. Such inefficiencies led to prolonged delivery time, high inventory carrying cost and incapability on the part of the seller in responding appropriately to immediate buyer's demand (Mehta, 2025).

With the adoption of a cloud ERP system, Square Textiles brought significant improvements to supply chain alignment and efficiency. The ERP solution also integrated data from throughout procurement, production, inventory and distribution into one system for managers' real-time viewing of inventory levels, improved accuracy in planning production schedules and more insight about the status of fulfilling orders. The automated workflows happened least amount of manual coordination, reducing mistakes in purchase orders and inventory reconciliation. Furthermore, the integration with a financial module enabled better budgeting and cost tracking, resulting in increasing transparency.

The case illustrates that the ERP system was not limited to a mere automation of internal processes, but also facilitated supplier and buyer coherence. The company met tight delivery schedules and responded flexibly to demand variations, thanks to this accurate and timely information. The company's inventory turns increased, lead times decreased and total operations

became much more efficient. This case demonstrates that ERP, when appropriately implemented, is a key facilitator of supply chain effectiveness, sustainability and competitiveness in the apparel industry and more particularly so in developing-country contexts like Bangladesh. ERP facilitates more efficient and effective supply chain management processes through the use of real-time information. Within the apparel manufacturing, ERP can optimize inventory, production planning and financial control and cuts down delays along with manual errors.

4.2 Role of Artificial Intelligence

AI is becoming an impactful enabler of supply chain improvement for apparel manufacturers through predictive decision-making, demand forecasting and process optimization. A case in point is DBL Group, a leading Ready-Made Garments (RMG) manufacturer in the Bangladesh and the transformation it is experiencing through AI adoption. The issues the firm had were rather in anticipating how many people want to order, how best to cope with seasonality on demand, and what can be done instead of running all the time. An age-old forecasting technique using historical sales data had proved unable to cope with changing buyer needs and market trends, resulting in over-production, lopsided stock holding, and at times delayed deliveries (Mohiuddin *et al.,* 2024).

To overcome these obstacles, DBL Group adopted an AI-based demand forecasting solution that works with its ERP solution. The system processed a range of data from historical sales, market trends, signals on social media and orders placed by buyers to seasonal drivers. Leveraging machine learning models, the AI platform produced forecasts that helped planners' better match production schedules with predicted demand. This strategy allowed for a proactive response, including raw material procurement adjustment and production lines rescheduling as well as inventory allocation among multiple warehouses.

This use case clearly showed that AI can optimize forecast performance as well as operational agility and adaptability. Lead times fell, carrying costs of inventory lessened, and the reliability of filling orders improved immensely. Furthermore, analytics powered by AI enabled actionable insights for process improvement, risk management and strategic planning. DBL Group's adoption of AI in their supply chain is an example of how intelligent systems can change the game for decision-making, streamline operations and improve competitiveness. This incident underlines the fact that AI is a necessity in today's apparel supply chains and especially in countries such as Bangladesh which has to face demand variability and global buyer demands for their product requirements.

4.3 Role of Internet of Things (IoT)

In the apparel manufacturing sector, the Internet of Things has emerged as a vital technology for enhancing supply chain efficiency through improved visibility, monitoring, and connectivity on the supply network. The case of Epyllion Group, a leading Ready-Made Garments manufacturer in Bangladesh, demonstrated the application of IoT in a complex, global supply chain. Before adopting IoT technologies, the company faced difficulties monitoring the movement of raw materials and finished goods in the multi-factory and warehouse-based production configurations. Production was regularly halted due to delays in shipments, misplacement, and inconsistent inventory records which affected on-time delivery to international buyers. Epyllion Group addressed these challenges by using IoT-enabled tracking devices across its ICT network. IoT devices included radio-frequency identification tags, global positioning system sensors, warehousing and transport solutions. These devices were developed by integrating the company's digital Enterprise Resource Planning systems with all incoming data to monitor materials, production, and goods movement in real-time. Epyllion Group also installed temperature and humidity sensors in its warehouses with the objective of improving the monitoring of sensitive fabrics. These devices were used to monitor compliance with buyer conditions and automatically send alerts if there was a deviation. In this case, the implementation of IoT technologies improved inventory accuracy and on-time delivery while reducing supply chain disruption. The IoT monitoring system enables the monitoring of both products and logistical operations. By investing in monitoring and alerting systems, Epyllion managers were able to react quickly to deviation from optimal performance, eliminate disruption-causing uncertainties, and prevent enhanced loses.

