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Balancing Supply Chain Ambidexterity and Performance: The Impact of Firm Innovation in Selected Manufacturing Companies in the Greater Accra Region of Ghana

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Abstract:- This study explored the relationship between supply chain ambidexterity, firm innovation, and supply chain performance among 161 manufacturing firms in Ghana. The main focus was to understand how firm innovation affects the link between ambidexterity and performance. Key findings include: (1) supply chain ambidexterity alone did not significantly impact performance, contradicting assumptions; (2) firm innovation capabilities, surprisingly, had a negative effect on performance, suggesting a need for better innovation alignment; and (3) innovation positively moderated the relationship between ambidexterity and performance, showing that combining innovation with ambidexterity can improve outcomes. Recommendations for managers emphasize the importance of aligning innovation strategies with supply chain goals and balancing exploration and exploitation activities. Future research should consider long-term studies, multi-region comparisons, and diverse data sources to increase validity. Overall, the study refines the understanding of how innovation and ambidexterity interact to enhance supply chain performance.

Keywords:- *Supply Chain Ambidexterity, Supply Chain Performance, Firm Innovation.*

I. INTRODUCTION

In today's increasingly complex and competitive business environment, firms must continuously adapt and innovate to survive and thrive. As such, their ability to both exploit existing competencies and explore new opportunities: thus, a capability known as supply chain ambidexterity, has become crucial (Escorcia-Caballero et al., 2022). This concept, derived from organizational ambidexterity, demands a delicate balance between seemingly opposing activities: exploration and exploitation (Roldán Bravo et al., 2018a). These contrasting activities are not mutually exclusive but are, in fact, synergistic elements that can jointly enable companies to navigate uncertainties and maintain a sustainable competitive advantage (Bin Makhashen et al., 2020). Supply chain performance, encompassing aspects such as cost efficiency, responsiveness, reliability, and flexibility, is a significant determinant of a firm's overall success. Previous research has pointed towards the potential of supply chain ambidexterity to drive superior supply chain performance (Aslam et al., 2020c; Jermsittiparsert & Pithuk, 2019; Rojo et al., 2016). Firms that successfully balance and integrate exploration and exploitation within their supply chain operations can adapt more swiftly to market changes, manage disruptions more effectively, and optimize resources more efficiently. These benefits ultimately contribute to improved operational efficiency, customer satisfaction, and profitability (Herlina et al., 2021a). However, the intriguing interplay between supply chain ambidexterity and supply chain performance doesn't occur in a vacuum. The role of firm innovation, defined as the process of introducing new or significantly improved products, services, or processes, could potentially serve as a moderating force in this relationship (Sung and Kim, 2021). More innovative firms might be better equipped to implement and integrate new supply chain practices, technologies, and strategies, thereby enhancing the positive effects of supply chain ambidexterity on performance (Popa et al., 2017). Conversely, less innovative firms may face challenges reconciling the tensions between exploration and exploitation, consequently limiting the positive outcomes of supply chain ambidexterity (Afonasova et al., 2019). Despite the inherent importance of these relationships, it remains unclear and therefore is a noticeable lack of research exploring how supply chain ambidexterity, firm innovation, and supply chain performance interact. This study aims to address this gap by delving into the role of firm innovation as a moderating factor in the relationship between supply chain ambidexterity and supply chain performance. As supply chain complexities and market uncertainties continue to grow, the insights gleaned from this research could offer valuable guidance for firms seeking to enhance their supply chain performance through the strategic application of ambidexterity and innovation. A large body of empirical work exists on the relationship between supply chain ambidexterity and supply chain performance outcomes. While some studies find that supply chain ambidexterity positively affects performance (Aslam et al., 2020b; Khan et al., 2021), other studies report that it positively impacts performance indirectly (Mbima & Tetteh, 2023). Still, other studies find that the relationship between these concepts is negative (Partanen et al., 2020). Furthermore, there have been calls for researchers to extend studies on supply chain

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ambidexterity by introducing innovation as a moderating variable (Aslam et al., 2020a). In part, these conflicting findings can be attributed to researchers linking supply chain ambidexterity to different performance dimensions such as operational performance, circular supply chain, supply chain agility, firm performance, new product development, supply chain management, supply chain flexibility, green supply chain management, and supply chain performance (Hald & Nordio, 2020; Khan et al., 2021; Rojo et al., 2016; Scott, 2016). This study therefore seeks to address the empirical gaps in the supply chain ambidexterity literature by developing a model that examines the moderating role of firm innovation on the relationship between supply chain ambidexterity and supply chain performance.

II. LITERATURE REVIEW

A. *Supply Chain Ambidexterity*

As organizations confront a world characterized by rapid technological advancements, ensuing disruptions compel the re-evaluation of traditional supply chain strategies. Old paradigms that focused on either innovation or efficiency now give way to a more holistic approach that combines the two. In such a dynamic setting, Supply Chain Ambidexterity serves as the linchpin that holds the promise of sustained organizational performance (Sahi et al., 2021). In an era marked by the omnipresence of technology, advancements in areas like artificial intelligence, data analytics, and automation have revolutionized the way supply chains operate. These technologies offer not just incremental changes but the potential for radical transformations in supply chain management. Consequently, organizations are compelled to adapt, necessitating a form of exploratory innovation that can harness the power of these new technologies effectively. Market volatilities further accentuate the importance of Supply Chain Ambidexterity. Events such as economic downturns, trade wars, and global pandemics present disruptions that traditional supply chain models are ill-equipped to handle efficiently. Such uncertainties require a supply chain that is not only efficient but also agile and resilient to encapsulate in the concept of Supply Chain Ambidexterity. The term "Supply Chain Ambidexterity" has elicited multiple interpretations across scholarly and industrial domains, each contributing to a nuanced understanding of the concept. Firstly, Jermsittiparsert and Pithuk (2019) define Supply Chain Ambidexterity as "the firm's capability to simultaneously pursue both incremental and radical improvement in supply chain processes." This definition emphasizes the coexistence of two different types of improvements. Incremental improvement refers to ongoing, gradual enhancements in existing processes for better efficiency, while radical improvement aims for game-changing innovations that could potentially revolutionize the supply chain. This approach highlights the organization's skill in managing both types of improvements without favoring one over the other. Secondly, Wamba et al. (2020) describe Supply Chain Ambidexterity as "the organization's strategic prowess to dynamically harmonize efficiency and responsiveness in its supply chain functions." Here, the focus is on strategic adaptability. Efficiency typically involves cost-saving and process optimization, while responsiveness is concerned with the speed and flexibility to respond to market changes. The definition points to the importance of an agile strategy that adapts according to market needs while maintaining operational efficiency. For this study, Supply Chain Ambidexterity is conceptualized as a strategic capability to balance and integrate both exploratory innovation and exploitative efficiency within supply chain operations to achieve optimal performance. This conceptualization synthesizes elements from the various definitions and focuses on the strategic nature of achieving a balanced yet integrated approach for overall supply chain excellence. Exploratory and exploitative ambidexterity serves as the primary types that characterize this organizational competency. Exploratory ambidexterity centers on innovation, flexibility, and adaptability to external market changes, such as shifts in technology or consumer preferences. Conversely, exploitative ambidexterity focuses on maximizing current operations through efficiency, cost-reduction, and optimization of existing resources (Khan et al., 2021b). Recognizing the importance of Supply Chain Ambidexterity holds significant implications for organizations, it enables them to navigate the complexities of the current business ecosystem, providing a competitive advantage over entities that focus solely on either innovation or efficiency. However, achieving this balance is fraught with challenges, including the necessity for cultural shifts within the organization, significant resource investments, and intricate performance measurement metrics. Moreover, the risk of diluting focus and underperforming in one area while striving for excellence in another presents an inherent challenge (Rojo Gallego Burin et al., 2020).

