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RESEARCH PAPER

The role of digital supply chain practices in enhancing firm performance: insights from the manufacturing sector of Bangladesh

Tahsina Khan[1], Md Mehedi Hasan Emon[1]

[1]Bangladesh University of Professionals (BUP), Bangladesh.

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ABSTRACT

Purpose: This study examines the impact of digital supply chain practices (DSCP) on firm performance (FP) in the context of Bangladesh's manufacturing sector, with a focus on supply chain responsiveness (SCR) and customer development (CD) as mediating factors.

Design/methodology/approach: A quantitative research design was employed, utilizing partial least squares structural equation modeling (PLS-SEM) to analyze survey data collected from 438 participants representing manufacturing firms in Bangladesh. The model evaluates the direct effects of DSCP on FP, as well as the mediating roles of SCR and CD.

Findings: Results indicate that DSCP positively and significantly impacts FP, with SCR and CD serving as effective mediators in this relationship. The study demonstrates that digital integration in supply chains enhances responsiveness and customer engagement, ultimately leading to improved organizational performance.

Through increased operational efficiency, streamlined logistics, and improved decision-making, the results show that Digital Supply Chain Practices (DSCP) are essential for boosting company performance. By empowering businesses to quickly adjust to market needs, minimize interruptions, and maximize resource usage, DSCP improves supply chain responsiveness and, in the end, increases agility and competitive advantage. Additionally, by enhancing engagement, trust, and service quality, DSCP improves customer development, which supports long-term business success and sustainability in Bangladesh's manufacturing industry.

Research limitations/implications: The study is limited by its focus on the manufacturing sector in Bangladesh, which may affect the generalizability of findings to other industries or regions. Future studies should examine additional variables, such as organizational culture and market conditions, that may influence DSCP's effectiveness.

Practical implications: The findings provide actionable insights for managers seeking to enhance performance through digital supply chain integration. Investing in digital tools can improve responsiveness and customer satisfaction, driving organizational success in competitive markets.

Social implications: This study underscores the potential of digital transformation to improve supply chain efficiency, fostering economic growth and sustainability in emerging economies like Bangladesh.

Originality/value: This research contributes to the limited literature on digital supply chains in developing economies, offering empirical evidence of their role in improving firm performance.

Keywords: Digital supply chain practices; Firm performance; Supply chain responsiveness; Customer development; Bangladesh; Manufacturing sector; PLS-SEM.

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1 INTRODUCTION

The emergence of digital technology has revolutionized supply chain operations worldwide, allowing companies to respond to swift market fluctuations and improve efficiency (Frederico, 2021). Digital Supply Chain Practices (DSCP), utilizing technologies such as artificial intelligence (AI), big data analytics, Internet of Things (IoT), and blockchain, are essential to these transformations, enabling companies to enhance resource allocation, inventory management, and customer responsiveness (Emon et al., 2025; Yevu et al., 2021). In this regard, the integration of DSCP has the potential to improve productivity and competitiveness in developing countries like Bangladesh, where manufacturing and export-oriented industries are essential to economic development (Li et al., 2023). Nonetheless, despite the potential for expansion, study on DSCP in the Bangladeshi setting is scarce, resulting in a deficiency in comprehending how digital improvements might be used to address specific regional difficulties.

As Bangladesh transitions to Industry 4.0, companies face increasing pressure to use digital techniques in supply chain management (SCM) to maintain global competitiveness (Núñez-Merino et al., 2020). Digitalization has transformed supply chains from linear processes into intricate, interconnected networks that provide flexibility and agility (Choudhury et al., 2021). This trend requires Bangladeshi companies to use digital strategies to improve supply chain visibility, optimize logistics, and boost demand forecasting management. Digital transformation in supply chains, marked by the incorporation of technologies such as IoT, AI, and blockchain, has shown the capacity to modify operational practices, providing real-time data-driven insights and enhanced decision-making skills (Khan & Emon, 2025; Sundarakani et al., 2021).

Developed economies have widely implemented DSCP, however developing countries like Bangladesh are in the early phases of this transition (Abdullah et al., 2021; Emon et al., 2024). Bangladesh's economy might greatly benefit from adopting DSCP to enhance operational efficiency and successfully adapt to global market demands, particularly in its expanding manufacturing sector, notably in ready-made garments. In Bangladesh, supply chain management is essential for industries such as textiles, leather, and pharmaceuticals, which are significant contributors to the national economy. Conventional supply chain management approaches often lack the adaptability necessary for the contemporary global economy, characterized by fluctuating demand, supply interruptions, and regulatory modifications (Makris et al., 2019). Digital methodologies, such as predictive analytics for demand forecasting and blockchain for supply chain transparency, might mitigate these deficiencies by augmenting operational efficiency, therefore raising overall organizational performance (Dutta et al., 2020).

Nonetheless, obstacles to the adoption of digital technology in Bangladesh remain owing to infrastructure deficiencies, a shortage of qualified labor, and resource limits (Emon & Khan, 2025). These limitations impede local enterprises from capitalizing on the advantages of DSCP, resulting in inefficiencies and lost opportunities (Jamil, 2021). This paper examines DSCP's impact on company performance via a thorough review of its effects on the distinctive business environment of Bangladesh. Bangladesh's economy has seen significant expansion in recent years, propelled by its manufacturing and export sectors, with the garments industry accounting for over 84% of the nation's total exports (Rahman & Chowdhury, 2020). Notwithstanding this advancement, Bangladeshi enterprises are underachieving in global competitiveness rankings, partly because to inefficiencies in supply chain management (Kabir & Ahmed, 2019). Conventional supply chain management techniques, marked by significant reliance on manual processes, exacerbate these inefficiencies, underscoring the need for digital transformation to enhance agility and resilience (Kassa et al., 2023).

The Government of Bangladesh has started initiatives for Industry 4.0; nevertheless, the private sector's adoption of DSCP remains sluggish. A constrained comprehension of the advantages, substantial initial investment expenses, and insufficient experience persist as significant obstacles for several companies (Estrada & Dong, 2020). As global supply chains increasingly depend on real-time data exchange, technologies such as RFID for monitoring, big data for predictive analytics, and blockchain for transparency have become essential for companies seeking to improve their performance (Pal & Yasar, 2020). While larger corporations have started experiments with DSCP, small and medium businesses (SMEs) have resource constraints that hinder their ability to fully use these technologies. Recent study has shown a deficiency of empirical studies addressing DSCP in Bangladesh, highlighting the need for an analysis that accounts for the region's distinct socio-economic and infrastructural limitations. This research examines the current status of DSCP in Bangladesh, investigating the determinants of its adoption and assessing its impact on company performance.

