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Let's Start!

Enhancing Business Profitability and Sustainability through Digitalized Supply Chain Elements

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Enhancing Business Profitability and Sustainability through Digitalized Supply Chain Elements

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Abstract

The digitalization is pervasively revolutionizing the structure, functioning and strategic responsiveness of the agri-food supply chain. This paper aims to examine the mediating influence of supply chain processes such as integration, operation, purchasing and distribution between the digitalization and business profitability and sustainability in Bangladesh. Convenience sampling was adopted to gather data from the 435 departments of supply chain in the agri-food industries across Bangladesh through a closed ended questionnaires. Respondents of the study were supply chain managers and other personnel in charges of the supply chain activities. The analysis shows that out of twelve hypothesis, seven were found significant and remaining five were non significant. This study finds out that advancement in digital technologies has a positive multiplier impact on business profitability and sustainability. Through the study, supply chain value could be enhanced through digitalization that would enable business organizations attain efficient integration, operation, purchasing and distribution with corresponding improvement on profitability and sustainability. The implications of the findings are useful for managers, businesses and to help achieve several of sustainable development goals such as SDG-8, SDG-9, SDG-12, SDG-13 and SDG-17.

Keywords: digitalization, agri food firms, supply chain elements, sustainability and business profitability.

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INTRODUCTION

The food supply chain is extremely important in the delivery of affordable and quality foods to everyone and groups of people (Treiblmaier & Garaus, 2023). It helps in transport of agricultural products from the producers to the processors, distributors, marketers, and consumers ensuring consistency of supply and stability in supply chain food (Bhat et al., 2021). Reduced supply chain cycles result in no hunger, no high prices and no interruption in the provision of basic necessities (Hobbs, 2020). Besides, they contribute to economic growth and generate employment in areas of connection between sectors like agriculture, retail and manufacturing sectors. The food supply chain enhances economic revenue and encourages the growth of small business, making the economy strong (Erokhin et al., 2020). Globally, it provides support to the trading systems as countries depend on imports and exports in order to feed its population and exercising export advantages. Digitalization has begun to receive massive attention from many industries across the globe due to its ability to present enhanced benefits to many organizations. According to Sanders and Swink (2020) supply chain digitization helps get the most out of digital technologies for planning and executing dealing and doings in transactional, communicational, and operational areas. Such digital technologies in the supply chain are usually categorized broadly as big data analytics, smart manufacturing technologies having sensors, decentralised agent-based control, robot control, and sophisticated tracking and tracing solutions (Ivanov et al., 2019).

Supply chains facilitate importation of food crops and implemented trade relations, thus promoting the progressive international trade of food crops. By adhering to quality measures in the supply chain networks consumers gain access to quality food products that do not pose risks of causing food borne diseases. It offers a significantly large number of food products throughout the year not restricted to the seasonal changes (McAdams et al., 2019). It also helps to meet the demands by the market signal feedback mechanism to develop new products (Abideen et al., 2021). Moreover, the food supply chain fosters the development of innovation in agricultural production through awareness of efficient technologies, environmentally-friendly techniques, and upgraded systems for producing more quantity of food items (Mushi et al., 2022). According to Barik et al., (2021) supply chain management makes it easy to allocate resources and coordinate the best ways of utilizing the available resources in order to minimize wastage and maximize efficiency.

Like most other nations, Bangladesh food sector supply chain is marred by a number of challenges. Among its shortcomings one can mention, for instance, the lack of enough logistic support and structures (Tarigan et al., 2021). As stated by Farman et al., (2022) roads, railways, and ports in Bangladesh is far from adequate and are very often congested, slow or have limited

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capacity which in effect translates to more expensive transportation as well as lengthened transportation time. For this reason, poor storage of perishable goods and short supply of refrigerator storage make pre-harvest losses a thing of small estimation compared to post-harvest losses. There is the lack of integration and coordination between the supply chain members (Ardra & Barua, 2022). Fragmented and discrete structures hinder the information flow and company cooperation, and thus, customer requirements aren't fulfilled, inventories are mismanaged, and real-time monitoring and control of product quality are mostly absent (Versino et al., 2023). Manual, human-controlled procedures and inability to automate some aspects of work are also marked causes of inefficiency (Aïmeur et al., 2023). Most times, manual data entry, record keeping, paperwork may lead to errors, delays and a lot of time wastage. Lacking technology, including supply chain management systems, the sector can hardly obtain timely information, improve its performance, and make adequate decisions (Psarommatis & Kiritsis, 2022).

Bangladesh's food industry also faces significant sustainability challenges, such as carbon emissions, wastage of food, inefficient transportation systems, inadequate infrastructure, inefficient manufacturing and processing, and shortage of water. These issues affect the overall productivity and sustainability of the supply chain, impacting the accessibility and affordability of food in the supply chain practices offers a potential solution to these challenges by enhancing collaboration and coordination, enabling efficient flow of information, and facilitating smooth interactions among diverse stakeholders (Ezeudu & Ezeudu, 2019; Rodríguez-Espíndola et al., 2020). Through data, digitalization allows organizations of supply chain to sustain high quality standards, meet the requirements of both markets such as domestic and global (HANDFIELD et al., 2020). Moreover, adopting digitalization in supply chain processes could boost up operational efficiency, enhance visibility, reduce waste, promote energy-efficient practices, assist in decision making, and support environmental practices. The purpose of this research work is to explore the influence of digitalization towards the profitability of business and sustainability within Bangladesh's agri-food area. Additionally, the research work will explore the mediated influence of supply chain elements among the independent and dependent variables. Consequently, the study addresses the following research questions.

How digitalization impacts supply chain practices?

1. What is the relationship between digitalization and supply chain business profitability?
2. What is the relationship between digitalization and supply chain sustainability?

On the basis of above research questions, the study leads to the following research objectives:

1. To examine the association of digitalization on supply chain practices.
2. To examine the association of digitalization on supply chain business profitability.

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3. To examine the association of digitalization on supply chain sustainability.

The paper has the following sections; introduction, literature review, research methodology, quantitative analysis and discussion. The introduction acts as a starting point by giving an overview of background and relevance with reference to problem and objectives of the study. The literature review therefore looks into the current research and relevant theories which will serve as the foundation of the research. The study establishes the plan on how the research is undertaken, where the data is collected, and how the data collected is analyzed in order to provide clarity on the data collection and analysis. The empirical results of the study are detailed in the results section of the manuscript. The last fourth part discusses the results highlighting what the analysis means, as well as how it can be contextualized with relation to sustainable development goals. The discussion section comprises of conclusion of the research, recommendations and further research are stated to control the limitations of the study.

LITERATURE REVIEW

DIGITALIZATION OF SUPPLY CHAIN

Communicating, collaborating and coordinating effectively through digitally enabled technology and systems with different suppliers, manufacturers, distributors, retailers and customers in the supply chain system is referred to as 'digitalizing supply chain' (Zhang et al., 2022). It encompasses the ability to coordinate information, tools and techniques for improving organizational productivity, visibility and responsiveness in decision making. Supply chain digitalization has brought significant changes in the business profitability and sustainability (Haleem et al., 2023). Many organisations have transformed their previous traditional supply chain operation processes; making them far more effective, integrated mechanisms with the help of innovative technologies such as artificial intelligence, big data analysis (Dohale et al., 2022).

