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Sustainability performance and supply chain leadership in logistic firms: The role of corporate sustainability strategies and digital supply chain

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Abstract

Purpose: The study investigates the relationship between supply chain leadership, digital supply chain practices, and corporate sustainability strategies on the sustainability performance of logistics firms in Nigeria, one of Africa's largest economies. It indicates that collaborative efforts within the supply chain context can improve sustainability performance.

Design/methodology/ approach: Data from 468 firms in a major sub-Saharan African market were collected through a structured questionnaire. The analysis employed descriptive statistics, principal component analysis (PCA), and hierarchical regression analysis. Factor analysis and Cronbach's alpha analysis were utilized to assess the validity and reliability of the instrument.

Findings: The results of the current study reveal significant findings: proactive sustainability strategies exert a substantial positive effect on sustainability performance ($\beta = .694$, $SE = .025$, $p < .01$). Even when proactive sustainability strategies are included in the model, the positive impact of reactive sustainability strategies remains significant ($\beta = .694$, $SE = .025$, $p < .01$: model 5). Regarding the moderating role of proactive and reactive corporate sustainability strategies, there is a notable interaction effect between supply chain leadership and proactive sustainability strategies concerning sustainability performance ($p < .05$). This confirms the positive relationship between supply chain leadership and sustainability performance when

proactive sustainability strategies are at a high level ($\beta = .844$, SE = .0010, $p < .01$), supporting Hypothesis 4 that this relationship strengthens with higher levels of proactive sustainability strategies. Conversely, for Hypothesis H5, the interaction effect of reactive sustainability strategies with supply chain leadership changes the relationship from significantly positive to significantly negative ($\beta = -.068$, SE = .0009, $p < .01$).

Using the Baron and Kenny approach to test mediation, the mediating effect of digital supply on digital leadership is significant ($\beta = .345$, $p = 0.000$, $p < .01$). Furthermore, the effect of digital supply on sustainability performance is statistically significant ($\beta = .081$, $p = 0.006$, $p < .01$), as is the effect of digital leadership on sustainability performance ($\beta = .181$, $p = 0.000$, $p < .01$). These results indicate a mediation effect of digital supply.

Originality: This study presents a novel perspective on the moderating role of corporate sustainability strategies in the relationship between supply chain leadership and the sustainability performance of logistics firms. It provides empirical evidence and fresh insights on proactive and reactive sustainability strategies for logistics firms in Nigeria. The findings highlight that proactive sustainability strategies enhance the connection between supply chain leadership and sustainability performance, whereas reactive strategies do not.

Practical implications: The study advises managers to exercise caution when selecting between proactive and reactive sustainability strategies to enhance sustainability performance. Proactive strategies reinforce the relationship between supply chain leadership and sustainability performance, while reactive strategies diminish it. Therefore, managers are encouraged to adopt more proactive strategies. The article suggests that managers in emerging economies should recognize the distinct impacts of proactive sustainability strategies and allocate more resources toward them to improve sustainability performance, even in competitive markets. Additionally, it highlights the importance of digital supply in fostering sustainability performance.

Research limitations/ implications: This study of logistic management has limitations, including its cross-sectional nature, which precludes the establishment of causality, thus necessitating longitudinal research to determine causal relationships. Additionally, the focus on Nigerian firms, which vary significantly in their stages of learning and institutional development, emphasizing the need for further research in diverse contexts. Future studies should examine alternative institutional environments or developed economies to validate these assumptions. Another limitation is the potential for bias due to six employees rating their firms on each variable; therefore, using multiple data sources is recommended to objectively evaluate the validity of the self-reported questionnaire.

***Keywords*: Sustainability production; supply chain leadership; corporate sustainability strategies; digital supply chain; logistic firms; emerging markets.**

1. Introduction

Global businesses are increasingly confronted with uncertain environmental challenges (Wenzel et al., 2020), necessitating firms to navigate these uncertainties by leveraging available knowledge and resources (Amjad et al., 2021; Wang et al., 2022). To achieve sustainability performance, firms must adopt reactive leadership skills, foster innovation, and uphold strong ethical values. It is imperative for firms to establish mechanisms to manage these uncertainties internally, ensuring a commitment to sustainability (Liu & Lin, 2018). In the context of supply chain management, effective leadership is crucial, as decisions made by one partner can significantly impact the growth and sustainability of others (Chaturvedi, 2013). Positive leadership can mobilize dedicated followers to devise successful solutions, enhancing overall performance and creating shared value (Epitropaki et al., 2017). Furthermore, the alignment of values between followers, the external environment, and supply chain leaders fosters increased trust and teamwork (Bastardoz & Van Vugt, 2019), enabling a collaborative environment where all stakeholders work together to build a sustainable business ecosystem.

