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RESEARCH PAPER

The Mediating Role of Supply Chain Responsiveness in the Relationship Between Key Supply Chain Drivers and Performance: Evidence from the FMCG Industry

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ABSTRACT

Goal: This study examines the relationships among key supply chain drivers supply chain agility (SCA), supply chain visibility (SCV), supplier collaboration (SC), and technology integration (TI) and their impact on supply chain performance (SCP), emphasizing the mediating role of supply chain responsiveness (SCR) in the FMCG sector in Bangladesh. By providing empirical insights into these interactions, the study aims to enhance both academic discourse and practical strategies for optimizing supply chain efficiency in a rapidly growing industry.

Design/methodology/approach: A quantitative research design was employed, utilizing a structured questionnaire distributed among FMCG companies in Bangladesh. Out of 360 distributed questionnaires, 217 responses were collected, with 198 valid responses used for analysis. Structural equation modeling (PLS-SEM) via Smart PLS 4 was applied to test the proposed relationships. The study assessed the measurement model for validity and reliability before evaluating the structural model to examine direct and mediating effects.

Findings: The results confirm that SCA and SCV significantly impact SCR, which in turn enhances SCP. While SC and TI do not have direct effects on SCP, they exert significant influence when mediated by SCR. These findings highlight the critical role of responsiveness in strengthening the effectiveness of key supply chain drivers in FMCG firms.

Practical implications: The study provides actionable insights for FMCG firms aiming to improve supply chain performance by enhancing agility, visibility, and responsiveness. Investments in digital integration and real-time monitoring can strengthen these relationships and drive operational excellence.

Social implications: By improving supply chain responsiveness, FMCG firms can enhance service efficiency, reduce lead times, and better meet consumer demands, ultimately contributing to a more resilient supply chain ecosystem in Bangladesh.

Originality/value: This study offers novel insights into the mediating role of SCR in supply chain management, particularly within an emerging market context. It expands existing literature by integrating responsiveness as a key factor in performance enhancement.

Limitations: The study is limited to the FMCG sector in Bangladesh and relies on cross-sectional data. Future research should explore longitudinal effects and comparative analyses across industries.

Keywords: Supply Chain Performance; Supply Chain Responsiveness; Supply Chain Agility; Supply Chain Visibility; Supplier Collaboration; Technology Integration; Supply Chain Governance; Sustainable Supply Chains; FMCG Industry.

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1 INTRODUCTION

In the current swiftly changing market environment, the Fast-Moving Consumer Goods (FMCG) industry has distinct issues that need improved supply chain efficiency and responsiveness. The FMCG sector is marked by intense rivalry, short product life spans, and fluctuating customer tastes, rendering efficient supply chain management essential for maintaining competitive advantage. Recent studies indicate that the performance of enterprises in this sector is significantly affected by critical supply chain factors, including supply chain integration, information exchange, and supplier relationships (Emon *et al.*, 2024; Zaman *et al.*, 2024).

The FMCG sector is a vital component of Bangladesh's economy, substantially impacting employment and contributing to GDP growth (Emon, 2023; Rahman & Chowdhury, 2020). This sector includes a diverse array of products, such as food and drinks, personal care items, and domestic goods, all distinguished by their quick consumption and frequent acquisition (Rahman & Chowdhury, 2020; Shakur *et al.*, 2024). Khan *et al.*, (2024) assert that the rise of the FMCG industry is mostly driven by a burgeoning population and escalating disposable incomes, resulting in amplified consumer demand. The Bangladesh Bureau of Statistics (BBS, 2022) said that the FMCG market is projected to grow as urbanization advances and customer tastes evolve towards convenience and quality (Hossain *et al.*, 2024; Khan & Emon, 2025). In this changing climate, efficient supply chain management (SCM) is essential for organizations aiming to meet customer expectations while reducing costs and enhancing operational efficiency (Chavez *et al.*, 2016). Effective SCM methods enable companies to optimize operations, minimize lead times, and increase product availability, hence enhancing customer satisfaction and loyalty (Emon & Khan, 2024a; Pasupuleti *et al.*, 2024). The intricacies of the FMCG supply chain are exacerbated by variable customer expectations, uncertain market circumstances, and fierce competition, requiring organizations to maintain agility and responsiveness (Bilal *et al.*, 2024). Critical supply chain determinants, such as supplier cooperation, demand management, information dissemination, and logistical efficiency, profoundly affect supply chain responsiveness (SCR). Supplier cooperation enhances ties between companies and their suppliers, resulting in better information exchange, innovation, and cost savings (Wang & Hu, 2020). Likewise, efficient demand management solutions allow firms to more precisely predict customer wants, hence aligning production and distribution operations appropriately (Seyedan & Mafakheri, 2020). Sharing information across the supply chain is essential for increasing transparency and enabling prompt decision-making, hence promoting responsiveness and performance results (Fatorachian & Kazemi, 2021). Logistical efficiency is a vital factor, since it includes transportation, storage, and distribution of commodities. Efficient logistics operations may markedly decrease expenses and elevate service standards, hence improving total supply chain performance (Fu *et al.*, 2022). Consequently, firms that proficiently integrate these supply chain drivers might attain enhanced responsiveness, allowing them to adjust to fluctuations in market circumstances and customer preferences more rapidly. Notwithstanding the acknowledged significance of these determinants, empirical studies investigating their interrelations, especially in the Bangladeshi setting, are few. Most current research has concentrated on singular elements of SCM, neglecting the synergistic impacts of several factors and their influence on responsiveness of supply chains and performance (Howe & Jin, 2022).

The FMCG business in Bangladesh is experiencing substantial upheaval, driven by many causes such as technical improvements, changing customer habits, and increasing rivalry. As customer expectations evolve towards quality, convenience, and sustainability, FMCG firms are necessitated to modify their supply chain strategies appropriately (Shakur *et al.*, 2024). The emergence of digital technology, including e-commerce platforms and sophisticated data analytics, has transformed corporate operations, allowing for enhanced comprehension of client demands and preferences. As a result, firms are progressively allocating resources to augment their supply chain capabilities to enhance efficiency, minimize lead times, and adapt more adeptly to market changes (Atieh Ali *et al.*, 2024). Nonetheless, despite these developments, several firms in the FMCG industry still have substantial issues pertaining to inefficiencies and insufficient reactivity in their supply chains. Inefficient operations, insufficient coordination with suppliers, and inadequate information exchange often lead to delays, elevated costs, and reduced customer satisfaction (Xue *et al.*, 2021). Furthermore, the rapid dynamics of the FMCG sector require firms to remain nimble and responsive; nevertheless, many have difficulties in attaining the requisite degree of SCR, which ultimately impedes their overall performance. In this context, it is essential to comprehend how primary supply chain drivers such as supplier cooperation, demand management, information exchange, and logistics efficiency impact performance in terms of SCR (Emon *et al.*, 2024). The current literature underscores the significance of these drivers in improving supply chain performance; however, empirical studies concentrating on the relationship between these drivers and SCR in the Bangladeshi FMCG sector are markedly limited (Antràs & Chor, 2022; Emon & Khan,

2025b; Sánchez-Flores *et al.*, 2020).

Despite the substantial expansion and significance of the FMCG sector in Bangladesh, several firms within this industry continue to confront enduring issues associated with inefficiencies and insufficient responsiveness in their supply chains. The rapid evolution of the FMCG sector propelled by technology innovations, changing consumer habits, and intensifying competition has amplified the need for organizations to improve their supply chain competencies (Jafari *et al.*, 2023). Empirical study demonstrates that several organizations have difficulties in adapting to these changes, leading to inferior performance and consumer unhappiness (Emon & Khan, 2025b; Na-Nan *et al.*, 2021). Essential supply chain drivers, including agility, visibility, supplier engagement, and technology integration, are acknowledged as vital determinants of organizational success (Choudhury *et al.*, 2021). Nonetheless, the interaction among these factors and their combined effect on SCR a vital factor in supply chain performance has not been well examined, especially within the Bangladeshi FMCG sector. Prior research has often concentrated on specific drivers in isolation, failing to sufficiently examine their interactions and impact on SCR and overall performance.

The absence of comprehension creates a notable deficiency in the current literature, hindering practitioners from developing effective solutions that use these supply chain factors to improve responsiveness and performance. Consequently, there is an urgent requirement for empirical evidence that clarifies the connections among supply chain agility, visibility, supplier collaboration, technology integration, and SCR, along with their resultant impacts on supply chain performance in Bangladesh's FMCG sector. Bridging this gap will provide significant insights for both academics and professionals aiming to enhance operational efficiency and competitive advantage in a more intricate market landscape.

