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Supply Chain Collaboration, Last Mile Delivery Performance and Customer Experience: An Analysis of the Boundary Condition of Supply Chain Integrity

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Abstract

Purpose: The primary objective of this study is to comprehensively examine the relationship between supply chain collaboration and customer experience in the Ghanaian delivery services market.

Methodology: The research employs a survey, quantitative, descriptive, and positivist approach as a research strategy. Convenience and purposive sampling techniques were used to obtain a sample size of 400. The study employed primary data gathered with questionnaires as the data collection tool. A total of 450 questionnaires were sent to senior managers in the manufacturing and service industries in Ghana. Out of these, 400 questionnaires were returned, with 280 from manufacturing businesses and 120 from service organizations.

Findings: The results support a positive relationship between supply chain collaboration and customer experience. There is strong support for the positive impact of supply chain collaboration on last-mile delivery performance. The study finds that last-mile delivery has a significant positive effect on customer experience. The results support the mediating role of last-mile delivery in the relationship between supply chain collaboration and customer experience. Interestingly, the moderating effect of supply chain integrity on the relationship between supply chain collaboration and customer experience was not supported. Investment in collaborative technologies is essential for modern companies aiming to enhance supply chain efficiency.

Unique Contribution to Theory, Policy and Practice: The study recommends that companies must prioritize the development and strengthening of collaborative relationships across their supply chains, establishing collaborative performance metrics and incentive systems can align goals across the supply chain, invest in technologies that optimize last-mile delivery efficiency, such as route optimization software and real-time tracking systems and consider partnerships with specialized last-mile delivery providers and explore innovative delivery models such as crowdsourced delivery or autonomous vehicles.

Keywords: *Supply Chain Collaboration, Last Mile, Delivery Performance, Customer Experience, Supply Chain Integrity*

1.1 Background of the Study

In the rapidly evolving global marketplace, customer expectations for seamless, reliable, and timely delivery have intensified. This trend is particularly pronounced in the last-mile delivery stage, which serves as the final leg of the supply chain and directly interfaces with end customers. Last-mile delivery performance has become a critical determinant of customer satisfaction, influencing not only repeat purchases but also brand loyalty and perception (Esper et al., 2020). However, achieving efficiency and excellence in last-mile logistics is fraught with challenges, such as urban congestion, high operational costs, and coordination difficulties across supply chain stakeholders. This necessitates a deeper exploration of supply chain collaboration as a strategic tool to mitigate these complexities. Supply chain collaboration, characterized by information sharing, joint decision-making, and resource integration, has emerged as a cornerstone for enhancing logistical performance and addressing inefficiencies (Kembro et al., 2020). Effective collaboration fosters alignment among supply chain partners, enabling the optimization of delivery processes and the reduction of costs. For instance, collaborative forecasting and inventory management ensure the availability of goods at the right time and place, minimizing delays in last-mile delivery. Despite these advantages, the success of collaborative efforts is often contingent upon the presence of supply chain integrity—defined as the adherence to ethical practices, transparency, and trust across all supply chain activities (Hohenstein et al., 2020). The absence of integrity can undermine collaboration, leading to issues such as information asymmetry, misaligned objectives, and reputational damage.

The significance of last-mile delivery performance lies in its direct impact on customer experience. Customers increasingly value attributes such as speed, reliability, flexibility, and environmental sustainability in their delivery interactions (Hübner et al., 2019). Poor last-mile performance manifested through delays, inaccurate deliveries, or lack of communication detracts from the overall customer experience and may lead to dissatisfaction and customer attrition. With the rise of e-commerce, where delivery often serves as the sole physical touchpoint between customers and businesses, the stakes for achieving excellence in last-mile logistics are higher than ever. Customer experience, as a multidimensional construct, encompasses customers' perceptions, emotions, and satisfaction levels resulting from their interactions with a business (Bolton et al., 2020). Positive experiences foster trust and loyalty, while negative experiences can tarnish brand reputation and affect customer retention. In this context, last-mile delivery acts as a critical interface where the quality of supply chain operations directly influences customer perceptions. Therefore, improving last-mile delivery performance is not merely a logistical concern but a strategic imperative for enhancing customer-centricity and competitive advantage.While last-mile delivery challenges persist, supply chain collaboration offers a pathway to improved performance. By leveraging shared resources, synchronized operations, and real-time information exchange, collaboration minimizes inefficiencies and enhances delivery accuracy (Gligor et al., 2021). For

instance, partnerships between retailers and third-party logistics providers can lead to streamlined operations and cost savings. Similarly, the integration of advanced technologies such as Internet of Things (IoT) devices and artificial intelligence facilitates better tracking, forecasting, and decision-making, further bolstering collaboration outcomes. However, the effectiveness of supply chain collaboration is inherently moderated by the level of integrity within the supply chain. In an environment characterized by trust and transparency, stakeholders are more likely to engage in open communication, adhere to agreements, and prioritize collective goals (Sodhi & Tang, 2021). Conversely, lapses in integrity such as unethical practices, lack of accountability, or misrepresentation of information can erode trust and impede collaborative efforts. Thus, integrity serves as a boundary condition that shapes the extent to which collaboration can enhance last-mile delivery performance and, consequently, customer experience.