In the changing global environment, digital supply chain practices (DSCP) have become essential

for companies aiming to improve performance via enhanced responsiveness, customer development, and operational efficiency (Tan et al., 2019). A multitude of firms globally have effectively embraced digital practices, using technology such as the Internet of Things (IoT), Artificial Intelligence (AI), and blockchain to revolutionize their supply chains. These innovations allow companies to adapt to changing needs, enhance decision-making precision, and guarantee uninterrupted operations (Dutta et al., 2020; Emon & Khan, 2024a; Myamba et al., 2024). Nonetheless, despite the established advantages of DSCP worldwide, numerous companies in developing economies, including Bangladesh, have been sluggish in embracing these practices due to obstacles such as elevated implementation costs, insufficient technical infrastructure, and restricted access to proficient personnel (Rahman et al., 2020). In Bangladesh, where companies often face supply chain interruptions stemming from infrastructure and logistical limitations, the use of digital supply chain technology may provide a considerable competitive edge. Effective adoption of DSCP might allow Bangladeshi enterprises to navigate risks, improve visibility in supply chain processes, and match more closely with customer needs, hence boosting company performance.

Nonetheless, there is a paucity of empirical research investigating the degree to which DSCP affects performance outcomes such as supply chain responsiveness, customer development, and overall firm performance within the context of Bangladesh. Developed countries have been the focus of most recent research, and the results may not be entirely applicable to Bangladesh's unique economic environment, which is marked by resource constraints, market instability, and logistical obstacles (Hobbs et al., 2023; Tumpa et al., 2019). Moreover, there is little information about the exact mechanisms by which DSCP influences firm performance, especially with intermediate elements such as supply chain responsiveness and customer development. In the absence of comprehension about these processes, companies may find it challenging to rationalize their first expenditures in digital practices or may be devoid of the strategic direction necessary for efficient implementation of these changes. A significant prospect to improve productivity and global competitiveness exists for Bangladesh's manufacturing sector through the adoption of digital supply chain practices. By enhancing transparency, demand forecasting, and real-time decision-making, digital technologies like big data analytics, IoT, and blockchain have the potential to completely transform supply chain operations, especially considering the nation's strong reliance on sectors like textiles and ready-made clothing. According to studies, DSCP adoption can lessen infrastructure constraints and logistical inefficiencies, two issues that Bangladeshi businesses continue to face. Additionally, with the advent of Industry 4.0, supply chain management can benefit from the integration of digital tools, which can improve responsiveness and agility and help businesses adjust to changing market conditions. Despite these advantages, there hasn't been much empirical research done on the effects of DSCP in Bangladesh, so this study is necessary to fill the knowledge gap and offer beneficial guidance to companies.

Therefore, there is an urgent need for research that investigates how DSCP might be used to improve performance measures in Bangladeshi organizations, therefore offering both theoretical insights and practical recommendations for enterprises in emerging nations.

This research seeks to address the gap by investigating the function of DSCP in improving business performance in Bangladesh, specifically focusing on how supply chain responsiveness and customer development moderate this link. This project will fill the research vacuum, enhancing the literature on digital supply chains and provide practical insights for Bangladeshi enterprises seeking to bolster their competitiveness in a global market. Based on the identified problem, the primary objective of this study is to examine the role of digital supply chain practices (DSCP) in enhancing firm performance among Bangladeshi firms. Specifically, the study aims to investigate how DSCP impact key performance dimensions, including supply chain responsiveness and customer development, and, ultimately, overall firm performance. It seeks to understand the mediating roles of supply chain responsiveness and customer development in the relationship between DSCP and firm performance, offering insights into how Bangladeshi firms can leverage digital technologies to gain competitive advantages. By achieving these objectives, this research will provide a comprehensive understanding of DSCP's potential for addressing the unique supply chain challenges faced by Bangladeshi firms. This will empower them to make better decisions about the adoption of technology, resource allocation, and strategy development in the context of supply chain digitalization.

2 THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

This research is grounded on the Resource-Based View (RBV) and the Dynamic Capabilities (DC) framework, which are extensively used to comprehend how businesses utilize resources and adjust capabilities to attain a competitive advantage (Ferreira & Coelho, 2020; Nayak et al., 2023). The

Resource-Based View (RBV) posits that valuable, rare, inimitable, and non-substitutable (VRIN) resources inside an organization may result in enduring competitive advantage. In this context, digital supply chain practices (DSCP) are essential tools that empower firms to swiftly adapt to market changes, streamline operational procedures, and elevate client happiness, therefore improving overall firm performance. DSCP is identified as a VRIN resource that facilitates operational efficiency and improves enterprises' capacity to respond to environmental changes, hence reinforcing the principles of the Resource-Based View (RBV). Furthermore, the DC framework underpins our research by highlighting the need for organizations to assimilate, develop, and reorganize internal skills in reaction to fluctuating market demands (Karman, 2020).

Digitalization in supply chain management is a dynamic capacity that enables organizations to adapt to rapid technical changes and react flexibly to variable market circumstances. The use of digital technologies, including the Internet of Things (IoT), Artificial Intelligence (AI), and blockchain in supply chains enables companies to optimize procedures, diminish decision-making delay, and enhance the transparency of supply chain operations (Bothra et al., 2023). The incorporation of DSCP as a dynamic capacity corresponds with the firm's objective to enhance responsiveness, customer development, and overall performance, since it enables swift modifications in resources and capabilities to line with market demands. The theoretical framework of this research investigates the influence of DSCP on three fundamental dimensions of supply chain and organizational performance: supply chain responsiveness (SCR), customer development (CD), and overall firm performance (FP). We hypothesize that DSCP favorably affects SCR, CD, and FP, grounded on the principles of RBV and DC. Moreover, SCR and CD are proposed to mediate the interaction between DSCP and FP, demonstrating how digital capabilities enhance customer-oriented efforts and influence overall company performance.