B. *Firm Innovation*

Firm innovation stands as an essential facet of organizational competency in the contemporary business landscape. It represents the process through which new ideas, practices, or products are developed and implemented, creating value for the organization and its stakeholders. In an environment marked by rapid technological progress, shifting consumer preferences, and escalating global competition, firm innovation has evolved from a peripheral business function to a core strategic imperative (Popa et al., 2017). It transcends mere research and development, encompassing a broader range of activities that include business processes, organizational structure, and market strategy (Shahbaz et al., 2018). Various trends and issues in firm innovation have come to the fore in recent years. The democratization of technology has leveled the playing field, allowing even smaller firms to compete effectively against well-established players. However, this has led to innovation clutter, with an overabundance of new products and technologies, some of which lack a compelling value proposition (Afonasova et al., 2019). The trend toward open innovation, where organizations collaborate with external partners, and the rise of disruptive innovation, which overturns existing market dynamics, add to the complexity and challenges firms face in innovating effectively (Che et al., 2019). Le and Lei (2018) consider firm innovation as "the implementation of novel solutions that result in better products, processes, or market effectiveness." This view underscores the outcome-based

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nature of innovation. Yuan and Zhang (2020) envision firm innovation as "the capacity to create and commercialize novel and useful ideas." Here, the focus is on the attributes of the idea itself and its commercial viability. This definition accommodates both creation and adoption from external sources. In this study, firm innovation is conceptualized as a strategic capability encompassing the creation, adaptation, and implementation of new ideas, processes, and products aimed at enhancing organizational value and responding to market changes. Firm innovation primarily manifests in two forms: product and process innovation. Product innovation pertains to the development of new or improved goods and services that meet customer needs more effectively. Process innovation involves the introduction or modification of business operations and production techniques to improve efficiency, quality, or scalability. Both types are not mutually exclusive but often interrelated, creating a symbiotic relationship that enhances organizational competency (Martinez-Conesa et al., 2017). Innovative firms are generally more resilient to changes in the business environment, as they are better equipped to adapt and evolve (Cuevas-Vargas et al., 2016). However, innovation presents its own set of challenges. High costs, especially in the initial stages, the difficulty in creating a culture of innovation, and the risks associated with unproven ideas are some of the hurdles that organizations often face (Tajpour et al., 2020).

C. Supply Chain Performance

As globalization expands and supply chains become more intricate, evaluating and enhancing supply chain performance has risen in priority for organizations seeking sustainable growth and competitive advantage (Anand and Grover, 2015). When this concept is applied to supply chains, supply chain performance becomes a critical measure of organizational capability (Wibowo and Sholeh, 2015). It captures how well a supply chain functions in terms of costs, speed, and reliability to deliver products from the point of origin to the point of consumption. Concurrently, the emphasis on sustainable practices introduces additional metrics for assessing performance, such as environmental impact and social responsibility. George and Madhusudanan Pillai (2019) posit supply chain performance as "the operational efficiency and effectiveness in producing and delivering products or services." This definition zeroes in on efficiency metrics such as cost, speed, and reliability. Fosso Wamba et al. (2020) defines it as "the extent to which a supply chain fulfills customer demands in terms of quantity, quality, and timing." Here, customer-centric metrics take center stage. Mbima and Tetteh (2023) view supply chain performance as "the strategic alignment of supply chain practices for competitive advantage," emphasizing the strategic role that supply chains play in business success. Supply chain performance is conceptualized as a multidimensional construct encompassing operational efficiency, customer fulfillment, strategic alignment, and adaptability to market conditions. When considering the dimensions of supply chain performance, three key aspects emerge: efficiency, reliability, and flexibility. Efficiency pertains to cost-effectiveness, speed, and the optimal use of resources. Reliability centers around the consistent performance of the supply chain in meeting deadlines and maintaining quality. Flexibility relates to the ability to adapt to changes in demand, supply, or other external conditions swiftly (Fatorachian and Kazemi, 2021).

III. THEORETICAL REVIEW

The RBV retains significant explanatory power in understanding sustainable competitive advantage in strategic management research and practice. In the context of the direct relationship between supply chain ambidexterity and supply chain performance, RBV posits that ambidexterity can be seen as a strategic resource that enables firms to gain a competitive advantage. The dual capabilities of exploration (innovative practices) and exploitation (efficiency-focused practices) represent valuable resources that enhance the performance of the supply chain. Firms adept at managing these paradoxical capabilities are likely to possess a unique, non-substitutable resource that enhances supply chain performance. The RBV, which claims that the key resources of a firm determine its competitive advantage, has become a pre-eminent theory in the field of business strategy (Karim, 2022). Efficient supply chains reduce costs and increase speed to market, while innovative supply chains allow for adaptation and market differentiation. Therefore, the resource of supply chain ambidexterity directly contributes to enhanced supply chain performance. When discussing firm innovation through the RBV lens, innovation can be considered a resource that is valuable, rare, and difficult to imitate. Innovation may manifest in product design, process efficiency, or customer engagement mechanisms, among others. Such innovative resources, when effectively deployed, significantly impact supply chain performance. Innovation can streamline supply chain processes, create value-added products, and open up new channels of customer engagement, thereby elevating supply chain performance. Organizations that prioritize innovation, therefore, align with RBV theory by accumulating strategic resources that enhance supply chain capabilities and supply chain performance.