Few studies have thoroughly examined the impact of collaborative behavior in supply chain management, particularly the role of transformational leadership in enhancing organizational performance (e.g., Liao et al., 2017). Although it is recognized that leadership practices can potentially boost sustainability performance, the specific mechanisms through which this occurs remain underexplored (Solis et al., 2023). Additionally, the interplay between supply chain leadership and the digital transformation of supply chains, particularly within the framework of corporate sustainability strategies, requires further investigation (Gong et al., 2018). Given the interconnected and unpredictable nature of the global business environment, understanding the drivers of sustainability performance in supply chains is increasingly important. Effective supply chain sustainability is closely tied to robust relationships among leaders, followers, and external stakeholders. Top-level leaders can achieve sustainability by

98 developing strategic capabilities, fostering successful business models, and ensuring alignment
99 with supply chain partners (Jiang et al., 2017). Furthermore, followers and the external
100 environment play a crucial role in executing these strategies by providing essential
101 recommendations and resources, which enhance working relationships and promote shared
102 goals (Storch et al., 2013). This highlights the necessity for more comprehensive research into
103 the connections among supply chain partners to elucidate how collaborative business
104 environments contribute to optimal performance. Moreover, it is essential to consider other
105 influencing factors, such as technological advancements, regulatory frameworks, and market
106 dynamics, which also play significant roles in shaping sustainable supply chain performance.
107 Understanding the role of digital supply chains and corporate sustainability strategies in
108 shaping a sustainable supply chain system is crucial. Despite extensive research in the area,
109 Gosling et al. (2016) argue that this field requires further empirical investigation due to its
110 complex nature. This study examines how supply chain leaders can enhance performance by
111 collaborating with external partners and employees, particularly within the digital supply chain,
112 to achieve sustainability performance. The goal is to contribute to the firm's sustainability and
113 its stakeholders, as influential firms that neglect their responsibilities to business partners may
114 lose value and negatively impact their entire supply chain system (Busse et al., 2016).
115 Conversely, less influential firms may miss unique opportunities for growth and sustainability
116 (Peng et al., 2023).
117 Research into sustainability performance and supply chain leadership in logistics firms
118 emphasizes the importance of integrating sustainability into business strategies and the role of
119 digital innovations in supply chain management. Mokhtar et al. (2019) emphasize the
120 significance of leadership styles in enhancing sustainability practices among suppliers. Seuring
121 and Müller (2008) provide a comprehensive review of sustainability supply chain management,
122 delineating key strategies for incorporating sustainability. Klimecka-Tatar et al. (2021) discuss

123 green transport strategies as a pathway to sustainable development in logistics. Luthra et al.
124 (2016) identify critical factors for implementing Green Supply Chain Management (GSCM) in
125 the Indian automobile industry, highlighting the importance of regulatory and internal
126 management practices. Golicic and Smith (2013) establish a link between environmentally
127 sustainable supply chain practices and firm performance, demonstrating that sustainability
128 practices contribute positively to various performance metrics. Together, these studies
129 (Mokhtar et al., 2019; Seuring & Müller, 2008; Klimecka-Tatar et al., 2021; Luthra et al., 2016;
130 Golicic & Smith, 2013) highlight the critical role of sustainability and digital supply chain
131 practices in achieving economic, environmental, and social sustainability in the logistics sector.
132 This study explores the correlation between supply chain leadership, digital supply chains,
133 and corporate sustainability strategies in achieving sustainability performance. It suggests that
134 collaborative activities within the supply chain can bolster sustainability outcomes. Drawing
135 upon resource dependency theory, the research explores how transformational and collective
136 approaches in logistics firms operating in emerging markets contribute to sustainability growth
137 through digital supply chains and both proactive and reactive sustainability strategies.
138 This research contributes significantly to the supply chain and logistics literature on
139 various fronts. Theoretically, it expands the limited body of knowledge concerning the
140 relationship between supply chain leadership and sustainability performance (Chen et al., 2021;
141 Gosling et al., 2016). This expansion goes beyond the predominant focus on how supply chain
142 leadership influences follower behavior (Fuller et al., 2015; Groves & LaRocca, 2011) and
143 leader-member exchange dynamics (Herdman et al., 2017). By examining the impact of supply
144 chain leadership on sustainability performance, this study addresses the ongoing debate about
145 the strategic drivers of sustainability in the supply chain and logistics context (Jermsittiparsert
146 et al., 2019).

