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Digital Technologies for Firms' Competitive Advantage and Improved Supply Chain Performance

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Abstract: Supply chain operation is more competitive in a dynamic business environment. Developing supply chain capability is, hence, important for gaining a competitive advantage and overall improved supply chain performance. The purpose of this study is to explore the potential of digital technologies to enhance supply chain performance and for firms to gain competitive advantage through improved supply chain capabilities. This study, through a survey questionnaire, gathered a total of 150 sample data from supply chain executives and managers in the ready-made garments (RMG) industry in Bangladesh. Findings of the study demonstrate that the digital supply chain is a significant contributor to improving the supply chain capabilities of RMG firms, and it subsequently leads to competitive advantage with a direct positive effect on firms' supply chain performance. The findings also indicate that digital technology has a direct effect on supply chain capability and supply chain performance in RMG firms. Based on these empirical findings, the study draws conclusion that digital technology integration in the supply chain would have a positive contribution to supply chain agility and flexibility, which would enable firms to effectively engage supply chain partners in dealing with unexpected situations in business operations. This study contributes to the current literature on digital supply chain capabilities, and it also provides insights for supply chain managers, policymakers, and practitioners in the fields of supply chains, logistics, and business performance.

Keywords: ready-made garments; Bangladesh; textile industry; supply chain agility; supply chain flexibility; supply chain capability; digitalization



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1. Introduction

The current business environment is more complex than before due to intense competition, fast changes in customer preferences, globalization, shorter product life cycle, and volatile customer satisfaction. Enterprises are under increasing pressure to address these issues effectively. Moreover, the effect of the COVID-19 pandemic (Zhou and Wang 2021) and the Russia–Ukraine war (Jagtap et al. 2022) have greatly influenced the global supply chain. The above concerns raise questions regarding the application of digital technologies towards the supply chain process to improve supply chain performance and to improve the agility of business processes overall. In this regard, digital technology has been reported as a driver to improve supply chain capability so as to enhance firms' competitive advantage and sustainable performance (Oh et al. 2019; Nekmahmud et al. 2020). This study investigates the relationship between the application of digital technology and supply chain performance in the ready-made garments (RMG) industry in Bangladesh. Bangladesh is known as one of the leading apparel manufacturing countries, and it is the

world's second largest source of apparel supply. This industry has become the driving force of the national economy by earning a value of 42.61 billion USD, which is 81.82% of total export earnings in the fiscal year 2021–2022 (Jahed et al. 2022). However, Bangladesh's apparel industry is in a critical and challenging situation compared to its competitors due to customer demand for diversified products at low cost and short lead time (Asgari and Hoque 2013; Jahed et al. 2022). However, unfortunately, Bangladesh is still taking higher lead times for product delivery, whereas Sri Lanka, Vietnam, China, and India are in a highly competitive position for the same products (Nuruzzaman et al. 2010; Razzak 2022). A dynamic business environment requires organizations to develop supply chain capabilities that emphasize rapid delivery to reduce lead times, reduce costs, and to pay attention to customer satisfaction. Organizations need to focus on greater flexibility and supply chain agility to meet these requirements (Chan et al. 2017). All these issues can make companies interested in improving their capabilities to increase their competitive advantage. As the modern supply chain is more complex than the traditional supply chain, manufacturers are integrating digital technology to increase the efficiency and capability of supply chain functions. Digital technology implication in the supply chain practice has become a potential area in the information system literature of today. A recent study by Zhou and Wang (2021) found that digitalization and flexibility of the supply chain have a significant effect on sustainable performance. The study by Ye et al. (2022) states that the deployment of digital assets in the supply chain increases the visibility and agility of the supply chain to increase responsiveness to deal with uncertainty. Rai et al. (2006) and Kim and Lee (2021) have found that digital infrastructure readiness in the supply chain improves operation processes, which impact firm performance. Moreover, Oliveira-Dias et al. (2022) have also found a similar relationship between digital technology and supply chain agility. Many previous studies have discussed the impact of supply chain digitalization on supply chain capability (Elrefae and Nuseir 2022; Birkmaier et al. 2021; Burin et al. 2020; Dehgani and Navimipour 2019; Büyüközkan and Göçer 2018; Korpela et al. 2017; Shahadat et al. 2023). However, there is still a limited understanding of the relationship between the implication of digital technology and supply chain performance. However, most previous studies have discussed the benefits of agility and flexibility in terms of firm performance, but there is a research gap that discusses the linkage of digital technology and its consequences regarding supply chain capabilities and competitive advantages. Nevertheless, there are limited published studies that discuss the impact of digital technology on supply chain capability in relation to competitive supply chain performance in apparel supply chain, especially in Bangladesh's RMG industry. Considering this phenomenon, Bangladesh's ready-made garments (RMG) industry was selected as the field of study for this research. The RMG industry in Bangladesh struggles to contest a globally competitive market. Manufacturing firms in this market face additional uncertainties, such as lack of operational diversification, higher operational costs, and lack of capabilities. Digital competencies in the supply chain would be more significant in strengthening organizations' capability to capitalize on information and knowledge management so as to achieve greater competitiveness and comprehensive performance (Burin et al. 2020). These consequences compel companies to adopt digitalization in the supply chain to improve supply chain capabilities so as to become more competitive.