The incorporation of digital supply chain practices (DSCP) is recognized as a vital element in improving supply chain responsiveness (SCR) (Hernández-Callejo, 2019). Technologies such as big data analytics, machine learning, and blockchain enable companies to collect and analyze real-time data, allowing for rapid adaptations to supply and demand variations and supporting agile reactions to disturbances (Modgil et al., 2022). IoT-enabled sensors provide companies with real-time data on inventory levels and equipment performance, allowing preventive measures that minimize downtime and enhance responsiveness (Tan & Sidhu, 2022). The incorporation of digital technology is particularly vital in unstable markets, since agility is directly associated with competitive advantage and consumer happiness (Ahmed et al., 2022). Furthermore, in the context of developing economies such as Bangladesh, the use of DSCP may alleviate logistical issues and infrastructure inefficiencies that often hinder supply chain procedures (Yevu et al., 2021). Utilizing digital technologies enables Bangladeshi companies to expedite decision-making, better demand forecasting, and streamline inventory management, therefore improving their capacity to promptly react to market demands. Thus, incorporating DSCP accords with the company's goals to sustain competitiveness and respond to external developments. Therefore, it is hypothesized that:

H1: Digital Supply Chain Practices (DSCP) positively influence Supply Chain Responsiveness (SCR).

Digital supply chain techniques significantly contribute to customer development (CD) by enhancing customer service levels and satisfaction (Asamoah et al., 2021). Utilizing digital technology enables companies to get profound insights into client preferences and behaviors, thereby tailoring goods and services to fulfill unique customer requirements (Javaid et al., 2021). Big data analytics enables companies to forecast consumer demand trends and allocate resources appropriately, hence enhancing customer connections and loyalty (Mariani & Wamba, 2020). Blockchain technology enhances customer trust by providing openness and accountability in the supply chain, especially in consumer-driven industries where traceability is esteemed (Rejeb et al., 2023). In areas such as Bangladesh, DSCP can substantially enhance client acquisition and retention initiatives by establishing a responsive and customer-focused supply chain. Improved customer service, enabled by prompt order fulfillment and transparency, fosters customer growth by guaranteeing dependable and timely delivery. By using digital technologies, Bangladeshi enterprises enhance their customer-centric and innovative qualities, which serve to attract and retain clients. Therefore, it is hypothesized that:

H2: Digital Supply Chain Practices (DSCP) positively influence Customer Development (CD).

Digital supply chain techniques significantly contribute to customer development (CD) by enhancing customer service levels and satisfaction (Asamoah et al., 2021). Utilizing digital technology enables companies to get profound insights into client preferences and behaviors, thereby tailoring goods and services to fulfill unique customer requirements (Gupta et al., 2020). Big data analytics enables companies to forecast consumer demand patterns and allocate resources accordingly, hence enhancing customer connections and loyalty (Hossain et al., 2020). Blockchain technology enhances customer trust by providing openness and accountability in the supply chain, especially in consumer-driven industries where traceability is esteemed (Rejeb et al.,

2023). In areas such as Bangladesh, DSCP can substantially enhance customer retention and acquisition initiatives by establishing a responsive and customer-focused supply chain. Improved customer service, enabled by prompt order fulfillment and transparency, fosters growth of business clients by guaranteeing dependable and timely delivery. By using digital technologies, Bangladeshi enterprises enhance their customer-centric and innovative qualities, which serve to attract and retain clients. Therefore, it is hypothesized that:

H3: Digital Supply Chain Practices (DSCP) positively influence Firm Performance (FP).

Supply chain responsiveness (SCR) is essential for customer development (CD) since it improves a firm's capacity to fulfill client requests swiftly and dependably, which is fundamental to establishing and sustaining customer connections (Haleem et al., 2023). A flexible supply chain allows companies to swiftly adapt to fluctuations in client preferences or demand surges, assuring prompt delivery and reducing stockouts, thereby enhancing customer satisfaction (Modi et al., 2019; Palakshappa et al., 2025). Responsiveness cultivates consumer trust and loyalty by demonstrating a company's dedication to fulfilling client expectations and adjusting to evolving demands. In Bangladesh, where companies often face logistical difficulties, a responsive supply chain offers a competitive edge in customer growth by guaranteeing product availability at the required time and location (Irfan et al., 2022). By improving SCR, companies may cultivate more robust connections with consumers, elevate satisfaction levels, and foster client retention and loyalty. Therefore, it is hypothesized that:

H4: Supply Chain Responsiveness (SCR) positively influences Customer Development (CD).

A business's capacity to sustain a responsive supply chain directly influences overall firm performance (FP) by improving operational efficiency, minimizing lead times, and fulfilling customer expectations (Agyei-Owusu et al., 2022). Supply chain responsiveness allows companies to reduce risks, adapt to market fluctuations, and improve the synchronization of supply and demand, resulting in superior resource management and financial performance (Munir et al., 2020). Shorter lead times diminish inventory holding costs and avert production delays, hence enhancing operational efficiency and profitability (Dey et al., 2021). For Bangladeshi enterprises, heightened responsiveness is essential for surmounting market hurdles and enhancing organizational performance. Investing in SCR enables organizations to get enhanced synchronization across the supply chain, hence augmenting cost-effectiveness and profitability. Therefore, it is hypothesized that:

H5: Supply Chain Responsiveness (SCR) positively influences Firm Performance (FP).

Customer development (CD) is a critical element in augmenting firm performance (FP) by cultivating client loyalty, increasing revenue, and boosting brand reputation (Singh et al., 2023). By implementing customer-centric supply chain strategies, companies may match their goods and services with consumer expectations, this will eventually result in enhanced customer satisfaction and more recurring business (Gupta & Ramachandran, 2021). A favorable customer experience results in financial advantages as companies gain from a devoted clientele and heightened sales. In Bangladesh, as customer needs evolve due to heightened knowledge and expectations, prioritizing customer growth enables enterprises to distinguish themselves, augment market share, and boost financial performance. Companies that emphasize customer requirements are more likely to achieve sustainable growth, since customer-centric strategies promote long-term profitability and competitive advantage. Therefore, it is hypothesized that:

H6: Customer Development (CD) positively influences Firm Performance (FP).