IV. EMPIRICAL REVIEW

Supply chain ambidexterity is increasingly capturing the attention of scholars and industry experts alike, with research conducted across different countries and business sectors. For instance, Jain et al. (2017) investigated the influence of ambidextrous supply chains on innovation and performance among multinational companies operating in Malaysia. Their study, employing web-based surveys and statistical methods, demonstrated a significant positive correlation between ambidextrous supply chains and both innovation and performance. Although they recognized some limitations in their study, including potential survey bias, the outcome underscores the necessity for companies, especially in emerging markets, to implement ambidextrous supply chain strategies. On another front, Güemes-Castorena et al. (2020) focused their research on American firms, examining how ambidextrous governance in supply chains affects innovation and cost-efficiency. Employing hierarchical regression analysis, they found that ambidextrous governance positively impacts both innovation and cost performance, although they left the door open for further investigation by not outlining

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explicit future research directions. In Poland, Kaliszuk, Partanen, et al. (2020) aimed to understand the effect of ambidextrous governance on supply chain performance from both the buyer's and supplier's viewpoints. Utilizing survey-based research and advanced statistical analysis, they revealed a strong positive influence, especially more pronounced from the supplier's standpoint. While cautioning that the geographical focus could be a limiting factor, they call for additional research to further explore the nuances of this relationship. Herlina et al. (2021), in contrast, turned their attention to the U.S. apparel sector intending to establish a clear framework for ambidexterity. They developed an assessment tool to help apparel companies achieve effective supply chain ambidexterity. Although they did not specify future research directions, their work serves as a guideline for industry professionals. In Taiwan, Tuan (2016) explored the implications of ambidextrous supply chain strategies for competitive capabilities and business performance among manufacturing firms. The study, based on survey research, pointed to promising outcomes, suggesting avenues for further research in diverse industries. Conducted in Pakistan, Aslam et al. (2020) aimed to gauge the role of supply chain ambidexterity in enhancing supply chain resilience. Through a survey of manufacturing firms and data analysis, they found a positive correlation and suggested that future research might benefit from extending the study to service-oriented supply chains and considering additional variables such as competition and technology. Roldán et al. (2018), based in Spain, sought to examine various capabilities and their impact on supply chain integration. Their survey-based research found that capabilities like desorption capacity have a direct positive influence on supply chain competence, which in turn affects supply chain integration. Finally, Ramdan et al. (2021) in Malaysia undertook a scoping review to map themes related to organizational ambidexterity in supply chain research. They found a positive association between supply chain management and organizational ambidexterity, suggesting that future studies could delve deeper into this relationship by utilizing a broader range of databases.

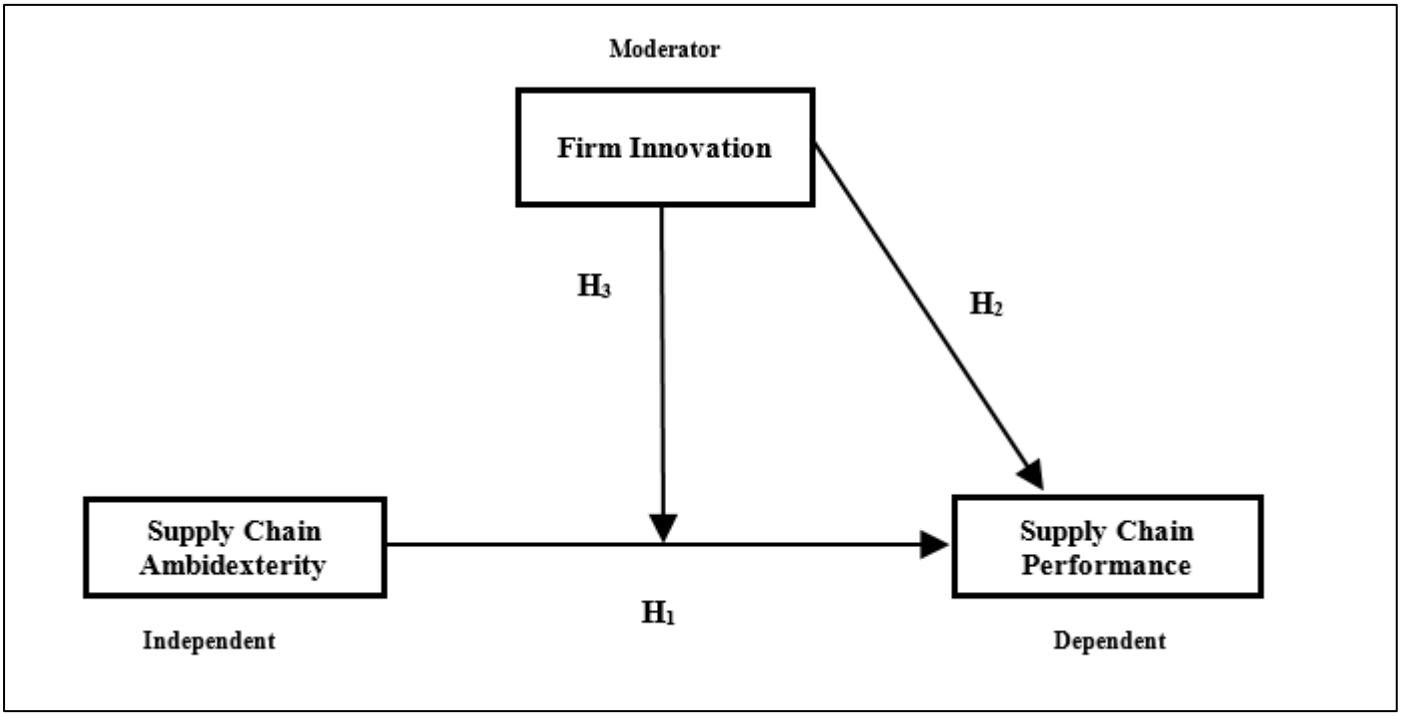

Fig 1: Empirical Review
Source: Researcher's Construct (2024)

V. METHODOLOGY

The Greater Accra region is a major industrial and manufacturing hub in Ghana, contributing significantly to the country's GDP (Obeng et al., 2020). Key manufacturing activities in Greater Accra include food and beverages, metal products, automotive, chemical and pharmaceuticals, and plastics (Boateng, 2019). The food and beverages sector comprises about 45% of manufacturing activities in the region (Amoako and Matlay, 2015). Major firms include Fan Milk, Coca-Cola, and Guinness Ghana Breweries. Metal fabrication companies like Aluworks produce aluminum products. Automotive manufacturing increased after Volkswagen established an assembly plant in Accra in 2008 (Obeng et al., 2020). Proximity to the Tema port as well as skilled labor supports manufacturing growth in Greater Accra (Boateng, 2019). However, high production costs, inadequate infrastructure, and unreliable power supply constrain optimization and competitiveness (Amoako and Lyon, 2014). The sample size for this study is limited to 200 respondents. Although the sample size is statistically adequate, a larger sample might have provided more generalizable results. Previous studies on related topics in supply chain management have utilized similar sample sizes (Brandon-Jones et al., 2014). As the study involves multiple variables and complex statistical analysis techniques like structural equation modeling, a minimum sample of 200 is recommended (Wolf et al., 2013). Of the 200 questionnaires

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distributed, 161 were successfully recovered and deemed legitimate for inclusion in the study. As a result, the retrieval rate was 80.5%. The study was made feasible by the use of recovered genuine surveys. To address this, the study was designed to ensure that the sample was as representative as possible within the given constraints. Data analysis was performed using SmartPLS (version 4) and IBM SPSS version 26. First, descriptive statistics including means, standard deviations, kurtosis, and skewness were examined for all variables. Then, a confirmatory factor analysis was conducted to assess the measurement properties of the scales in terms of reliability and validity. Key metrics that were evaluated included factor loadings, composite reliability, Cronbach's alpha, average variance extracted (AVE), and heterotrait-monotrait ratio (HTMT). Next, the structural model was tested using partial least squares structural equation modeling (PLS-SEM). PLS-SEM allowed for testing the hypothesized relationships and path coefficients in the research model (Hair Jr et al., 2016).