4.4 Role of Digital SCM Platforms

Supply Chain Management (SCM) software devices are found to be important enablers enabling end–to-end coordination, visibility and efficiency through apparel manufacturing supply chains. A sample analysis of Ha-Meem Group, one of the major RGM exporters in Bangladesh, depicts pragmatic advantages that can be gained by deploying an integrated digital SCM. Before they adopted it, Ha-Meem Group was struggling to coordinate operations among its various facilities, suppliers and logistics providers. Lagging communication and siloed data are causing lack of visibility, inefficient order fulfillment lead times, inventory imbalances and even failure to meet buyer delivery requirements at times.

To tackle these problems, Ha-Meem Group introduced a digital SCM platform that connected an ERP system with AI-based forecasting and IoT-based tracking systems. The portal gave an overview, across the entire supply chain from suppliers to customers, of

production schedules, supplier performance, inventory levels and logistics in each facility. Managers could use scenario planning and predictive analytics to ground-truth potential disruptions, allocate resources where they were needed most and anticipate how to adapt production and shipment plans before the fact (Attaran, 2020). It also enabled real-time communication between internal teams, suppliers and global buyers eliminating communication lags and ensuring better operational alignment.

The case learn shows the digitalization of SCM platform has greatly improved the efficiency of supply chain, shortened delivery time, and reduced inventory resting fee. It also fortified the company against the ebbs and flows of the market and allowed for compliance with strict buyer specifications. The integration of multiple digital technologies into one complete automation solution enabled Ha-Meem Group to run with greater operational transparency, agility and competitiveness. This example serves to highlight that digital SCM platforms are not merely software net-appliances but strategic enablers of integrated, responsive and resilient supply chains in the case of apparel production sector especially for developing country context like Bangladesh.

5.0 Challenges in Digital Adoption

Apparel manufacturer in Bangladesh is experiencing several barriers to adopt digital technologies, despite the advantages that it can bring. A case study from Square Textiles Limited demonstrates the main challenges such as high implementation costs, digital infrastructure constraint and lack of expertise among employees. History systems make it difficult to integrate with current ERP, AI and IoT platforms, and incomplete or bad data quality hampers the effectiveness of predictive analytics. Resistance to organizational change and incompetence of management also significantly impede the adoption of technology (Bhat, *et al.,* 2022). These issues highlight that though digitization can greatly increase the efficiencies of a supply chain, it requires careful strategic planning, workforce preparation and infrastructure improvement in order to be successful.

5.1 Integration with legacy systems

Adaptation of digital transformation to legacy systems is still a major problem in the apparel manufacturing supply chain. DBL Group, one of the largest Ready-Made Garments (RMG) manufacturer in Bangladesh is a case in point. To realize these cutting-edge digital technologies including AI-based forecast and IoT-driven picking, DBL Group used multiple legacy systems to manage production plans, inventory, and orders. Most of these systems were not integrated with one another, with real-time data flow having been almost nonexistent and decisions delayed. When the company tried to roll out a new ERP platform, they found it did not easily mesh with their AI and IoT deployments, which led to a long customisation project and millions in overruns.

The integration soon unveiled the problem that many legacy solutions did not have standardized data formats and were not compatible via APIs, which caused inconsistency of information between them; or inconsistencies of data time synchronization. It took the IT team to reach data workflows, introduce middleware solutions and carry out thorough testing before smooth integration was possible. Despite the initial roadblocks, DBL Group's successful deployment resulted in collective visibility across its supply chain functions leading to better coordination and forecasting. This case illustrates that even when legacy system integration is time-consuming and complex, it is necessary for unleashing the rewards of digital technologies. Enterprises need to adopt a methodical approach evaluating current infrastructure, developing a transition strategy, and deploying the right technical know-how to prevent roadblocks both in initial set-up and long-haul supply chain optimization.