Practically, this research offers actionable insights for logistics firms in emerging markets, emphasizing the importance of integrating digital supply chains and comprehensive sustainability strategies to achieve sustainability growth. It illustrates how supply chain leaders can utilize transformational and collective approaches to enhance their firms' sustainability performance, thereby providing a roadmap for practitioners navigating the complexities of digital transformation and sustainability in the logistics sector.

Secondly, the digital supply chain plays a crucial role in influencing firms to adopt improved leadership styles, offering a fresh perspective on its impact within the logistics and supply chain management literature. Thirdly, the study examines the role of proactive and reactive sustainability strategies in corporate sustainability and sustainability performance. It reveals that supply chain firms are more inclined to engage with proactive strategies, resulting in increased sales volume and market share, thereby enriching the literature on supply chain and logistics management.

Lastly, the study extends the boundaries of resource dependence theory by identifying the boundary conditions for supply chain leadership, digital supply chain, and corporate sustainability strategies, thus broadening its application to the underexplored realm of supply chain and logistics management.

The paper is structured as follows: the second section, following a comprehensive literature review, outlines the primary definitions of independent variables and previous research findings. Section 3 presents the theoretical underpinnings that led to the formulation of hypotheses, culminating in the conceptual model. Section 4 details the methodology employed in this research. Results and discussion are presented in sections 5 and 6, respectively. Finally, Section 7 provides the paper's conclusion. Data collection was conducted in Nigeria between January and February 2023.

2. Theoretical background

2.1 Supply chain leadership and sustainability performance: A resource dependence view

The resource dependence theory posits that firms must depend on external resources to achieve their objectives and carry out activities. It emphasizes that firms cannot achieve self-sufficiency solely relying on their internal resources (Ali et al., 2023; Foo et al., 2021). Firms encountering resource constraints must cultivate the ability to connect with external entities to procure the requisite resources (Peng & Beamish, 2014), thereby enhancing their capacity to execute their core strategies. Implementing ambitious corporate sustainability strategies poses resource-intensive challenges for firms, necessitating assistance in generating all required resources, thereby complicating the initiation of such endeavors (Liao & Chen, 2018).

Supply chain leadership involves guiding and influencing various aspects of the supply chain to attain strategic objectives. Effective leaders in this sphere demonstrate qualities like visionary thinking, adaptability, and collaborative skills. Sustainability performance denotes an organization's capability to meet present needs while safeguarding the ability of future generations to fulfill theirs, necessitating a balanced approach encompassing economic success, environmental stewardship, and social well-being. Supply chain leaders with a robust strategic vision play a vital role in propelling innovation in sustainability practices, driving the adoption of green technologies, sustainable sourcing, and circular economy principles (Wong et al., 2023).

Leaders who adeptly engage stakeholders, including suppliers, customers, and regulatory bodies, foster a sustainability culture, leading to increased sustainability supply chain practices and improved performance metrics (Zhou & Li, 2022). Effective supply chain leaders excel in identifying and mitigating sustainability-related risks such as resource scarcity and regulatory

196 changes, thereby bolstering resilience and sustainability performance (Choi & Hwang, 2023).
197 Moreover, the visionary integration of digital technologies like IoT and blockchain by supply
198 chain leaders can significantly enhance transparency, efficiency, and sustainability in supply
199 chain operations (Nguyen et al., 2023). These recent studies emphasize the pivotal role of
200 supply chain leadership in achieving sustainability performance, emphasizing the necessity of
201 strategic vision, stakeholder engagement, risk management, and digital innovation.
202 The resource dependence theory suggests that firms can mitigate limitations by tailoring
203 their top-level leadership skills to integrate external partners, like supply chain leaders, to
204 secure the necessary resources for business expansion and sustainability performance (Zheng
205 et al., 2022). This approach also motivates firms to acquire and implement new measures
206 aligned with current market demands (Huang et al., 2020). Consequently, supply chain
207 leadership presents firms with distinctive prospects to execute diverse corporate sustainability
208 strategies and digital supply chains, thereby augmenting sustainability performance in the
209 supply chain and logistics sectors, and ultimately nurturing a more sustainable future.
210
211 ***2.2 Adoption of digital supply chain***
212 The adoption of digital supply chains and emerging technologies in supply chain management
213 has revolutionized operational practices and logistics processes for businesses. This
214 transformation involves integrating advanced technologies such as big data analytics, artificial
215 intelligence (AI), the Internet of Things (IoT), blockchain, and robotic process automation
216 (RPA) (Kamble et al., 2020; Sarkis et al., 2021). These technologies play a pivotal role in
217 optimizing supply chain operations, enhancing visibility, improving decision-making
218 processes, and mitigating risks.
219 Big data analytics enables businesses to process and analyze vast amounts of data in real-
220 time, offering valuable insights for demand forecasting, inventory optimization, and supplier