To address this gap, the main objective of this study is to explore the potential of digital technologies for supply chain performance through competitive advantage and supply chain capability enhancement. The following research questions were answered in this study. 1. How do information and digital technology impact supply chain capabilities and performance? 2. How do supply chain agility and flexibility help to gain a competitive advantage? To answer these questions, this study used theoretical knowledge from a resource-based view (RBV) and dynamic capability perspectives to classify the elements of the study. Digital technologies are unique assets in organizational fields that create supply chain dynamic capabilities that can achieve competitive advantage and long-term performance. Employing the resource-based view and a dynamic capabilities perspective,

this study develops a conceptual framework to establish the relationship between digital supply chains, agility, flexibility, competitive advantage, and supply chain performance, which are major contributions to the study and relatively new dimensions in the supply chain. This study will contribute to the current literature on digital supply chains, as well as provide guidance for supply chain managers, policymakers, and practitioners interested in digital supply chain implications. The rest of this paper is organized as follows: theoretical background and the literature review, methodology, results, discussion, implications, and conclusion, which are discussed sequentially.

2. The Literature Review

2.1. Theoretical Background and Conceptual Framework

In today's competitive business environment, manufacturing companies are seeking the opportunity to gain a competitive advantage to achieve overall performance in volatile market conditions. To obtain this competitive advantage, the company should have some strength of flexibility to reformulate product price, quality, cost, and technological capability, which rapidly respond to unpredictable market changes. Implementation of technological resources to enhance supply chain capabilities is very important to supply chain performance. The resource-based view and dynamic capability theory are the most imperative theories applied to explain organizational resources and capability in competitive advantage and performance. According to the resource-based view (RBV), organizational resources, which are valuable, rare, non-substituted, and inimitable, are a source of competitive advantage (Barney 1991). In the previous IS literature, RBV was widely used to explain the digital technology competencies to enhance organizational skills to improve capabilities in supply chain performances. Digital technology is a physical resource, which is implemented in organizational strategy to enhance capability (Chaudhuri et al. 2022). Digital technology increases supply chain capabilities, which directly impacted business operations by reducing operational costs, improving the quality of products, developing new products, increasing market share, and meeting customer satisfaction (Ehie and Ferreira 2019). The dynamic capability perspective refers to the ability to adapt, reconfigure, renew, and develop the resources and capabilities to manage internal and external factors in a changing environment (Teece et al. 1997; Li 2022). Supply chain agility is a kind of capability that refers to the ability to improve efficiency within the supply chain network for rapid response to potential suppliers and customers in a changing environment (Chen 2019). Moreover, supply chain flexibility is a process that increases the ability to rapidly create alternatives and better mechanisms for internal and external entities in reacting to unanticipated market situations (Shekarian et al. 2020).

According to current studies in information technology, researchers increasingly consider digital technology capability as an organizational resource in order to create higher order capabilities, such as agility and flexibility relating to operational and strategic supply chain capabilities. Digital capability in the supply chain enables the supply chain to collaborate and disseminate information in time for decision-making, which enhances reliability and effectiveness. This study proposes that digital technology in the supply chain would be an enabler in developing supply chain capability through agility and flexibility, which would directly affect firms' abilities to achieve competitive advantages.

2.2. Digital Transformation in Supply Chain Management

A supply chain is a network of individual organizations and their suppliers that produce and distribute a specific product and service to customers (Benzidia and Makaoui 2020). It is very important for proper management in the different stages of the supply chain process. According to the GSCF model, this management consists of customer relationship, customer service, demand, order fulfillment, production, supplier relationship, product development, delivery, and return management (De Barros et al. 2015). As a result of globalization, the traditional supply chain has faced difficulties in dealing with changing environments to manage the relationships optically. Today's modern supply chain is

more complex than the traditional one due to widespread disruptions, increasing pressure, lower product life cycle, and increased customer demand all over the world. However, digital technology has broken down the barriers to managing the supply chain and has made significance changes in visibility and efficiency (Oh et al. 2019; Ślusarczyk et al. 2020). The digital supply chain is the process of incorporating digital technologies into the functions of the supply chain and its stakeholders so that they can make precise and quick decisions about the sources of supply and customer demand (Kalogiannidis et al. 2022). According to Büyüközkan and Göçer (2018), the digital supply chain is a technological system with the help of software and hardware to support and synchronize the activities within the supply chain networks to deliver service in a more valuable and effective way. The digital supply chain is the application of digital technology in the supply chain to operate the business with suppliers and customers so as to enhance capability and supply chain performance (Ehie and Ferreira 2019; Yerpude et al. 2023). In line with this, Lee et al. (2022a) state that the digitalization of the supply chain not only increases the supply chain performance, but also the overall organizational performance. However, digital supply chain integration on supply chain performance is still in its infancy. Although the previous literature on digitalization in the supply chain has shown the relationship between digital technology and supply chain performance (Nandi et al. 2020; Pakurár et al. 2020), digitalization in the supply chain is about incorporating cost efficiencies into services, creating a competitive advantage, reducing lead times, and increasing supply chain capabilities (Korpela et al. 2017). Digital technology integration into the supply chain process creates new opportunities for supply chain performance. Digital capability in the supply chain enables the supply chain capability to collaborate and disseminate information in time for decision-making, which enhances reliability and effectiveness (Chen 2019; Bi et al. 2013).