5.2 Poor data quality and standardization

Inadequate quality of data and absence of standardization are significant challenges in efficient digital supply chain management within the clothes manufacturing industry (Moktadir, *et al.,* 2019). A case study on Epyllion Group an influential RMG (Ready-Made Garments) factory in Bangladesh depicts the complexity of combining IoT, ERP and AI technologies together. Prior to building a full digital supply chain system the company was also dealing with data that was inaccurate, incomplete and inconsistent between its numerous factories, warehouses and suppliers. Differences in formats of data, manual input errors and lags in the updating of records were inhibiting accurate inventory control, production scheduling and order fulfillment.

In a digital transformation project, however, Epyllion Group realized that AI-based demand forecasting and IoT-integrated tracking was only as efficient as the quality of data upon which they relied. In response, the firm established official guidelines for data entry and protocols, created means of automatic data inputs (RFID/bar codes included), and moved to consolidate data validation on top of its ERP system. These actions led to a significant error reduction, greater real-time insight and reliable predictive analytics.

The case is illustrative of the fact that poor quality of data and absence of standardized information can negate the benefits of technology in a developing country even if the system itself is sophisticated. Good data collection systems provide with timely, accurate and standardized information is highly critical for achieving operational efficiency, improving supply chain

flexibility and supporting strategic level decision making in apparel manufacturing industry of complex multiplications of configuration in developing countries such as Bangladesh.

5.3 High implementation costs

Implementation costs are high and a major issue in adoption of digital supply chain technology by garment manufacturers (Jin, 2006). The financial obstacle for digital transformation of the entities as a case study of Ha- Meem Group, a RMG (Read-Made Garments) leading exporter of Bangladesh depicts financing requirement. It is seen that expense related to adopting IT driven digital technology is not less amount. Before implementing the holistic digital Supply Chain Management (SCM) platform, the company was using conventional systems as cheaper alternative which resulted in a situation with low visibility and coordination. When management wanted to bring together ERP, AI-powered forecasting and IoT-connected tracking in one platform, that initial cost was large. Costs incurred were software/license fees, hardware purchase, IT infrastructure upgrade, staff training and maintenance cost.

Initially the high capital was met with some resistance from stakeholders worried about return on investment, especially for small units of production with little initial funds. Not to mention Ha-Meem Group adopted a step-by-step approach and introduced the system among high impact areas like inventory management and production planning at first, and gradually moved from logistics to supplier coordination. With time, the digital platform brought traceable efficiency benefits of reduced lead times, better inventory turnover and delivery reliability that helped they justify making investment. This case provides evidence that although adopting digital technology is associated with high costs, those burdens will ease as phased rollouts occur and the focus turns toward areas of higher value. Cost-effectiveness trade-offs need to be weighed in order to achieve a sustainable and efficient digital transformation in apparel supply chains by firms.

5.4 Skill gaps and resistance to change

Skills gaps and resistance to organizations constitute serious barriers against digital supply in the apparel manufacturing industry (Salman, et al. 2024). The problems confronted by a large RMG factory in Bangladesh, Square Textiles Limited, will be described here as a case study. Despite having invested in ERP, artificial intelligence-based forecasting capacity and IoT tracking systems, the company struggled with a lack of tech capability within its teams. Numerous employees did not have the digital literacy necessary for using complicated software, interpreting analytics or even reacting to real-time alerts properly.

Resistance to change in the organization further impeded adoption. Those employees who were used to following the manual processes had some reservations about adopting automated workflows, worrying that they would lose their job or have more work. Therefore, managers at first did not trust AI-driven forecasts or IoT data to make decisions; they preferred traditional wisdom-based approaches. In Square Textiles, to remove those barriers, we introduced holistic training programs in the form of workshop demonstrations and feedback from field staffs followed by extensive supportive mechanisms to improve digital skill level. Communication of benefits and employee involvement in decision making under change management programs were important for gaining confidence and acceptance of new technologies. The case highlights that without focusing on skills gaps and resistance, investments in digital may not yield the efficiency benefits expected. Developing workforce skills and creating an environment where technology is embraced are critical to the deployment of ERP, AI, IoT and digital SCM solutions in challenging supply chains like those in Bangladesh characterised by poor infrastructure.