VI. DATA ANALYSIS AND RESULTS DISCUSSION

In the Demographic Characteristics section, an insightful analysis is conducted on key factors that define the participant profile in the context of this study. These factors include the Length of Business Operation, Estimated Annual Revenue (in GHS), Number of Employees, Age, Highest Qualification, and Work Experience of the Respondents. The significance of examining these characteristics lies in their potential to influence the outcomes and interpretations of the study. Regarding the length of business operation, a significant proportion (32.3%) of the participants have been in operation for 6-10 years, indicating a considerable representation of businesses with a moderate level of experience. The distribution across different categories, from 1-5 years to above 20 years, reflects a diverse range of business maturity levels. In terms of estimated annual revenue, a notable portion (30.4%) falls within the range of 500,001-1,000,000 GHS, suggesting a substantial presence of businesses with a moderate to high revenue bracket. The distribution across various revenue ranges signifies a diverse economic landscape among the respondents. Regarding the number of employees, the majority (30.4%) have employee counts ranging from 500 to 1,000, indicating a prevalence of medium to large-sized enterprises in the sample. The age distribution shows a concentration of respondents in the 30-39 years range (45.3%), suggesting a focus on the mid-career demographic. Educationally, the study encompasses a well-educated group, with 34.8% holding master's degrees and 18.6% possessing a PhD. The work experience distribution indicates a balanced representation across different experience levels.

Table 1. Demographic Characteristics

Variables		Frequency	Valid Percentage
Length of business operation	1-5 years	14	8.7%
	6-10 years	52	32.3%
	11-15 years	36	22.4%
	16-20 years	46	28.6%
	Above 20 years	13	8.1%
Estimated Annual Revenue (GHS)	Below 10,000	5	3.1%
	10,001-30,000	7	4.3%
	30,001-100,000	27	16.8%
	100,001-500,000	44	27.3%
	500,001-1,000,000	49	30.4%
	Above 1,000,000	29	18%
Number of employees	Less than 50	4	2.5%
	50-100	5	3.1%
	101-150	10	6.2%
	151-200	13	8.1%
	201-250	15	9.3%
	251-300	19	11.8%
	301-350	14	8.7%
	351-400	25	15.5
	401-450	10	6.2%
	451-500	11	6.8%
	501-550	15	9.3%
	551-600	9	5.6%
	More than 600	11	6.8%
Age	20-29 years	24	14.9%
	30-39 years	73	45.3%
	40-50 years	49	30.4%
	Above 50 years	15	9.3%
Highest qualification	Undergraduate	42	26.1%

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	Masters	56	34.8%
	PhD	30	18.6%
	Professional/Vocational	23	14.3.4%
	Others	10	6.2%
Work experience of Respondents	0-5 years	14	8.7%
	6-10 years	47	292%
	11-15 years	67	41.6%
	Above 15 years	33	20.5%

Source: Field Survey (2024)

A. Descriptive Statistics

Descriptive design as viewed by Saunders et al. (2017) is the process where data is gathered for the goal of producing as well as testing the hypothesis to provide answers to the research question in a specific area of study.

➢ *Supply Chain Ambidexterity*

Table 2 furnishes descriptive statistics concerning Supply Chain Ambidexterity, employing a composite scale. The mean of the composite scale is 5.5885, indicating a generally high level of agreement among respondents with statements related to supply chain ambidexterity. The standard deviation (SD) of 1.21812 suggests a moderate degree of dispersion around the mean, signifying a certain level of variability in respondents' perceptions. The negative skewness (-1.964) indicates that the data is skewed to the left, suggesting a tendency towards higher levels of agreement with the statements rather than divergence. The kurtosis value of 3.758, higher than the expected 3 for a normal distribution, implies a more peaked distribution, indicating a concentration of responses around the mean. Examining individual items, the lowest mean of 5.26 pertains to the statement "We proactively pursue new supply chain solutions," indicating a slightly lower level of agreement compared to other items. Conversely, the highest mean of 5.87 is associated with the statement "To improve our supply chain, we continually explore new opportunities," indicating a particularly strong agreement with this aspect of supply chain ambidexterity. The standard deviations across items range from 1.218 to 1.481, suggesting relatively consistent agreement levels among respondents, with limited variability in their perceptions.

Table 2: Descriptive Statistics on Supply Chain Ambidexterity

Items	Mean	SD	Skewness	Kurtosis
To stay competitive, our supply chain managers focus on reducing operational redundancies in our existing processes.	5.67	1.259	-1.411	2.21
Our company effectively utilizes existing resources and processes to improve supply chain efficiency.	5.55	1.355	-1.464	2.704
Leveraging of our current supply chain technologies is important to our firm's strategy.	5.48	1.392	-1.425	2.135
To stay competitive, our supply chain managers focus on improving our existing technologies.	5.57	1.327	-1.533	2.549
Our managers focus on developing stronger competencies in our existing supply chain processes.	5.62	1.274	-1.366	2.055
We continuously refine and optimize our current supply chain practices to achieve cost reductions and improved performance.	5.39	1.366	-1.424	2.239
We proactively pursue new supply chain solutions.	5.26	1.481	-1.452	2.184
Our company actively invests in new technologies and processes to improve our supply chain capabilities	5.67	1.368	-1.802	3.363
We continually experiment to find new solutions that will improve our supply chain	5.8	1.409	-1.894	3.645
To improve our supply chain, we continually explore new opportunities.	5.87	1.314	-1.898	3.663
We are constantly seeking novel approaches to solve supply chain problems.	5.59	1.367	-1.723	3.248
We encourage experimentation and innovation in our supply chain practices uncovering new growth opportunities.	5.59	1.339	-1.681	3.153
COMPOSITE SCALE	**5.5885**	**1.21812**	**-1.964**	**3.758**

Source: Field Survey (2024)