Based on the predicted links derived from the examined literature and theoretical considerations, the study's conceptual framework has been established, as shown in Figure 1.

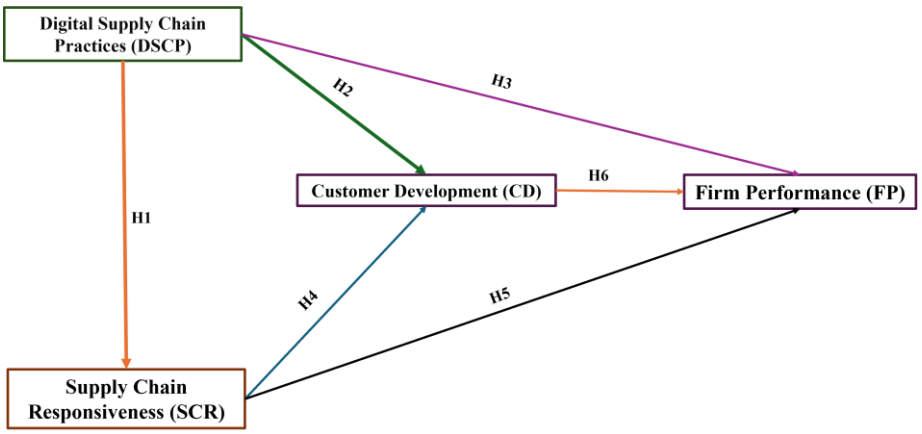

Figure 1 - Research Framework

3 MATERIALS AND METHOD

The study used a quantitative approach to analyze the influence of digital supply chain practices on organizational performance, a vital consideration due to the manufacturing sector's significance in Bangladesh's economy (Ali et al., 2021). The Bangladesh Bureau of Statistics (BBS, 2020) reports that there are around 46,110 manufacturing enterprises in the nation, including 6,034 medium and large-sized businesses (3,178 medium and 2,856 big). This research primarily focused on manufacturing enterprises because of their socio-economic importance, since the sector significantly contributes to national GDP and employs 5.5 million people. The study focused on firms located in the principal industrial centers of Dhaka, Narayanganj, and Chattogram, areas recognized for their economic advancement and significant density of manufacturing enterprises, which are vital to the nation's supply chain and economic framework (Ali et al., 2021). These cities were chosen for their significant supply chain connectedness and their increased likelihood of adopting sustainable and competitive supply chain practices, attributed to heightened market competitiveness (Rupa & Saif, 2022; Sarkar et al., 2020). Given that there is no comprehensive list of supply chain professionals within the country's manufacturing sector, convenience sampling was used (Syed & Mahmud, 2022).

Due to the unavailability of an extensive database of supply chain experts in Bangladesh's manufacturing sector, convenience sampling was employed; nevertheless, this method may create bias by restricting the findings' generalizability. Because the selection of respondents was mostly based on accessibility, the results may be skewed by the overrepresentation of companies with higher degrees of digital adoption. To allay this worry, the study focused on a wide variety of supply chain jobs, firm sizes, and industries to guarantee a more representative sample. In order to ensure that comments represented knowledgeable viewpoints on digital practices, participants also had to have at least three years of experience in supply chain management. The report admits that convenience sampling might not accurately represent the viewpoints of all industrial companies, especially those with little digital integration, notwithstanding their attempts. Probabilistic sampling techniques may be used in future studies to improve the results' generalizability to the larger manufacturing industry.

The study targeted upper and middle-level supply chain executives, including directors, managers, and professionals in operations, distribution, and logistics functions, all with a minimum of three years of experience. This ensured that participants had sufficient expertise and insights into supply chain practices and digital strategies, which allowed for a reliable understanding of supply chain dynamics within these firms (Craighead et al., 2011). To encourage participation, respondents were assured of the confidentiality, anonymity, and voluntary nature of their involvement.

The data gathering technique included a standardized questionnaire administered to 570 persons, yielding answers from 650 participants. Upon filtering out incomplete replies, the final dataset included 432 valid entries, hence assuring a sufficient sample size for dependable statistical analysis (Hair Jr et al., 2020). The questionnaire was distributed both in person and over email, using a Google Form link, with follow-up reminders conducted via phone and email to enhance response rates. Data were encoded and readied for entry into SmartPLS, a program selected for its appropriateness in examining intricate interactions in structural equation modeling (Hair et al., 2020). The utilization of PLS-SEM is warranted, as it facilitates the examination of both direct and indirect interactions among digital supply chain practices, supply chain responsiveness, customer development, and firm performance.

Table 1 displays the reliability analysis for the constructs evaluated in this study: Digital Supply Chain Practices (DSCP), Supply Chain Responsiveness (SCR), Customer Development (CD), and Firm Performance (FP). The reliability of each construct was evaluated using Cronbach's alpha, yielding values between 0.84 to 0.87, which indicates robust internal consistency. The DSCP and FP constructions attained a Cronbach's alpha of 0.84, whilst SCR and CD recorded a somewhat superior score of 0.87. The results above the suggested criterion of 0.70 for Cronbach's alpha, indicating that the constructs are trustworthy and appropriate for further investigation (Emon & Khan, 2024b; Hair et al., 2020; Legate et al., 2023). Elevated Cronbach's alpha values indicate that the items within each construct reliably assess the intended latent variable, which is crucial for producing trustworthy findings. The internal consistency of DSCP indicates that respondents had a unified comprehension of digital practices in supply networks, corroborating previous research that highlights the significance of digitalization in contemporary supply chain strategies.

The robust reliability score for SCR corroborates the notion of responsiveness as a comprehensively recognized dimension across participants, consistent with research linking responsiveness to the flexible capacities essential for successfully managing disturbances. Furthermore, the elevated Cronbach's alpha for Customer Development and Firm Performance

indicates that respondents regard these constructs as coherent and essential elements of organizational success, corroborated by recent research connecting customer engagement to ongoing performance enhancements. The measurement scale is considered credible due to its strong dependability across all constructs, hence verifying the following structural model analysis (Hair et al., 2020).