The main aim of this study is to examine the connections among critical supply chain drivers specifically, supply chain agility (SCA), supply chain visibility (SCV), supplier collaboration (SC), and technology integration (TI) and their influence on supply chain performance (SCP), particularly emphasizing the mediating effect of supply chain responsiveness (SCR) within the FMCG sector in Bangladesh. This research seeks to provide empirical data that elucidates the interaction of these independent factors in affecting SCR and, therefore, overall SCP. The project aims to provide significant insights that might enhance academic discourse and practical solutions for improving supply chain efficiency and effectiveness in Bangladesh's fast developing FMCG sector.

This study contributes novel insights into the existing literature by examining the complex interrelations among critical supply chain drivers SCA, SCV, SC, and TI and their combined effect on SCP, mediated by SCR in the Bangladeshi FMCG sector. Although prior research has recognized the significance of individual supply chain drivers, a substantial gap exists in comprehending how these drivers synergistically interact to improve SCR and performance in the distinct context of Bangladesh, where the FMCG sector is marked by rapid growth and changing consumer demands. This research utilizes a complete empirical method to examine these linkages, using current data and sophisticated analytical approaches to provide findings that are relevant and practical to practitioners. This study focuses on the FMCG sector in Bangladesh, addressing the essential need for context-specific research that considers the distinct difficulties and possibilities encountered by local enterprises. This study's results will boost theoretical comprehension of supply chain dynamics in developing economies and provide practical advice for managers aiming to improve their supply chain strategies in a competitive environment. This combined emphasis on theory and practice is a substantial addition to the literature on SCM, especially within the context of emerging economies such as Bangladesh.

This study's relevance resides in its capacity to provide significant insights for many players in the FMCG market in Bangladesh. The results will enhance academic literature by addressing study gaps about the links among major supply chain drivers, SCR, and SCP within a developing economy. This study will augment the theoretical framework of SCM by integrating empirical facts and modern analytical methods, especially in developing markets where research is scarce. Furthermore, the research has significant ramifications for FMCG enterprises functioning in Bangladesh. Given the industry's increasing demands from shifting customer tastes, technological innovations, and competitive forces, it is important to comprehend how to adeptly use supply chain drivers to improve responsiveness and performance. This study will provide managers and decision-makers with practical solutions to enhance supply chain operations, resulting in increased operational efficiency, decreased costs, and greater customer satisfaction. Moreover, policymakers and industry regulators may get advantages from this study's results by enhancing their comprehension of the difficulties and possibilities within the FMCG sector. This research may guide policy formulation to enhance the industry's growth and competitiveness, therefore aiding larger economic development objectives in Bangladesh. This study highlights the significance of SCR in attaining lasting competitive advantage in the FMCG industry. The research underscores the need for agility, visibility, cooperation, and technological integration, advocating for a comprehensive

approach to SCM that promotes responsiveness as a fundamental performance driver. This research intends to be a significant resource for scholars, practitioners, and policymakers, enhancing comprehension of supply chain dynamics and advocating best practices in the Bangladeshi FMCG sector.

2 LITERATURE REVIEW

This research is based on three fundamental theories: Resource-Based View (RBV) Theory, Systems Theory, and Relational View (RV) Theory. Collectively, these theories provide an extensive comprehension of the dynamics inherent in supply chains, especially within the FMCG sector in Bangladesh.

The RBV asserts that firms achieve a competitive advantage via the efficient use of their distinctive resources and capabilities (Myamba *et al.*, 2024; Varadarajan, 2020). In SCM, resources include both real and intangible assets, such as human capital, technology skills, supplier connections, and operational procedures. Agility, visibility, and cooperation are essential elements for improving SCP. Agile supply chains can rapidly adapt to market changes, variations in customer demand, and external interruptions, which is especially crucial in the very competitive FMCG industry (Udokporo *et al.*, 2020). Organizations that use agile approaches may update production schedules, manage inventory levels, and alter logistics tactics in real time, thereby reducing delays and enhancing customer satisfaction. The RBV emphasizes that companies using their distinctive resources efficiently are more likely to attain exceptional performance results. Recent studies indicate that FMCG businesses that emphasize agility and visibility in their supply chains are better positioned to maintain competitive advantages in a swiftly evolving market (Neboh & Mbhele, 2021). This theory highlights the interconnectedness of diverse components within a system and the significance of their connections (Mattioli *et al.*, 2020). In SCM, seeing the supply chain as a system enables firms to comprehend how many factors, including TI, SC, and internal procedures, interact to influence overall performance. This comprehensive viewpoint enhances the comprehension of the intricacies and dynamism inherent in supply networks.

ST asserts that the whole surpasses the mere aggregation of its components, indicating that optimal SCP arises from the interaction and synergy among its elements (Allioui & Mourdi, 2023). Integrating sophisticated technology with conventional supply chain operations may augment coordination and information flow, resulting in enhanced responsiveness and efficiency. This idea posits that SCR arises not from isolated activities but from the interconnectivity of diverse supply chain components, including suppliers, manufacturers, and distributors. Organizations in the FMCG industry, aiming to increase operational capabilities, may use a systems-oriented approach to identify possible bottlenecks and areas for improvement across the supply chain, hence facilitating superior performance results. The RV emphasizes the importance of inter-organizational interactions and cooperation in attaining competitive advantage (Randolph *et al.*, 2020). Robust connections with suppliers, distributors, and partners in supply chains may augment cooperation, facilitate information exchange, and promote overall efficiency, resulting in superior performance results. This theory emphasizes the significance of relationship capacities in enhancing SCR and performance.

Companies that foster collaborative connections with their suppliers may get advantages from resource sharing, knowledge transfer, and collective problem-solving, therefore substantially improving SCP (Abuzaid *et al.*, 2024; Faruquee *et al.*, 2021). Collaborative planning and forecasting between suppliers and manufacturers may enhance demand accuracy and optimize inventory levels. This relational viewpoint is especially pertinent in the FMCG sector, where rapid alterations in customer preferences and market dynamics need significant flexibility and adaptation. Furthermore, the RV emphasizes that the efficacy of supply chain partnerships is contingent upon trust, dedication, and mutual benefit, which are crucial for creating enduring relationships. As firms increasingly acknowledge the significance of strategic alliances and partnerships in managing intricate supply chain dynamics, the relational perspective offers a framework for comprehending how these interactions might be used to attain competitive advantages.

The amalgamation of RBV, ST, and Relational View Theory provides a comprehensive framework for analyzing the dynamics of SCM within the FMCG industry of Bangladesh. This research seeks to elucidate the characteristics that enhance SCP and responsiveness by acknowledging the relevance of distinctive resources, interdependence across supply chain elements, and the value of relationship skills. These theoretical views not only inform the formulation of research hypotheses but also enhance comprehension of the difficulties and possibilities confronting the FMCG business in Bangladesh.

SCA is widely seen as an essential competency for firms seeking to succeed in contemporary dynamic and competitive marketplaces. SCA, characterized by the capacity to swiftly adjust to market fluctuations and consumer requirements, is essential for improving overall SCP (Shekarian

et al., 2020). In the Fast-Moving customer Goods (FMCG) industry, where customer tastes may change fast, an agile supply chain allows companies to react promptly to demand variations, manage inventory efficiently, and alleviate disruptions (Ishak *et al.*, 2023). The significance of agility in SCM is highlighted by its effect on operational efficiency and customer satisfaction. Agile supply chains optimize resource usage by synchronizing production and logistics with real-time market signals. This responsiveness decreases lead times, eliminates surplus inventory and stockouts, and thus improves service levels (Taleizadeh *et al.*, 2021). Companies that have implemented agile techniques may swiftly modify their production schedules and distribution strategies in reaction to evolving consumer habits, so assuring timely fulfillment of client expectations (Ayoub & Abdallah, 2019).

Empirical research has continuously shown a favorable correlation between SCA and performance across several sectors. A research by Shukor *et al.*, (2021) indicated that firms exhibiting elevated SCA had enhanced operational performance measures, such as decreased order fulfillment times and heightened customer satisfaction ratings. Research by Li *et al.*, (2024) shown that SCA substantially enhances competitive advantage, allowing enterprises to surpass their less agile rivals in market share and profitability . Furthermore, the capacity to preserve agility across disruptions be they supply chain breakdowns, natural catastrophes, or economic fluctuations has become increasingly vital for maintaining performance. Agile supply chains are more adept at executing contingency plans and swiftly adjusting operations to alleviate risks, therefore preserving a competitive advantage in volatile conditions (W. Ahmed & Huma, 2021).