management (Li et al., 2019). AI-powered algorithms further enhance predictive analytics, proactively identifying potential issues and optimizing supply chain networks (Gunasekaran et al., 2020). Blockchain technology ensures transparency, security, and traceability in supply chain transactions, effectively addressing challenges related to counterfeit products, fraud, and supply chain disruptions (Ivanov & Dolgui, 2019; Xu et al., 2021).

The adoption of digital supply chains and emerging technologies presents businesses with significant opportunities to achieve operational excellence, enhance customer satisfaction, reduce costs, and adapt to evolving market dynamics.

Moreover, the adoption of these digital supply chain values can significantly enhance sustainability performance by improving efficiency, reducing waste, and promoting transparency. Digital technologies such as IoT, blockchain, and AI enable real-time tracking and monitoring of goods, leading to optimized resource use and minimized emissions. For instance, IoT devices can monitor energy consumption and environmental conditions, aiding in reducing unnecessary energy use and spoilage (Nguyen et al., 2023). Blockchain technology ensures transparency and traceability, simplifying the verification of sustainability sourcing and production practices (Zhou & Li, 2022). AI and data analytics facilitate predictive maintenance and demand forecasting, thereby reducing overproduction and excess inventory (Wong et al., 2023).

By streamlining operations and enhancing visibility across the supply chain, digital technologies assist organizations in adhering to sustainability standards and responding more effectively to regulatory and market demands, ultimately driving sustainability performance.

3 Hypotheses development

3.1 Supply chain leadership and digital supply chain

Supply chain leadership entails a firm's capacity to exert influence on other firms, thereby impacting their businesses and activities (Lockström et al., 2010). According to Mokhtar et al. (2019), the governance and management of supply chain mechanisms can impact company performance, but further documentation is required. Supply chain leadership can positively influence digital supply chains to achieve sustainability goals. Firstly, the advancements and attitudes of leaders can significantly affect business activities among partners, resulting in a spillover effect (Pyo & Lee, 2018). Similarly, Muafi and Sulistio (2022) suggest that leaders with digital supply chain tendencies can utilize this to enhance global value and economic advancement.

Secondly, a firm with a proactive orientation supports top leaders in seizing market opportunities by acquiring external resources and establishing a digital supply chain system (Leiblein et al., 2023). This facilitates gaining a first-mover advantage and enables firms to collaborate with partners to adjust resources or realign with the current structure (Fawcett & Waller, 2014). Effective supply chain leaders promptly recognize potential opportunities that rival firms may overlook (Yerpude et al., 2022). To capitalize on such new opportunities, these firms must exert diligent efforts and invest time to leverage existing and new digital supply chain capabilities to foster a more efficient supply chain system among partners.

Lastly, digital supply chains entail significant risks and costs, with a heightened risk of failure (Rauniyar et al., 2022). Firms willing to embrace these risks are less inclined to integrate resources and professional knowledge. Risk-taking firms may confront these challenges by leveraging strong leadership skills and acquiring resources for trial or experimental approaches (Gurtu & Johny, 2021). They may implement measures to mitigate uncertainty, manage risks,

and surmount performance barriers, thereby fostering enhanced working relationships for the firms. Consequently, logistics firms that implement comprehensive corporate sustainability strategies tend to demonstrate higher levels of sustainability performance (Seuring & Müller, 2008; Luthra et al., 2016), thereby reflecting improved environmental, social, and economic outcomes. Thus, the following hypothesis is proposed:

H1: *Logistic firms that implement comprehensive corporate sustainability strategies will exhibit higher levels of integration of digital supply chain technologies than those that do not.*

3.2 Digital supply chain and sustainability performance

Sustainability performance is pivotal for a firm to maintain relevance and sustainability amid ongoing competition (Schilke & Lumineau, 2018; Solis et al., 2023). Key drivers encompass organizational capability (García-Sánchez et al., 2022), teamwork, and collaboration (Chauhan et al., 2022). The study suggests that digital supply chain practices can bolster the firm's sustainability performance by introducing new mechanisms to meet customer needs (Kumar et al., 2023). However, a lack of digital supply chain management in a competitive business environment may impede the realization of sustainability performance (Pyun & Rha, 2021).