Supply chain integrity encompasses ethical conduct, compliance with regulations, and the establishment of trust among stakeholders. It is particularly relevant in the context of last-mile logistics, where ethical considerations such as fair labor practices, environmental sustainability, and data privacy play a pivotal role (Hohenstein et al., 2020). Integrity not only builds credibility but also ensures that collaborative initiatives are grounded in shared values and mutual respect. For example, a logistics provider known for ethical practices is more likely to attract and retain partners, fostering an ecosystem of collaboration. Furthermore, the growing emphasis on ethical consumerism amplifies the importance of integrity in supply chains. Modern consumers are increasingly conscious of the ethical and environmental implications of their purchases, influencing their preferences and loyalty. A supply chain that prioritizes integrity not only meets these expectations but also differentiates itself in a crowded marketplace (Dablanc et al., 2019). Consequently, examining the interplay between supply chain collaboration, last-mile delivery performance, and customer experience through the lens of integrity offers valuable insights into building resilient and customer-centric supply chains. Although substantial research exists on supply chain collaboration and last-mile logistics, the moderating role of supply chain integrity remains underexplored. Most studies focus on operational and technological factors while neglecting the ethical dimensions that underpin successful collaboration. This oversight limits the understanding of how integrity influences the effectiveness of collaborative strategies in improving last-mile delivery performance and customer experience (Kembro et al., 2020). Addressing this gap is critical for both theoretical advancement and practical application. By examining supply chain integrity as a boundary condition, this research aims to provide a nuanced understanding of the mechanisms through which collaboration impacts last-mile logistics and customer satisfaction. Such insights are invaluable for businesses seeking to align their logistical strategies with ethical standards and customer expectations in an increasingly competitive landscape.

1.2 Problem Statement

The dynamic and competitive nature of modern business environments has intensified the need for efficient supply chain management, with particular emphasis on last-mile delivery performance and customer experience. Last-mile delivery, the final stage of the delivery process, is critical for achieving customer satisfaction. However, persistent challenges, including delivery delays, logistical inefficiencies, and mismanagement, often compromise customer expectations (Dablanc et al., 2019). While supply chain collaboration has been identified as a critical enabler of improved delivery performance, its effectiveness is moderated by contextual factors such as supply chain integrity, which involves trust, transparency, and adherence to ethical standards (Kembro et al., 2020). This research seeks to explore the intricate relationships between these variables, highlighting the importance of supply chain integrity as a boundary condition. Supply chain collaboration is pivotal in integrating resources, enhancing information sharing, and optimizing logistics to address last-mile delivery inefficiencies. Yet, studies suggest that collaboration alone may not guarantee optimal outcomes if underlying issues of integrity within the supply chain are not addressed (Hohenstein et al., 2020). For instance, the lack of trust and transparency among stakeholders can lead to information asymmetry, eroding the efficiency of collaborative efforts. Such deficiencies are particularly evident in emerging markets, where weak institutional frameworks and infrastructure limitations exacerbate last-mile delivery challenges (Gligor et al., 2021). These gaps call for an investigation into how supply chain integrity moderates the relationship between collaboration and last-mile delivery performance, ultimately impacting customer experience. Customer experience, defined as the overall perception of a customer's interaction with a business, is increasingly viewed as a determinant of competitive advantage. In e-commerce and retail sectors, last-mile delivery significantly influences this experience, with factors such as timeliness, order accuracy, and flexibility playing critical roles (Esper et al., 2020). Despite the growing body of literature on last-mile logistics, there is limited empirical evidence on how supply chain collaboration, when moderated by integrity, affects both delivery performance and customer satisfaction. This gap hinders businesses from developing strategies that holistically address the complexities of last-mile logistics and customer engagement. Moreover, the rising prominence of ethical consumerism underscores the criticality of supply chain integrity in fostering customer trust and loyalty. Ethical lapses, such as non-compliance with labor standards or environmentally unsustainable practices, can damage a brand's reputation and weaken the perceived value of last-mile delivery services (Sodhi & Tang, 2021). Therefore, understanding the interplay between collaboration, delivery performance, and customer experience through the lens of integrity offers valuable insights into creating resilient and customer-focused supply chains. There is a pressing need for research that examines the moderating role of supply chain integrity in the relationship between supply chain collaboration, last-mile delivery performance, and customer experience. Addressing this gap will not only advance theoretical understanding but also provide actionable insights for businesses seeking to enhance operational efficiency and customer satisfaction in a rapidly evolving marketplace.

2. Literature Review

2.1 The Concept of Supply Chain Collaboration (SCC)

Supply Chain Collaboration (SCC) serves as a cornerstone in the realm of Supply Chain Management (SCM), embodying a strategic approach that revolves around cooperation and mutual engagement among diverse entities within the supply chain network(Cao and Zhang, 2011). The Emergence of Supply Chain Collaboration The notion of supply chain collaboration (SCC) began to take root in the late 1990s and early 2000s. Collaboration was introduced as a way to overcome the limitations of traditional SCM, which often operated in silos, with each player focused on optimizing their own processes rather than the performance of the supply chain as a whole (Cao & Zhang, 2011). The idea of SCC was predicated on the belief that supply chains perform better when all participants work together towards shared goals, supported by mechanisms for information sharing, synchronized decision-making, and aligned incentives (Simatupang & Sridharan, 2002). The seminal work of Simatupang and Sridharan (2005) on supply chain collaboration highlighted the need for inter-company benchmarking, collaborative performance metrics, and the alignment of collaborative enablers such as trust and shared risk. Their framework for SCC introduced a paradigm shift in SCM by recognizing that the interdependence of firms in a supply chain required more than transactional relationships; it necessitated a higher level of coordination and mutual commitment to performance improvement. The drive toward SCC was fueled by the increasing complexity and volatility of global supply chains. Factors such as shorter product life cycles, increased customer expectations, and the need for real-time responsiveness made it imperative for firms to collaborate with their suppliers and customers (Barratt, 2004). Moreover, the rise of e-commerce and omnichannel retailing in the early 2000s placed additional pressure on supply chains to be agile and responsive to changing consumer demands, further amplifying the need for collaboration (Wang et al., 2021)

2.2 The Concept of Customer Experience (CX)

Customer Experience (CX) has emerged as a pivotal determinant of business success in the interaction a customer has with a company, spanning from the initial order placement to the final delivery, influencing their perceptions and long-term relationship with the brand. According to Waqas et al. (2019), customer experience encompasses all touchpoints encountered by a customer during their engagement with a company, directly impacting their perception of service quality, and consequently, their satisfaction and loyalty. A well-orchestrated customer experience is intricately linked to brand loyalty, market share, e-commerce growth, environmental sustainability, and emerging industry trends (Vakulenko et al., 2019). In today's consumer-driven markets, a positive experience can lead to repeat business and increased customer lifetime value. As argued by Raina et al., (2019) and Grawe et al. (2015), a seamless functioning of every element within the supply chain enhances the quality-of-service delivery. This encompasses aspects such as timely