Table 1 - Reliability of the Measurements

Constructs	Items	Cronbach's alpha
Digital Supply Chain Practices (DSCP)	5	0.84
Supply Chain Responsiveness (SCR)	6	0.87
Customer Development (CD)	3	0.87
Firm Performance (FP)	5	0.84

4 RESULTS

The demographic profile of the respondents offers significant insights into the features of the sample population, enabling a more profound comprehension of their variability across essential dimensions. The sample is largely male, including 81.47% of respondents, while females constitute 18.53%. This indicates a male-dominated presence among the assessed manufacturing enterprises, aligning with the industry standard in Bangladesh. The bulk of responders (53.57%) are aged 40–49 years, followed by those aged 30–39 years (30.36%). This indicates that mid-career professionals comprise the predominant section of the workforce in these organizations, while younger and older age groups are underrepresented.

The educational attainment of respondents indicates a well-educated cohort, with 65.97% possessing master's degrees, and 24.66% having specialized degrees or advanced qualifications (e.g., PGD, MPhil, or PhD). This illustrates the knowledge-intensive characteristics of the industrial industry and its focus on technical and managerial proficiency. Regarding employment experience within the current organization, 43.62% of respondents had 8–10 years of experience, whilst 34.74% have 5–7 years. This signifies a considerable percentage of personnel with extensive tenure, implying stability and institutional expertise within the studied organizations.

The industrial representation indicates that textiles and RMG constitute 30.14%, while FMCG accounts for 24.43%, highlighting the substantial impact of these sectors on the Bangladeshi economy. Other sectors, like pharmaceuticals (9.82%) and electronics and electrical equipment (12.79%), also contribute, but to a smaller degree. The ownership structure is mostly characterized by family-owned enterprises (37.03%) and multinational corporations (25.78%), reflecting the presence of traditional ownership forms with global corporate frameworks. Sole proprietorships (18.05%) and joint businesses (19.18%) are minor but significant divisions. The personnel data indicates that most organizations (38.56%) employ between 301 and 500 individuals, followed by those with 501 to 700 people (31.30%). Firms with less than 300 workers represent a minor proportion, suggesting that medium to large organizations are the predominant participants in the research.

Table 2 - Demographic Profile of The Respondents

Variable	N	%
Gender		
Male	357	81.47%
Female	81	18.53%
Age		
20-29 Years	37	8.45%
30-39 Years	133	30.36%
40-49 Years	235	53.57%
50-59 Years	26	5.94%
60 Years and above	7	1.60%
Education		
Bachelor	41	9.36%
Master's	289	65.97%
Others (Specialized degrees, PGD, MPhil, PhD)	108	24.66%

Work Experience in the Present Company		
2-4 years	56	12.78%
5-7 years	152	34.74%
8-10 years	191	43.62%
10 years & above	39	8.90%
Industry		
FMCG	107	24.43%
Textiles & RMG	132	30.14%
Pharmacy	43	9.82%
Furniture & Interior	15	3.42%
Electronics & Electrical equipment	56	12.79%
Automobile	35	7.99%
Agribusiness	13	2.97%
Oil and Gas	7	1.60%
Ceramics	26	5.94%
Others	4	0.91%
Ownership of Company		
Sole ownership/ proprietorship	79	18.05%
Family Owned	162	37.03%
Joint venture	84	19.18%
MNC	113	25.78%
Number of Employees		
Below 100	23	5.25%
101 - 300	78	17.83%
301 - 500	169	38.56%
501- 700	137	31.30%
700 and above	31	7.08%
Total	438	100%

Table 3 illustrates the outcomes of the measurement model, including factor loadings, average variance extracted (AVE), and composite reliability (CR) for each construct. All factor loadings for individual items across the constructions above the acceptable threshold of 0.70, indicating that each item sufficiently contributes to its associated construct (Hair et al., 2017; Hair et al., 2020). Items within the Digital Supply Chain Practices (DSCP) construct had loadings ranging from 0.73 to 0.85, indicating a significant degree of consistency within this construct. Item loadings for Supply Chain Responsiveness (SCR) varied between 0.75 and 0.81, indicating the construct's dependability and its efficacy in encapsulating the responsiveness dimension inside the supply chain framework. The AVE values for each component above the suggested minimum of 0.50, with DSCP and FP both at 0.62, SCR at 0.60, and CD at 0.80. An AVE of 0.50 signifies sufficient convergent validity, indicating that each construct accounts for more than 50% of the variation in its corresponding items, hence confirming the constructs' strength (Fornell & Larcker, 1981; Hair Jr et al., 2020).

The elevated AVE of 0.80 for Customer Development (CD) indicates a robust convergence across its elements, consistent with recent research highlighting the growing significance of customer engagement and development in improving business performance. The composite reliability (CR) scores for each construct above the 0.70 criterion, indicating strong internal consistency. The CR values for DSCP, SCR, CD, and FP were 0.85, 0.87, 0.88, and 0.85, respectively. These values enhance the credibility of the constructs, since Composite Reliability (CR) offers a more thorough assessment of reliability than Cronbach's alpha by considering the differing loadings of different items. The measuring model demonstrates robust convergent validity and reliability, indicating that the constructs are appropriate for the subsequent structural analysis (Hair et al., 2020).

Table 3 - Measurement Model

Constructs	Items	Loading	AVE	CR
Digital Supply Chain Practices (DSCP)	DSCP1	0.73	0.62	0.85
	DSCP2	0.75		
	DSCP3	0.82		
	DSCP4	0.85		
	DSCP5	0.77		
Supply Chain Responsiveness (SCR)	SCR1	0.78	0.60	0.87
	SCR2	0.75		
	SCR3	0.77		
	SCR4	0.75		
	SCR5	0.78		
	SCR6	0.81		
Customer Development (CD)	CD1	0.86	0.80	0.88
	CD2	0.92		
	CD3	0.90		
Firm Performance (FP)	FP1	0.73	0.62	0.85
	FP2	0.74		
	FP3	0.82		
	FP4	0.85		
	FP5	0.78		