➢ *Firm Innovation*

Table 3 presents descriptive statistics for Firm Innovation, utilizing a composite scale. The mean of the composite scale is 3.0671, indicating a moderate level of agreement among respondents with statements related to firm innovation. The standard deviation (SD) of 1.53349 suggests a considerable degree of dispersion around the mean, signifying variability in respondents' perceptions. The positive skewness (1.026) indicates that the data is skewed to the right, suggesting a tendency towards lower levels of

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agreement with the statements. Examining individual items, the lowest mean of 2.66 is associated with the statement "Our company continuously improves and optimizes its internal processes to enhance efficiency," indicating a relatively lower level of agreement compared to other items. Conversely, the highest mean of 3.62 is linked to the statement "Our company consistently develops and introduces new products to the market," indicating a stronger agreement with this aspect of firm innovation. The standard deviations across items range from 1.533 to 1.773, indicating a varied range of responses and perceptions among respondents. Overall, the results suggest a moderate level of agreement regarding firm innovation, with some variation in respondents' perspectives. The positive skewness implies that, on average, respondents tend to lean towards lower agreement levels with the statements, indicating a need for potential improvements in fostering a culture of innovation within the organization.

Table 3: Descriptive Statistics on Firm Innovation

Items	Mean	SD	Skewness	Kurtosis
Our company consistently develops and introduces new products to the market.	3.62	1.662	0.463	-0.462
We actively invest in research and development to create innovative product offerings.	3.09	1.618	0.602	-0.571
Our company regularly enhances the features and functionality of our existing products.	3.11	1.632	0.797	-0.216
Our products are often considered more innovative than those of our competitors.	3.21	1.656	0.787	-0.173
We encourage a culture of creativity and risk-taking to foster new product development.	2.94	1.704	0.887	-0.24
Our company continuously improves and optimizes its internal processes to enhance efficiency.	2.66	1.616	1.053	0.187
We actively seek and implement innovative solutions to streamline production and operations.	2.98	1.653	0.863	-0.121
Our company is open to adopting new technologies and methods to improve process efficiency.	3.01	1.69	0.903	-0.187
We regularly evaluate and update our internal processes to maintain a competitive edge.	3.0373	1.6729	0.881	-0.264
Our company encourages employees to propose and test new process improvements and best practices.	3.01	1.773	0.931	-0.251
COMPOSITE SCALE	3.0671	1.53349	1.026	-0.192

Source: Field Survey (2024)

- *Supply Chain Performance*

Table 4: Descriptive Statistics on Supply Chain Performance

Items	Mean	SD	Skewness	Kurtosis
Our firm with supply chain partners offers highly reliable products	5.55	1.392	-0.964	0.536
Our firm with supply chain partners offers high-quality products to our customers	5.47	1.428	-1.177	0.994
Our firm and supply chain partners have helped each other to improve product quality	5.37	1.35	-1.215	1.849
Our firm with supply chain partners increases the rate at which we fulfill customer orders	5.51	1.333	-1.383	2.304
Our firm with supply chain partners reduces inbound and outbound cost of transport	5.54	1.313	-1.379	2.345
Our firm with supply chain partners reduces warehousing and inventory holding costs	5.65	1.185	-1.214	1.434
Our firm with supply chain partners meets on-time delivery requirements for all product	5.49	1.365	-1.36	2.072
Our firm with supply chain partners reached agreed costs per unit as compared with the industry	5.55	1.401	-1.527	2.524
COMPOSITE SCALE	5.5155	1.20633	-1.558	2.618

Source: Field Survey (2024)

Table 4 provides descriptive statistics for Supply Chain Performance, utilizing a composite scale. The mean of the composite scale is 5.5155, indicating a generally high level of agreement among respondents with statements related to supply chain performance. The standard deviation (SD) of 1.20633 suggests a moderate degree of dispersion around the

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mean, signifying some variability in respondents' perceptions. The negative skewness (-1.558) indicates that the data is skewed to the left, suggesting a tendency towards higher levels of agreement with the statements. Examining individual items, the lowest mean of 5.37 is associated with the statement "Our firm and supply chain partners have helped each other to improve product quality," indicating a slightly lower level of agreement compared to other items. Conversely, the highest mean of 5.65 is linked to the statement "Our firm with supply chain partners reduces warehousing and inventory holding costs," indicating a particularly strong agreement with this aspect of supply chain performance. The standard deviations across items range from 1.185 to 1.428, indicating relatively consistent agreement levels among respondents, with limited variability in their perceptions. Overall, the results suggest a prevalent positive disposition towards supply chain performance, as evidenced by the high mean and the overall trend of agreement across individual items. This implies that organizations, in collaboration with their supply chain partners, are achieving high levels of reliability, quality, and efficiency in their supply chain operations. However, the slight variation in responses indicates some diversity in the emphasis on different aspects of supply chain performance.

- *Reliability and Validity Test*

Reliability and validity serve as crucial benchmarks in research, playing a vital role in guaranteeing the consistency and credibility of results. To evaluate reliability, the study utilized Cronbach's alpha and composite reliability, focusing on the internal consistency of the measures over time. Following the criteria established by Hair et al. (2013), values equal to or surpassing 0.7 in these metrics are considered indicative of satisfactory reliability. In the assessment of validity, the study computed the average variance extracted (AVE) within the structural equation modeling framework. This was conducted to confirm the convergent validity of each construct. An AVE value of 0.5 or higher is considered adequate for demonstrating convergent validity, suggesting that the indicators effectively capture the underlying construct. Conversely, an AVE value below 0.5 may suggest a lack of clear construct definition or insufficient measurement. The outcomes for Cronbach's alpha, composite reliability, and AVE, as presented in Table 5, affirm the reliability and validity of the measures employed in the study.

Table 5: Cronbach Alpha, Composite Reliability and AVE Results

Construct	Codes	Loadings	Cronbach Alpha (CA)	Composite Reliability (CR)	AVE
Supply Chain Ambidexterity	SCA1	0.84	0.98	0.98	0.81
	SCA2	0.85			
	SCA3	0.91			
	SCA4	0.90			
	SCA5	0.89			
	SCA6	0.89			
	SCA7	0.92			
	SCA8	0.92			
	SCA9	0.93			
	SCA10	0.92			
	SCA11	0.90			
	SCA12	0.90			
Firm Innovation	FI1	0.87	0.98	0.98	0.85
	FI2	0.88			
	FI3	0.91			
	FI4	0.92			
	FI5	0.94			
	FI6	0.94			
	FI7	0.93			
	FI8	0.94			
	FI9	0.94			
	FI10	0.92			
Supply Chain Performance	SCP1	0.87	0.97	0.97	0.81
	SCP2	0.86			
	SCP3	0.89			
	SCP4	0.91			
	SCP5	0.93			
	SCP6	0.92			
	SCP7	0.89			
	SCP8	0.90			