2.3. Supply Chain Capability

Agility and flexibility are organizational capabilities that enable firms to deal with unforeseen situations, to cope with uncertainties, and to create new opportunities to achieve competitive advantage. Agile function in organization is the most imperative supply chain capability for improving competitiveness (Dehgani and Navimipour 2019). On the other hand, organizational flexibility is a capability that relates to deploying resources effectively to deal with environmental uncertainty (Dubey et al. 2021). Moreover, organizational effectiveness and competitiveness depend on flexible strategy in the supply chain. Previous studies have found that manufacturing flexibility is a supply chain capability that affects the competitiveness level (Elrefae and Nuseir 2022). To gain competitive advantage, both agility and flexibility focus on customer responsiveness in turbulent business environment. It can be said that agility and flexibility are key factors and prerequisites for improving supply chain capability. Therefore, this study measures agility and flexibility in supply chain performance and competitiveness.

2.4. Supply Chain Agility

Agility is the ability to adapt and cope with unpredictable and rapid market and environmental changes (Benzidia and Makaoui 2020; Li 2022). Supply chain agility refers to the capability of an enterprise's internal and external supply chain function to rapidly respond to its potential suppliers and customers in a changing environment (Chan et al. 2017). Supply chain agility deals with unexpected changes and makes timely decisions to improve responsiveness and convert it to business opportunities (Chen 2019; Sheel et al. 2019). This responsiveness helps organizations to survive in a competitive market environment. Agility is measured as the most imperative capability of contemporary supply chain performance by integration with suppliers and customers (Dehgani and Navimipour 2019). Agile functionality in supply chain processes helps organizations to respond effectively and to survive in uncertain and volatile markets. This functionality deals with reducing lead time, provides quality services, ensures JIT, ensures customer

satisfaction, deals with shorter product life cycle, quickly responds to product and market gaps, reduces costs, and manages inventory (Chen 2019; Dehgani and Navimipour 2019). To achieve supply chain agility, proper coordination and flexibility among supply chain members are required to manage a turbulent market.

2.5. Supply Chain Flexibility

Supply chain flexibility is the ability to adjust demand to the optimal level to meet customer desires through the cooperation of different parts of the supply chain. Supply chain flexibility is a process that increases the ability to quickly develop alternatives and better controls in response to unexpected market conditions (Elrefae and Nuseir 2022). Earlier studies have shown that flexibility is the ability of supply chain managers to effectively manage the changing demands to meet customer satisfaction (Shekarian et al. 2020; Dubey et al. 2021). In a volatile business environment, supply chain flexibility is essential for adaptability. Previous studies identified different dimensions of supply chain flexibility, and Chan et al. (2017) believe that strategic flexibility and manufacturing flexibility are essential for compliance in an unpredictable business environment. While Benzidia and Makaoui (2020), have focused on the dimensions of product development flexibility, sourcing, and production flexibility. Moreover, flexibility at various levels in the supply chain process is a critical ability for responding rapidly in an effective manner. A study by Burin et al. (2020) measured supply chain flexibility regarding four aspects: sourcing/procurement, operating system, distribution, and information system flexibility, which are all important for reacting efficiently to changing situations. Supply chain flexibility increases the capacity to easily adjust to shifted demand and improves lead time, quality of product, and service (Zhou and Wang 2021). Therefore, flexibility builds the supply chain capabilities of organizations to respond rapidly to market changes in emerging situations.

2.6. Digital Technology and Supply Chain Agility

Accessibility of real-time information in supply and demand is important for the agile supply chain to respond to changing markets. There are some implicit benefits of digital technology for agile supply chain, such as speed, visibility, cost optimization, real-time inventory, and scalability (Yerpude et al. 2023). According to Ye et al. (2022), the digital platform among supply chain partners from upstream to downstream can provide real-time information, such as demands, inventory, and production information. Dehgani and Navimipour (2019) state that information technology-based system integration, digital knowledge and skill, and digital platforms in supply chain networks increase efficiency and effectiveness in business, as well as agility in the supply chain. The study by Chen (2019), in a survey, investigated IT integration in the supply chain, which has increased the speed, flexibility, and responsiveness of dealing with channel partners that aggregate real-time data from suppliers and customers to support decision-making. This ability enhances supply chain agility. Moreover, digital technology capabilities enhance supply chain capabilities in inter-organizational processes through information sharing, coordination, and integration to respond to environmental changes to ensure organizational agility (Bi et al. 2013; Queiroz et al. 2019). A recent study by Chowdhary (2022) states that the digital supply chain has a significant impact on accelerating logistics processes and systems. However, digital innovation improves the firm's ability to collaborate with its supply chain players seamlessly to implement plans more precisely and timely in an effective manner in a volatile market (Far et al. 2017). Based on this argument, this study forwards digital technology as a factor that would have a positive relationship with supply chain agility, as per Hypothesis 1 below.

Hypothesis 1 (H1). *Digital technology has a positive relationship with supply chain agility.*

2.7. Digital Technology and Supply Chain Flexibility

Supply chain flexibility is the capability to respond to structural changes in the supply chain process so as to adjust production and operational activities in terms of technological and environmental changes (Shekarian et al. 2020; Sen et al. 2022). Previous studies have illustrated that digital technology is an essential element for supply chain flexibility. A study by Zhou and Wang (2021) states that technological flexibility is a substantial capability of an organization to manage its supply chain in a dynamic and complex environment. Digital technology improves the information system capability of an enterprise, which leads to supply chain flexibility in the changing business environment. Moreover, information technology adoption in supply chain management has a great impact on the efficiency of operations and processes, accurate and reliable information, coordination, and collaboration, thus increasing supply chain flexibility (De Barros et al. 2015). Blockchain technology is data-based system where all stakeholders can take and share data in the supply chain network, which ensures supply chain flexibility (Wang and Yang 2022). Furthermore, Lee et al. (2022a) claim that the transformation of AI and IoT technology improves the connectivity and collaboration among the supply chain partners, which analyze a large amount of real-time data to share accurate information to enhance efficiency and supply chain flexibility. In addition, the digital technology-based supply chain has a dynamic capability to respond to an unforeseen change in a turbulent environment, as, for example, in the COVID-19 pandemic. A study by Ye et al. (2022) states that digital technology asset deployment in supply chain management achieved a higher level of supply chain flexibility and performance during the pandemic. Accordingly, the following hypothesis is forwarded for testing.