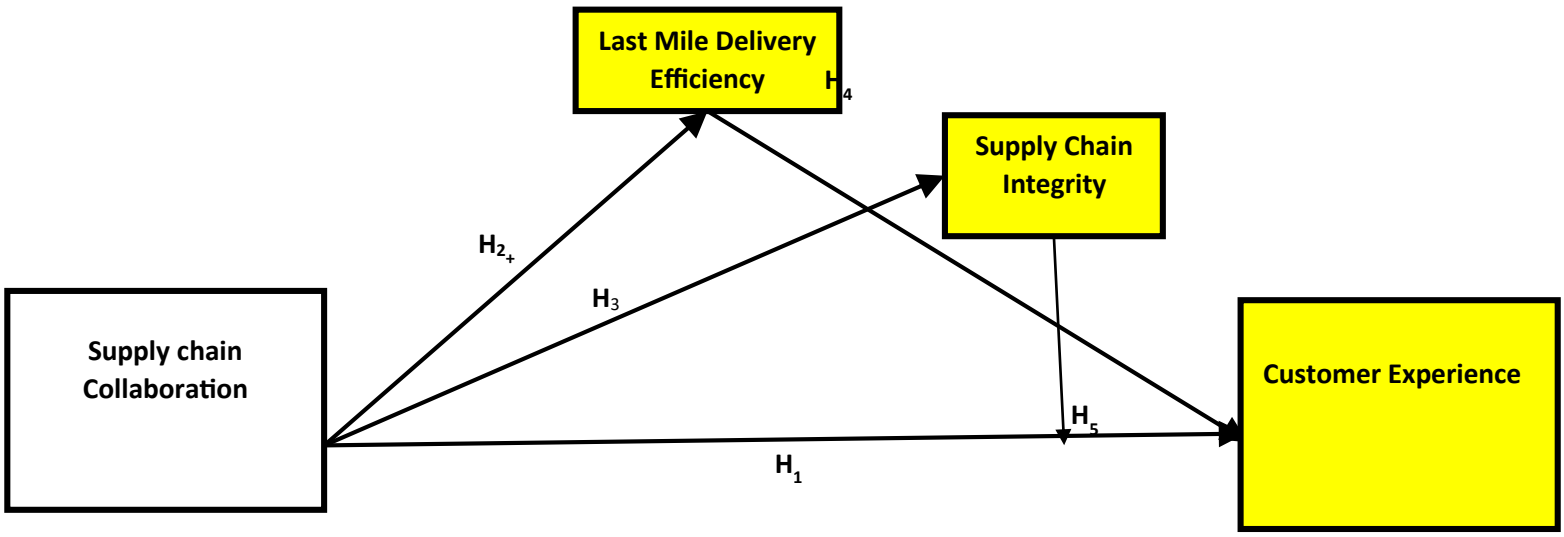
deliveries, accurate order fulfillment, and effective customer support, all of which contribute to an enhanced customer experience. Companies achieve superior CX by ensuring well-coordinated efforts across all facets of the supply chain, including procurement, logistics, warehousing, and last-mile delivery. These integrated endeavors are essential in upholding high service standards, which directly impact customer satisfaction and brand perception. The study by Tax et al. (2013) further elaborates on this, viewing customer experience as the result of interactions within a series of exchanges, involving multiple stakeholders in overlapping service ecosystems. This perspective underscores the complexity of managing CX across diverse actors, all of whom contribute to the end customer's overall experience. Moreover, the transition towards consumer-centric supply chain management (Esper et al., 2020) emphasizes the significance of aligning supply chain strategies with customer expectations. By prioritizing consumer needs, businesses can adapt to changing demands, offer personalized services, and cultivate stronger customer relationships. In consumer-centric models, companies prioritize responsiveness, flexibility, and customer engagement, ensuring that each aspect of the supply chain is designed to enhance customer satisfaction (Raina, 2019; Grawe et al., 2015). Customer experience serves as a vital driver of brand loyalty and market growth. By adopting a consumer-centric approach, companies can ensure that their supply chains are equipped to deliver high-quality, reliable services that exceed customer expectations (Waqas et al., 2019). The integrated coordination of supply chain elements is crucial for fostering positive customer experiences that ultimately contribute to long-term business success (Tax et al., 2013).

2.3 The Resource Orchestration Theory (ROT)

Resource Orchestration Theory (ROT) was first introduced by Sirmon, Hitt, and Ireland in 2007. This theory emerged as an extension and refinement of the Resource-Based View (RBV) of the firm, which focuses on how firms can leverage their internal resources to gain and sustain competitive advantage. ROT emphasizes the dynamic processes through which firms effectively manage and deploy their resources to create value. According to Sirmon, Hitt, and Ireland (2007), the key tenets of ROT include structuring the resource portfolio, bundling resources to build capabilities, and leveraging capabilities to exploit market opportunities.The structuring of the resource portfolio involves the acquisition, accumulation, and divestment of resources. Bundling denotes the integration and combination of resources to develop capabilities. Leveraging is the deployment of capabilities to achieve strategic objectives. ROT posits that these processes are interrelated and need to be orchestrated effectively to create value and achieve competitive advantage. Resource Orchestration Theory extends the Resource-Based View (RBV) by emphasizing not just the possession of valuable resources but also the effective management and deployment of these resources across an organization. It highlights three main processes: Structuring: Acquiring and accumulating resources, Bundling: Integrating and combining resources, Leveraging: Deploying resources to create value. Structuring in SCC involves acquiring

the necessary resources such as advanced technologies, a skilled workforce, and establishing strategic alliances. Structuring of resources (e.g., investment in collaborative technologies, recruitment of skilled supply chain managers) contributes to the foundation of effective SCC. Bundling in SCC process entails combining and integrating resources to create capabilities. For SCC, this could mean integrating supply chain processes, information systems, and knowledge sharing practices. Bundling of resources leads to enhanced capabilities in SCC, such as improved coordination, seamless information flow, and collaborative problem-solving. Leveraging in SCC involves the strategic deployment of bundled resources to achieve competitive advantage and superior outcomes. In the context of your study, this pertains to how these capabilities are used to enhance customer experience. Through leveraging the integrated resources and capabilities in SCC results in improved customer experience metrics such as satisfaction, loyalty, and perceived value. ROT as a framework to explain how strategic resource management in SCC leads to superior customer experiences. This includes understanding the orchestration processes and their impact on the supply chain's ability to meet and exceed customer expectations.