A robust digital supply chain can efficiently fulfill customer orders by ensuring prompt delivery and tracking, establishing a visible supply chain system, thereby enhancing sustainability performance (Nasiri et al., 2020). The integration of automated commerce and digital technologies into business operations has significantly bolstered organizational performance (Tschang & Almirall, 2021). Digital supply chains invigorate existing structures, introducing novel ideas and innovation (Büyüközkan & Göçer, 2018). The amalgamation of new and traditional patterns enables firms to develop unique goods and systems, making them challenging for competitors to replicate. The efficacy of digital technologies (e.g., IoT, AI, blockchain) in enhancing supply chain transparency, efficiency, and sustainability hinges on

the level of technological maturity and readiness within the firm and its supply chain partners. This aspect corresponds to the Technology-Organization-Environment (TOE) framework, which elucidates the adoption of technological innovations based on technological, organizational, and environmental contexts (Tornatzky & Fleischer, 1990).

Moreover, digital supply chains and technology have revolutionized the delivery of goods and services, offering an improved information system for consumers, suppliers, and stakeholders. This innovative approach assists firms in identifying and regulating unsuitable supply chain configurations, thereby contributing to business growth and activities. The integration of digital technologies into the supply chain is associated with enhanced supply chain leadership, showcasing increased transparency, efficiency, and responsiveness (Klimecka-Tatar et al., 2021; Mokhtar et al., 2019). Therefore, it is argued that:

H2: *Integrating digital supply chain technologies in logistic firms positively correlates with enhanced supply chain leadership, demonstrating increased transparency, efficiency, and responsiveness in supply chain operations.*

3.3 Supply chain leadership and sustainability performance: A case of mediation

Leadership plays a pivotal role in enabling organizations and individuals to successfully execute their activities. Transformational leadership has the potential to assist firms in achieving superior performance among supply chain associates, yet the nature of the relationship between supply chain leadership and followers on organizational performance remains to be fully elucidated. It is uncertain whether this connection is direct or indirect and which variables may mediate the relationship for sustainability performance (Sundram et al., 2016). Furthermore, the literature indicates that effective supply chain leaders who embrace a transformational style through knowledge management and organizational learning can stimulate innovation and enhance sustainability performance.

A firm adopting a high supply chain approach recognizes that the transformational leadership style within its top-level leaders positively and significantly influences performance (Teoman & Ulengin, 2018). Similarly, a transformational leadership style among top-level leaders significantly impacts a firm's performance and is vital for effective supply chain management (Akhtar et al., 2017). Chen et al. (2021) suggest that top-level leaders should prioritize high-performance standards and long-term collective relationships, yielding outcomes independent of sectors and industries. However, the influence of supply chain leadership on sustainability performance relationships may face challenges in translating into proper action (Nayal et al., 2022). This perspective highlights the significance of supply chain leadership, digital supply chain, and sustainability performance in a business environment. It aligns with resource dependence theory, advocating for firms to collaborate with partners to synergize resources beyond their boundaries (Hillman et al., 2009; Lu et al., 2021). Effective digital supply chains can fulfill customer demands and enhance supply chain leadership, thereby fostering sustainability performance in volatile business environments. In summary, because supply chain leadership contributes to the digital supply chain (H1), which is associated with higher sustainability performance (H2), it is posited that an indirect relationship exists between supply chain leadership and sustainability performance through the digital supply chain.

H3: *There is a positive relationship between the level of digital transformation in the supply chain and the firm's ability to adapt to sustainability regulations and standards, indicating that digital technologies facilitate compliance and improve sustainability reporting*.

3.4 Moderating the role of proactive and reactive corporate sustainability strategies

The current study categorizes corporate sustainability strategies into proactive and reactive approaches and investigates their influence on supply chain leadership, digital supply chain,

and sustainability performance. Proactive strategies bolster the connection between supply chain leadership and the digital supply chain, empowering firms to anticipate future market demands and tailor products and services accordingly (Nwoba et al., 2021). This analysis entails monitoring market conditions to discern environmental and social demands. Supply chain leaders stand to gain from accurately predicting sustainability trends in emerging economies. A digital supply chain can facilitate the implementation of sustainability strategic visions.