The first impact of digitalization of operations on corporate earnings is increased operational efficiencies. Businessmen may be enhancing inventory control, reducing the length of time it takes to deliver the products, and optimizing the flow of the products using real time tracking and evaluation of the data (Mohsen, 2023). Firms that use digital technologies can easily determine demand, production and inventory, and costs associated with stocking. Automate approaches to distribution centers and warehouses through digitalization make distribution more efficient and relieves the need for many employees (Mariwala, 2023). It also enhances the commitment, monitoring and traceability of the supply chain. Thus, organizations can track the movement of products within the supply chain allows businesses to monitor the status of products and enhance control over its inventory and reduce losses due to theft or damage or expiration (Jagtap et al., 2021). Through timely exchange of information concerning

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supply, production, and consumption between suppliers, manufacturers and customers there is facilitation of relations and agreement, enhancement of agreements and decisions, and prevention of inefficiencies (Li et al., 2022).

Digitalization makes decisions on sustainable supply chain possible by proactively promoting environmental and social responsibility. Such advantages may mean that firms discover areas of waste or even process improvements that can be made on vehicle routes thereby reducing fuel consumption and environmental impacts (Freitag et al., 2021). As stated by Mukhopadhyay and Kekre (2002), both at the micro and macro levels, digitalization in the supply chain could enhance productivity by minimizing the manufacturing cost of paper based process, enhance the speed of inventory turnover, decrease the logistic steps, increase automation in production, facilitate rapid billing and settlement of payment etc. A firm can achieve higher manufacturing throughput and quality as well as a lower number of breakdowns if the manufacturing process as a whole is made to be more intelligent, for example with the help of digital technologies and more and better data (Björkdahl, 2020).

This paper has established that digitalization of the supply chain has brought changes to business profitability and sustainability. Shashi (2023) highlighted a net positive impact on the business, in terms of the cost, income and customer satisfaction, where increased operation efficiency, visual portrayal and enhancement of sustainability. Any enterprises that accept digitalization, and seek to harness its opportunities will have higher likely estimates of success in today's rapidly evolving and competitive commercial landscape with technology development (Troise et al., 2022).

DIGITALIZATION AND SUPPLY CHAIN INTEGRATION

Digitalization helps in enhancing the over-arching transparency and visibility of the supply chain. Automated technologies and platforms make it possible to access real-time information on how products move, oversee inventory and gain insights of the function of the supply chain by stakeholders. Through enhancing chances of visibility and facilitating timely problem-solving, risk management and managing interruptions and delays are minimised (Deiva Ganesh & Kalpana, 2022). Digitalization also propitiates communication and cooperation. The producers, suppliers, distributors, and consumers of goods can convey information and schedule their tasks and integrate the actions through networks, platforms and reliable links (Segovia & Garcia-Alfaro, 2022). Information sharing in real-time as well as improving responsiveness are instruments that help in accurate demand forecasting, inventory optimization and planning for reduced supply chain cost (Khanfar et al., 2021).

Furthermore, numerous researchers suggested that supply chain digitalization could significantly contribute to the creation of integration in the organisation (Gautr, 2020). From the

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study, Rai et al., (2006) have postured it that through the use of the ERP and CRM as digital tools of supply chain integration, firms realize progressive improvements in performance. Researcher has also expanded upon this line of reasoning by pointing out that through the use of digital technologies, the individual functions within a firm (such as planning, scheduling and material management) must be made to work in concert so that all multi-disciplinary teams are aligned in the direction of shared objectives. Some of these studies have posited that the use of digital technologies enables supply chain coordination to enhance firm performance (Gautr, 2020).

According to Villar and Khan (2021) digitized system converts manual processing integration tasks in an automated way rather then in traditional system. Through the practical application of bots in routine tasks like order entry, billing, and record keeping, RPA combined with machine learning algorithms could enable organizations release capacity for high value added work. Reduction of errors, speed up of processes, and increase of operational efficiency are the benefits of automation. In sum, the increase of digitalization has affected supply chain integration to result in collaboration, visibility, data driven decision and automation (Tariq et al., 2021). It also establishes how through the application of digital technology, organizational operations can be made easy, operation effectiveness enhanced and market changes managed efficiently. As firms embark on digitalization, integration in supply chain shall enhance sustainability by improving on the level of integration, effectiveness, efficiency and responsiveness to consumers' demands (Sheth & Parvatiyar, 2020).

DIGITALIZATION AND SUPPLY CHAIN OPERATION

By digitalizing the supply chain, efficiency and agility to work have significantly improved while overall performance has equally risen. The conventional supply chain relationships that were earlier quite distinct, have been transformed into accurate functional systems through the help of digital technology all accompanied by innovative ideas (Zdolsek Draksler et al., 2023). Hence, tracking and visibility in real-time have risen due to the enhanced uses of digital technology in the supply chains. As a result of emerging and using digital platforms, businesses can easily monitor inventories, shipment, and manufacturing processes in realtime. It becomes easier to coordinate hence reduces the probability of facing stock related challenges and easy to address them because they would have been noticed earlier (Hosseinnia Shavaki & Ebrahimi Ghahnavieh, 2022).

Digitalization also contributes to supply chain efficiencies and easier facilitation of automating supply chain processes. Constant mechanical and related procedures such as orders, billing, and data entry, if handled by RPA and machine learning, may reduce human errors as well as increase efficiency. Moreover, accurate demand forecasts, inventory control and production scheduling may also be enhanced by advanced analytic and algorithm resulting to

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better supply and demand matching, cost reduction as well as customers' satisfaction enhancement (Ivanov & Rozhkov, 2017). Cloud solutions provide flexibility, it gives firms the ability to store and process large volumes of information, collaborate with others, and use software and applications from anywhere. It enables real time sharing of information with staffs, reduces expenditure on technology infrastructure, and fosters growth aspect in organizations as they grow and transform (Sanders, 2016).

In conclusion, the current work has demonstrated that digitalization offers the opportunity to enhance supply chain collaboration, automate and optimise procurement tasks, as well as exploit the use of advanced technology. Organizations that plan on having a digital strategy end up getting a competitive edge through the effectiveness, efficiency, and effectiveness gains in expenses and customers. Supply chain operations of the future will be defined more by the level of digitalization as technology advances giving organizations the capability to adapt to the dynamics in the market while fostering sustainability (Helms et al., 2000).

DIGITALIZATION AND SUPPLY CHAIN PURCHASING

The strategic management of the supply chain has undergone change through digitization, affecting procurement performance, costs of supply, and the management of supply chain partners. While adopting digital technology, the buying processes of the businesses have been transformed into digital streamlined systems (Clancy et al., 2021). It also enables the automation to make order for processes such as supplier identification, preparation of (RFPs) request for proposals and bids evaluation. Ultimately these computerized methods decrease number and period of the procurement phase while accelerating the decision making processes and handling errors (Bibri & Krogstie, 2020).