Figure 3.1 Conceptual Framework



2.4. Hypothesis Development

2.4.1 Supply Chain Collaboration and Customer Experience.

The strategic alignment and joint efforts among supply chain partners to achieve shared objectives, encompassing activities such as information sharing, joint planning, and coordinated decision-making involves the integration of resources, capabilities, and processes across multiple entities in the supply chain to optimize operations and enhance satisfaction, loyalty and expectation of customers. Numerous studies have emphasized the interconnectedness between SCC, CX. Research by Johnson et al. (2018) demonstrates that SCC facilitates agile supply chain

configurations, allowing firms to adapt swiftly to changing customer demands. Additionally, Xu and Choi (2017) accentuated how collaboration among supply chain partners leads to increased logistics flexibility, enabling companies to provide better customer service. However, counterarguments against this hypothesis exist in the challenges of achieving a direct link between SCC and CX. Research by Brown and Smith (2019) suggests that while SCC may enhance logistics flexibility, its impact on CX can be indirect and context-dependent, influenced by other factors such as product quality and pricing strategies. Similarly, Jones et al. (2021) argue that while SCC might improve logistics flexibility, its translation into enhanced CX is contingent upon effective implementation and alignment of strategies. The hypothesis rests on the premise that SCC catalyzes enhancing logistics flexibility, speed and reliability within supply chains. the researcher hypothesizes that; ***H1: Supply chain collaboration has a significantly positive influence on Customer Experience (SCC- CX).***

2.4.2 Supply Chain Collaboration and Last-mile Delivery.

Supply chain collaboration and last-mile delivery constitute essential components in the modern logistics landscape (Asif et al., 2020). The proposed hypothesis suggests that effective supply chain collaboration positively influences last-mile delivery performance, mediated by the application of Institutional Theory. This hypothesis aims to explore the intricate relationship between collaboration among supply chain entities and the optimization of last-mile delivery processes within(Hagberg and Hulthén, 2022). Collaboration is a strategic alignment and cooperative efforts among diverse entities, including manufacturers, distributors, retailers, and logistics providers towards achieving a perceived terminus. This collaboration involves joint planning and decision-making, information sharing, and mutual trust to enhance the responsiveness and efficiency of last-mile delivery, the crucial final phase of the supply chain and product delivery to customers(Bates *et al.*, 2018). Applying ROT implies that the leveraging of the process ensures that the capabilities developed are effectively deployed to deliver consistent and reliable services, which is critical for maintaining high levels of customer satisfaction (Vrhovac *et al.*, 2023). The theory sheds light on how bundling resources to develop robust quality control and compliance capabilities that ensure supply chain delivery operations are reliable and trustworthy, which is essential for moderating the relationship to drive collaborative efforts among supply chain partners optimizing last-mile delivery capability and performance (Janjevic and Winkenbach, 2020). Advocates supporting this hypothesis highlight the positive impact of effective collaboration on last-mile delivery in arguing that when supply chain entities collaborate strategically, they streamline processes, reduce delivery times, minimize costs, and enhance customer satisfaction (Bayliss *et al.*, 2023).The potential benefits of collaborative efforts align with the need to ensure that products reach the end customer efficiently and reliably while recognizing the complexities and challenges inherent in achieving optimized last-mile delivery in the transport supply chain context, this necessitates that the researcher's hypothesizes that:

H2: There is a significantly positive relationship between Supply chain Collaboration and Last-mile Delivery (SCC- LMD)

3.4.3 Last-Mile Delivery and Customer Experience.

The final stage of the supply chain process, encompasses the movement of goods from a distribution centre or transportation hub to the end customer's location that the intricate processes of sorting, transportation, and delivery execution, typically covering the last segment of the supply chain journey denoting an efficient last-mile delivery capability. Several studies underscore the significant impact of LMD on CX. Garcia and Patel (2017) emphasize that the efficient and timely final touchpoint of the end user LMD positively influences the CX of a business. Additionally, Brown et al. (2019) highlights how superior last-mile delivery experiences, such as accurate and convenient delivery options, contribute to an improved satisfaction and loyalty experience. However, (Chen and Wang (2021) with contrasting perspectives regarding the direct influence of the relationship argue that LMDs' crucial role in the transport logistics supply chain operation on CX might be limited since its direct impact is interdependent. They suggest that other factors such as product quality, and pricing, may have a more substantial influence on CX than just the last-mile delivery experience. Similarly, Smith and Jones (2020) point out that although efficient LMD is essential, it might not always translate directly into a significant enhancement of CX due to diverse customer preferences and expectations. The pivotal role of the final delivery phase in shaping customer perceptions and satisfaction significantly influences CX through effective responsiveness and optimization of last-mile delivery operations representing a valuable resource for busines ROT aligns bundling resources to include real-time tracking and communication capabilities ensuring that LMD is not only timely but also transparent to enhance CX. The logic behind this hypothesis lies in recognizing the critical link that Last-Mile Delivery represents in the customer journey. Timely and efficient delivery, personalized options, accurate tracking, and hassle-free experiences during the final delivery stage contribute significantly to customer satisfaction and loyalty. Moreover, the ROT accentuates the significance of LMD capability as a strategic resource, that aids competitive edge through creating differentiated positions in the market, establishing superior customer experience,

H3: Last-mile Delivery has a significantly positive influence on Customer experience. (LMD - CX)

2.4.4 The Mediating Role of Last-Mile Delivery, in the Relationship between Supply Chain Collaboration and Customer Experience. (SCC-CX-LMD)