Table 4 displays the Fornell-Larcker criteria outcomes for evaluating discriminant validity among the constructs: Customer Development (CD), Digital Supply Chain Practices (DSCP), Firm Performance (FP), and Supply Chain Responsiveness (SCR). The Fornell-Larcker criteria stipulates that discriminant validity is established when the square root of the average variance extracted (AVE) for each construct exceeds its correlation with any other construct (Fornell & Larcker, 1981). This guarantees that each construct is unique and assesses a specific component inside the model. The diagonal displays the square root of the Average Variance Extracted (AVE) for each construct, with values of 0.89 for Construct Discriminant (CD), 0.78 for Data Supply Chain Performance (DSCP), 0.79 for Financial Performance (FP), and 0.77 for Supply Chain Resilience (SCR). All diagonal values surpass the inter-construct correlations inside their respective rows and columns, so affirming discriminant validity. The correlation between CD and DSCP is 0.64, which is less than the square root of the AVE for CD (0.89) and for DSCP (0.78). This signifies that CD and DSCP are separate entities inside the model. Comparable patterns are seen among the other constructions, reinforcing the notion that each construct is adequately separate from the others. The proven discriminant validity is crucial for the dependability of the structural model, as it indicates that each construct distinctly helps to elucidating the linkages within the model, hence reducing possible multicollinearity difficulties (Hair & Alamer, 2022). In digital supply chain research, it is crucial to differentiate constructs such as customer development and supply chain responsiveness, since they are interconnected but must be analyzed separately to correctly assess their respective effects on company performance. The constructs exhibit clear discriminant validity, allowing for their confident use in subsequent structural analysis to investigate their predicted links.

Table 4 - Fornell-Larcker criterion

Constructs	CD	DSCP	FP	SCR
CD	0.89			
DSCP	0.64	0.78		
FP	0.51	0.84	0.79	
SCR	0.54	0.63	0.62	0.77

Table 5 exhibits the inner variance inflation factor (VIF) values for the model's components, all of which are much below the suggested threshold of 5.0. The VIF scores span from 1.00 to 2.09, indicating the absence of substantial multicollinearity concerns across the predictor factors in this research. Multicollinearity may skew the outcomes of structural equation models by raising

standard errors, hence complicating the accurate assessment of connections (Hair & Alamer, 2022). A VIF score under 5.0 is generally recognized as signifying minimal multicollinearity, so assuring that each predictor uniquely contributes to the explanation of variation in the dependent variables. The inner VIF score of 1.79 for CD → FP indicates that Customer Development (CD) does not significantly overlap with other variables affecting Firm Performance (FP). Analogously, Digital Supply Chain Practices (DSCP) exhibited minimal VIF values across all its associations, including DSCP → CD (1.64), DSCP → FP (2.09), and DSCP → SCR (1.00), so affirming that DSCP is a unique and dependable predictor inside the model. These values substantiate the notion that digital supply chain practices substantially affect both organizational performance and customer development, devoid of excessive collinearity, consistent with recent research highlighting the significance of distinct digital practices in improving organizational outcomes (Dolgui & Ivanov, 2020). Supply Chain Responsiveness (SCR) exhibited low Variance Inflation Factor (VIF) values in its associations with Customer Delight (CD) (1.64) and Firm Performance (FP) (1.73), signifying that SCR is distinctly capable of influencing these constructs independently, thereby reinforcing its unique function in moderating supply chain impacts on customer engagement and organizational performance. The generally low inner VIF values validate that the structural model is well described, facilitating further examination of the proposed linkages.

Table 5 - Inner VIF Values

Constructs	Inner VIF Values	VIF <5
CD→FP	1.79	✓
DSCP → CD	1.64	✓
DSCP → FP	2.09	✓
DSCP → SCR	1.00	✓
SCR → CD	1.64	✓
SCR → FP	1.73	✓

Table 6 exhibits the results of hypothesis testing inside the structural model, including T-values, P-values, and acceptance status for each proposed association among Digital Supply Chain Practices (DSCP), Supply Chain Responsiveness (SCR), Customer Development (CD), and Firm Performance (FP). All hypotheses are validated at a significance level of $p < 0.05$, showing statistically significant correlations among constructs. H1 (DSCP → SCR) attained a T-value of 14.62 and a P-value of 0.00, providing robust evidence for the hypothesis that Digital Supply Chain Practices substantially influence Supply Chain Responsiveness. This corresponds with studies indicating that digital integration in supply chains promotes responsiveness by increasing flexibility, decreasing lead times, and facilitating quicker adaptability to market fluctuations. H2 (DSCP → CD), with a T-value of 9.35 and a P-value of 0.00, substantiates that Digital Supply Chain Practices strongly affect Customer Development. Effective digital supply chain management enables companies to enhance customer insights and provide tailored services, which is essential for cultivating robust customer connections and engagement. H3 (DSCP → FP) indicates a T-value of 19.19 and a P-value of 0.00, indicating a substantial correlation between Digital Supply Chain Practices and Firm Performance. This study corroborates existing research indicating that digitalized supply chain procedures augment operational efficiency, decrease costs, and eventually boost financial performance. The H4 hypothesis (SCR → CD), exhibiting a T-value of 4.09 and a P-value of 0.00, substantiates that Supply Chain Responsiveness has a positive impact on Customer Development. Rapid reaction to client requests is crucial for fostering loyalty and improving satisfaction, as it enhances the company's adaptability to evolving demands. H5 (SCR → FP) attained a T-value of 3.36 and a P-value of 0.00, corroborating the hypothesis that Supply Chain Responsiveness positively influences Firm Performance. A responsive supply chain enhances efficiency, hence increasing profitability and competitiveness. Ultimately, H6 (CD → FP), exhibiting a T-value of 2.07 and a P-value of 0.04, substantiates the correlation between Customer Development and Firm Performance. Successful customer development programs enhance client loyalty and retention, hence fostering sustainable revenue and organizational growth.