Hypothesis 2 (H2). *Digital technology is positively associated with supply chain flexibility.*

2.8. Competitive Advantage

Competitive advantage is an organizational ability to achieve higher level of competitiveness for products and services in an industry compared to its competitors. This competitiveness comes from the trim of production and operational cost, better products and services, and higher customer satisfaction (Chen 2019). Dubey et al. (2021) state that the common indicators of competitive advantage are better control and superior performance. Elrefae and Nuseir (2022) state that competitive advantage depends on how an organization defensively acts in front of its rivals, for example, new product and service innovation, competitive price, product quality, and delivery systems. However, in the competitive market environment, to gain a competitive advantage in supply chain management, it is essential for firms to have dynamic capabilities, including supply chain agility and supply chain flexibility. Supply chain agility is the capability to deal with unexpected business environments to improve operational efficiency and competitive advantage so as to achieve sustainable business (Bi et al. 2013). Supply chain agility is a tool to enhance capability in terms of flexibility, speed, innovation, and cost, which promote competitive advantage in a changing market (Wu et al. 2017). Supply chain agility is the key factor in rapid response to produce new products or services according to customer demand, which improves responsiveness to gain a competitive advantage (Dehgani and Navimipour 2019). On the other hand, flexibility has been considered as another capability to manage internal and external factors for the potential supplier and customers in a volatile business environment. These flexibilities include the ability to change the existing business process, product, and operation on the basis of customers' demand, as well as to face unexpected changes. In supply chain management, strategic flexibility and production flexibility are the most important factors to gain a competitive advantage in a competitive business (Chan et al. 2017). A higher level of organizational flexibility in the supply chain process has a better chance of gaining a competitive advantage (Dubey et al. 2021). Flexibility is a supply chain capability that effectively engages supply chain partners in the production process to better serve the customer to achieve a competitive advantage (Ehie and Ferreira 2019). Supply

chain flexibility has a great impact on global supply chain performance. According to (Kazancoglu et al. 2022), improving practices for the integration of agility and flexibility in the global supply chain has a positive impact on competitiveness and supply chain performance from the perspective of the global supply chain impact of COVID-19. Hence, the following hypotheses, H3 and H4, are formulated for analysis in this study.

Hypothesis 3 (H3). *Supply chain agility has a positive impact on competitive advantage.*

Hypothesis 4 (H4). *Supply chain flexibility has a positive impact on competitive advantage.*

2.9. Relationship between Competitive Advantage and Supply Chain Performance

Supply chain performance and competitive advantage are interrelated processes in supply chain management. Supply chain performance directly and positively influences the long-term relationship between upstream suppliers to downstream customers. Good relationships with suppliers and customers have improved responsiveness. Responsiveness improves competitiveness in supply chain management. Organizations realize that competitive advantage is not only achieved by improving an organization, but more importantly, it is required to enhance the performance of member firms in the supply chain. Li et al. (2006) found that performance in supply chain factors (e.g., logistics, inventory) has a significant effect on the competitive business environment. The goal of supply chain practices is to transfer information and materials throughout the supply chain in a competitive manner, without disruption, so supply chain performance is essential for achieving a competitive advantage (Childerhouse and Towill 2003). It was also found that responsiveness and effectiveness are highly essential for supply chain performance, which is positively related to competitive advantage (Sukati et al. 2012). In addition, Lee et al. (2022a) found a high correlation between supply chain performance and a firm's competitive advantage. Supply chain performance has led to enhanced company competitiveness, as well (Putri et al. 2019). Thus, we propose the following hypothesis for testing.

Hypothesis 5 (H5). *Supply chain performance has a positive relationship with a firm's competitive advantage.*

2.10. Supply Chain Performance

According to Saha et al. (2022), digital transformation in the supply chain process has a positive effect on improving the performance in manufacturing, distribution, and consumption levels to meet customers' requirements. Unhelkar et al. (2022) found that industry 4.0-based technologies, especially RFID implementation in supply chain methods, would effectively manage the supply lead time and very efficiently reduce costs, which improves supply chain performance. Lee et al. (2022a, 2022b) investigated IoT technology, which has a significant effect on bringing tangible benefits to supply chain performance and organizational performance in manufacturing companies in Malaysia. Ślusarczyk et al. (2021) found a significant contribution of industry 4.0 technologies (including automation and robotization of the industry with information management) for supply chains and logistics firms in Poland and Malaysia. Kim and Lee (2021) found that digitalization has a profound effect on accelerating supply chain performance in the healthcare manufacturing industry. Previous studies suggest that the digital supply chain promotes business efficiency and productivity. Accordingly, H6 is formulated as follows.