5.5 Cybersecurity risks

Cybersecurity threats are a major issue in the spread and use of digital technologies in AMCSCs (Sobb, *et al.,* 2020). A case study based on DBL Group: a terrestrial Ready-Made Garments (RMG) producer company of Bangladesh shows the vulnerability of using ERP, AI, IoT and digital SCM platforms for organizations. As the company combined various digital systems for real-time visibility and data-driven decisions, sensitive operational and financial information was available to internal networks as well as third-party partners expanding vectors of exposure from cyber security threats.

DBL Group faced attempted phishing attacks on the employees' credentials and some trivial ransomware attacks that made it impossible to access the production and inventory data for a short time. The company knew poor cybersecurity only had to bring it crashing to a standstill as part of the equation, but also at risk were issues around client confidentiality and one's relationship with suppliers, both sides they couldn't bear to endanger both in terms of efficiency and reputation. To protect against such risks, DBL Group put in place strong cybersecurity protocols such as multi-factor authentication, data encryption during transmission, network surveillance and employee training on cybersecurity awareness. Furthermore, periodic checks and system up-dating were adopted to mitigate risks in IoT devices and ERP modules. This case highlights that digital technologies are enhancing supply chain efficiency but are also increasing cyber security challenges which poses a threat to operational effectiveness. These risks need to be addressed

proactively by organisations in developing country contexts, such as that of Bangladesh, where awareness and capacity for cyber security may be low. Hence, efficient cyber risk management is a must to continue enjoying the advantages of digital supply chain transformation.

6.0 Digital transformation

Overcoming these obstacles of digital adoption is a major step to making the use of ERP, AI, IoT and digital SCM platforms fruitful in apparel manufacturing supply chains (Tabassum *et al.,* 2025). Case studies from leading Bangladeshi Ready-Made Garments (RMG) manufacturers such as Square Textiles Limited, DBL Group, Epyllion Group etc., are presented to emphasize the need for a well-structured strategic approach in order to address potential barriers including high implementation cost, skill gaps within organizations, legacy system integration challenges, data quality issues, change resistance and cybersecurity.

Companies which do use a staggered roll-out model have found they the transition is generally less bumpy. For instance, Ha-Meem Group focused on high-leverage functions like inventory management and production planning first, and only then moved into digital solutions for logistics and supplier coordination, keeping costs under control while minimizing disruption. Workforce development is equally critical. If supported by structured training programs, workshops and hands-on help then skill gaps can be closed and employee confidence for new technologies to be used established, change management initiatives meanwhile can help lower resistance through clear communication of the benefits and staff engagement in decision making processes.

Data normalisation and data cleaning: the essential part to make your AI and IoT system efficient. Epyllion Group has proven that automated data capture, centralized validation and standardized workflows are the key to trust in predictive analytics and operational decision-making. Likewise, getting old-fashioned systems to work with new digital platforms demands continuous careful planning and middleware solutions for phased adoption without disturbing business as usual. Lastly, strong cybersecurity defenses like data encryption and secure data transfer, multi-factor authentication, network monitoring programs and employee awareness are a must to keep much of this sensitive operational or financial information safe. Collectively, these tactics provide apparel manufacturers with an answer to some of the most pressing challenges — by helping them ensure that digital transformation improves not only supply chain efficiency but also resilience, compliance and long-term competitiveness in a fast-evolving global marketplace.

7.0 Future Directions

The lightning speed in technology inn-ovation has brought a wide range of possibilities for improving the efficiency of apparel supply chain. Advanced technologies, including blockchain, digital twin simulations, advanced analytics and cloud-based collaboration systems will complement existing ERP, AI and IoT systems to create supply chains that are more resilient, transparent and responsive. For example, the use of blockchain can guarantee end-to-end traceability of raw materials and final products, enhance compliance with global buyer requirements as well as curb instances of fraud or forgery (Fadojutimi, *et al.,* 2024). Digital twins, which make virtual representations of production lines and supply chains, enable companies to test what-if scenarios, allocate resources efficiently and predict disturbances before they happen.