Table 6 - Hypothesis Testing

Hypothesis	Constructs	T Values	P values	Remarks
H1	DSCP → SCR	14.62	0.00	Accepted
H2	DSCP → CD	9.35	0.00	Accepted
H3	DSCP → FP	19.19	0.00	Accepted
H4	SCR → CD	4.09	0.00	Accepted

H5	SCR → FP	3.36	0.00	Accepted
H6	CD → FP	2.07	0.04	Accepted

Table 7 depicts the R-squared and modified R-squared values for the constructs of Customer Development (CD), Firm Performance (FP), and Supply Chain Responsiveness (SCR), indicating the model's explanatory capacity for each dependent variable. These values represent the amount of variation in each concept accounted for by its predictors, with higher values often indicating more predictive significance (J. Hair & Alamer, 2022). The R-square value for Customer Development (CD) is 0.44, indicating that Digital Supply Chain Practices (DSCP) and Supply Chain Responsiveness (SCR) together account for 44% of the variation in CD. This moderate explanatory power corresponds with research indicating that good supply chain procedures and responsiveness significantly enhance a firm's capacity to cultivate and sustain customer connections. The remaining 56% may be affected by other variables not accounted for in the model, such customer service or product quality, both of which are essential for customer growth. Firm Performance (FP) has an R-square value of 0.72, indicating that DSCP, SCR, and CD jointly account for 72% of the variation in FP. The substantial explanatory power indicates that digital supply chain methods, along with responsiveness and customer development initiatives, are essential for enhancing firm performance in the manufacturing industry. Prior research corroborates this conclusion, demonstrating that digital integration in supply chains enhances efficiency, reduces costs, and improves overall organizational performance. Finally, Supply Chain Responsiveness (SCR) has an R-square value of 0.39, indicating that DSCP accounts for 39% of the variation in SCR. This result indicates a modest degree of predictiveness, reinforcing the notion that digital practices substantially improve supply chain responsiveness, while other variables, such as logistical flexibility and inventory management, may also play a role. These R-square values indicate that the model offers a robust explanation for firm performance and modest predictive capability for customer development and supply chain responsiveness. This underscores the significance of digital supply chain activities in shaping these constructs, emphasizing the model's practical applicability for companies seeking to improve performance via digital efforts.

Table 7 - R Square and R Square Adjusted

Constructs	R-square	R-square adjusted
Customer Development (CD)	0.44	0.44
Firm Performance (FP)	0.72	0.72
Supply Chain Responsiveness (SCR)	0.39	0.39

Figure 2 presents the structural equation modeling (SEM) findings using the Partial Least Squares (PLS) method, showcasing the route coefficients, factor loadings, and R-squared values of the structures. Each route coefficient signifies the magnitude and orientation of the association between constructs, and the R-square values reflect the explained variance for each endogenous variable inside the model. Digital Supply Chain Practices (DSCP) have substantial positive impacts on Supply Chain Responsiveness (SCR) (path coefficient = 0.63), Customer Development (CD) (0.50), and Firm Performance (FP) (0.79). These linkages demonstrate that DSCP is essential for augmenting responsiveness, fostering client interactions, and eventually promoting business performance. The R-square values provide more understanding of the model's explanatory capacity. DSCP and SCR account for 44% of the variation in CD (R^2 = 0.44), indicating a modest predictive capacity in elucidating customer development. Likewise, 72% of the variation in firm performance (FP) is accounted for by the combined effects of demand supply chain performance (DSCP), supply chain resilience (SCR), and competitive dynamics (CD) (R^2 = 0.72), indicating a significant influence of these dimensions on organizational performance. The significant explanatory power supports the idea that digital integration and customer-centric initiatives are essential for improved organizational performance. The correlation between SCR and FP (path coefficient = 0.17) and SCR and CD (0.22) is considerable, highlighting the critical role of responsiveness in improving both customer development and company success. Companies that swiftly adjust their supply chains are more inclined to cultivate superior client connections and attain enhanced performance. Finally, the relationship from CD to FP (path coefficient = -0.08) seems weak and negative, indicating that in this specific sample, customer development may not directly enhance performance, or other mediating variables might be at play. This conclusion contradicts several previous research that highlight customer development as a direct factor influencing performance. Subsequent study may explore other mediators or modifiers to further

comprehension of this association.

Figure 2 illustrates the importance of digital supply chain techniques in enhancing supply chain responsiveness, which subsequently favorably affects both customer development and organizational success. This approach offers critical insights for companies seeking to improve performance via digital supply chain activities and emphasizes the interrelation of supply chain, customer, and performance results.

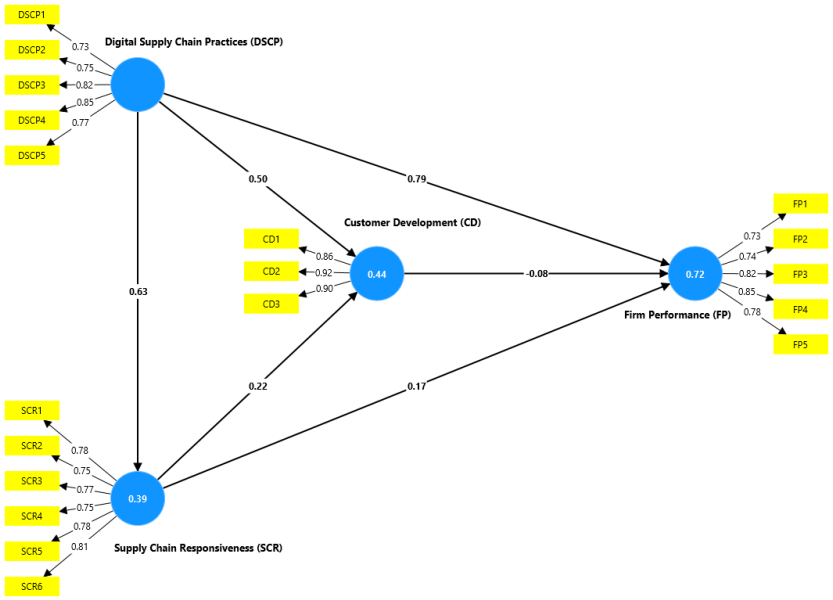

Figure 2 - Structural Equation Model (PLS-SEM Approach)

5 DISCUSSION

This research seeks to evaluate the impact of digital supply chain practices, supply chain responsiveness, and customer development on the performance of firms in the manufacturing sector. This study highlights the importance of digital integration and supply chain flexibility in enhancing competitive advantage among medium and big manufacturing enterprises in Bangladesh's industrial centers. The research used structural equation modeling to investigate the connections identified in a large survey of supply chain specialists, demonstrating the significant impact of digital supply chain practices and customer-centric tactics on improving Firm performance.