To effectively drive a successful customer experience, businesses need to establish a clear and consistent capability and strategy influenced by collaborative structures and systems. An essential capability for fostering this growth is the LMD capability mechanism that demonstrates the alignment and adaptability directly relating to an entire supply chain effort and simultaneously enhances the relationship between SCC and CX. LMD capability has a great significance in

contemporary supply chain management, particularly in interacting directly with end-users and eventually shaping the experience derived. The interconnectedness between supply chain collaboration, last-mile delivery, and customer experience within the context involves the point where the customer meets the supply chain interrelation and the outcome of the entire network operation and process of a business. The efficient and timely transportation of goods from distribution centres to the end consumers' doorsteps is timely and secure (Ivanov et al., 2017). It represents a crucial stage wherein successful execution contributes significantly to customer satisfaction and the overall competence of supply chain operations. ROT a pivotal concept underscores the sustained valuable, available potential resources and capabilities (the skills, technologies, processes, and resources) possessed within an organization to execute various tasks effectively and deliver desired outcomes (Allen, J., et al 2019; Barney, 1991). In the context of this hypothesis, ROT tenets elucidate the resources and capabilities mechanisms through optimizing the ability to maintain clear and effective communication with customers about delivery status, and expected arrival times, and handling any issues that arise during delivery demonstrating the critical mediating role of LMD capability on SCC and CX. The researcher hypothesizes that:

H4: Last-mile Delivery positively mediates the relationship between Supply Chain Collaboration and CX (SCC-LMD-CX)

2.4.5 The Moderating Role of Supply Chain Integrity on the Relationship Between SSC and CX

Coordination Theory can be applied to examine how the reliability and trustworthiness of supply chain processes in supply chain integrity moderates the relationship between supply chain collaboration and customer experience. Effective coordination mechanisms such as standardized processes and compliance protocols ensure that supply chain activities are conducted transparently and reliably. Managing dependencies such as quality control and regulatory compliance through coordination mechanisms can enhance supply chain integrity, thereby strengthening the positive impact of supply chain collaboration on customer experience (Koufteros et al., 2010). Supply chain integrity is a strategic resource characterized by transparency, trustworthiness, and adherence to ethical standards enhances the seamless flow of collaborative practices, thereby improving customer experience. A supply chain integrity strategy involves a comprehensive, long-term plan aimed at achieving specific organizational goals such as trust, compliance, risk management, competitive advantage and experience. It encompasses various capabilities, such as traceability, transparency, and ethical sourcing, which are integral to executing the strategy successfully. Ensuring that products are consistently delivered in the right condition, on time, as specified and encompasses transparency, traceability, compliance with regulations, and ethical sourcing. This aligns with broader organizational goals such as building trust with customers, maintaining brand reputation, and ensuring regulatory compliance, a strategic ability in nature and requires a comprehensive plan. The researcher Hypothesizes that.

H5: Supply chain Integrity Positively Moderates the relationship Between Supply Chain Collaboration and Customer Experience (SCC-SCI-CX)

3. RESEARCH METHODOLOGY

3.1 Research Design

The research design combines descriptive and explanatory approaches. A descriptive design helps outline the characteristics of supply chain collaboration and customer experience among the firms and customers surveyed (Creswell, 2014). The explanatory design, on the other hand, seeks to investigate the causal relationships between the variables. By using this dual approach, the study can provide both a detailed account of current practices and insights into the factors that influence customer experience and supply chain effectiveness. The research employs a survey, quantitative, descriptive, and positivist approach, which is appropriate for examining the relationships between the specified variables in a structured and objective manner. This approach allows for the collection of numerical data that can be the study population. The survey research, which is effective for collecting large amounts of data from a significant number of respondents. Surveys are particularly useful in supply chain research for capturing data on practices, experiences, and outcomes across different firms and customer groups (Groves et al., 2011). The study implemented a dual methodology, integrating convenience sampling and purposive sampling, both of which are well-regarded in diverse practical and context-specific research frameworks. Initially, convenience sampling was employed to engage delivery companies that were readily accessible within the established research timeline and geographical parameters. This approach facilitated the inclusion of operationally active companies willing to participate, thereby optimizing data collection efficiency (Suen et al., 2014; Etikan et al., 2016). The hybrid sampling strategy and sample size were meticulously designed to address constraints related to time, accessibility, and resource availability, while ensuring the inclusion of companies pertinent to the study's objectives. By prioritizing quality over quantity, the data collected yielded meaningful insights into the research topic, thus avoiding dilution by less relevant participants.It is imperative that the sample size is sufficiently expansive to provide adequate variability in responses, thus allowing for meaningful insights to be derived in light of the study’s scope and objectives. In this research, two non-probability sampling techniques were employed: convenience sampling was selected due to constraints pertaining to resources and the study area, while purposive sampling was utilized to achieve data saturation, specifically targeting companies that specialize in last-mile delivery. The inclusion of 400 respondents constitutes a purposeful subset of the broader population, emphasizing the significance of relevance over absolute sample size. Data analysis involves the application of logical and analytical techniques to examine, cleanse, transform, and model data to uncover useful insights, inform conclusions, and support decision-making (Stabell, 2019). The key stages of the data analysis process undertaken for this study encompassed Data Examination. These statistics provided insights into the distribution and variability of the data, laying the foundation for further analysis. Convergent validity was assessed with average variance extracted

(AVE) ratios to determine indicator adequacy. Finally, discriminant validity was checked through heterotrait-monotrait (HTMT) analysis to establish distinctiveness between constructs. The Measurement Model Assessment focused on evaluating the reliability and validity of the measurement instruments employed in the study. This stage involved assessing the internal consistency, convergent validity, and discriminant validity of the constructs under investigation. The results of this assessment determined the suitability of the measurement models for subsequent hypothesis testing and structural model assessment. Finally, the Hypotheses and Model Assessment stage involved testing the proposed hypotheses and evaluating the structural model.