The research clearly establishes the link between SCA and SCP, highlighting agility as a vital determinant of business success. By using agile methods, companies in the FMCG industry may improve their responsiveness, efficiency, and overall performance, therefore placing themselves advantageously in a swiftly changing marketplace. Consequently, the following hypothesis is posited:

H1: SCA has a positive effect on SCP

SCV is widely acknowledged as a crucial component of contemporary SCM, especially in dynamic sectors such as FMCG. Enhanced visibility, defined as the capacity to watch and monitor items along the supply chain, empowers firms to make timely and informed choices that may substantially affect overall performance (Rogerson & Parry, 2020). Enhanced visibility enables firms to more effectively coordinate activities across supply chain partners, resulting in increased operational efficiency and decreased lead times. A primary advantage of SCV is its capacity to improve cooperation among supply chain stakeholders. Organizations that can obtain real-time data on inventory levels, shipping status, and demand changes may coordinate their operations more efficiently. This coordination reduces the probability of stockouts and surplus inventory, which may significantly affect service levels and customer satisfaction (Tadayonrad & Ndiaye, 2023). Retailers using modern visibility technologies, such as RFID and IoT sensors, may track product movement and guarantee the availability of the correct items at the appropriate moment, therefore enhancing the efficiency of consumer demand fulfillment.

Recent studies have continuously emphasized the beneficial effects of SCV on performance results. Research by Ahi and Searcy (2022) revealed that organizations with strong visibility capabilities saw reduced operating expenses and enhanced customer service levels. Research by Zhang *et al.* (2023) shown that firms with improved visibility were more proficient in addressing market risks, including demand swings and supply interruptions. These results highlight the significance of visibility as a mechanism that enhances operational efficiency and allows organizations to address difficulties more adeptly. Furthermore, SCV is crucial for risk management. In a more intricate and integrated global supply chain environment, firms encounter many hazards, ranging from natural catastrophes to geopolitical conflicts. Companies with enhanced visibility are more adept at forecasting probable interruptions and executing contingency measures, hence reducing the effect on their operations (Katsaliaki *et al.*, 2022). This proactive strategy for risk management enhances overall performance and resilience.

The correlation between SCV and SCP is well-documented in the literature, highlighting the essential role of visibility in enhancing operational efficiency, fostering cooperation, and managing risk. By investing in visibility-enhancing technology and techniques, firms in the FMCG industry may enhance their reactivity to market fluctuations, resulting in improved performance results. Consequently, the following hypothesis is proposed:

H2: SCV has a positive effect on SCP.

Collaboration with suppliers is widely acknowledged as a vital element in attaining exceptional supply chain efficiency. It entails strong collaboration and strategic alliances with suppliers to augment mutual advantages and streamline operations (Rejeb *et al.*, 2021). By cultivating collaborative connections, companies may use suppliers' experience and resources, resulting in enhanced quality, innovation, and responsiveness throughout the supply chain. These

advantages are especially crucial in the Fast-Moving customer Goods (FMCG) industry, where customer tastes and market circumstances may fluctuate swiftly. Efficient engagement with suppliers improves several aspects of SCP. Initially, it may result in substantial improvements in product quality. Involving suppliers in the design and development stages enables businesses to guarantee that materials and components adhere to rigorous quality requirements, hence minimizing the risk of errors and returns (Hegab *et al.*, 2023). This collaborative strategy enhances the final product and fortifies the connection between the company and its suppliers, promoting a culture of ongoing development.

Alongside improvements in quality, engagement with suppliers may foster innovation within the supply chain. When suppliers are seen as strategic partners instead of just vendors, they are more inclined to provide ideas and insights that might facilitate new product development and process improvements. Joint product development projects may provide creative goods that more effectively address consumer wants, providing enterprises with a competitive advantage in the market (Qiu *et al.*, 2020). This joint innovation may markedly improve the overall SCP by synchronizing product offers with customer demand. Furthermore, engagement with suppliers improves SCR. In a climate marked by unpredictability and volatility, firms that have robust connections with their suppliers are more adept at swiftly responding to fluctuations in demand or supply interruptions. Collaborative approaches, including the exchange of real-time data and projections, provide more flexible decision-making and resource allocation, essential for sustaining service levels and customer satisfaction (Rane, 2023).

Empirical research further substantiates the favorable correlation between supplier cooperation and SCP. Janda *et al.* (2023) found that firms who actively collaborate with suppliers had significant improvements in operational efficiency and customer service. Research by Liao *et al.* (2022) also showed that companies with robust collaborative connections with their suppliers attained superior inventory management and reduced lead times, hence directly influencing overall performance indicators. The correlation between supplier cooperation and SCP is well-documented in the literature, underscoring the significance of relationship management in improving supply chain results. Through the active engagement of suppliers in collaborative practices, businesses within the FMCG industry may boost product quality, stimulate innovation, and improve responsiveness, so achieving superior performance outcomes. Consequently, the following hypothesis is asserted:

H3: SC has a positive effect on SCP.

TI is an essential element in contemporary SCM, characterized as the smooth absorption of technology into diverse supply chain operations to improve functionality and efficiency (Kamble *et al.*, 2022). This connection facilitates real-time data exchange and communication across supply chain participants, enhancing decision-making speed and operational responsiveness. As firms progressively embrace sophisticated technologies like IoT, big data analytics, and artificial intelligence, the influence of TI on SCP has become more evident (Emon *et al.*, 2024; Palakshappa *et al.*, 2025). A key advantage of TI is the improvement of operational efficiency. Organizations may decrease lead times, reduce operational expenses, and diminish mistakes by automating regular operations and optimizing procedures (Flechsig *et al.*, 2022). The introduction of automated inventory management systems enables enterprises to maintain ideal stock levels, hence minimizing holding costs and assuring product availability. This efficiency significantly enhances SCP, allowing firms to fulfill consumer requests more efficiently and consistently.

Moreover, the incorporation of technology promotes innovation in supply networks. Utilizing sophisticated analytics technologies allows companies to extract insights from extensive data, revealing trends and patterns that may guide strategic choices. Predictive analytics enables firms to foresee fluctuations in customer demand, allowing proactive operational adjustments (Conboy *et al.*, 2020). This capacity promotes responsiveness and facilitates the creation of new goods and services that correspond with market demands, eventually generating performance gains. Empirical research substantiates the favorable correlation between TI and SCP. Research by Huang *et al.* (2023) revealed that companies who adeptly use technology had substantial improvements in performance indicators, including order fulfillment rates, inventory turnover, and customer happiness. Research by Saenz *et al.* (2022) indicated that firms with integrated technological systems attained superior coordination across supply chain partners, resulting in diminished lead times and improved overall performance. Furthermore, the integration of technology is crucial for improving SCV. Organizations may use technology like RFID and cloud computing to monitor items in real-time throughout the supply chain, enhancing transparency and facilitating informed decision-making (Helo & Shamsuzzoha, 2020). This visibility is essential for mitigating interruptions and guaranteeing the seamless operation of the supply chain, hence enhancing performance.

The incorporation of technology into supply chain operations is a crucial catalyst for

performance enhancement. TI enhances operational efficiency, fosters innovation, and improves visibility, allowing firms to adapt more effectively to market demands and competitive challenges. Consequently, the following hypothesis is proposed:

H4: TI has a positive effect on SCP.

SCR is the capacity of a supply chain to promptly and efficiently respond to fluctuations in demand and market dynamics (Sabahi & Parast, 2020). In the current volatile economic landscape, marked by changing client demands and unforeseen interruptions, possessing a responsive supply chain is essential for firms seeking to sustain competitiveness. This skill enables organizations to optimize operations, regulate inventory levels, and reallocate resources effectively, ultimately improving performance results. An agile supply chain is proficient in adjusting to variations in client demands, which directly influences service levels. A supply chain that can swiftly adapt its procedures to fluctuating demand patterns results in enhanced order fulfillment rates and reduced lead times (Modgil *et al.*, 2022). For example, during busy seasons or abrupt market fluctuations, agile supply chains may enhance production, accelerate logistics, and guarantee prompt delivery to clients. This agility not only meets immediate client needs but also enhances customer loyalty, as customers increasingly prioritize speed and dependability in service delivery.