It also equally facilitates interaction, supplier relationship management, and eProcurement. Internet supplier markets and portals involve the identification and procurement of providers, products and services, by business firms on the basis of set standards online. Moreover, these systems support real time cooperation and enhance the supplier relation together with the functions of the document sharing, communication and performance evaluation (Johnson et al., 2021). Furthermore, digitalisation decreases risks of fraud and increases accountability and transparency within procurement functions as compliance checks are integrated, available regulatory compliance information and data is analyzed and multi-dimensional supplier performance evaluation against set standards is conducted automatically. All of these features are useful in risk management processes involved in supply chain, especially in the procurement process. Digitalization enhances inventory control through data

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collection and follow-up analysis, and demand sensing tools help to identify demand in order to address it prior to procurement, and to optimize product inventory (Chen et al., 2022).

E-Procurement technology has brought changes in organization's supply chain purchasing by enhancing integration, responsibility, accuracy, and innovation. Hence the cost reduction, improvement of supplier relations and strategic sourcing, meanings that firms that incorporate digital technologies in fulfilling the function of purchasing over their counterparts. Purchasing trends in supply chain shall be more influenced by digitalization as time goes by since implementation of technology to enhance supply chain purchasing proscribes ways of providing maximum added value (Gutierrez-Franco et al., 2021).

DIGITALIZATION AND SUPPLY CHAIN DISTRIBUTION

The supply chain distribution with all its processes of movement, storage, delivery of the goods has been completely digitized. A digital organisation strategy involves restructuring the company's old distribution processes into data driven systems (Sala et al., 2022). Because of digital technologies, There are several distribution activities in businesses, which can be automated, and these include order processing, management of warehouses, and the planning of logistics (Dehning et al., 2006). This has the impact of reducing lead times as well as enhancing productivity, which in turns improves distribution performance and order fulfilment time. Companies may be able to regulate inventory, minimize stock out situations or excess stock, and increase supply chain productivity when distribution data is correlated with other supply chain functions (Zhan et al., 2022).

In addition, functioning as a subordinate concept digitalisation also enables the application of elaborated logistical approaches. These big data sets can be used with optimization algorithms to get the best of scheduling and routing. Consequently, the process of distribution become more sustain, lowers the transportational costs lower and reduces carbon emissions and improved transportational, load planning and optimizeed global cost is achieved (Garola et al., 2023). The level of efficiency, visibility and client experiences of every item that is being delivered today has enhanced due to the supply chain distribution that has gone digital. By integrating IT in a business, distribution processes are standardized, and visibility is enhanced, inventory is enhanced, and customers are individualized (Attaran, 2020).

MEDIATING INFLUENCE OF SUPPLY CHAIN ELEMENTS BETWEEN DIGITALIZATION AND PROFITABILITY OF BUSINESS

The digitalized supply chain elements have been made efficient by digitalization hence improving business profitability. One of the significant discussions in supply chain management today is integration bridging various participants at various supply chain levels through such tools as cloud computing and blockchain. These technologies create real time information flow

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minimizing errors, making the right choices which increase profitability. For example, digital integration helps firms in managing inventory where they avoid holding excess stocks which are costly or scanning for stocks inventory that are not easily available (Ben-Daya et al., 2019). Furthermore, this integration is digitalized and encourages strategic partnerships towards innovation and market sensitiveness (Kamble et al., 2020). Operational efficiency has been obtained through digitalization. Firms might make swift information based decision for stock, manufacturing and distribution through real-time integration (Katoch, 2022). Using automation reduces expanse of time through reducing repetitive work increases efficiency and reduces errors enabling utilization of other valuable resources. Lower costs and improved revenue are the basic benefits of these efficient processes. Further, supply chain partners may work well together due to the technical connection since use of technology may minimize problems of stock holding and therefore supplying the right stock at the proper time and at a lower cost (Miah et al., 2021).

Digitalization has high interaction with supply chain purchasing element and especially realised advantages such as transparency and improved relations with suppliers. Visibility in procurement through the use of blockchain technology helps check on people who engage in fraudulent activities. This results in enhanced pricing models as well as supply chain management and cost control which mirror success and affect the bottom line (Saberi et al., 2019). Another benefit of the use of digital tools is time variation of market information, which helps organizations to use the knowledge gained in the procurement process, and conclude better contracts with suppliers. Distribution processes have been experiencing reform with the advanced digitalization; especially in the supply and delivery chain. The use of artificial intelligence within the supply chain and automated warehousing helps to reduce error within the inventory process and enable quick delivery of orders. For example, route optimization built decide decreased fuel consumption and delivery time, decreasing transportation cost and improving customer satisfaction (Ben-Daya et al., 2019; Rahman, 2024). In this regard, RFID and GPS tracking technologies allow gaining the end-to-end control of the distribution networks, and contribute to increased logistic efficiency and cost control.

MEDIATING INFLUENCE OF SUPPLY CHAIN ELEMENTS BETWEEN DIGITALIZATION AND SUSTAINABILITY

The digitalized supply chain elements are transforming the business which produces a transformational effect on sustainability. Companies have been able to raise the order of supply chain and its visibility through the use of IoT, AI and blockchain among others. The use of real-time data analytics and sharing makes it easy to enhance the lead time, lead reduction among other productivity results (Korzynski et al., 2023). Another drastic influence of these four

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processes' is reduction in supply chain's environmental impact. With help of digitization resource utilisation can be managed in more precise manner and, therefore, there would be less waste and energy consumption. Companies might find sectors with high impacts or risks and apply focused actions to reduce them using enhanced awareness of supply chain operations (Mageto, 2021). Practices that relate to sustainable supply chain activities include buying and packaging that is environmentally friendly; these are some of the key areas, that might not pose much difficulty in terms of policy imposition, and easy to implement throughout the supply chain for the creation of a sustainable and socially responsible culture. Through digitalization, there is support for the adoption of sustainable ideas and practices as there is creation of an environment that brings together stakeholders so that they can share information (Migdadi, 2022).

Consequently, more products are designed to be long-lasting, easy to fix and reusable which in turn reduces the rates of depletion of natural resources in the long-run (Javaid et al., 2022; Rahman, 2023). The technology of electronic monitoring and tracing also enable the firms to key in on ethical labor practice, sustainable suppliers, and environmental compliance regulations, thereby ensuring a better social responsibility (Asokan et al., 2022). Overall, these supply chain elements have been proved to have a positive, and to some extent substantial impact on advanced sustainability. Managers can incorporate environmental and social responsibility goals into the company's functions, improve efficiency, reduce unnecessary output, encourage recycling, and uphold morality (Rahman & Makableh, 2024). Combining attentiveness and ethical perspective toward the given trend and reliance on the potential benefits that digitalization can bring to various companies to enhance the protection of environment and natural resources is possible.

THEORETICAL FRAMEWORK AND HYPOTHESIS

A theory is required in general as it forms the foundation in putting up a field of knowledge. It provides the basic framework of ideas that defines and sustains the studies, practices, and enhancements within a subject matter. The following theories form the theoretical framework of this research. In an effort to capture the essential information construct of the digital supply chain concept, this study formulates the following theories:

THEORY OF DIGITAL SUPPLY CHAIN INTEGRATION

The theory places tremendous value on the diffusion of digital technology across the ecosystem. Companies, suppliers, distributors, manufacturers and retailers may find collaboration, closeness, and joint access to relevant information through digital work environments (Bosona & Gebresenbet, 2013). This integration enhances sustainable strategies in a business entity while increasing efficiency and reducing lead time. So that the major implications associated

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with the digital SCM transformation financial performance. Technology enhances the SCM in terms of visibility, speed, effectiveness, and enhances the risks management aspects by applying analytics, and communicating in real-time. Consequently, firms are capable of reducing the effect they have on the environment, improving efficiency, and increasing profitability levels (Debnath et al., 2023). There are again four managerial approaches which include; Transparent traceability, customer focus and suppliers which are helpful in sustainability. Scholars have pointed out that sustainability and profitability are within the reach of firms through supply chain digitalisation.