4.ANALYSIS AND RESULTS

4.1 Response Rate

A total of 450 questionnaires were sent to senior managers in the manufacturing and service industries in Ghana. Out of these, 400 questionnaires were returned, with 280 from manufacturing businesses and 120 from service organizations. A total of fifty (50) questionnaires were not returned due to the unavailability of the managers for questionnaire retrieval. There were 35 manufacturing enterprises and 15 service firms included in this group. The obtained response rate was 88.8%. The researcher used an online survey instrument to assure comprehensive completion of the questionnaire by all participants and to minimize the occurrence of missing data.

4.2 Confirmatory Factor Analysis (CFA)

In this section, the study embarks on a rigorous assessment of these constructs' reliability and validity. Utilizing statistical measures such as Cronbach's alpha (CA), Composite Reliability (CR), Average Variance Extracted (AVE), and individual item loadings, this study delves into each construct's internal consistency, reliability, and convergent validity. The findings from this confirmatory factor analysis ensure that these lower order constructs—supply chain exploration, exploitation, speed, flexibility, responsiveness, Strategic sense-making capacity, Timely decision-making capacity, and Change implementation, product, process innovation, proactive and reactive are methodically validated, thereby reinforcing the study's credibility and robustness.

Table 4.1 CFA Results

CFA					
Supply Chain Collaboration		**Factor Loadings**	**CA**	**CR**	**AVE**
Information Sharing	IS_1	0.836	0.952	0.952	0.771
	IS_2	0.922			

	IS_3	0.906			
	IS_4	0.903			
	IS_5	0.892			
	IS_6	0.804			
Decision Synchronization	DS4	0.760	0.915	0.915	0.682
	DS5	0.785			
	DS6	0.866			
	DS7	0.848			
	DS3	0.865			
Incentive Alignment	IA_1	0.84	0.897	0.896	0.742
	IA_2	0.83			
	IA_3	0.82			
Customer Experience			**0.957**	**0.956**	**0.690**
	CX1	0.842			
	CX2	0.800			
	CX3	0.762			
	CX4	0.741			
	CX5	0.818			
	CX6	0.842			
	CX7	0.883			
	CX8	0.898			

	CX9	0.850	
	Cx10	0.854	
	LM1	0.802	
Last-Mile Delivery	LM2	0.852	**0.971 0.971 0.735**
	LM3	0.875	
	LM4	0.824	
	LM6	0.922	
	LM7	0.896	
	LM8	0.905	
	LM9	0.871	
	LM11	0.886	
	LM12	0.827	
	LM13	0.841	
	LM14	0.775	
Supply Chain Integrity	SCI1	0.885	**0.973 0.973 0.818**
	SCI2	0.887	
	SCI3	0.917	
	SCI4	0.941	
	SCI5	0.930	
	SCI6	0.895	
	SCI7	0.892	

	SCI8	0.886	

Source: Field Study (2023)

Table 4.1 provides an extensive display of the Confirmatory Factor Analysis (CFA) results for the variables. The confirmatory factor analysis (CFA) results provide insights into the validity and reliability of the constructs measured in the study. These constructs include Supply Chain Collaboration, Customer Experience, Last-Mile Delivery, and Supply Chain Integrity. The key statistics considered in this analysis are factor loadings, Cronbach's Alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE). These metrics help to assess the internal consistency and convergent validity of the measurement models. For the construct of Supply Chain Collaboration, it is divided into three dimensions: Information Sharing, Decision Synchronization, and Incentive Alignment. The factor loadings for the items under Information Sharing (IS_1 to IS_6) are all above 0.8, indicating strong individual item reliability. Specifically, IS_1 has a loading of 0.836, IS_2 is 0.922, IS_3 is 0.906, IS_4 is 0.903, IS_5 is 0.892, and IS_6 is 0.804. The Cronbach's Alpha (CA) and Composite Reliability (CR) for this dimension are both 0.952, showing excellent internal consistency. The Average Variance Extracted (AVE) is 0.771, which exceeds the threshold of 0.5, indicating good convergent validity.The factor loadings for Decision Synchronization (DS4, DS5, DS6, DS7, and DS4) range from 0.760 to 0.866. Notably, there seems to be a duplicate label for DS4. The CA and CR for this dimension are 0.915, reflecting high internal consistency. The AVE is 0.682, which is above the acceptable limit, indicating good convergent validity. The factor loadings for Incentive Alignment (IA_1, IA_2, and IA_3) are 0.84, 0.83, and 0.82, respectively. The CA and CR for this dimension are 0.897 and 0.896, respectively, showing high internal consistency. The AVE is 0.742, indicating good convergent validity.The factor loadings for Customer Experience (CX1 to CX10) range from 0.741 to 0.898. The CA is 0.957 and CR is 0.956, reflecting excellent internal consistency. The AVE is 0.690, which indicates that a significant portion of the variance is captured by the construct, demonstrating good convergent validity. The factor loadings for Last-Mile Delivery (LM1 to LM14) range from 0.775 to 0.922. The CA and CR for this dimension are both 0.971, which are indicative of very high internal consistency. The AVE is 0.735, exceeding the minimum threshold and indicating good convergent validity. The factor loadings for Supply Chain Integrity (SCI1) is 0.885. The CA and CR are both 0.973, showing excellent internal consistency. The AVE is 0.818, indicating strong convergent validity. The CFA results indicate that all the constructs exhibit high levels of internal consistency, as evidenced by Cronbach's Alpha and Composite Reliability values well above the commonly accepted threshold of 0.7. The AVE values for all constructs are above 0.5, suggesting that more than half of the variance in the indicators is captured by the underlying construct, thereby confirming good convergent validity. It is

instructive to note that the items (DS1, DS2, IA4, IA5, IA6, LM5, LM10, LM15) were eliminated because they did not meet the threshold for the CFA.

Table 4.2 Hypotheses Table SEM Results

Hypothesis	Path	T-value	Coefficient (P-value)	Conclusion
H_{1+}	SC -> CX	2.907	0.258; $p < 0.05$	Supported
H_{2+}	SC -> LM	6.563	0.434; $p < 0.01$	Supported
H_{3+}	LM -> CX	2.087	0.326; $p < 0.01$	Supported
H_{4+}	SC -> LM -> CX	2.076	0.141; $P < 0.05$	Supported
H_{5+}	INT -> CX	**0.329**	**-0.108**; $p > .05$	Not Supported

4.3 Discussion of Results

Supply Chain Collaboration and Customer Experience.