Research indicates that enhanced SCR leads to increased customer satisfaction and overall performance. Research by Li *et al.* (2022) shown that firms exhibiting superior responsiveness measures saw increased consumer satisfaction, thereby fostering repeat purchases and brand loyalty. Moreover, firms that emphasize responsiveness often encounter reduced stockouts and surplus inventory, leading to diminished operating expenses and enhanced profitability (Taleizadeh *et al.*, 2021). Furthermore, responsiveness is intricately associated with the capacity to manage external interruptions efficiently. Supply networks that can rapidly adapt to unanticipated events such as natural catastrophes, geopolitical conflicts, or global pandemics exhibit resilience and sustain performance under tough conditions (Roscoe *et al.*, 2022). This resilience is essential for maintaining operational continuity and reducing the adverse effects of interruptions on service delivery and customer satisfaction. Empirical studies underscore the significance of SCR by demonstrating its beneficial impact on performance measures. Research by Ho *et al.* (2023) indicates that firms investing in responsive capabilities see substantial improvements in key performance measures, such as operational efficiency, customer service metrics, and overall SCP. The results highlight the need for companies to develop responsiveness as a fundamental ability to adeptly manage the intricacies of contemporary supply chains. SCR is a crucial factor influencing SCP. Its capacity to adjust to client requirements and market variations not only improves service quality and customer contentment but also strengthens organizational resilience against interruptions. Consequently, the following hypothesis is assumed:

H5: SCR has a positive effect on SCP

2.1 Mediating Effects of Supply Chain Responsiveness

SCR is significantly affected by SCA, since agile organizations are intrinsically more capable of adapting to changes and interruptions in their operational contexts (Richey *et al.*, 2022). SCA denotes an organization's capacity to adapt promptly and efficiently to client needs, market variations, and unexpected occurrences. By cultivating agility in their supply chains, companies may improve their reactivity, allowing them to fulfill client demands more effectively and efficiently.

Agile supply chains are defined by their adaptability and capacity to swiftly modify their procedures and tactics. This adaptability enables firms to react to fluctuations in client demand, manage inventory levels more efficiently, and utilize resources in real time. The correlation between SCA and responsiveness is reciprocal; when companies boost their agility, their responsiveness increases, thereby improving their total SCP (Nath & Agrawal, 2020). Consequently, grasping the mediating function of SCR is crucial for understanding how agility converts into enhanced performance results. Empirical research substantiates the claim that SCR mediates the relationship between SCA and performance. Research by Chen *et al.* (2023) revealed that firms exhibiting elevated SCA showed considerable enhancements in responsiveness, resulting in improved performance indicators, including service levels, customer happiness, and operational efficiency. This signifies that the capacity to swiftly adapt to market fluctuations, facilitated by SCA, is crucial for attaining exceptional performance results. Furthermore, the mediating role of SCR highlights the need of strategic actions designed to improve both agility and responsiveness. Companies that engage in cultivating agile processes and skills may use this agility to enhance their responsiveness to market needs, hence improving performance (Geyi *et al.*, 2020). Companies that use sophisticated analytics and technology to improve SCV and coordination may respond more adeptly to fluctuations in demand and supply interruptions, leading to superior performance results.

The relationship between SCA, responsiveness, and performance underscores the importance of agility as a prerequisite for responsiveness, which in turn enhances SCP. The intermediary function of SCR in this connection underscores the need for firms to prioritize the development of agile skills to enhance their responsiveness. Therefore, the following hypothesis is posited:

H6a: SCR mediates the relationship between SCA and SCP

SCV is widely acknowledged as an essential element of efficient SCM, markedly improving responsiveness by delivering fast and precise information for decision-making and coordination among supply chain stakeholders (Rejeb *et al.*, 2020). Visibility denotes the capacity to monitor items, information, and processes throughout the supply chain, allowing companies to acquire insights on inventory levels, demand variations, and any disruptions. By expanding visibility, firms may react more rapidly and efficiently to fluctuations in market circumstances, thereby improving overall performance.

The correlation between SCV and responsiveness is well-documented in the literature. Companies that invest in technology that improve visibility, such as real-time tracking systems and data analytics, are more adept at overseeing their supply chain operations and reacting to unforeseen circumstances. This increased visibility enables faster decision-making and improved coordination among stakeholders, crucial for responding to evolving customer expectations and reducing risks (Settembre-Blundo *et al.*, 2021). Thus, firms with superior SCV are expected to achieve heightened responsiveness, resulting in higher performance results.

Research indicates that SCV enhances responsiveness, which then mediates the connection between visibility and performance. Research by Zhao *et al.* (2023) revealed that organizations with more visibility had enhanced adaptability in addressing client demands and market fluctuations. This heightened agility immediately resulted in enhanced performance measures, including diminished lead times, elevated order fulfillment rates, and higher customer satisfaction. These findings underscore the essential function of SCR in connecting visibility to performance results. Moreover, the mediating role of SCR underscores the need for enterprises to concentrate on attaining visibility while ensuring that such information converts into actionable insights that enhance responsiveness. Companies that adeptly use their visibility to improve responsiveness may optimize their supply chain processes, resulting in enhanced performance. Companies using sophisticated forecasting methods with real-time data visibility may more effectively predict client requests and modify their inventory levels appropriately, leading to enhanced service delivery and operational efficiency (Aljohani, 2023). The relationship between SCV, responsiveness, and performance highlights the significance of visibility as a catalyst for responsiveness, which in turn enhances SCP. Organizations that emphasize visibility efforts and concentrate on converting this visibility into responsive actions are likely to attain considerable performance advantages. Consequently, the following hypothesis is proposed:

H6b: SCR mediates the relationship between SCV and SCP.

Robust supplier cooperation is fundamental to efficient SCM, promoting improved information exchange and resource optimization (Rejeb *et al.*, 2021). Collaborative connections with suppliers provide firms access to vital insights and data, crucial for informed decision-making and improving supply chain operations. When companies participate in successful cooperation, they boost their operational capabilities and considerably improve their response to market volatility and client needs.

The influence of supplier cooperation on SCR is extensively recorded in the literature. Through strong collaboration with suppliers, firms may get prompt access to essential resources, exchange pertinent market knowledge, and participate in collective problem-solving (Faruquee *et al.*, 2021). This heightened connection fosters an enhanced comprehension of supply chain dynamics, enabling organizations to swiftly adjust to alterations, such as fluctuations in customer preferences or supply interruptions. Thus, a responsive supply chain is more capable of providing high-quality goods and services, thus enhancing performance metrics. Recent empirical investigations substantiate the claim that the advantages of supplier cooperation are magnified by improved responsiveness. Research by Zhao *et al.* (2023) indicates that companies that cultivate collaborative connections with their suppliers have enhanced responsiveness, which directly corresponds with superior performance results. These firms can rapidly modify their processes to fulfill client requirements, resulting in enhanced customer satisfaction and loyalty. The mediating function of SCR is essential in connecting supplier cooperation to overall SCP. Supplier cooperation enhances responsiveness, enabling firms to optimize inventory management, minimize lead times, and improve service delivery (Asamoah *et al.*, 2021). Consequently, firms that adeptly manage their supplier connections and use this cooperation to enhance responsiveness are more inclined to attain exceptional performance in their supply chains.

The correlation between supplier cooperation, responsiveness, and performance highlights

the need to cultivate robust connections with suppliers. Organizations that emphasize cooperation have enhanced operational efficiency and are better equipped to adapt to changing market circumstances. By improving responsiveness, companies may leverage the benefits of SC, hence boosting performance results. Consequently, the following hypothesis is asserted:

H6c: SCR mediates the relationship between SC and SCP

The incorporation of technology is a crucial element in contemporary SCM, markedly improving communication and information flow across the supply chain (Di Vaio & Varriale, 2020). The integration of technology such as sophisticated data analytics, cloud computing, and IoT allows enterprises to get real-time insights and enhances coordination across supply chain partners. Enhanced visibility and information exchange are essential for improving SCR, enabling enterprises to swiftly adjust to changing market circumstances and client requirements.

Studies indicate that firms that proficiently use technology into their supply chain operations are more adept at responding to demand changes and supply interruptions (Gu *et al.*, 2021). For example, predictive analytics may allow companies to anticipate demand with more precision, while automated systems can optimize processes, decreasing lead times and enhancing agility. Thus, these competencies enable firms to provide goods and services that better meet consumer expectations, leading to improved overall performance. Furthermore, empirical research demonstrates that the influence of TI on SCP is often mediated by its capacity to improve responsiveness. Zhao *et al.* (2023) demonstrate that companies using sophisticated technology achieve substantial improvements in responsiveness, resulting in better performance results. Companies that use integrated software solutions for SCM may react more rapidly to changes in client preferences or supply chain interruptions, therefore improving their competitive advantage. The intermediary function of SCR is crucial in connecting TI to performance enhancement. When technology enhances responsiveness, firms may manage inventory levels, minimize surplus stock, and improve service delivery (Ahmed *et al.*, 2023; Li *et al.*, 2020). This responsiveness enables organizations to function more effectively and address client requests swiftly, which is essential in the current rapid market landscape.

The correlation between TI, SCR, and performance highlights the need of implementing advanced technological solutions in supply chains. Organizations that emphasize TI boost operational efficiency and become more responsive to client needs and market swings. Consequently, the following hypothesis is proposed:

H6d: SCR mediates the relationship between TI and SCP.