THEORY OF RESOURCE BASED VIEW (RBV)

According to Resource-Based View (RBV) theory proposed by Barney (1991), the firms enjoy superior performance as a result of using resources that are valuable, rare, inimitable, and could not be substituted. Digitalization connects with RBV as it is an intangible, strategic asset that strengthens supply chain activities to yield profit and sustainability. Digital tools help in integrated, purchase, operation and distribution functions by cutting cost, improving quality to make it real time function. For example, digitalization helps firms adopt predictive analytics and automations, which RBV also highlights as using resource-specific strengths to beat rivals (Wernerfelt, 1984). Furthermore, RBV asserts that internal technological capabilities determine how firms can attain environment sustainability through reduction of resource waste and carbon emissions, which is a core value among current business entities (Barney et al., 2011). Hence firms place digital technologies as a strategic asset that results in both profitability and sustainability which in turn establishes a positive relationship with supply chain functions.

THEORY OF DYNAMIC CAPABILITIES

This theory was developed by Teece et al., (1997) and is based on the concept of the company's organisational capability to integrate, configure or reconfigure internal and external resources in order to respond to the rapidly evolving business environment. This theory is well applicable to the subject under consideration since the processes of digitalization require supply chain adjustments from firms. Integration, operation, purchasing, and distribution are magnificent activities that receive a larger extent of value from a diverse array of digital developments such as digital cloud, digital blockchain, and digital intelligence. For example, IoT (Internet of Things) in distribution enables real-time tracking whereas big data in the same process enables the right purchase decision (Teece, 2018). Furthermore, dynamic capabilities contribute to the achievement of sustainability objectives by allowing organisations to address measurable regulatory changes concerning eco-friendly activities and customer preferences. Through proper integration of digital tools into supply chain activities, companies increase organisational effectiveness, decrease sustainability costs, and achieve business viability. This paper finds

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dynamic capabilities particularly appropriate to this study because they bring an interface between digitization and sustainability through providing agility and innovation to supply chain advancement (Eisenhardt & Martin, 2000).

DIGITAL PROCUREMENT AND SUPPLIER COLLABORATION THEORY (DPSCT)

It is therefore aimed at increasing the digitalisation of procurement processes and at cooperation with suppliers which in turn lead to sustainable procurement decisions (Aung & Chang, 2014). Suppliers can enable firms to make sound buying decisions in a way that helps achieve their environmental goals through online tools for evaluating the sustainability efforts of potential partners. It provides a good background to demonstrate how supply chain digitalization can enhance organization's operational performance and competitiveness. If implemented, digital procurement practices enhance procurement operations and supply chain management while improving the selection of vendors. Digital procurement practices lie in continuous promoter scrutiny of supplier performance and compliance with environment standards thus minimizing hazards to the environment. The integration of Supplier Portals allows suppliers to share knowledge and cooperate on sustainability initiatives within the context of responsible purchasing, resources management, and cost reduction achieving both sustainability and profit improvements.

THEORETICAL MECHANISM

Companies may use the TDSCI, RBV, DCT and DPSCT to design a comprehensive and efficient strategy to renovate their supply networks digitally. Peculiar elements from each theory are integrated into one framework in order to secure sustainability and make profit as well (Marchi et al., 2022). One important element of the structure is the integration of digitized platform from which the agri food chain is to engage all the stake-holders, with application in sharing of information, decision making, communication, and forecasting of demands. Each link in the supply chain can work by using a digital technology to address fluctuations in demand, minimize overstocking while guaranteeing timely delivery of products (Beske et al., 2014). It also encourages proactive risk management since it allows the identification of potential disruptions, the management of various risks, operations maintenance, and proactive intervention at the earliest signal possible. The resource based view theory with digitalization is a strategic asset that strengthens supply chain activities to yield profit and sustainability. Digital tools help in integrated, purchase, operation and distribution functions by cutting cost, improving quality to make it real time function (Wernerfelt, 1984).

The dynamic capability theory is well applicable to the subject under consideration since the processes of digitalization require supply chain adjustments from firms. Integration, operation, purchasing, and distribution are magnificent activities that receive a larger extent of

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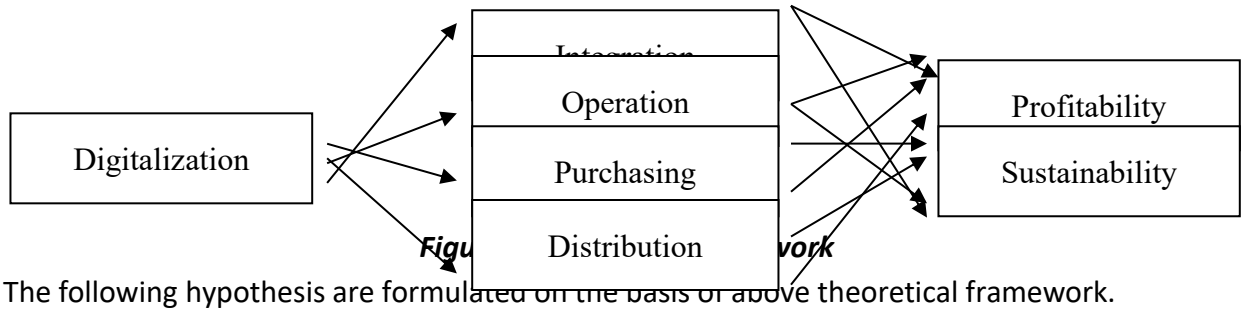
value from a diverse array of digital developments such as digital cloud, digital blockchain, and digital intelligence. For example, IoT (Internet of Things) in distribution enables real-time tracking whereas big data in the same process enables the right purchase decision (Teece, 2018). Lastly, DPSCT also enhances effectiveness, and sustainability in managing the supply chain. Thus, using the digital technologies, the work on procurement is conducted, and the demands for considerable amounts of manual work are reduced. Effective networks enhance supplier relations by allowing firms to obtain goods that enhances sustainability aspect of operations (Sardana et al., 2020). To sum up, this theoretical scheme offers an overall strategy of digitalized supply chain for profitability of business and sustainability and holds that the industries can build a supply network more effectively and sustainably based on digitalized integration, analytical prescriptive, and digital purchasing, illustrated by the following figure 1.



Figu vork

The following hypothesis are formulated on the basis of above theoretical framework.

H1. There is a significant influence between digitalization and supply chain integration.

H2. There is a significant influence between digitalization and supply chain operation.

H3. There is a significant influence between digitalization and supply chain purchasing.

H4. There is a significant influence between digitalization and supply chain distribution.