The results support a positive relationship between supply chain collaboration and customer experience (H1 supported, coefficient = 0.258, $p < 0.05$). This suggests that when companies collaborate effectively across their supply chains, it leads to improved customer experiences. This could be due to better coordination resulting in more reliable deliveries, improved product quality, or more responsive customer service. Supply chain collaboration has a profound positive influence on customer experience by fostering efficiency, reliability, and adaptability in delivering goods and services. Collaboration among supply chain partners ensures synchronized operations, shared information, and aligned goals, all of which directly enhance the end-to-end customer journey. Gligor et al. (2021) demonstrated that collaborative forecasting and joint decision-making minimize disruptions and improve service levels, creating consistent and reliable experiences for customers. Through collaboration, businesses can leverage real-time information sharing to anticipate and meet customer demands more effectively. For example, Esper et al. (2020) highlighted that supply chain transparency, enabled by information sharing among partners, enhances customers' trust and confidence in the brand. This transparency allows customers to track their orders in real time, a feature that has become a critical driver of satisfaction in e-commerce and retail sectors. Moreover, collaborative practices facilitate innovations that directly improve customer experience. Shared investments in technology and logistics infrastructure enable faster

and more flexible delivery options, meeting modern customers' expectations for speed and convenience (Kembro et al., 2020).

Supply Chain Collaboration and Last-Mile Delivery

There is strong support for the positive impact of supply chain collaboration on last-mile delivery performance (H2 supported, coefficient = 0.434, $p < 0.01$). This indicates that collaborative efforts across the supply chain significantly enhance the efficiency and effectiveness of last-mile delivery operations. Better information sharing and coordinated decision-making likely contribute to smoother last-mile logistics. Supply chain collaboration positively influences last-mile delivery by fostering synergy among supply chain partners through shared resources, information exchange, and coordinated decision-making. Collaboration enhances the ability to address the complexities of last-mile logistics, such as unpredictable demand and urban congestion. Kembro et al. (2020) highlighted that collaborative forecasting and inventory management among suppliers, manufacturers, and logistics providers lead to more reliable and timely deliveries. This efficiency reduces operational bottlenecks and improves the overall performance of last-mile delivery systems.Empirical studies have shown that supply chain collaboration enables adaptive strategies that improve the accuracy and responsiveness of deliveries. Gligor et al. (2021) demonstrated that integrating advanced technologies like real-time tracking and predictive analytics within collaborative frameworks enhances the visibility and flexibility of last-mile operations.

Last-Mile Delivery and Customer Experience:

The study finds that last-mile delivery has a significant positive effect on customer experience (H3 supported, coefficient = 0.326, $p < 0.01$). This underscores the critical role that the final stage of delivery plays in shaping overall customer satisfaction. Timely, accurate, and convenient last-mile delivery appears to be a key driver of positive customer experiences. The efficiency and reliability of last-mile delivery significantly influence customer experience, as this stage represents the final interface between a business and its customers. High-performing last-mile delivery operations, characterized by timeliness, accuracy, and flexibility, directly enhance customer satisfaction and loyalty. For instance, Hübner et al. (2019) found that customers highly value precise delivery schedules and the availability of multiple delivery options tailored to their preferences. This is particularly important in e-commerce and retail sectors, where customer expectations for convenience and reliability are paramount. Timely deliveries not only meet customer expectations but also build trust and reinforce brand loyalty. Bolton et al. (2020) highlighted that businesses capable of providing consistent and reliable last-mile delivery services are more likely to retain customers, even in highly competitive markets. Conversely, delivery inefficiencies, such as delays or damaged goods, can erode customer trust and negatively impact repeat purchase behavior.

Mediating Role of Last-Mile Delivery

The results support the mediating role of last-mile delivery in the relationship between supply chain collaboration and customer experience (H4 supported, indirect effect = 0.141, $p < 0.05$). This suggests that supply chain collaboration enhances customer experience partly through its positive impact on last-mile delivery performance. Effective collaboration seems to improve last-mile operations, which in turn leads to better customer experiences. Last-mile delivery efficiency plays a critical mediating role in the relationship between supply chain collaboration and customer experience. Effective collaboration among supply chain partners fosters streamlined operations, shared resources, and synchronized decision-making, all of which are essential for improving the efficiency of last-mile logistics (Gligor et al., 2021). For example, collaborative practices such as joint forecasting and real-time information sharing enable better route optimization and inventory allocation, ensuring faster and more accurate deliveries (Kembro et al., 2020). These operational improvements directly enhance customer experience by meeting expectations for timeliness, reliability, and convenience. Empirical evidence supports the notion that last-mile efficiency translates the benefits of collaboration into tangible customer outcomes.

Moderating Effect of Supply Chain Integrity:

Interestingly, the hypothesized moderating effect of supply chain integrity on the relationship between supply chain collaboration and customer experience was not supported (H5 not supported, coefficient = -0.108, $p > 0.05$). This suggests that the impact of supply chain collaboration on customer experience does not significantly vary at different levels of supply chain integrity. Supply chain integrity, although crucial for maintaining transparency and ethical standards, can negatively moderate the relationship between last-mile delivery and customer experience. This dynamic arises because of potential conflicts between stringent integrity measures and the agility or flexibility needed to optimize last-mile delivery. Supply chain integrity involves strict adherence to regulatory requirements, ethical standards, and transparency measures. While these are important, they can introduce additional layers of checks, documentation, and verification that slow down last-mile delivery (Christopher, 2016). For example, rigorous documentation and traceability efforts might delay shipment processes, leading to longer lead times. The delay in last-mile delivery negatively affects customer experience, as modern consumers prioritize speed and convenience (Hao & Choi, 2019). Thus, high levels of integrity may conflict with the fast-paced demands of efficient last-mile delivery. Last-mile delivery often requires dynamic adjustments based on customer availability, traffic conditions, or other external factors. However, supply chain integrity can impose constraints on flexibility. For instance, rigid adherence to ethical sourcing practices or strict environmental policies may prevent delivery teams from making agile decisions, such as changing the route to expedite delivery or rescheduling at the customer's convenience (LeMay et al., 2017). The research confirmed a significant positive relationship between supply chain collaboration and customer experience, supporting Hypothesis 1. Interestingly, the study did not find support for the moderating role of supply chain integrity in the relationship between supply chain collaboration and customer experience (Hypothesis 5 not supported). Perhaps the most