According to the above discussion, Figure 1 illustrates the conceptual framework created for this investigation. This paradigm demonstrates the mediating function of SCR in the association between essential supply chain drivers SCA, SCV, SC, and TI and SCP. It emphasizes that SCR serves as a vital intermediate, amplifying the impact of these factors on total performance. Based on actual evidence and theoretical perspectives, the framework offers a systematic method for comprehending the dynamics of SCM within the FMCG sector.

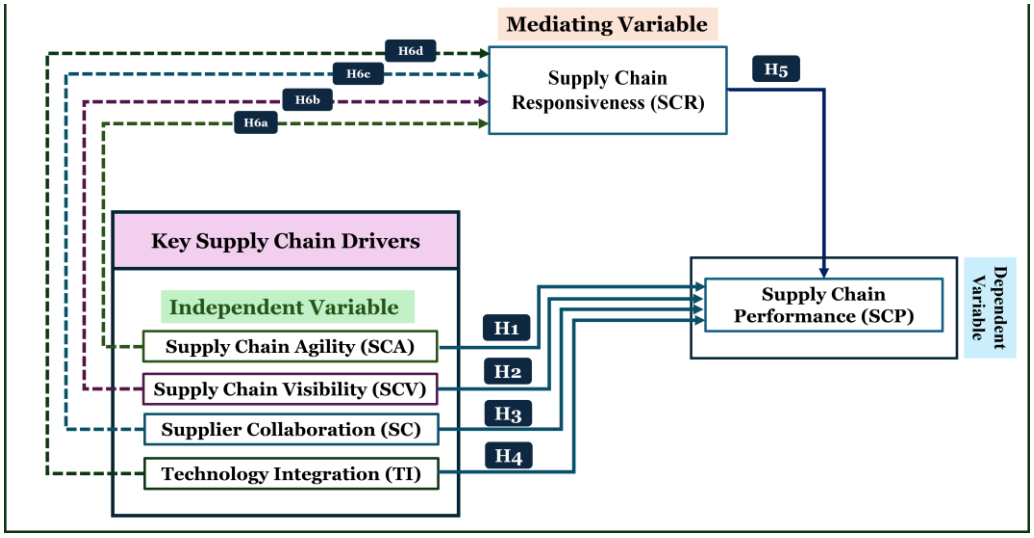

Figure 1 - Conceptual Framework

3 MATERIALS AND METHOD

This research used a quantitative approach to examine the determinants affecting SCP in the FMCG industry in Bangladesh. The study methodology was designed to collect empirical data

using a standardized questionnaire, which was disseminated across many FMCG firms. A total of 360 questionnaires were disseminated, yielding 217 replies. Following the exclusion of 19 unusable replies due to insufficient information, a final dataset comprising 198 valid responses was used for analysis.

The study technique was validated since the quantitative approach enabled statistical examination of the correlations among variables, therefore elucidating the elements influencing SCP. This method enabled the testing of hypotheses and the analysis of the mediating impacts of SCR in the Bangladeshi FMCG sector (Abu-Bader & others, 2021).

The data gathered was mostly primary data, acquired using a standardized questionnaire particularly tailored for this research. The research population included diverse stakeholders engaged in the supply chains of Bangladeshi FMCG businesses, including supply chain managers, logistics people, and procurement specialists, therefore providing a holistic perspective of the sector. The research was conducted at several FMCG enterprises around Bangladesh, showcasing a wide array of goods and market sectors.

This study analyzed individual answers from professionals in the FMCG supply chain, concentrating on their perspectives and experiences regarding SCP, SCA, SCV, SC, TI, and SCR. The sample strategy included convenience sampling, considered suitable owing to respondent accessibility and the need for rapid data collection within a constrained period.

The sample frame included personnel engaged in supply chain activities at several FMCG firms in Bangladesh. Convenience sampling was utilized in this context since it facilitated the acquisition of data from accessible participants, which was crucial for the prompt completion of the research. This approach was deemed appropriate due to the research's nature and the aim of obtaining ideas from experts actively involved in SCM (Stratton, 2021).

The study's sample size was established to ensure statistical validity and reliability, targeting a response rate conducive to significant analysis. The final dataset had 198 valid replies, providing an acceptable sample size for completing the requisite statistical analysis and verifying the robustness of the results.

The instrument development method included the formulation of a structured questionnaire with questions specifically tailored to accurately assess each study variable. The questionnaire was subjected to a pre-test phase to enhance questions based on comments from field experts, including supply chain specialists and academics. This pre-test guaranteed clarity and relevancy, facilitating the discovery of any unclear or inadequately phrased questions.

The assessment scale's validity was confirmed by using recognized Constructs from existing literature, confirming that the items properly represented the underlying theoretical notions. This methodology improved the dependability of the results, as it indicated that the measurements used were suitable for the study's setting.

Data collection occurred from September 2024 to December 2024, during which questionnaires were sent to the selected respondents within the Bangladeshi FMCG industry. The replies were gathered methodically, assuring compliance with ethical standards and confidentiality rules. After Collection, the data were coded to facilitate analysis.

Data analysis was conducted using Smart PLS 4, a statistical software program renowned for its proficiency in executing Partial Least Squares Structural Equation Modeling (PLS-SEM). The rationale for using Smart PLS 4 arose from its efficacy in assessing intricate models and managing tiny sample sizes, making it an appropriate selection for the data analysis in this work. Furthermore, PLS-SEM facilitated the analysis of both the measurement and structural models, yielding insights into the interrelationships among the components (Hair *et al.*, 2019). The data analysis used statistical approaches to analyze the measurement model for validity and reliability, then analyzing the structural model to test the given hypotheses. The investigation offered an in-depth knowledge of the interconnections between SCA, SCV, SC, TI, SCR, and SCP within the Bangladeshi FMCG sector. This methodological approach facilitated a thorough examination of the study topics, providing significant insights into SCM.

The reliability study in Table 1 confirms that all constructs have good internal consistency, with Cronbach's Alpha values above the 0.70 criterion advised by Nunnally *et al.*, (1994). SCP (0.92) and SCR (0.91) exhibit the greatest dependability, indicating robust consistency across its measurement items. Likewise, TI (0.88), SCV (0.88), and SC (0.87) also show robust reliability, supporting their consistency in capturing the intended constructs. SCA (0.84) exhibits satisfactory reliability, hence affirming the validity of the measuring scale (Emon & Khan, 2025; Hair *et al.*, 2019).

Table 1 - Reliability of the Measurements

CONSTRUCTS	ITEMS	CRONBACH'S ALPHA
Supply Chain Agility (SCA)	5	0.84
Supply Chain Visibility (SCV)	5	0.88
Supplier Collaboration (SC)	5	0.87
Technology Integration (TI)	5	0.88
Supply Chain Responsiveness (SCR)	5	0.91
Supply Chain Performance (SCP)	3	0.92

4 RESULTS AND FINDINGS

The socio-demographic profile of the respondents offers significant insights into the attributes of professionals involved in the supply chain activities of the FMCG industry in Bangladesh. The sample largely comprises male respondents (63.6%), while female participants account for 36.4%, highlighting a gender difference in the field. A substantial percentage of respondents (52.5%) belong to the 31–40 years age bracket, while 28.8% are in the 41–50 years range. This indicates that mid-career professionals with substantial experience comprise the predominant segment of the workforce in FMCG supply chains. The distribution of job levels corroborates this fact, with mid-level workers being the predominant group (55.1%), followed by senior-level employees (29.3%) and entry-level employees (15.7%). Regarding industrial experience, Majority of the respondents (48.5%) had 6–10 years of experience, while 29.3% have 3–5 years, and just 7.1% exceed 10 years. This underscores a workforce with intermediate industry experience, advantageous for supply chain decision-making and operational efficiency. The monthly income distribution indicates that around 46.0% of respondents earn between BDT 30,000 and 50,000, whilst 23.2% earn between BDT 50,001 and 80,000. A minority (11.1%) earns over BDT 80,000, suggesting that while supply chain positions in the FMCG industry provide excellent remuneration, elevated pay is allocated to seasoned individuals. Majority of the respondents (59.1%) own a master's degree, whilst 23.7% have a bachelor's degree. Significantly, 14.6% have undertaken specialist courses in supply chain management, indicating an increasing focus on professional training and qualifications within the business. The allocation of employment positions in the supply chain has a very balanced representation across procurement (21.2%), logistics (27.8%), inventory management (25.3%), and distribution (25.7%). The variety of positions illustrates the extensive scope of supply chain management in FMCG enterprises. Data on company size indicates that around 48.0% of respondents are working in organizations with 101–500 people, while 26.8% work in enterprises with 50–100 employees. A lesser percentage (14.1%) is employed in major enterprises with over 500 people, whilst 11.1% are affiliated with smaller businesses with less than 50 employees. The analysis of the FMCG businesses in the sample reveals that 57.6% of respondents are employed by local FMCG firms, whereas 42.4% are employed by global FMCG organizations. This indicates that both local and international enterprises significantly contribute to Bangladesh's FMCG supply chain, with local businesses marginally surpassing their multinational counterparts.