H5. Supply chain integration significantly mediates the relationship between digitalization and profitability.

H6. Supply chain integration significantly mediates the relationship between digitalization and sustainability.

H7. Supply chain operation significantly mediates the relationship between digitalization and profitability.

H8. Supply chain operation significantly mediates the relationship between digitalization and sustainability.

H9. Supply chain operation significantly mediates the relationship between digitalization and profitability.

H10. Supply chain operation significantly mediates the relationship between digitalization and sustainability.

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H11. Supply chain distribution significantly mediates the relationship between digitalization and profitability.

H12. Supply chain distibution significantly mediates the relationship between digitalization and sustainability.

METHODOLOGY

RESEARCH PHILOSOPHY

Positivism paradigm is selected as the theoretical framework of this study as its philosophical foundation. A deductive approach which stems from the quantitative approach will now come in to solve the problem. Both qualitative and quantitative data were used for the study. The theoretical framework for the study was derived from secondary data, while the results were analyzed from the primary data collected. In this quantitative study, the data were collected through convenience sampling where 435 departments of the supply chain firms of the Bangladeshi agri-food sector were surveyed using a closed-ended questionnaire. The study targets involved supply chain managers as well as individuals who are directly involved in supply chain management. The collected data were analyzed by the partial least squares (PLS) technique with the help of Smart PLS software. Because this research is based on existing theories, the variance-based approach selected here is appropriate. Therefore, the researcher determines that Smart PLS (v4) is suited for structural equation modeling as recommended by many scholars using variance based approaches.

This study explores the association of digitalization on business profitability and sustainability with mediating role of integration, operation, purchasing and distribution. A five point likert scale was used to measure the variable ranging from strongly disagree (1) to strongly agree (5). Digitalization was measured by using 4 item scales (Bagais & Aljaaidi, 2020), supply chain integration was measured by using 5 item scales (Bagais & Aljaaidi, 2020), supply chain operation and supply chain purchasing was measured with the help of 3 item scales (Bagais & Aljaaidi, 2020), supply chain distribution was measured by using 7 item scales (Hair et al., 2021), whereas, business profitability and sustainability was measured by using 3 and 5 item scales (Bagais & Aljaaidi, 2020; Pandiyan Kaliani Sundram et al., 2011) respectively. In evaluating the reliability and validity of testing the measures of the study, PLS-SEM software was used. Furthermore, to analyze the association between the variables, bootstrapping test was performed in order to accept or reject the hypothesized hypothesis (Magno et al., 2022).

RELIABILITY AND VALIDITY

In an effort to evaluate the accurateness of the data and ensure validity the following tests were conducted; factor loading, AVE, cronbach's alpha, composite reliability and discriminant validity. The discriminant validity includes two tests as; HTMT ratio (Henseler et al., 2015) & fornell and

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larckers (Fornell & Larcker, 1981). The threshold level for factor loading is > 0.6, which has also been explained in the below figure 2 showing that all the items have crossed the threshold level (Gefen & Straub, 2005). In the table 1, the value of loading, cronbach's alpha, composite reliability and average variance extracted are depicted. The acceptable level for cronbach's alpha and composite reliability is >0.7 while for AVE it is > 0.5 (Ringle et al., 2020). Thus, it is achieved that this study establishes internal consistency, composite reliability, and convergent validity.

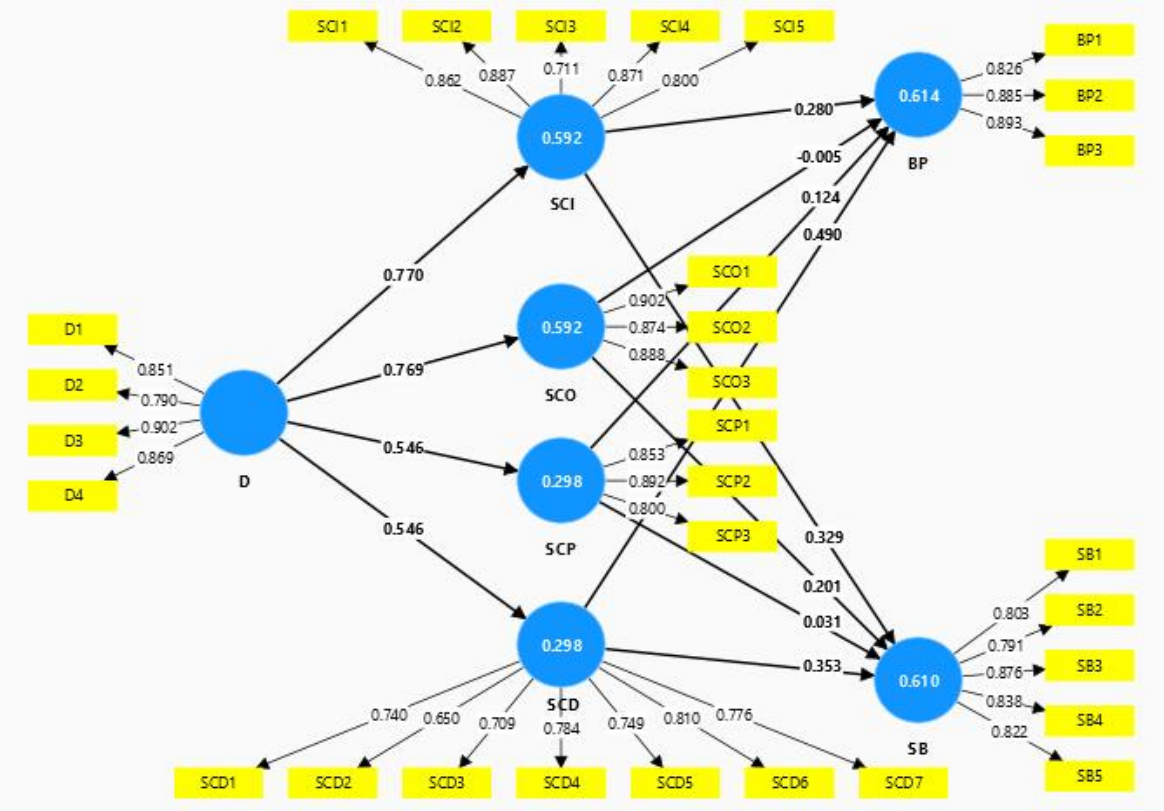

Figure 2. ***Confirmatory factor analysis***

TABLE1. FACTOR LOADINGS AND CONSTRUCT AND RELIABILILITY

Constructs	Items	Loadings	Alpha	Composite reliability	Average variance extracted
BP	BP1	0.826	0.837	0.842	0.754
	BP2	0.885			
	BP3	0.893			
D	D1	0.851	0.875	0.878	0.729
	D2	0.790			
	D3	0.902			

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	D4	0.869			
SB	SB1	0.803	0.884	0.887	0.683
	SB2	0.791			
	SB3	0.876			
	SB4	0.838			
	SB5	0.822			
SCD	SCD1	0.740	0.867	0.876	0.558
	SCD2	0.650			
	SCD3	0.709			
	SCD4	0.784			
	SCD5	0.749			
	SCD6	0.810			
	SCD7	0.776			
SCI	SCI1	0.862	0.885	0.900	0.687
	SCI2	0.887			
	SCI3	0.711			
	SCI4	0.871			
	SCI5	0.80			
SCO	SCO1	0.902	0.866	0.872	0.788
	SCO2	0.874			
	SCO3	0.888			
SCP	SCP1	0.853	0.809	0.833	0.721
	SCP2	0.892			
	SCP3	0.800			

Source: Smart PLS

DISCRIMINANT AND VALIDITY

Discriminant validity is the degree we use to identify the distinctiveness between the variables before they are tested for further analysis. Measurement is undertaken using the Fornell and Larcker correlation criterion and heteroterait-monotrait (HTMT) ratio. The table 2 indicates Fornell and Larcker criterion where threshold value should be less than 0.85. However, table 3 shows HTMT ratio that is been compared to the preset threshold. Therefore, if the value of HTMT ratio is greater than the preceding threshold it can be concluded that discriminant validity is absent. The benchmark value is 0.85. With regard to the above mentioned discriminant validity criteria all the construct of the study have yielded discriminant validity.