Source: Field Survey (2024)

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Table 5 displays the results of Cronbach Alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE) for the constructs of Supply Chain Ambidexterity (SCA), Firm Innovation (FI), and Supply Chain Performance (SCP). These measures are crucial for assessing the reliability and validity of the research instrument. For Supply Chain Ambidexterity, the Cronbach Alpha values range from 0.81 to 0.98, indicating a high level of internal consistency. The Composite Reliability values, all exceeding 0.98, further affirm the reliability of the construct. The Average Variance Extracted values, ranging from 0.81 to 0.98, demonstrate strong convergent validity, as they surpass the recommended threshold of 0.5. Similarly, for Firm Innovation, the Cronbach Alpha values range from 0.85 to 0.98, indicating excellent internal consistency. The Composite Reliability values, consistently exceeding 0.98, reinforce the reliability of the construct. The Average Variance Extracted values, ranging from 0.85 to 0.98, demonstrate strong convergent validity. For Supply Chain Performance, the Cronbach Alpha values range from 0.81 to 0.97, indicating satisfactory to high internal consistency. The Composite Reliability values, all exceeding 0.97, affirm the reliability of the construct. The Average Variance Extracted values, ranging from 0.81 to 0.97, indicate robust convergent validity. In summary, the results from Table 5 indicate that all constructs exhibit strong internal consistency, as evidenced by high Cronbach Alpha and Composite Reliability values. Additionally, the constructs demonstrate robust convergent validity, as indicated by the high Average Variance Extracted values. These findings validate the reliability and validity of the measurement instrument, instilling confidence in the integrity of the data collected for the study.

- *Heterotrait-Monotrait Ratio Test*

The Heterotrait-Monotrait Ratio (HTMT) serves as a method for evaluating discriminant validity in structural equation modeling and various multivariate techniques. Discriminant validity assesses how distinct a construct is from others within the model. The HTMT achieves this by comparing correlations between different constructs (heterotrait) with correlations within the same construct (monotrait). A lower HTMT ratio suggests stronger discriminant validity, indicating that correlations between different constructs are weaker than those within the same construct. Typically, HTMT values below 0.90 are considered indicative of satisfactory discriminant validity.

Table 6: HTMT Results

	FI	**SCA**	**SCP**	**FI x SCA**
FI				
SCA	0.53			
SCP	0.44	0.46		
FI x SCA	0.39	0.83	0.52	

Source: Field Survey (2024)

Note: Supply Chain Ambidexterity (SCA); Firm Innovation (FI); Supply Chain Performance (SCP)

The Heterotrait-Monotrait Ratio (HTMT) results presented in Table 6 offer insights into the discriminant validity of the main constructs in the study: Supply Chain Ambidexterity (SCA), Firm Innovation (FI), and Supply Chain Performance (SCP). The HTMT values in the table represent the ratios of the correlations between different constructs (heterotrait) to the correlations within the same construct (monotrait). The HTMT value between Firm Innovation (FI) and Supply Chain Ambidexterity (SCA) is 0.53. This value is below the commonly accepted threshold of 0.90, suggesting adequate discriminant validity between FI and SCA. It indicates that the correlation between these two constructs is weaker than the correlations within each construct, supporting the idea that FI and SCA are distinct constructs. The HTMT value between Firm Innovation (FI) and Supply Chain Performance (SCP) is 0.44, and the HTMT value between SCA and SCP is 0.46. Both of these values are below 0.90, indicating satisfactory discriminant validity between FI and SCP and between SCA and SCP. These results suggest that the correlations between each pair of these constructs are weaker than the correlations within each construct, affirming their distinctiveness. The HTMT value for the interaction term (FI x SCA) is 0.39. This value falling below 0.90 indicates adequate discriminant validity for the interaction term. It implies that the correlation between the interaction term and the individual constructs (FI and SCA) is weaker than the correlations within each construct, reinforcing the uniqueness of the interaction term.

B. Confirmatory Factor Analysis

In the research, Figure 1 depicts the CFA, illustrating that all thirty items related to supply chain ambidexterity, firm innovation, and supply chain performance, exhibit loadings above 0.70. This signifies a robust association of each item with its corresponding latent variable.

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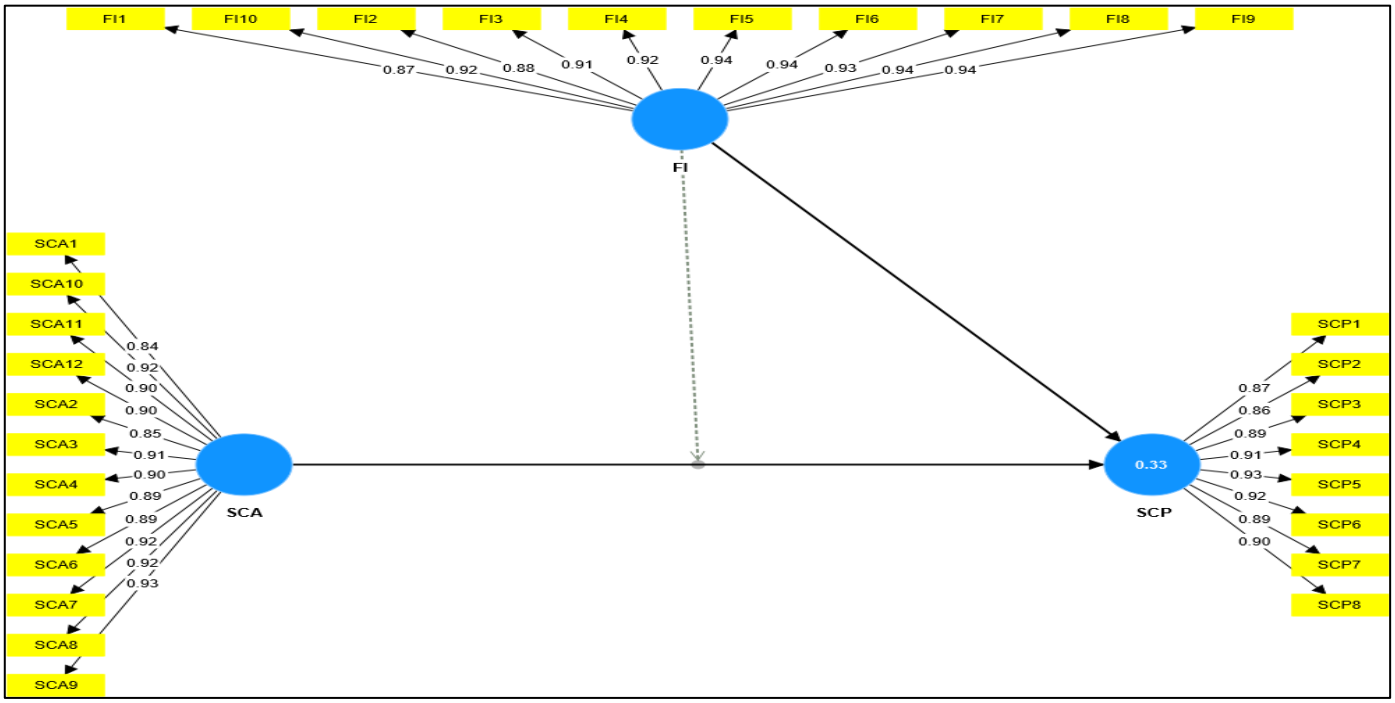

Fig 1: Confirmatory Factor Analysis
Source: Field Survey (2024)

C. Structural Equation Modelling

Integrating the capabilities of Confirmatory Factor Analysis (CFA) and path analysis, SEM enables the simultaneous evaluation of both the measurement model and the structural model. The findings derived from the SEM analysis are outlined in Table 7.