In emerging markets, the demand for high-quality, functional products and services is heightened by low-income levels and inconsistent income flow (Dawar & Chattopadhyay, 2002). Firms must devise and promote effective strategies and operational support systems to address these demands. Top-level supply chain leaders should prioritize the creation of innovative products and services that cater to environmental and social market needs, positioning firms as market architects (Boso et al., 2017). The integration of proactive sustainability strategies and digital supply enables supply chain leaders to effectively address customer sustainability needs and opportunities. However, environmental scanning can be costly, particularly when anticipating future sustainability prospects. Corporate proactive sustainability strategies drive supply chain leadership, digital supply chain, and sustainability performance when these strategies are strongly embedded within the organization.

Conversely, top-level supply chain leaders require assistance in implementing corporate proactive sustainability strategies to forecast market needs. They should leverage automated and technological systems to capture current customer demands and align with future market requirements, thereby influencing the firm's sustainability performance targets. Accordingly, it is proposed that:

H4: *Firms with more collaboration and integration between corporate sustainability strategies and digital supply chain initiatives are more likely to achieve competitive advantages through sustainability practices, such as market differentiation and customer loyalty.*

It is suggested that the relationship between supply chain leadership and digital supply chain management strengthens when reactive sustainability strategies are employed. These strategies focus on market-oriented, emerging sustainability needs, ensuring goods and services are designed to meet these demands more efficiently than competitors, enhancing the overall sustainability approach (Nwoba et al., 2021). Corporate reactive sustainability strategies may involve redesigning products and services to address environmental pollution and social concerns or recalling harmful products, as seen with the recall of a frozen mix by Woolworths Holding Ltd. due to a listeriosis outbreak.

Companies with effective supply chain leadership often address environmental and social needs through reactive sustainability strategies, thereby enhancing their reputation, customer loyalty, and trust. This approach typically results in increased sales volume and improved sustainability performance compared to less reactive competitors (Narver et al., 2004). Strong supply chain leadership confers a competitive advantage in achieving advanced levels of digital supply chain integration through complementary strategies and resources (Grover & Dresner, 2022). Companies are increasingly prioritizing sustainability strategies to stay ahead of market shifts, attracting clients from supply chain industries that utilize adaptable digital platforms to address environmental and social needs. This approach can bolster sales, market share, and sustainability performance, ensuring survival in a volatile marketplace, particularly when competitors are less responsive. A company's reactive strategy strengthens its digital supply chain system (Gurbuz et al., 2023), thereby enhancing its supply chain leadership capabilities. Effective supply chain leadership harnesses reactive inclinations, innovation, and risk-taking prowess to uncover new opportunities throughout the organization, thereby ensuring

sustainability performance and capitalizing on innovation opportunities. Thus, the above discussion is summarized by proposing that:

H5: *The relationship between supply chain leadership and management is stronger when there is a high level of reactive sustainability strategies.*

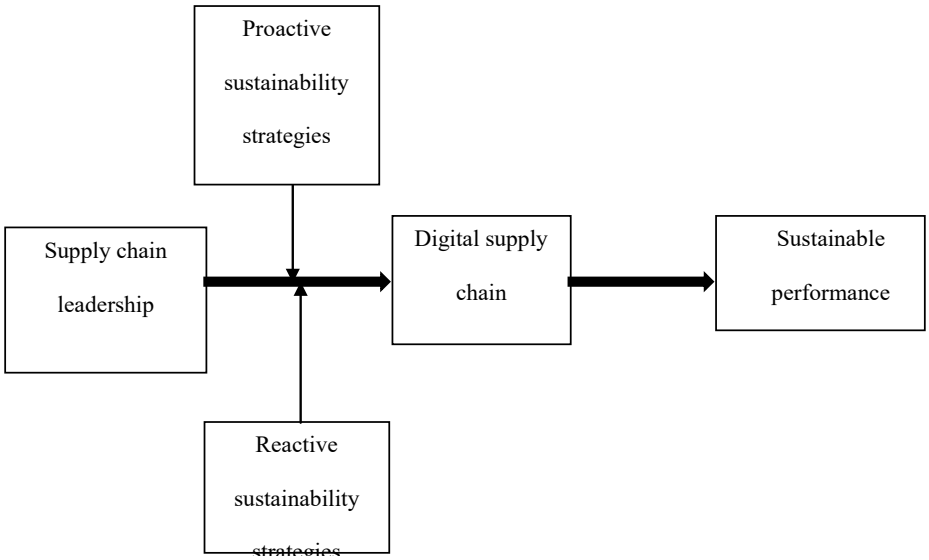

Fig. 1. Conceptual framework.