Table 2 - Socio Demographic Profile of Respondents

Variable	Frequency	Percentage
Gender		
Male	126	63.6%
Female	72	36.4%
Age Group		
21-30 Years	24	12.1%
31-40 Years	104	52.5%
41-50 Years	57	28.8%
50 Years and Above	13	6.6%
Employment Level		
Entry Level Employee	31	15.7%
Mid-Level Employee	109	55.1%
Senior Level Employee	58	29.3%
Industry Experience		
Less Than 3 Years	30	15.2%

3–5 Years	58	29.3%
6–10 Years	96	48.5%
More Than 10 Years	14	7.1%
Monthly Income (BDT)		
Below 30,000	39	19.7%
30,000 – 50,000	91	46.0%
50,001 – 80,000	46	23.2%
Above 80,000	22	11.1%
Educational Qualification		
Bachelor's Degree	47	23.7%
Master's Degree	117	59.1%
Supply Chain Specialized Course	29	14.6%
Others	5	2.5%
Job Role In Supply Chain		
Procurement	42	21.2%
Logistics	55	27.8%
Inventory Management	50	25.3%
Distribution	51	25.7%
Company Size		
Less Than 50 Employees	22	11.1%
50–100 Employees	53	26.8%
101–500 Employees	95	48.0%
More Than 500 Employees	28	14.1%
Company Type		
Local FMCG	114	57.6%
Multinational FMCG	84	42.4%
Total	**198**	**100%**

The findings of the measurement model indicate the reliability and validity of the Constructs used in the investigation. The primary metrics evaluated are factor loadings, average variance extracted (AVE), and composite reliability (CR). All item loadings for the constructions above the suggested level of 0.70 (Hair & Alamer, 2022), indicating robust individual item dependability. The loadings vary from 0.74 to 0.95, indicating that each item substantially contributes to its corresponding Construct. The maximum loading is recorded for SCP3 (0.95), indicating a robust representation of SCP, whilst the lowest loading is for SCA2 (0.74), which, although being lower, nevertheless adheres to the acceptable norm. All constructs have AVE values beyond the 0.50 criterion established by Fornell and Larcker (1981), so affirming convergent validity (Fornell & Larcker, 1981). The AVE values span from 0.62 (SCA) to 0.87 (SCP), indicating that a substantial percentage of the variation in each concept is explained by its corresponding components. The greatest AVE is recorded for SCP (0.87), underscoring the robust explanatory capacity of its indicators. The robust AVE values indicate that the Constructs accurately encapsulate the variation in their corresponding measurement items, so guaranteeing that the latent variables are adequately represented in the model. All constructs demonstrate high composite reliability (CR), with values above 0.70, hence affirming internal consistency (Hair & Alamer, 2022; Hair *et al.*, 2020). The CR values span from 0.89 (SCA) to 0.95 (SCP), indicating that the measurement model is robust. The greatest CR is recorded for SCP (0.95), indicating its robust dependability, while SCA (0.89) exhibits the lowest CR, however, remains within the acceptable range. The elevated CR values indicate that the measurement items consistently reflect the underlying construct, minimizing the potential for measurement mistakes and maintaining the constructs' stability over several assessments.

The findings show that the measuring model exhibits robust reliability and validity. The elevated AVE values demonstrate that the constructs adequately capture variation from their elements, and the robust CR values confirm internal consistency. The results validate the strength of the measurement model, confirming that the Constructs are appropriate for further structural analysis. These findings correspond with the current research highlighting the significance of reliability and validity in structural equation modeling (Hair *et al.*, 2019; Hair *et al.*, 2020). The model

quality indicates that the study's constructs are well specified and appropriate for hypothesis testing and further inferential research.

Table 3 - Measurement Model

Constructs	Items	Loading	AVE	CR
Supply Chain Agility (SCA)	SCA1	0.82	0.62	0.89
	SCA2	0.74		
	SCA3	0.79		
	SCA4	0.77		
	SCA5	0.80		
Supply Chain Visibility (SCV)	SCV1	0.85	0.68	0.91
	SCV2	0.83		
	SCV3	0.85		
	SCV4	0.80		
	SCV5	0.79		
Supplier Collaboration (SC)	SC1	0.75	0.65	0.9
	SC2	0.82		
	SC3	0.82		
	SC4	0.86		
	SC5	0.78		
Technology Integration (TI)	TI1	0.89	0.67	0.91
	TI2	0.80		
	TI3	0.76		
	TI4	0.76		
	TI5	0.89		
Supply Chain Responsiveness (SCR)	SCR1	0.79	0.73	0.93
	SCR2	0.89		
	SCR3	0.85		
	SCR4	0.92		
	SCR5	0.81		
Supply Chain Performance (SCP)	SCP1	0.90	0.87	0.95
	SCP2	0.94		
	SCP3	0.95		

The Fornell-Larcker criteria evaluates the discriminant validity of constructs by juxtaposing the square root of the AVE for each construct against its correlations with other constructs. Discriminant validity is confirmed when the square root of the AVE for a concept exceeds its correlations with other constructs (Fornell & Larcker, 1981). In this research, the diagonal components signify the square root of the AVE, whilst the off-diagonal elements denote the correlation coefficients across constructs. The findings indicate that all Constructs provide sufficient discriminant validity. The square root of the AVE for SC is 0.81, exceeding its correlations with other variables, including SCA at 0.94 and SCR at 0.78. In a similar vein, the square root of the AVE for SCA is 0.78, surpassing its association with SCP at 0.76 and TI at 0.79. The findings validate that each construct is separate and accounts for unique variation, hence mitigating the possibility of multicollinearity in the model (Hair & Alamer, 2022). SCP has robust discriminant validity, with a square root of AVE of 0.93, surpassing its greatest correlation with SCA (0.76). Similarly, the square root of the AVE for SCR is 0.85, exceeding its correlations with SC (0.78) and TI (0.85). The data demonstrates that SCP and SCR possess separate conceptual limits, hence reinforcing the validity of the measuring model. The component exhibiting the strongest connection is SCA and SC at 0.94, indicating a robust association. Nonetheless, the square root of the AVE for both constructs (0.78 and 0.81, respectively) exceeds their inter-construct correlation, hence preserving discriminant validity. This conclusion aligns with prior research highlighting that while constructs may exhibit robust theoretical connections, they must retain conceptual individuality (Hair & Alamer, 2022).

The Fornell-Larcker criterion findings validate that all constructs satisfy the criteria for discriminant validity, guaranteeing that each latent variable encapsulates distinct facets of the

study model. The results bolster confidence in the structural model's validity, affirming the appropriateness of the components for further hypothesis testing and inferential analysis. These findings correspond with contemporary guidelines in structural equation modeling research, whereby discriminant validity serves as a vital criteria for assessing model quality (Hair *et al.*, 2017; Hair & Alamer, 2022; Hair *et al.*, 2019).

Table 4 - Fornell Larcker criterion among Constructs

Constructs	SC	SCA	SCP	SCR	SCV	TI
SC	0.81					
SCA	0.94	0.78				
SCP	0.68	0.76	0.93			
SCR	0.78	0.86	0.73	0.85		
SCV	0.85	0.82	0.54	0.79	0.83	
TI	0.75	0.79	0.6	0.85	0.76	0.82

The findings of hypothesis testing elucidate the interrelations among SCA, SCV, SC, TI, SCR, and SCP. The results demonstrate that three direct connections substantially affect SCP, but two direct links lack support. Furthermore, all indirect interactions via SCR are substantial, underscoring the mediating function of SCR within the model.

The findings validate that SCA has a substantial beneficial influence on SCP ($\beta = 3.28$, $p = 0.00$), corroborating H1. Likewise, SCV has a favorable effect on SCP ($\beta = 2.81$, $p = 0.00$), hence corroborating hypothesis H2. This aligns with other research highlighting that more visibility enables organizations to monitor operations, reduce uncertainty, and promote performance (Razak *et al.*, 2023). Furthermore, SCR has a substantial effect on SCP ($\beta = 3.15$, $p = 0.00$), hence validating hypothesis H5. This discovery substantiates the assertion that responsiveness allows organizations to effectively manage variations in demand and supply, thereby enhancing overall performance (Salamah *et al.*, 2023; Singh & Modgil, 2024).