This study provides significant contributions to the academic literature and the wider subject of supply chain management. The research enhances theoretical comprehension of digital supply chain activities in developing economies, a setting often overlooked in existing work (Kamble et al., 2020; Khan et al., 2024). This study integrates supply chain management and digitalization theories to provide a framework for assessing the enhancement of supply chain responsiveness and customer development via digital practices, eventually resulting in enhanced firm performance. This contribution is especially pertinent due to the little empirical information about the influence of digital technology on supply chain management in developing economies. The study's results fill a gap in the literature by showing the efficacy of digital practices in improving operational performance, aligning with previous research on digital supply chain integration (Ivanov & Dolgui, 2020).

This research empirically enhances the literature by analyzing digital supply chain practices in the context of Bangladeshi manufacturing enterprises, a sector that has seen substantial expansion and transition. The use of structural equation modeling approaches enhances the methodological rigor of the investigation, guaranteeing that the identified associations are dependable and reproducible in analogous circumstances. This study's findings emphasize the essential role of customer development and supply chain responsiveness in enhancing business performance, illustrating the significance of both elements in attaining competitive advantage. This research targets supply chain specialists with substantial experience, ensuring that the data represents educated viewpoints, hence enhancing the reliability of the empirical results and providing practical implications for managers aiming to improve their firms' supply chain skills.

The research offers theoretical and empirical contributions by analyzing the intersections of digitalization, supply chain responsiveness, and customer development within the manufacturing industry. These results underscore the need of digital supply chain techniques for improving

business performance, particularly in emerging nations where digital adoption is still developing. This study enhances current frameworks on supply chain management and digital transformation, offering practical consequences for manufacturing enterprises seeking to bolster their competitive stance in a fluctuating market environment (Kamble et al., 2022; Yu et al., 2021).

While pointing out particular difficulties and possibilities in Bangladesh's manufacturing sector, the study's observations are consistent with earlier studies on digital supply chain practices (DSCP) in other developing nations. Similar research has demonstrated that DSCP adoption boosts company performance by improving customer interaction and supply chain responsiveness in countries like Vietnam and India; however, these countries have benefited from stronger digital infrastructure and regulatory backing (Kamble et al., 2020; Yu et al., 2018). On the other hand, structural obstacles like a lack of technology infrastructure, a skills gap, and high upfront investment costs could hinder the rate of digital transformation in Bangladesh. Despite these drawbacks, the study demonstrates that DSCP significantly improves company performance in Bangladesh, supporting earlier research findings that highlight the importance of digitization in addressing operational inefficiencies (Ivanov & Dolgui, 2021).

As seen in other developing markets where early adopters saw notable performance advantages, Bangladesh's relatively lower adoption rate implies that businesses can obtain a competitive edge by utilizing DSCP. The report also emphasizes how DSCP promotes consumer development and supply chain responsiveness, but how effective it is dependent on outside variables including industry cooperation, digital preparedness, and governmental regulations. Bangladeshi businesses are largely dependent on internal strategic initiatives to integrate digital technologies, in contrast to certain emerging economies where digital transformation has been propelled by robust institutional backing. These findings emphasize the pressing need for focused legislative changes and initiatives to increase capacity in order to hasten the implementation of DSCP and optimize its effects on business performance.

6 CONCLUSION

This study examines a significant research issue: the influence of digital supply chain practices on organizational success, focusing specifically on the mediating roles of supply chain responsiveness and customer development. This study examines how the integration of digital practices throughout the supply chain might improve overall company performance in Bangladesh's manufacturing industry, which is in need of digital transformation but has not yet completely adopted it. This research seeks to enhance the knowledge of digitalization's impact on supply chain management by examining the interconnections among digital supply chain practices, responsiveness, customer development, and performance, especially in developing economies. The study's results indicate that digital supply chain practices positively and significantly impact firm performance, mainly by enhancing supply chain responsiveness and customer development. Digital supply chain methods immediately promote supply chain responsiveness, which in turn improves customer development and firm performance.

The results indicate that organizations that invest in digital tools and technology for supply chain management are more adept at responding to market fluctuations, satisfying consumer expectations, and ultimately attaining superior performance levels. The findings highlight the significance of digital integration in improving flexibility and responsiveness in the supply chain, emphasizing the necessity of digital transformation initiatives in the manufacturing industry. This study has significant implications for supply chain managers, corporate strategists, and policymakers in developing economies. The results indicate that digital supply chain techniques may work as a strategic tool for managers to improve organizational performance, particularly in dynamic and competitive marketplaces. This report underscores the need for authorities to bolster digital infrastructure and capacity-building measures that empower manufacturing enterprises to fully capitalize on the advantages of digital transformation. Moreover, the study enhances academic literature by offering empirical information about the influence of digitalization on supply chain management in a developing country, a situation often neglected in supply chain research. Future research avenues may expand upon these observations by investigating supplementary aspects that might affect the efficacy of digital supply chain processes, like corporate culture, technology preparedness, or market volatility. Additionally, subsequent study might investigate these associations across other industrial sectors or geographic locations to evaluate the generalizability of the results. Broadening the scope to include other developing economies may provide significant information into the influence of differing degrees of digital infrastructure on the efficacy of digital supply chain strategies. By exploring these paths, further research may enrich the comprehension of digital transformation's significance in global supply chain management and further augment the relevance and application of digitalization techniques across various settings.

Since small and medium-sized businesses (SMEs) frequently confront technological and financial obstacles, governments should implement tailored incentives to speed up the use of digital technology in Bangladesh's manufacturing sector. SME adoption of IoT, AI, and blockchain technologies can be made more affordable by government subsidies or low-interest loans for digital infrastructure investment. Tax breaks for businesses implementing digital supply chain practices (DSCP) may also promote broad adoption and increase industry competitiveness.

In order to close the digital skills gap and guarantee that workers are prepared to efficiently manage and optimize digital supply chains, policymakers should also create training programs tailored to certain industries. By giving SMEs access to common resources and knowledge, public-private partnerships can be formed to create innovation clusters and digital supply chain hubs. Lastly, government-sponsored awareness programs and regulatory frameworks that standardize digital integration across industries will incentivize businesses to adopt digital transformation, hence increasing Bangladesh's industrial competitiveness in the global market.

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Author Contributions: TK**:** Project Supervision, Conceptualization, Methodology, Resources, Validation, Writing – original draft, Writing – review & editing; M. M. H. E: Data Collection, Resources, Data Analysis, Validation, Writing – original draft.