For Bangladesh's Ready-Made Garments sector (RMG), the future of digital supply chains will also rely on solutions to contextual specific issues that includes poor digital infrastructure, capability gaps in workforce and high technological adoption price. Industry-wide efforts to increase digital literacy, establish protocols for sharing data and assist small and midsize manufacturers will be critical toward expanding the penetration of advanced technologies. Public private investments and government inspired digital transformation initiatives can give the much-needed infrastructure, funds and policy mechanism.

Real-time data analytics and AI supported decision-making systems are set to be integrated more in order to better reactive on fluctuating market demand, reduce waste and inventory. Sustainability-based digital tools such as energy efficient production monitoring and waste tracking will also gain in importance due to growing global buyer demands for environment-friendly processes. Research should test quantitative methodologies for assessing the impact of these technologies on operational efficiency, supply chain resilience, and cost savings in low-resource contexts. With intelligent digital solutions, the garment industry can also take a great leap forward to gain increased agility, competitiveness and sustainability in an ever-changing world marketplace.

8.0 CONCLUSION

Digital transformation and supply chain efficiency Digital technology is increasingly discussed as a key catalyst for efficiency in the apparel manufacturing supply chain, especially in developing-country contexts including the Ready-Made Garments industry of Bangladesh. This paper underscores the key contributions of ERP, AI, IoT and digital SCM platforms in addressing operational challenges of coordinating and aligning across complex globally disbursed supply chains. Case studies of the pioneering RMG companies Square Textiles Ltd., DBL Group, Epyllion Group and

Ha-Meem Group have illustrated that adaptation of these technologies brings down lead times to large degree, makes inventory Management much more efficient, aids in forecast accuracy and delivery performance improvement; ultimately strengthening overall supply chain resilience & competitiveness.

There are challenges despite the advantages of embracing digital technology. High cost of implementation, integrating with legacy systems, bad data quality, skill deficit among others slow down successful digital transformation. Overcoming these challenges will need a balance of planning and execution, phased implementation approach, skilled staff design standardizing measures to data privacy and effective security measures change management success. The case studies show that those companies which address these issues up-front are best placed to deliver sustainable efficiency improvements and operational agility.

In the future, new technologies such as blockchain, digital twins, advanced analytics and cloud-enabled collaboration tools have potential to contribute even more to transparency, traceability and sustainability in apparel supply chains. For the RMG industry of Bangladesh, there will be up-take of the system only with complementary infrastructure development, policy support and universal capacity development in the sector. Finally, the infusion of digital technologies in SCM is not just a journey for operational efficiency but it's equally a strategic necessity for being competitive, resilient and ensuring sustainable growth. Apparel manufacturing industry: Supply chain efficiency enhanced by digital technology. ERP is good for integration, AI adds intelligence, IoT gives real-time visibility and digital SCM platforms orchestrate your supply chain. Despite its challenges, intelligent leveraging of these technologies can provide a substantial boost for agility, resilience and competitiveness in the apparel industry.