In contrast, the direct associations between SC and SCP ($\beta = 0.13$, $p = 0.90$) and TI and SCP ($\beta = 1.02$, $p = 0.31$) are not statistically significant, resulting in the dismissal of hypotheses H3 and H4. The findings indicate that cooperation and TI alone may not immediately improve SCP, maybe owing to implementation obstacles or the need for supplementary skills. The little impact of TI may suggest that companies have challenges in achieving performance advantages without sufficient technical preparedness or personnel adjustment (Khan *et al.*, 2024).

The mediating effects of SCR provides more insights. The results substantiate the mediating function of SCR in the associations between SCA and SCP ($\beta = 4.21$, $p = 0.00$), SCV and SCP ($\beta = 2.34$, $p = 0.02$), SC and SCP ($\beta = 2.22$, $p = 0.03$), and TI and SCP ($\beta = 4.58$, $p = 0.00$). These findings validate that responsiveness serves as a vital mechanism via which agility, visibility, cooperation, and TI enhance performance. Prior research has highlighted the significance of responsiveness in connecting operational skills with performance results, as organizations that improve responsiveness may more effectively adjust to external changes and uncertainties (Susitha *et al.*, 2024).

The hypothesis testing findings emphasize the critical importance of SCA, visibility, and responsiveness in improving performance, while also highlighting the essential function of responsiveness as a mediating element for supplier cooperation and TI. These results corroborate the current literature on SCM and provide empirical data that underscores the strategic significance of agility, visibility, and responsiveness in enhancing SCP (Emon *et al.*, 2025; Mishra *et al.*, 2024; Rashid *et al.*, 2024; Singh & Modgil, 2024).

Table 5 - Hypothesis Testing

Hypothesis	Relationship	T Statistics	P Values	Decision
H1	SCA -> SCP	3.28	0.00	Accepted
H2	SCV -> SCP	2.81	0.00	Accepted
H3	SC -> SCP	0.13	0.90	Rejected
H4	TI -> SCP	1.02	0.31	Rejected

H5	SCR -> SCP	3.15	0.00	Accepted
H6A	SCA -> SCR -> SCP	4.21	0.00	Accepted
H6B	SCV -> SCR -> SCP	2.34	0.02	Accepted
H6C	SC -> SCR -> SCP	2.22	0.03	Accepted
H6D	TI -> SCR -> SCP	4.58	0.00	Accepted

The R^2 and modified R^2 values elucidate the model's explanatory capacity by revealing the percentage of variation in the dependent variables accounted for by the independent variables. This research reports a R^2 score of 0.65 for SCP, with an adjusted R^2 of 0.63. This indicates that 65% of the variation in SCP is accounted for by the predictor variables used in the model. The corrected R^2, which considers the number of predictors to avoid overestimation, validates the model's robustness with a little decrease to 63%. These values provide significant explanatory power, consistent with previous studies highlighting the importance of SCA, visibility, and responsiveness in influencing SCP (Dubey *et al.*, 2018).

The R^2 score for SCR is 0.83, and the modified R^2 is 0.82, indicating that 83% of the variation in SCR is accounted for by the independent variables. The significant explanatory power indicates that agility, visibility, cooperation, and technological integration are crucial in influencing response. The little decrease in the adjusted R^2 indicates that the model continues to be stable and dependable. Prior research has emphasized that responsiveness is a critical result of well linked supply chains, especially in dynamic market conditions when swift adaptation is essential (Hsieh *et al.*, 2023). The elevated R^2 and modified R^2 values for both SCP and SCR validate the model's efficacy in elucidating variances in SCP and responsiveness. These findings bolster the theoretical underpinnings of SCM, whereby agility, visibility, and responsiveness are essential factors influencing performance outcomes (Alshawabkeh *et al.*, 2024; Aziz *et al.*, 2024; Emon & Khan, 2024b; Sahoo *et al.*, 2024; Zamani *et al.*, 2023).

Table 6 - R^2 and R^2 Adjusted

Constructs	R^2	R^2 Adjusted
Supply Chain Performance (SCP)	0.65	0.63
Supply Chain Responsiveness (SCR)	0.83	0.82

The findings of the SEM, shown in Figure 2, demonstrate the interrelationships among SCA, SCV, SC, TI, SCR, and SCP. The route coefficients signify the intensity and orientation of these interactions, whilst the R^2 values illustrate the explanatory capacity of the endogenous components. The model indicates that SCA significantly positively influences SCR ($\beta = 0.74$), suggesting that businesses exhibiting more agility are likely to improve their responsiveness to market dynamics. Likewise, SCV significantly influences SCR ($\beta = 0.72$), underscoring the significance of real-time information exchange in enhancing response (Riaz *et al.*, 2024). SCV adversely affects SCP ($\beta = -0.36$), indicating that much visibility without proficient management may lead to complexity and inefficiencies (Jena & Ghadge, 2021).

SC has a modest positive correlation with SCR ($\beta = 0.40$), supporting the idea that effective coordination with suppliers improves flexibility and responsiveness (Salam & Bajaba, 2023). Nonetheless, its direct impact on SCP is minimal ($\beta = 0.03$), suggesting that cooperation alone may not substantially enhance performance unless facilitated by responsiveness. TI has an unexpected negative correlation with SCP ($\beta = -0.13$), indicating possible difficulties in the successful adoption and use of modern technology. This outcome aligns with existing research suggesting that while technology might improve efficiency, it may also create complexity and early operational inefficiencies (Khan *et al.*, 2025; Khurshid *et al.*, 2024).

The R^2 values demonstrate that SCR accounts for 83% of its variation, but SCP is elucidated by 65% of the model's variables, indicating substantial predictive efficacy. Furthermore, SCR has a favorable effect on SCP ($\beta = 0.48$), validating that increased responsiveness results in enhanced SCP. The results confirm the proposed correlations and emphasize areas where companies must address challenges related to visibility and TI to enhance performance.

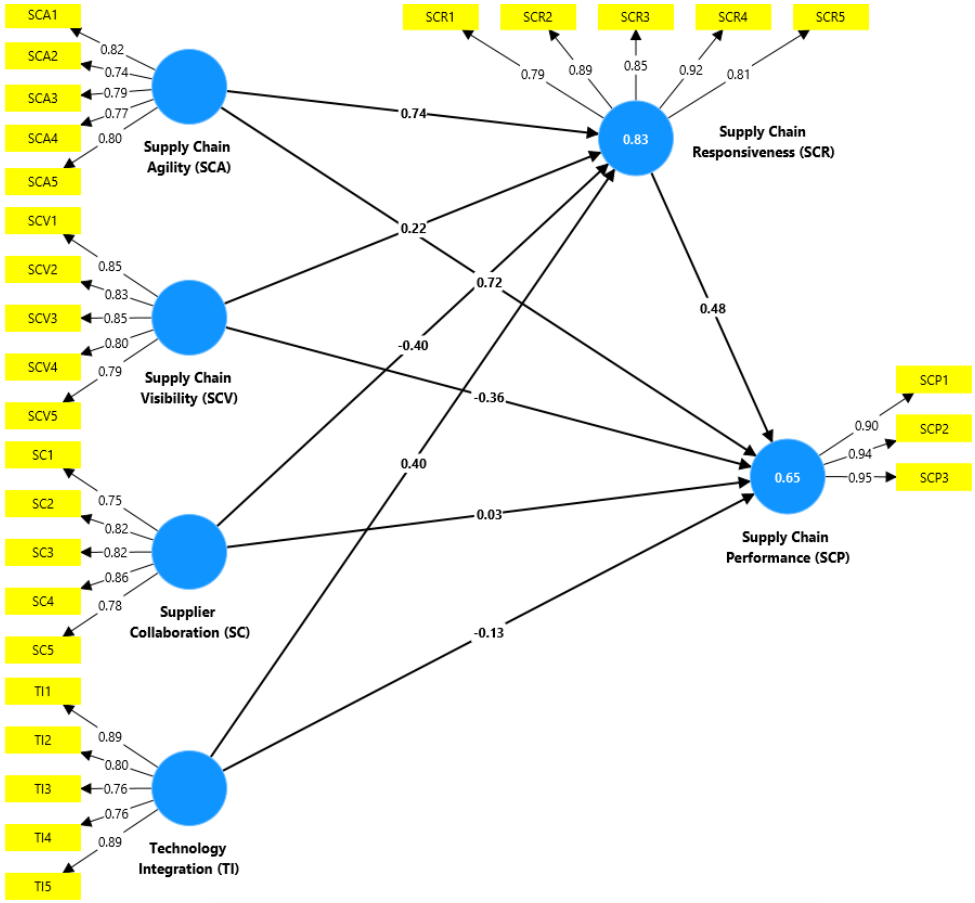

Figure 2 - Structural Equation Modelling and Path Coefficient

5 DISCUSSION

This research investigates the mediating function of SCR in the correlation between principal supply chain drivers and performance in the FMCG sector. The research experimentally evaluates the impact of SCA, SCV, SC, and TI on SCP using a PLS-SEM technique, both directly and indirectly via responsiveness. The results provide robust empirical evidence that responsiveness is a vital mechanism connecting supply chain capabilities to improved performance outcomes. The findings correspond with previous studies indicating that companies exhibiting more agility and visibility attain enhanced responsiveness, hence resulting in better SCP (Dubey *et al.*, 2018, 2022; Eslami *et al.*, 2024)