Hypothesis 6 (H6). *Digital technology positively affects supply chain performance.*

2.11. Conceptual Framework

Based on the findings of the previous literature on information systems and supply chain management, a conceptual framework is developed in Figure 1. Firstly, this study tries to investigate digital technology's impact on supply chain capabilities. Here, we

examine two antecedents of supply chain capability: supply chain agility and supply chain flexibility. The previous studies showed that digital technology is directly associated with supply chain agility and supply chain flexibility (Ye et al. 2022; Dehgani and Navimipour 2019; Chen 2019; Bi et al. 2013; Far et al. 2017; Shekarian et al. 2020; Sen et al. 2022; Zhou and Wang 2021; Lee et al. 2022a). On the other hand, both supply chain agility and supply chain flexibility are sources of competitive advantage. Supply chain agility is the key supply chain capability for quick response to customers' requirements through speed, innovation, and reduced cost to gain a competitive advantage in a turbulent market. Previous studies suggest a relationship between supply chain agility and competitive advantage (Bi et al. 2013; Wu et al. 2017; Dehgani and Navimipour 2019; Mustafid et al. 2018). In addition, supply chain flexibility has been considered to be the capability to manage internal and external factors relating to a potential supplier and customers in a volatile business environment to gain a competitive advantage. Earlier studies also suggest that supply chain flexibility has a significant effect on competitiveness in uncertain market conditions (Chan et al. 2017; Dubey et al. 2021; Ehie and Ferreira 2019; Kazancoglu et al. 2022). Moreover, the digital supply chain is viewed as a driver for overall supply chain performance.

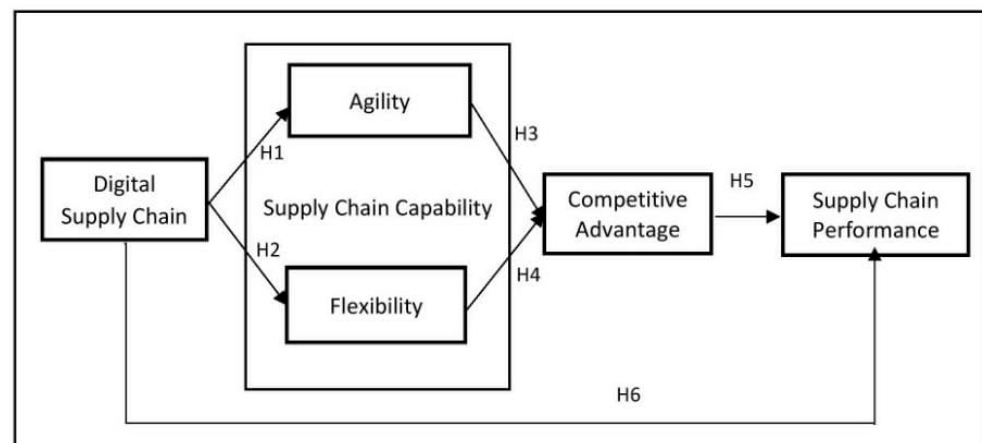


Figure 1. Theoretical framework of digital technology for supply chain performance.

3. Methodology

3.1. Method and Measurement

This study aims to explore the implications of digital technology in supply chain performance through supply chain capability and competitive advantage. The study follows a quantitative approach using a questionnaire as the tool for data collection. Bangladesh is one of the world's leading apparel manufacturers and a source of the fashion supply chain in the world. Due to its prominence, data for this study were collected from the RMG industry in Bangladesh. The survey questionnaire was developed based on an extensive review of the literature. The questionnaire has two parts: the first part consists of general demographic information (e.g., professional experience, formal education, and location). The second part contains 22 items from five constructs, and these items were developed following a two-steps pretesting process. In the initial stage, the questionnaire was reviewed by experienced academics in business performance and supply chain fields, and the latter was reviewed by two industry experts from the supply chain and logistics industries. Some items were modified to improve the understanding for local respondents, as per the experts' suggestions. Appendix A showed the measurement items and the literature sources. All items were measured on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree).

3.2. Sample and Data Collection

Data for this study were collected from 150 supply chain managers and executives in the RMG industry of different sizes and locations in Bangladesh. Samples were selected from apparel manufacturing and exporter companies from the registered members of BGMEA (Bangladesh Garment Manufacturing and Exporters Association). In the first phase, 350 questionnaires were sent to the respondents to observe the response rate. One month later, we distributed another 150 questionnaires. In total, 500 questionnaires were sent to potential respondents. A reminder email was sent after one month to those who had not responded. During the three-month data collection period (June to August 2022), we obtained 150 completed responses after excluding for incomplete responses and removing responses with missing data.

4. Analysis

PLS-SEM is recommended by scholars as an effective statistical technique for marketing management, consumer behaviors, and environmental management research studies. PLS-SEM is an appropriate method for prediction-oriented modeling purposes (Hair et al. 2021). The PLS-SEM method is especially suitable when a relatively complex model has low data size and non-parametric data (Hair et al. 2021; Janavi et al. 2021). The entire structural equation model can be divided into two models: measurement/outer model and structural/inner model. In the outer model, different constructs are used, and, for the conceptual model, elements are measured with different items adapted from the prior literature. The constructs that have been used in this study were measured for their reliability and validity in the measurement model through different tests, as shown in Tables 1 and 2.

Table 1. Measurement Model.

	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
CA	0.819	0.83	0.881	0.651
DSC	0.835	0.843	0.901	0.751
SCA	0.786	0.795	0.841	0.533
SCF	0.804	0.823	0.864	0.564
SCP	0.703	0.749	0.833	0.628

Table 2. Discriminant Validity with HTMT.