significant contribution of this study is the strong evidence it provides for the mediating role of last-mile delivery in the relationship between supply chain collaboration and customer experience (Hypothesis 4 supported). This finding underscores the crucial role that last-mile delivery plays in translating collaborative efforts into tangible customer benefits. Specifically, the study found that supply chain collaboration has a significant positive impact on last-mile delivery performance (Hypothesis 2 supported), which in turn demonstrated a significant positive effect on customer experience (Hypothesis 3 supported).

5. Practical Implication

Investment in collaborative technologies is essential for modern companies aiming to enhance supply chain efficiency. Prioritizing advanced information systems that facilitate real-time data sharing can significantly streamline operations. This could be achieved through the implementation of cloud-based supply chain management platforms, adoption of Internet of Things (IoT) devices for real-time tracking and monitoring, and the use of artificial intelligence and machine learning for demand forecasting and inventory optimization. Optimizing last-mile delivery is another critical focus for companies. Enhancing this aspect involves partnering with local delivery startups or established logistics companies, implementing route optimization software to improve delivery efficiency, and exploring alternative delivery methods such as pickup points or locker systems. Developing cross-functional teams is vital for improving supply chain collaboration. By fostering teams that break down silos between departments, companies can create a more integrated approach to operations. Practical steps include establishing regular cross-departmental meetings involving supply chain, marketing, sales, and customer service teams, implementing job rotation programs to build understanding across different functions, and developing shared KPIs that encourage collaboration rather than departmental competition.

5.1 Policy Implication

First, the positive relationship between supply chain collaboration and customer experience suggests that policies should promote collaborative practices among stakeholders in the supply chain. Encouraging manufacturers, service providers, and logistics companies to share information and synchronize decisions can enhance operational efficiency and customer satisfaction. Policies might include incentives for joint ventures, shared logistics platforms, and standardized information-sharing protocols. Second, the significant impact of last-mile delivery on customer experience underscores the need for policies that support the development of efficient and reliable last-mile logistics. Investments in infrastructure, such as dedicated delivery hubs and improved road networks, are crucial. Additionally, regulatory frameworks should facilitate innovative delivery solutions, such as drone deliveries or automated lockers, to enhance last-mile performance. Third, despite the non-significant moderating role of supply chain integrity, maintaining high standards of integrity remains essential. Policies should enforce stringent quality control measures and ethical standards across the supply chain to ensure reliability and

trustworthiness. This might involve regular audits, certifications, and penalties for non-compliance.

5.2 Recommendations

The results of this study underscore the critical importance of supply chain collaboration and last-mile delivery in shaping customer experience within the Ghanaian manufacturing and service sectors. To capitalize on these findings, organizations should implement a multi-faceted approach that addresses key areas of opportunity. Moreover, establishing collaborative performance metrics and incentive systems can align goals across the supply chain. Regular cross-functional and inter-organizational meetings should be conducted to ensure ongoing alignment of strategies and objectives. Supply chain managers play a crucial role in this process and should focus on cultivating a collaboration-oriented culture within their organizations. Organizations should also consider partnerships with specialized last-mile delivery providers and explore innovative delivery models such as crowdsourced delivery or autonomous vehicles. Implementing customer-centric policies for delivery, such as flexible delivery windows and real-time notifications, can further enhance the last-mile experience. Supply chain managers should stay abreast of emerging last-mile delivery technologies and best practices, conducting regular benchmarking to ensure their organizations remain competitive in this crucial area.

6. Suggestions for Further Research

One potential area of further research is to explore the specific levels of supply chain collaboration that impacts customer experience. This could involve examining different levels of collaboration (e.g., deeply integrated strategic partnerships and joint ventures) and their individual effects on various aspects of customer experience, such as satisfaction, loyalty, and perceived value. Studied cold focus on the last delivery practices that can influence the health of customers and integrity practices within the delivery services. Extensively explore the non-supported SCI on SCC and CX. studying additional variables such as; culture, leadership styles, and regulatory compliance policies. The variables can play mediating-moderating roles respectively Complement quantitative analyses with qualitative or both Methodological and theoretical diversity of variables. Another area worth investigating is the role of digital technologies in enhancing supply chain collaboration and customer experience. Future research could examine how technologies such as blockchain, Internet of Things (IoT), and artificial intelligence (AI) can be leveraged to improve transparency, efficiency, and responsiveness in the delivery supply chain, thereby enhancing customer experience. Additionally, the study could benefit from exploring the influence of cultural and contextual factors on supply chain collaboration and customer experience. Comparative studies between different regions or countries could provide insights into how cultural norms, regulatory environments, and market conditions impact the effectiveness of collaborative practices and customer outcomes. Further research could also examine the long-term effects of supply chain collaboration on business performance and sustainability. This would involve investigating how

sustained collaborative efforts influence financial performance, market competitiveness, and environmental sustainability over time. Another interesting avenue for research is the impact of customer feedback on supply chain practices. Studies could explore how integrating customer feedback into supply chain decision-making processes can enhance responsiveness and customer satisfaction. Finally, research could focus on the role of small and medium-sized enterprises (SMEs) in the supply chain. Given that SMEs often face unique challenges and opportunities in collaboration, understanding their specific needs and contributions could provide valuable insights for policy-making and practical applications. These suggested areas for further research aim to build on the findings of the current study, offering new perspectives and deeper insights into the complex dynamics of supply chain collaboration and its impact on customer experience.

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