This research substantially enhances both theoretical and practical knowledge by elucidating the role of SCR in mediating critical interactions within the FMCG industry. This study expands the RBV, ST and RV framework by illustrating that agility, visibility, and technological integration serve as essential facilitators of supply chain response, hence improving performance. The findings enhance the SCA literature by demonstrating that agility directly influences performance, with its impact significantly heightened by responsiveness, thereby corroborating prior assertions that responsiveness is a crucial factor in competitive advantage (Shahadat *et al.*, 2024). The study enhances the literature on SCV by highlighting its indirect impact on performance via responsiveness, supporting the notion that firms possessing real-time visibility into their supply chains can respond more effectively to market disruptions and demand variations (Kashem *et al.*, 2024).

The study offers pragmatic insights for supply chain managers in the FMCG sector. The results indicate that augmenting agility and visibility may significantly enhance response, hence improving total SCP. Managers must prioritize the integration of digital technology, including real-time monitoring and predictive analytics, to enhance visibility and facilitate expedited, informed decision-making. The research highlights the restricted direct influence of supplier cooperation and technological integration on performance, indicating that these elements provide more significant advantages when mediated via enhanced responsiveness. This observation is especially pertinent for FMCG companies functioning in rapidly changing contexts where agility and responsiveness are essential for sustaining competitive advantage (Singh & Modgil, 2024).

This research empirically provides substantial quantitative evidence of the mediating effect of responsiveness in the setting of a developing market, notably within the FMCG sector. This

research particularly emphasizes the indirect paths via responsiveness, despite prior work exhaustively examining the direct benefits of SCA and visibility on performance. The study utilizes a rigorous PLS-SEM strategy to assure the validity and dependability of its results, hence advancing methodology in supply chain research. The study's findings support the assertion that companies must not only concentrate on developing individual supply chain competencies but also emphasize augmenting responsiveness to fully use these capabilities for enhanced performance (Dubey *et al.*, 2018).

The novelty of this research is in investigating supply chain responsiveness (SCR) as a mediating variable between fundamental supply chain drivers and supply chain performance (SCP) in Bangladesh's FMCG sector. Unlike previous studies that mostly focused on direct connections among these variables, this research especially shows that supply chain resilience (SCR) is a vital intermediary that improves the relationships between supply chain agility (SCA), supply chain visibility (SCV), supplier collaboration (SC), and technology integration (TI) (Emon & Khan, 2025b; Jum'a *et al.*, 2025). Although earlier research has shown the importance of certain supply chain drivers, they have generally ignored the synergistic mediating role of Supply Chain Resilience (SCR), particularly in a dynamic and highly competitive Fast-Moving Consumer Goods (FMCG) industry.

This study provides a comprehensive view by illustrating that SCR acts as a strategic intermediate, enhancing the efficacy of agility, visibility, and TI, in contrast to prior studies that only focused on direct partnerships. This innovative idea emphasizes the need to implement an integrated approach to SCM, whereby responsiveness is deliberately cultivated as a fundamental capability rather than a mere consequence. The research enhances the literature and presents practical suggestions, significantly contributing to academics and business while underscoring the essential role of responsiveness in contemporary supply chain strategy.

6 CONCLUSION

This research investigates the mediating function of SCR in the correlation between primary supply chain driver's agility, visibility, cooperation, and technological integration and SCP within the FMCG sector. Considering the dynamic and competitive characteristics of the FMCG business, companies must augment their supply chain capabilities to get exceptional performance. Nevertheless, prior research has mostly neglected the indirect influence of responsiveness in converting supply chain capabilities into measurable performance enhancements. This research offers actual data demonstrating that responsiveness serves as a vital facilitator, enhancing the influence of SCA and visibility on performance.

The results indicate that SCA and visibility substantially affect response, hence improving SCP. Although agility and visibility directly influence performance, their effect is more significant when mediated by responsiveness. Moreover, supplier cooperation and technological integration do not directly enhance performance but have a substantial impact when mediated by responsiveness. This underscores the significance of seeing responsiveness as a dynamic capacity that amplifies the efficacy of other supply chain factors. These findings correspond with other studies highlighting the strategic significance of responsiveness in SCM (Ayoub & Abdallah, 2019; Emon & Khan, 2024b). The research indicates that companies have to prioritize the integration of digital technologies, enhance real-time visibility, and improve agility to develop a more responsive and high-performing supply chain. The results differ from previous studies by showing that SC and TI mostly influence SCP via SCR rather than directly enhancing it. This runs counter to other studies (Abdallah *et al.*, 2025; Emon & Khan, 2025b; Warmbier & Kinra, 2022), which suggested a direct association among SC, TI, and SCP, therefore ignoring the intermediary effect of responsiveness. Emphasizing responsiveness, this study clarifies how companies may increase performance using SCR as a main enabler instead of relying only on direct supply chain costs. The results show that while cooperation and technology integration require an indirect approach via SCR to affect overall performance, agility and visibility are fundamental factors influencing responsiveness; hence, the current body of knowledge is enhanced and practical insights are given for supply chain managers.

Future study should investigate the influence of supplementary mediating and moderating factors that might elucidate the link between supply chain skills and performance. Factors like digital transformation, supply chain resilience, and market volatility may affect the relationship between responsiveness and performance. Furthermore, extending the research to several businesses outside the FMCG sector may provide a comparative analysis about the generalizability of the results. A intriguing direction for future study is the incorporation of artificial intelligence and machine learning into supply chain systems, potentially improving visibility, agility, and responsiveness. Longitudinal research investigating the enduring impact of SCR on business performance may provide profound insights into how companies maintain competitive advantage over time. By exploring these prospective areas, scholars may enhance their complete grasp of the emerging dynamics in SCM.

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Appendix I - Questionnaire Survey

Constructs	Acronym	Items
Supply Chain Agility (SCA)	SCA1	Our supply chain quickly adapts to market changes.
	SCA2	We rapidly respond to customer demand fluctuations.
	SCA3	Our company adjusts supply chain operations efficiently in uncertain conditions.
	SCA4	Our supply chain can handle disruptions with minimal impact.
	SCA5	Decision-making processes in our supply chain are flexible and responsive.
Supply Chain Visibility (SCV)	SCV1	Our company has real-time tracking of inventory and shipments.
	SCV2	Information flow across supply chain partners is seamless and transparent.
	SCV3	We have full visibility of supplier operations and lead times.
	SCV4	Our supply chain data is shared accurately and timely across departments.
	SCV5	Technology enables us to monitor and predict supply chain issues proactively.
Supplier Collaboration (SC)	SC1	We maintain strong partnerships with key suppliers.
	SC2	Suppliers are actively involved in our supply chain planning.
	SC3	Our company and suppliers share critical supply chain data regularly.
	SC4	We collaborate with suppliers to improve product quality and delivery performance.
	SC5	Long-term relationships with suppliers contribute to overall supply chain efficiency.

Technology Integration (TI)	TI1	Our company utilizes advanced digital tools for supply chain management.
	TI2	Automation enhances efficiency in our supply chain operations.
	TI3	Real-time data analytics is used for decision-making in the supply chain.
	TI4	We have integrated AI and machine learning in supply chain optimization.
	TI5	Our organization invests in emerging supply chain technologies for competitive advantage.
Supply Chain Responsiveness (SCR)	SCR1	Our supply chain quickly addresses customer complaints and concerns.
	SCR2	We can rapidly adjust production and distribution schedules.
	SCR3	Our company can scale operations up or down based on market demand.
	SCR4	We respond efficiently to supply chain disruptions.
	SCR5	Customer orders are fulfilled promptly without significant delays.
Supply Chain Performance (SCP)	SCP1	Our supply chain effectively minimizes operational costs.
	SCP2	We achieve high levels of customer satisfaction through reliable deliveries.
	SCP3	Our company experiences continuous improvement in overall supply chain efficiency.

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