Constructs	HTMT Ratio				F & L Ratio				
	CA	DSC	SCA	SCF	CA	DSC	SCA	SCF	SCP
CA					0.807				
DSC	0.733				0.609	0.867			
SCA	0.725	0.579			0.605	0.52	0.658		
SCF	0.823	0.773	0.697		0.688	0.65	0.595	0.751	
SCP	0.74	0.812	0.867	0.896	0.586	0.636	0.688	0.7	0.792

4.1. Construct Reliability

Before constructs can be used for measuring the relationship amongst them, first, making sure all the constructs are reliable is mandatory, or else the relationship will not be correct. Accordingly, the construct reliability has been measured with two measurements: Cronbach's alpha and the composite reliability (rho_c) ratio. From the table above, it can be found that all the values for all selected constructs—digital supply chain (DSC), supply chain capability (SC), supply chain agility (SCA), supply chain flexibility (SCF), competitive advantage (CA), and supply chain performance (SCP)—are above the threshold level. For both Cronbach's alpha and rho_c, the threshold value is 0.70. This is evidenced by the table, wherein all the values for all constructs are above 0.70, suggesting that the constructs are

reliable. Regarding this connection, Cronbach's alpha values are between 0.835 and 0.703, but, on the other hand, the rho_c values range from between 0.901 to 0.833. This simply suggests that the data collected from the respondents based on the sampling plan are quite reliable and consistent for constructs used for measuring the relationship.

4.2. Construct Validity

Construct validity is another criterion that needs to be ensured before using constructs for measuring the relationship in the structural model. In this study, two different types of validity—convergent validity and discriminant validity—have been ensured through different tests. The average variance extracted (AVE) ratio has been used to ensure the convergent validity of the constructs. The threshold value for the AVE is 0.50 (Fornell and Larcker 1981). Again, from the above table, it can be found that all the AVE values are also greater than the threshold value, which is 0.50. The AVE value for the constructs is between 0.751 and 0.533, which is greater than the threshold value for AVE. It can be argued that all the items used for measuring different constructs are well thought-out and true indicators of the corresponding constructs.

On the other hand, for ensuring discriminant validity, three different ratios, including Heterotrait-Monotrait (HTMT) ratio, Fornell and Larcker (F and L) ratio, and cross loading ratio, have been used. Discriminant validity makes sure that the constructs used for the study are different from each other and are truly required for measuring the relationship in the conceptual model. From the HTMT ratio table, it was found that all the values for different constructs are well below 0.85, which is considered the threshold value for the ratio. The HTMT values for the constructs are between 0.846 and 0.579, suggesting that the discriminant validity has been established. F and L is another measurement that is used for testing the discriminant validity amongst different constructs. The square root value of the AVE of any given construct should be greater than the correlation values with other constructs (Fornell and Larcker 1981). Here, the square root value of AVE with respect of one of the constructs—competitive advantage—is 0.807, which is greater than all the correlation values between other constructs put below or above the value 0.807, and it holds well for all other constructs. Furthermore, the cross-loading table also suggests that all the indicators/items load better with regard to measuring their parent construct than other constructs, which are the criteria for constructs to become valid in the discriminant measurement. The indicators (DSC1, DSC2, and DSC3) used for measuring the construct digital supply chain (DSC) load better (0.858, 0.895, and 0.847) onto their parent construct (DSC) than any other constructs, suggesting that DSC as a construct is different from other constructs used in this conceptual framework.

Collinearity has also been tested for the constructs with regard to calculating VIF value, and the value was found to be well below the threshold value of 5. Here, the VIF values range from 1.21 to 2. VIF measures whether any of the variables are correlated with the rest of the variables. Here, in this data set, it was found that variables are not highly correlated to each other. From this VIF analysis, it is evidenced that each variable used in this study is different from the rest of the variables, which are requirements for further data analysis. Furthermore, this analysis ensures that there is a collinearity issue amongst constructs. For brevity's sake, results for different ratios of the dataset have not been provided.

Before going on to test the relationship amongst constructs or testing the hypotheses so-formulated, it should be ensured that the model fits. Table 3 shows the indices for model fit. In the estimated model column of the model fit summary, it was found that the value of SRMR, which is the difference between observed correlation and the model's implied correlation matrix between constructs (average magnitude of discrepancies) and value of SRMR is 0.098, which is smaller than 0.10, which indicates that the model fits (Hair et al. 2021). The NFI value is 0.496 (it should be between 0 and 1 and the closer it is to 1; the better the fit), which suggests that the model is a good fit.

Table 3. Model Fit Summary.

	Saturated Model	Estimated Model
SRMR	0.107	0.098
d_ULS	2.873	4.147
d_G	1.707	1.877
Chi-square	1195.142	1241.45
NFI	0.515	0.496

From Table 4, it was observed that 27.1% and 42.3% changes in the first-tier-dependent variables SCA and SCF can be explained by the independent variable digital supply chain (DSC), respectively. On the other hand, 53.3% of changes in the final dependent variable CA can be explained by all other independent variables, including DSC, SCA, and SCF. Falk and Miller (1992) suggested that if the R^2 value is greater than 0.10 for any dependent variable, it is acceptable and adequate to be explained with independent variables. The goodness of the model is determined by the strength of each structural path determined by the R^2 value for the dependent variable (Abdulkarem and Hou 2021). Therefore, all the values are above the threshold value, suggesting that digital supply chain (DSC), supply chain agility (SCA), and supply chain flexibility (SCF) are appropriate indicators for explaining the changes in the dependent variable competitive advantage (CA) for all the companies. F^2 is the effect size, and if the value is ≥ 0.02 is small, ≥ 0.15 is medium and ≥ 0.35 is large (Cohen and Williamson 1988). The F^2 value of both dependent variables for the relevant independent variables is between 0.00 and 0.1, which means that the effect size on the R^2 value with the removal of exogenous variables is large. This also means that the exogenous variables that have been considered for studying the relationship are justified and valid, and changing any one of them does not affect the relationship significantly.