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TABLE2. FORNELL AND LARCKER CRITERIA

Variable	1	2	3	4	5	6	7
BP	0.712						
D	0.480	0.833					
SB	0.682	0.624	0.826				
SCD	0.741	0.546	0.673	0.747			
SCI	0.626	0.770	0.688	0.577	0.829		
SCO	0.520	0.769	0.634	0.534	0.690	0.588	
SCP	0.635	0.546	0.583	0.742	0.538	0.563	0.819

Source: Smart PLS

TABLE3. HTMT RATIO

Variable	1	2	3	4	5	6	7
BP							
D	0.556						
SB	0.787	0.707					
SCD	0.714	0.622	0.759				
SCI	0.717	0.670	0.748	0.641			
SCO	0.612	0.674	0.718	0.604	0.771		
SCP	0.752	0.634	0.684	0.581	0.621	0.658	

Source: Smart PLS

QUANTITATIVE ANALYSIS

STRUCTURAL MODEL

After the completion of measurement model the next step is to evaluate the structural model which entails two processes such as the path hypothesis and the bootstrapping. The path hypothesis and bootstrapping provides the experts to explore the association of all the co-efficients. We examined and captured both direct and indirect effects by using the bootstrapping method. In order to elaborate the aim of this study, we uses structural equation modelling to investigate the direct and indirect relationships among the variables (Kenny et al., 2003). Below figure 3 depicts path hypothesis and figure 4 illustrates the bootstrapping for the study. The regression value R^2 is 61.5% for business profitability and 61% for sustainability which illustrates that this model is proficient in explaining both profitability and sustainability.

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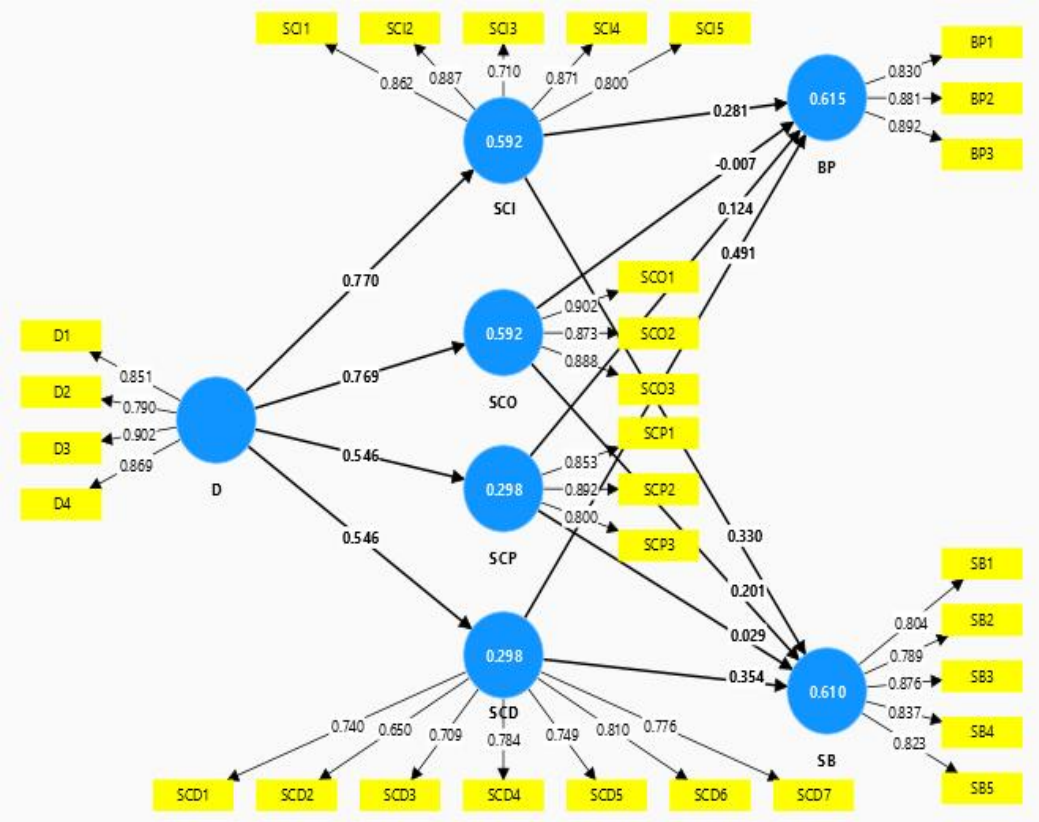

Figure 3. Structural model (path hypothesis)

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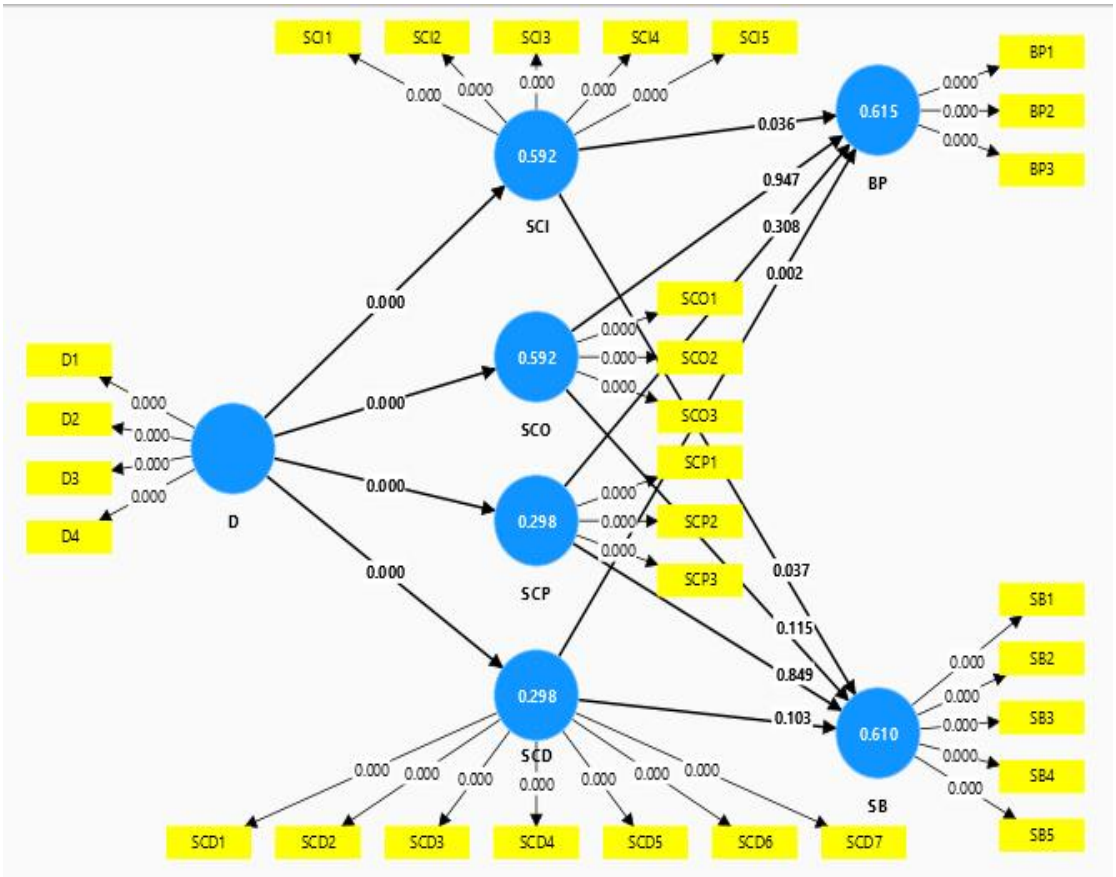