Table 7: Structural Equation Model (SEM) Result

Path	**Coefficients**	**T-value**	**P-value**
Direct Effects			
SCA → SCP	-0.11	1.07	0.29
FI → SCP	-0.30	3.52	0.00
Moderation Effect			
FI × SCA → SCP	0.31	4.53	0.00

Source: Field Survey (2024)
Note: Supply Chain Ambidexterity (SCA); Firm Innovation (FI); Supply Chain Performance (SCP)

Table 7 provides the outcomes of the Structural Equation Model (SEM) analysis, delineating path coefficients, t-values, and p-values for the specified paths in the model. Let's analyze and interpret the SEM results: in terms of direct effects, the path from Supply Chain Ambidexterity (SCA) to Supply Chain Performance (SCP) exhibits a path coefficient of -0.11. This negative coefficient suggests a potential inverse relationship between SCA and SCP. However, with a t-value of 1.07 and a p-value of 0.29, the association is not statistically significant. Therefore, there is insufficient evidence to support a direct effect of SCA on SCP in the model. On the contrary, the path from Firm Innovation to supply chain performance displays a path coefficient of -0.30, indicating a negative relationship. The t-value of 3.52 and the low p-value of 0.00 suggest statistical significance, providing evidence for a significant negative direct effect of FI on SCP. Furthermore, the moderation effect is examined through the interaction between FI and SCA on SCP. The path coefficient for this interaction term is 0.31, reflecting a positive moderation effect. The high t-value of 4.53 and the low p-value of 0.00 indicate statistical significance, signifying that the interaction between FI and SCA significantly influences SCP. This underscores the importance of considering the joint impact of Firm Innovation and Supply Chain Ambidexterity in shaping Supply Chain Performance.

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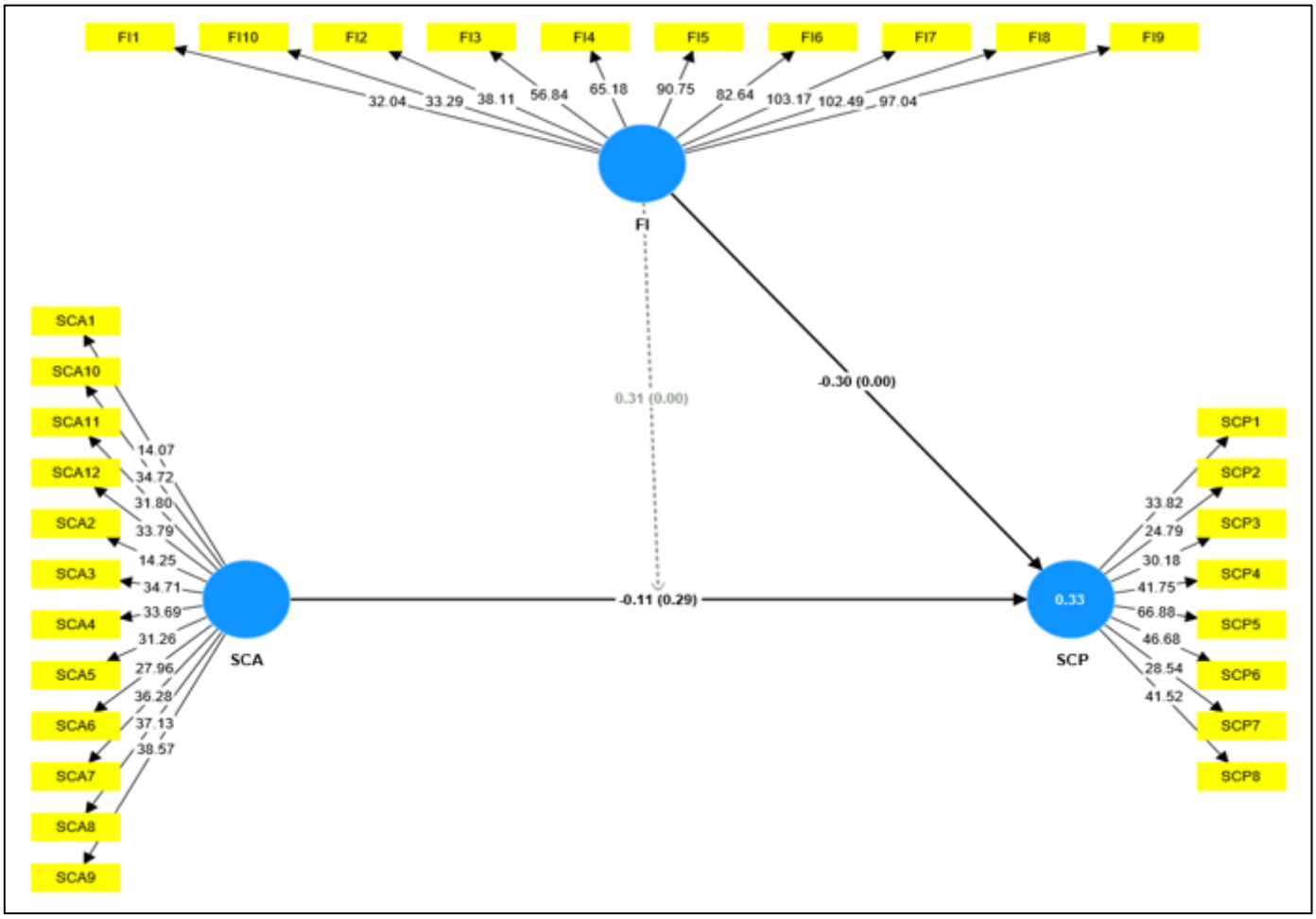

Fig 2: Structural Equation Modelling
Source: Field Survey (2024)

D. Hypotheses Confirmation

Based on a comprehensive review of the available literature, this research formulated three hypotheses. Through meticulous analysis of the collected data, the study aimed to assess the validity of these hypotheses. Out of the nine hypotheses proposed, only one received empirical support. Table 8 provides a concise overview, outlining the confirmation or refutation of each hypothesis based on the empirical evidence.