Table 4. Regression and Effect Size.

Independent Variable	R^2 Value				F^2 Value		
	Dependent Variable (Tier 1)		Dependent Variable (Tier 2)	Final Dependent Variable	Dependent Variable (Tier 2)		Final Dependent Variable
DSC	SCA 0.271	SCF 0.423	CA 0.533	SCP 0.467	SCA 0.371	SCF 0.733	CA 0.118 SCP 0.350

4.3. Hypotheses Test

In Table 5, H1; $\beta = 0.52 >$ threshold 0.20, t value 11.818 $>$ than 1.96, and P value $0.00 < 0.05$, suggest that the hypothesis is accepted. DSC improves the SCA, which is required to improve supply chain capability so as to gain a competitive advantage. H2; $\beta = 0.65 >$ threshold 0.20, t value 16.482 $>$ 1.96 and p value $0.00 < 0.05$ suggest that the hypothesis is accepted. DSC improves the SCF, which indirectly improves supply chain capability. H3; $\beta = 0.302 >$ threshold 0.20, t value 3.959 $>$ 1.96, and p value $0.00 < 0.05$ suggest that the hypothesis is supported, which means that SCA improves CA. H4; $\beta = 0.509 >$ threshold 0.20, t value 4.83 $>$ 1.96, and p value $0.00 < 0.05$ suggest that the hypothesis is accepted. SCF has a positive effect on CA. In addition, CA has a positive relationship to SCP. From the table above, it can be seen that, with $\beta = 0.315$, which is greater than threshold 0.20, the t value 8.312 $>$ 1.96, and the p value $0.00 < 0.05$ suggests that the hypothesis is accepted. Similarly, in H6, $\beta = 0.444 >$ threshold 0.20, t value 6.345 $>$ 1.96, and P value $0.00 < 0.05$ suggest that the hypothesis is accepted. DSC has a direct relation with SCP.

Table 5. Path Coefficient.

Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	p Values	Result
DSC -> SCA	0.52	0.53	0.044	11.818	0.00	Supported
DSC -> SCF	0.65	0.657	0.039	16.482	0.00	Supported
SCA -> CA	0.302	0.307	0.076	3.959	0.00	Supported
SCF -> CA	0.509	0.509	0.061	8.312	0.00	Supported
CA -> SCP	0.315	0.322	0.065	4.83	0.00	Supported
DSC -> SCP	0.444	0.442	0.07	6.345	0.00	Supported

5. Discussion

In a competitive market environment, manufacturing companies are very concerned about their supply chain's ability to help their businesses gain competitive advantage by improving their entire supply chain performance. This study used both a resource-based view and a dynamic capabilities approach to empirically examine whether the combined alignment of digital technology and supply chain capabilities could lead to competitive advantage and improved supply chain performance.

The results show that digital technology application in the supply chain has positive impact on supply chain agility. Findings also show that the integration of digital technology in the supply chain significantly improved the agility of the supply chain in turbulent market conditions. This study also indicates that the integration of digital technologies into supply chain networks enhances the effectiveness and efficiency in response to environmental changes to increase supply chain agility. The previous study also supports the positive relationship between digital transformation and supply chain agility. A study by [Benzidia and Makaoui \(2020\)](#) found that IT applications are essential processes that enable organizations to improve their ability to respond to changing markets and to remove bottlenecks that increase supply chain agility. However, in line with earlier studies by [Benzidia and Makaoui \(2020\)](#), [Chen \(2019\)](#), and [Sheel et al. \(2019\)](#), it can be concluded that digital connections with supply chain partners are more helpful in swiftly recognizing market changes and building supply chain agility. Similarly, the digital supply chain has been found to be positive and directly linked with supply chain flexibility. The digital supply chain has a substantial capability to effectively manage the supply chain risk. The study found that digital technology has a significant impact on supply chain flexibility. This research finding is supported by previous studies by [Zhou and Wang \(2021\)](#), [Birkmaier et al. \(2021\)](#), and [Burin et al. \(2020\)](#).

On the other hand, we found that supply chain agility and supply chain flexibility simultaneously have a profound impact on firms' competitive advantage. A high level of flexibility in the supply chain is the ability to increase responsiveness in a competitive market environment ([Elrefae and Nuseir 2022](#)). Therefore, flexibility in the supply chain is an essential factor for achieving a competitive advantage. Previous studies also support this result ([Shekarian et al. 2020](#); [Dubey et al. 2021](#); [Itang et al. 2022](#)). Similarly, supply chain agility has a positive impact on competitive advantage. This is in line with earlier studies ([Chen 2019](#); [Jahed et al. 2022](#)).

Finally, this study has found that digital supply chain practice has a direct impact on overall supply chain performance. Digital supply chain processes have created a new relationship in supply chain performance that can leverage deeper interactions with upstream suppliers and downstream partners in the supply chain. This finding agrees with previous studies by [Lee et al. \(2022a\)](#), [Gupta et al. \(2021\)](#), and [Kim and Lee \(2021\)](#).