Figure 4. Bootstrapping structural model

HYPOTHESIS TESTING ANALYSIS

This research work aims to explore the association between the variables via direct and indirect effets. The p-value and a t-value are the two common measures used for the statistical significance of hypothesis. For both the p-value and t-value the threshold level is 0.05 and 1.96. the following table shows that out of twelve hypothesis, seven hypothesis are significant and remaining five hypothesis are non significant. The value of beta depicts the strength among the variables relationship. Hence, H7, H8, H9, H10 and H12 are non siignificant hypothesis on the basis of threshold level.

TABLE4. PATH COEFFICIENTS

H	Relation	O.S	O.M	T.S	P.V	Results
H1	D – SCI	0.77	0.769	12.261	0.000	Supported
H2	D – SCO	0.769	0.766	12.90	0.000	Supported
H3	D – SCP	0.546	0.553	7.012	0.000	Supported
H4	D – SCD	0.546	0.542	5.055	0.000	Supported

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H5	D–SCI-BP	0.216	0.206	2.06	0.039	Supported
H6	D-SCI-SB	0.254	0.241	2.035	0.042	Supported
H7	D-SCO-BP	-0.005	0.004	0.066	0.947	Not Supported
H8	D-SCO-SB	0.155	0.165	1.546	0.122	Not Supported
H9	D-SCP-BP	0.068	0.064	1.011	0.312	Not Supported
H10	D-SCP-SB	0.016	0.013	0.187	0.851	Not Supported
H11	D-SCD-BP	0.268	0.265	2.915	0.004	Supported
H12	D-SCD-SB	0.193	0.197	1.618	0.106	Not Supported

Source: Smart PLS

DISCUSSION

This research work explore the influence of digitalization on profitability of business and sustainability with mediating effect of four main supply chain processes such as integration, operation, purchasing and distribution in the agri sector of Bangladesh. The study reveals that digitalized supply chain processes significantly influence the profitability and sustainability.

The first hypothesis is to argue that increased digitalisation has a strong effect on supply chain integration. The results reveals that integration is significantly effected by digitalization with a p-value of < 0.05 and t-value > 1.96. Investigating the previous literature, we observe similar conclusions from the researchers as well (Isaksson et al., 2018). The second hypothesis stated that digitalization would enhance the supply chain operations functionality. The outcome also justified the same argument with p value and t value 0.000 and 12.90. Some studies with similar association established within different contexts with different authors also reveal similar results highlighting a strong influence of digitalization on supply chain processes (Björkdahl, 2020). The third hypothesis is expected that the agribusiness firms of Bangladesh will be able to make better purchasing through digitalization of supply chain departments. The research also revealed a positive effect of digitalization on the better purchasing acts of the supply chain departments of the agribusiness firms of Bangladesh with p-value of 0.000 and t-value of 7.012. From the literature review of the previous studies on the effects of digitalization on purchasing across various sectors in various settings, the same results were obtained and it revealed that after the implementation of digitalization, the overall purchasing process of the firms were more efficient than the traditional methods (Vern et al., 2022; Schlüter et al., 2017).

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The fourth hypothesis posits that digitalization will resolve the issue of supply chain distribution system. Using the results of this research, it is also possible to observe that it supports the argument constituting p-value and t-value of 0.000 and 5.055, respectively. Similar results are found in previous researches that used the same relationship under different conditions. However, the findings of this study are consistent with those of earlier studies carried out in dissimilar settings (Mak & Max Shen, 2021; Frei et al., 2020). The fifth hypothesis posits that the supply chain integration when mediates between digitalization and profitability, enhances business profitability. The findings of this study are also aligned with the opinion that better and proper integration results into any firm toward profitability with p-value and t-value of 0.039 and 2.06, respectively. The past work rooted from various industries and geographical settings also confirmed that appropriate supply chain integration is one of the essential aspects in the firm's profitability (Lee et al., 2022; Zheng et al., 2021). The sixth hypothesis of the study is that after the implantation of digitalization, the firms' supply chain integration acting as a mediator will result in the sustainability of businesses. Hence, the above result supports the argument claim in this study using the p and t-values of 0.042 and 2.035 respectively. But, the past literature on integration also states that better and proper integration system at any firm takes the firm towards sustainability. Nonetheless, the studies have been done in different settings and geographical locations but are as applicable to this study (Choi et al., 2020).

The seventh and eight hypothesis being postulated is that of supply chain operations mediates among digitalization and business profitability and sustainabilty. However, according to the findings of this study, the hypotheses of having p and t- values of 0.947 and 0.066; 0.122 and 1.546 were not supported. Some context as mentioned in the past literature in this relationship has either strong evidence while other contexts are indicated to have negligible evidence. The rationale for this minimal consideration may plausibly be that Bangladesh is a developing nation for which the majority of industries are yet to advance to the phase of digitalization (Agrawal et al., 2022). The ninth and tenth hypothesis posits that with mediating supply chain purchasing being granted in digitized forms, growth in business profitability and sustainability will be the outcome. But the results as per this study showed that the argument cannot be supported with the p-value and t-value of 0.312 and 1.011; 0.851 and 0.187 respectively. The arguments put forward in the previous literature concerning the purchasing process of different companies in diverse firms with change geological locations are also consistent with the statement, which state that a improved and proficient buying procedure makes the firm profitable (Trivellas et al., 2020; Singh et al., 2019).

The eleventh and twelfth hypothesis stated that supply chain distribution significantly mediates the association between digitalization and business profitability and sustainability. Whereas, the

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results shows a significant relationship among digitalization and business profitability with a mediating role of supply chain distribution and non significant relationship with sustainability scoring p-value and t-value 0.004 and 2.915; 0.106 and 1.618 respectively. Few research studies conducted on developed economy shows significant results, while others conducted on developing eonomies depicts non significant association (Bogdanov et al., 2021; Li et al., 2020).