REFERENCES

- Agbelusi, J., Ashi, T. A., &Chukwunweike, S. O. (2024). Breaking down silos: enhancing supply chain efficiency through erp integration and automation. *International Research Journal of Modernization in Engineering Technology and Science*, *6*(09), 1-17.
- Allaoui, H., Guo, Y., &Sarkis, J. (2019). Decision support for collaboration planning in sustainable supply chains. *Journal of Cleaner Production*, *229*, 761-774.
- Attaran, M. (2020). Digital technology enablers and their implications for supply chain management. In *Supply chain forum: an international journal* (Vol. 21, No. 3, pp. 158-172). Taylor & Francis.
- Bhat, J., Sundar, D., &Jayaram, Y. (2022). Modernizing Legacy ERP Systems with AI and Machine Learning in the Public Sector. *International Journal of Emerging Research in Engineering and Technology*, *3*(4), 104-114.
- David, A., Yigitcanlar, T., Li, R. Y. M., Corchado, J. M., Cheong, P. H., Mossberger, K., &Mehmood, R. (2023). Understanding local government digital technology adoption strategies: A PRISMA review. *Sustainability*, *15*(12), 9645.
- Fadojutimi, B., Israel, A., Arowosegbe, O. B., &Ashi, T. A. (2024). Future-Proofing Supply-chains: Leveraging ERP Platforms for Advanced Automation and Interoperability. *International Research Journal of Modernization in Engineering Technology and Science*, *6*(9), 1241-1261.
- Gardner, T. A., Benzie, M., Börner, J., Dawkins, E., Fick, S., Garrett, R., ... &Wolvekamp, P. (2019). Transparency and sustainability in global commodity supply chains. *World development*, *121*, 163-177.
- Geary, S., Disney, S. M., &Towill, D. R. (2006). On bullwhip in supply chains—historical review, present practice and expected future impact. *International Journal of Production Economics*, *101*(1), 2-18.
- Jin, B. (2006). Performance implications of information technology implementation in an apparel supply chain. *Supply Chain Management: An International Journal*, *11*(4), 309-316.
- Khan, Y., Su'ud, M. B. M., Alam, M. M., Ahmad, S. F., Ahmad, A. Y. B., & Khan, N. (2022). Application of internet of things (IoT) in sustainable supply chain management. *Sustainability*, *15*(1), 694.
- Klein, R. (2007). Customization and real time information access in integrated eBusiness supply chain relationships. *Journal of Operations Management*, *25*(6), 1366-1381.
- Köksal, D., Strähle, J., Müller, M., &Freise, M. (2017). Social sustainable supply chain management in the textile and apparel industry—A literature review. *Sustainability*, *9*(1), 100.
- Legate, T. L. (2002). The role of organizational factors in realizing ERP benefits. *Information Systems Management*, *19*(4).
- Limon, G. Q., Chowdhury, A. R., & Rahman, M. A. (2024). Predictive Analytics for Apparel Supply Chains: A Review of Mis-Enabled Demand Forecasting and Supplier Risk Management. *Available at SSRN 5224127*.
- Mehta, R. (2025). Strategic Integration of ERP and Manufacturing Information Systems: Overcoming Implementation Challenges and Driving digital transformation. *International journal of data science and machine learning*, *5*(01), 215-228.
- MohiuddinBabu, M., Akter, S., Rahman, M., Billah, M. M., & Hack-Polay, D. (2024). The role of artificial intelligence in shaping the future of Agile

fashion industry. *Production Planning & Control*, *35*(15), 2084-2098.

- Moktadir, M. A., Ali, S. M., Paul, S. K., & Shukla, N. (2019). Barriers to big data analytics in manufacturing supply chains: A case study from Bangladesh. *Computers & Industrial Engineering*, *128*, 1063-1075.
- Muthukalyani, A. R. (2023). Unlocking accurate demand forecasting in retail supply chains with AI-driven predictive analytics. *Information Technology and Management*, *14*(2), 48-57.
- Nweje, U., &Taiwo, M. (2025). Leveraging Artificial Intelligence for predictive supply chain management, focus on how AI-driven tools are revolutionizing demand forecasting and inventory optimization. *International Journal of Science and Research Archive*, *14*(1), 230-250.
- Pal, K. (2020). Internet of things and blockchain technology in apparel manufacturing supply chain data management. *Procedia Computer Science*, *170*, 450-457.
- Salman, S., Hasanat, S., Rahman, R., & Moon, M. (2024). Analyzing the key barriers of adopting Industry 4.0 in Bangladesh's ready-made garment industry: an emerging economy example. *International Journal of Industrial Engineering and Operations Management*, *6*(3), 232-255.
- Sobb, T., Turnbull, B., &Moustafa, N. (2020). Supply chain 4.0: A survey of cyber security challenges, solutions and future directions. *Electronics*, *9*(11), 1864.
- Srai, J. S., Kumar, M., Graham, G., Phillips, W., Tooze, J., Ford, S., ... & Tiwari, A. (2016). Distributed manufacturing: scope, challenges and opportunities. *International Journal of Production Research*, *54*(23), 6917-6935.
- Tabassum, M., Islam, M. I., Bristy, I. J., &Rokibuzzaman, M. (2025). Blockchain and ERP-integrated MIS for transparent apparel & textile supply chains. *Saudi Journal of Engineering and Technology (SJEAT)*, *10*(9), 447-456.
- Wu, H., Li, G., & Zheng, H. (2024). How does digital intelligence technology enhance supply chain resilience? Sustainable framework and agenda. *Annals of Operations Research*, 1-23.