6. Implications and Conclusions

6.1. Managerial Implication

This study found the relationship between digital supply chain integration in supply chain agility and supply chain flexibility to achieve competitive advantage and supply chain

performance, and it also addressed gaps in the literature on this topic. In a highly competitive global market, digital competence is an asset for supporting supply chain capabilities, which are critical for enabling businesses to achieve competitive advantage. This study has an important contribution in terms of managerial implications from two perspectives.

From the digitalization perspective, research findings reveal that digital technology applications in supply chain management to connect with supply chain partners can positively impact supply chain capabilities. Digital technology integration in the supply chain will improve the flow of information between different departments of manufacturing companies and their supply chain members in the decision-making process. Digital supply chain practice improves a firm's ability to respond to the unpredictable market by combining a plan that addresses market changes promptly, identifies customer needs, and develops products accordingly, thus reducing manufacturing lead time and eventually increasing customer satisfaction. Thus, managers can understand the importance of digital technology to enhance the supply chain capability and, therefore, need to develop successful integration of digital technology in the inter-firm supply chain processes.

In terms of the capabilities perspective, to develop supply chain performance and gain competitive advantage, supply chain partners need to identify risk factors that have disrupted supply chain capabilities. Supply chain flexibility and agility are supply chain strategies that effectively engage supply chain partners to deal with unexpected business environments so as to improve operational efficiency to achieve a competitive advantage. Therefore, this shows that supply chain agility and flexibility are determinants of supply chain capabilities, and they are important determinants that significantly impact supply chain performance. This study will guide managers to better understand the impact and benefits of DSC adoption for improved competitive advantage and supply chain performance.

6.2. Theoretical Implication

This study formed and tested a conceptual framework to explain the direct impact of the digital supply chain on supply chain strategy concerning competitive advantage and supply chain performance. Furthermore, this study integrated information systems and the supply chain management literature to explore the implication of digital technology in supply chain capability development and its consequences on overall supply chain performance. This interrelationship between the supply chain resources and supply chain capability is highly significant for developing competitiveness in a dynamic business environment. Secondly, the framework provides insight for supply chain flexibility and agility as critical enablers for firms' competitive advantage. Several studies have been conducted recently in the context of the digital supply chain in developed economies. To extend these investigations, this research empirically studied the impact of DCM on a fast-growing and highly significant textile and garment industry in Bangladesh. This study helps future researchers to better understand the relationship between the digital supply chain, supply chain capability, and organizational performance.

6.3. Conclusions

This study found that digital technologies in the supply chain process will create a competitive advantage for companies through supply chain capabilities. This study also discovered the positive relationship between digital supply chains and supply chain performance. First, digitalization of the supply chain has a significant effect on agility and flexibility to generate supply chain capability. Then, supply chain agility and supply chain flexibility have positive effects on competitive advantage. Flexibility and agility in the supply chain possess a distinct ability to deal with the high uncertainty of the market environment, and they are used as mediating roles between the digital supply chain and competitive advantage. On the other hand, digitalization of the supply chain has an enormous contribution towards enhancing supply chain performance of the RMG industry of Bangladesh through implementing digital technologies in supply chain networks for long-

term relationships with each supplier and customer to enhance supply chain performance and customer satisfaction. This study highlights the critical role of the digital supply chain in achieving a competitive advantage and supplying chain performance in the ready-made garments industry in Bangladesh. Earlier studies conducted on digital technology effect on agility and flexibility in supply chains were mostly from developed economies. Hence, the present study is conducted in a developing country, Bangladesh, and the findings add novel contributions for understanding digitalization in developing economies.

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Appendix A

Constructs	Items	Sources
Digital Supply chain (DSC)	DSC1. Our company builds a digital supply chain development strategy. DSC2. Our company has accelerated the construction of digital infrastructure. DSC3. Our company has run digital supply chain platforms with customers, distributors, and suppliers.	Zhou and Wang (2021)
Supply chain Agility (SCA)	SCA1. Digital technology helps reduce manufacturing lead time. SCA2. Digital technology helps reduce development cycle time. SCA3. Digital technology helps improve the frequency of introducing a new product. SCA4. Digital technology helps increase product customization. SCA5. Digital technology helps increase customer service. SCA6. Digital technology is helpful in delivery reliability. SCA7. Digital technology helps adjust to changing market needs.	Sheel et al. (2019)
Supply chain Flexibility (SCF)	SCF1. Enterprises can monitor and alert supply chain operation risks by an information data platform system. SCF2. Enterprises can adjust supply chain structure to respond to customer demand changes or a new supply market pattern by using digital technology. SCF3. Enterprises can adjust production and manufacturing processes to respond to the fundamental technological progress in the market. SCF4. Digital technology helps enterprises to adjust their daily production process, output and inventory level, and distribution channel quickly. SCF5. The member enterprises of supply chain can generate valuable and creative knowledge through information interchange.	Zhou and Wang (2021)

Constructs	Items	Sources
Competitive advantage (CA)	CA1. Compared with our competitors, our company responds more quickly and effectively to changing customer needs CA2. Compared with our competitors, our company responds more quickly and effectively to changing supply chain strategy. CA3. Compared with our competitors, our company develops new products more quickly and effectively for a competitive price. CA4. Compared with our competitors, our company is competing effectively based on quality.	Sheel et al. (2019)
Supply chain performance (SCP)	SCP1. Transaction cost of supply chain operations will be reduced by using digital technology. SCP2. Level of service provided to customers will be improved by using digital technology. SCP3. Speed of supply chain operations will be improved by using digital technology.	Sheel et al. (2019)

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