Table 8: Hypothesis Confirmation

Hypothesis	Path	T-Value	Coefficient (P-Value)	Decision
H1	SCA → SCP	1.07	-0.11; p > 0.05	Not Supported
H2	FI → SCP	3.52	-0.30.; p < 0.01	Not Supported
H3	SCA × FI→ SCP	4.53	0.31.; p < 0.01	Supported

Source: Field Survey (2024)
Note: Supply Chain Ambidexterity (SCA); Firm Innovation (FI); Supply Chain Performance (SCP)

VII. DISCUSSION OF FINDINGS

Supply Chain Ambidexterity (SCA) and Supply Chain Performance (SCP) yield noteworthy insights. The findings, as presented in Table 8, indicate a t-value of 1.07 and a coefficient (p-value) of -0.11, where p > 0.05, suggesting that the empirical evidence does not support a significant positive effect of SCA on SCP. This outcome contradicts the hypothesis, which posited that supply chain ambidexterity would positively and significantly impact supply chain performance. In the context of the literature reviewed, this result aligns with the mixed empirical evidence regarding the impact of supply chain ambidexterity on performance outcomes. While some studies, such as Ramdan et al. (2021) and Roldán Bravo et al. (2018), found positive effects on operational and business performance, other research, like Herlina et al. (2021) and Gualandris et al. (2018), reported negative or no effects on short-term performance and flexibility. This inconsistency in findings underscores the complexity of the relationship between supply chain

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ambidexterity and performance, emphasizing the need for further exploration in specific contexts. Hypothesis 2 (H2) centers on the association between Firm Innovation (FI) and Supply Chain Performance (SCP). The analysis reveals a t-value of 3.52 and a coefficient (p-value) of -0.30, where $p < 0.01$. These results indicate a significant negative effect of FI on SCP. This contradicts the hypothesis, which proposed a positive and significant impact of firm innovation on supply chain performance. Contrary to this result, existing literature has generally supported the positive relationship between innovation capabilities and supply chain performance. Studies by Agarwal et al. (2018) and Blome et al. (2014) found that innovation in supply chain processes positively influenced operational and business performance. Hypothesis 3 (H3) explores the moderating role of Firm Innovation on the relationship between Supply Chain Ambidexterity and Supply Chain Performance. The analysis indicates a t-value of 4.53 and a coefficient (p-value) of 0.31, where $p < 0.01$, providing support for the hypothesis. This signifies that firm innovation positively and significantly moderates the effect of supply chain ambidexterity on supply chain performance. In the context of the literature, the findings align with the resource-based view (RBV) logic, which suggests that combining rare and valuable resources, such as supply chain ambidexterity and firm innovation, can strengthen overall competitive positioning. Studies by Blome et al. (2014) and Kristal et al. (2010) have demonstrated that innovation can amplify the positive relationship between supply chain learning and performance outcomes. This result underscores the strategic importance of integrating both supply chain ambidexterity and firm innovation capabilities to achieve competitive advantages in dynamic business environments.

VIII. CONCLUSION

The motivation for this study stems from the increasing complexity and competitiveness in today's business environment, where firms must continually adapt and innovate to thrive. The crucial role of supply chain ambidexterity in balancing exploration and exploitation activities has been acknowledged, with potential benefits for supply chain performance. However, the interaction between supply chain ambidexterity, firm innovation, and supply chain performance remains underexplored. The main findings reveal a non-significant direct effect of supply chain ambidexterity on supply chain performance, challenging previous assumptions about their straightforward positive relationship. Additionally, a surprisingly negative effect of firm innovation on supply chain performance was observed. However, the study uncovered a significant positive moderating effect of firm innovation on the relationship between supply chain ambidexterity and supply chain performance. In conclusion, this research contributes to academics by refining the understanding of supply chain ambidexterity and firm innovation. The findings suggest that the relationship between supply chain ambidexterity and supply chain performance is nuanced and contingent on the moderating role of firm innovation. This underscores the importance of considering the contextual influence of innovation capabilities when exploring the impact of ambidexterity on performance outcomes. For practitioners, the study offers insights into the delicate balance required for effective supply chain management. The unexpected negative impact of firm innovation on performance highlights the need for organizations to critically evaluate their innovation practices. The positive moderating effect of firm innovation emphasizes the strategic advantage of integrating innovation capabilities to enhance the positive influence of supply chain ambidexterity on performance.

IX. IMPLICATION TO RESEARCH AND PRACTICE

The first finding reveals that there is no significant relationship between supply chain ambidexterity (SCA) and supply chain performance (SCP). Supply chain managers should carefully evaluate the potential benefits and drawbacks of adopting ambidextrous practices in their supply chain operations. Given the absence of a clear positive impact on performance, managers might reconsider the extent to which they balance exploration and exploitation activities. A tailored approach, aligned with the specific needs and context of the organization, should guide the implementation of supply chain ambidexterity. The second finding indicates that firm innovation (FI) does not have a direct positive influence on supply chain performance (SCP). This challenges the common assumption that increased innovation necessarily leads to improved operational efficiency and customer satisfaction in the supply chain. Supply chain managers are advised to shift their focus from a general pursuit of innovation to a more targeted and goal-oriented approach. Instead of merely increasing innovation efforts, managers should strategically align innovation initiatives with specific supply chain objectives, ensuring that innovations directly contribute to key performance indicators. On a positive note, the third finding suggests that firm innovation (FI) positively moderates the relationship between supply chain ambidexterity (SCA) and supply chain performance (SCP). This implies that the negative impact of supply chain ambidexterity on performance can be mitigated by high levels of firm innovation. Supply chain managers are recommended to foster a culture of continuous innovation alongside ambidextrous practices. This could involve integrating innovation goals into the overall supply chain strategy, investing in technologies that enhance both exploration and exploitation capabilities, and encouraging a work environment that promotes experimentation and learning. By doing so, managers can leverage innovation as a strategic tool to enhance the positive outcomes of supply chain ambidexterity on performance.

X. FUTURE RESEARCH SUGGESTIONS

Firstly, the study predominantly relies on cross-sectional data, limiting the ability to establish causal relationships. Future research could adopt a longitudinal approach to better capture the dynamics and temporal aspects of supply chain ambidexterity, firm innovation, and their impact on performance over time. Future research could adopt a multi-region or global approach to enhance the external validity of the study's conclusions. Additionally, the study primarily relies on self-reported data, introducing the

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possibility of common method bias. Future research could incorporate objective performance metrics or triangulate data from multiple sources to strengthen the robustness of the findings.

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