The effect of digitalization interfered on business strategies focused on sustainable supply chain was established significant. Because of its efficiency in providing data for improved decision making, real time evaluation, and openness, it has revolutionized the way businesses manage sustainability. Through implementing digital technologies, companies are in a position to optimize resource utilization, as well as to observe the negative environmental impact of supply chains. It is going to improve lead timings, reduce scrap and wastage, and reduce carbon footprint. Digitalisation has also created new modalities to engage and interact with stakeholders, customers, and suppliers who also have increased their commitment to sustainability pathways. The cleavage in strategic management is a crucial driver of sustainable supply chains in the current firm environment; supporting environmentalism and enhancing competitiveness and performance (Barman et al., 2021).

IMPLICATIONS

There are several implications of this study between the association of digitalization and business profitability and sustainability with mediating effect of supply chain activities including integration, operation, purchasing, and distribution. From the managerial point of view, the study provides practical recommendations as to how various supply chain functions can be enhanced by the use of technologies. Managers are able to increase the level of integration, optimize flows and eliminate inefficiency which affects the company's profits. Further, adopting environmentally sustainable digital strategies aligns the processes to cover the goals of sustainability and, at the same time, reduce costs. Thus, with the help of data management, the managers are able to make decision that aims at creating long-term value for the company.

From the theoretical perspective, the research incorporates supply chain processes as the intermediary in the relation between digitalization and business. It incorporates the needs of digital transformation, SCM, and sustainability, and refines inter-disciplinary research. The study further empirically supports concepts from both the Dynamic Capabilities Theory and RBV showing how digital resources enhance operational and strategic capabilities towards firm performance.

It also presents useful advice for policymakers. Based on what they identify as being the advantages that firms derive, they are easily able to set policies that would foster use of digital tools in supply chains with special emphasis on industries that they think would be most

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profitable and sustainable. Subsidy for incentives, and training, among others, are among the ways that can help to promote the transformation, particularly in developing economies. In addition, if sustainability performance indicators are included as part of the supply chain policies, then policymakers can encourage people to follow sustainable laws and support the achievement of sustainable goals.

In its broader sense to businesses the study serves as a guide on how to acquire a competitive edge. Companies can use digital applications to increase SCM, increase consumers' satisfaction, and diversify their market. While large firms invest heavily on new technologies, SMEs require huge investment that can achieve similar improvement at a lower cost of finance. Greater clarity in supply chain relationships and a smoother day-to-day functioning also benefit customer loyalty and market stability.

The research also contributes to the international and social consequences of supply chain digitalization. Sustainability consists in cutting CO_2 emissions and improving resource utilization to support wider efforts motivated by commercial activity. Digitalization also fosters ability to respond to global challenges as events like pandemic, change of geopolitical map and climate change as well as ensuring business continuity. Furthermore, improvements toward supply chain management increase economic development because they enhance efficiency, participation in employment opportunities, and global cooperation. Therefore, the study focuses on the impact of digitalization for achieving profitability, sustainability and economic and societal development.

This research falls under various SDGs, placing much focus on the role that digitalization of processes within the supply chain has on sustainability and profitability. Particularly, 8 SDG: Decent Work and Economic Growth by proving how supply chain digitalization makes work easier, increases organization productivity and assured growth of the business, economic development and employment opportunities. Integration, operation, buying and distribution of goods and services benefit from enabling coefficients for the continual improvement of the economic growth of businesses and employment. The study also highlights the 9 SDG: For Industry, Innovation, and Infrastructure, we have called for the promotion of technologies and digital ideas to enhance the conventional supply chain management systems, the development of strong structures, and hence ensuring industrial advancements.

Furthermore, the study addresses the 12 SDG: Sustainable Consumption and Production, by encouraging the use of resources that are optimal and waste generation minimum, and by adopting sustainable procedures in production. The flexible and integrated supply chains today can help reduce cost overruns, time wastage, and institutional measures of unsustainable consumption and production. The 13 SDG: Climate Action, as efficiency enhanced overall steps

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in supply chain provide solutions that eliminate excessive usage of Carbon such as; transportation, purchasing and distribution help companies to implement sustainable strategies. Besides, this research work also puts light on 17 SDG: Partnerships for the Goals, focusing on the need of cooperation with businesses, policymakers, and technology suppliers, in order to ensure the effective adoption of digital supply chain solutions. The multiplication of partnerships increases the effectiveness of knowledge transfer, creativity and international collaboration for development.

To achieve these goals, supply chain can be digitalized by companies using technology in their production activities, which are backed by policies and funding for industrial development (SDGs 8 & 9). The SDG 12 can be achieved by training and developing understanding on sustainable measures that reduce waste, and measure on how to deploy digital solutions to avoid wastage of resources. Possibilities for emissions reductions should be communicated through green logistics and carbon tracking systems to deliver climate action aims (SDG 13). Last, forming alliances for business sectors can help establish the harmonized process of forging strategies for the digital transformation where everybody triumphs (SDG 17). Altogether, the findings of this research support the possibilities of using digitalisation for delivering the SDGs focusing on sustainable organisational development and solving crucial enviornmental and social problems, providing significant contributions to numerous of the defined goals.

CONCLUSION AND LIMITATIONS

This research investigates the influence of mediating role of supply chain processes such as operation, integration, purchasing and distribution among digitalization and business profitability and sustainability. Out of the twelve hypothesis, five hypothesis were rejected and remaining seven were found significant and depicts that there is a strong impact of digitalization on supply chain processes such as; integration, operation, purchasing and distribution. This study also reveals that high level of supply chain integration increases business profitability and sustainability. Whereas, non significant mediating impact was found of operation and purchasing between digitalization and profitability and sustainabilty. On the other hand, the mediating digitized supply chain distribution was found signifcant for business profitability and non significant for sustainabilty.

Through the use of information within the supply chain processes, organizations can remove supply chain wastes and embrace the application of green technology. It also further optimizes organizational operations and expenses while also fostering corporate responsibilities to environmental issues across the world. Digitization enables timely exchange of information, enhanced decision making and optimization of processes, which are essential for realisation of sustainable profit making and environmental conservation. In addition, the presented research

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discusses the significance of supply chain redesign efforts, particularly with regards to unprecedented digital transformation, in contributing to the advancement of the economy and the care of the environment. However, it is important to understand that digitalized supply chains are yet to be established and necessarily take some time before they are achieved; they need organizational readiness, investment in technology, and coordination among different stakeholders.

However, this research has the following limitations. Firstly, the fact that this study restricts supply chain processes to the four mediator constructs implies that other potential supply chain processes can influence the results are neglected. Secondly, it tends to generalize the nature of business digitalization across the businesses while ignoring differences in technological infrastructure, resource availability, and organizational culture. Thirdly, although this study attempts to relate digitalization to sustainability, it fails to provide measurable outcomes in terms of economical and environmental benefit. Finally, external sources including and not limited to regulatory structures, geopolitical strategies, and markets are not captured. To overcome these limitations in the future research, quantitative data, other mediating variables could be included, and the nature of the digitalization strategies could be dissected by industry type to advance the understanding of how digitalization affects supply chain performance.

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