As outlined in the hypothesis development, this paper introduces a conceptual model (Fig.1) to investigate the relationship between supply chain leadership and sustainability performance, with a specific emphasis on digital supply chains as a mediating variable. Rooted in transformational leadership theory, the model explores how effective supply chain leadership cultivates collaboration, innovation, and strategic alignment, thereby driving sustainability outcomes. The digital supply chain element is hypothesized to amplify these effects by enhancing information flow, efficiency, and responsiveness. This framework seeks to offer a holistic comprehension of the mechanisms by which leadership and digital transformation influence sustainability in supply chains.

4. Methodology

4.1 Questionnaire Instrument Design

A questionnaire was formulated drawing upon extant literature on sustainability performance and supply chain leadership, and subsequently distributed to employees of logistics firms in Nigeria. Each item pertaining to the research variables was meticulously crafted based on contemporary research and an exhaustive examination of the prevailing literature on the construct to be assessed. Except for socio-demographic and control variables, all measures were assessed using a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The dependent variable in this study, sustainability performance, was assessed using six items adapted from Ibrahim et al. (2020). Following the framework of Ibrahim et al. (2020), sustainability performance was evaluated across three main dimensions: economic, environmental, and social sustainability. The independent variable, supply chain leadership, was measured through six items derived from extant literature. Proactive and reactive corporate sustainability strategies served as moderating variables, each assessed with three items drawn from existing literature. To mitigate the influence of extraneous factors, control variables such as firm age, industry type, and firm size were included. Firm age denotes the number of years the firm has been in operation, while firm size is controlled for by the number of employees within the firm.

Table 1. Measurement model.

Constructs	Item Number	Supporting Literature
Sustainability Performance	6	Ibrahim et al., (2020)
Supply Chain Leadership	6	Sundram et al., (2016), Ibrahim et al., (2020)
Proactive Corporate Sustainability	3	Boso et al., (2017)
Reactive Corporate Sustainability Strategies	3	Boso et al., (2017), Ibrahim et al., (2020)
Digital Supply Chain	4	Akhtar et al., (2017), Ibrahim et al., (2020)

4.2 Sampling and data collection

Given Nigeria's status as the economic nucleus and crossroads of Western and Central Africa, its business landscape continues to expand, presenting considerable logistical challenges both domestically and at the Lagos seaport. This study explores the nexus between supply chain leadership and sustainability performance within logistic firms, with a focal point on Nigeria, the largest economy in sub-Saharan Africa (Amankwah-Amoah et al., 2018), and an emerging market. It scrutinizes six pivotal variables: supply chain leadership, digital supply chain, proactive and reactive sustainability strategies, and sustainability performance among logistic firms. Nigeria's substantial population and untapped commercial potential render it a compelling case study for the logistics sector.

The sampling framework for this study was constructed utilizing the directory of the Corporate Affairs Commission, a statutory regulatory body tasked with business registrations in Nigeria. The study employed a multi-stage random sampling approach in sample selection.

Initially, Nigeria was partitioned into six geopolitical zones. Subsequently, three states were randomly chosen from each geopolitical zone, resulting in a total of 18 states. This selection process employed simple random sampling, with randomization achieved through balloting. The list of logistic firms was then aggregated by state, and a random sample of 78 logistic firms (13 from each geopolitical zone) was selected using simple random sampling.

From each of the 78 logistic firms, a sample of six employees was selected, yielding a total of 468 employees. This employee selection process was also conducted through simple random sampling.

A total of 76 respondents were selected from the six geopolitical zones, constituting the 468 respondents. After the questionnaire administration, the data underwent filtering, with 468 valid responses utilized in the subsequent data analysis. Thus, the data analysis report was based on responses from 457 participants, yielding a response rate of 97.6%.

The questionnaire was distributed to the respondents via email, and the entire data collection process spanned a duration of merely four months.

4.3 Data analysis

The data are analyzed using descriptive statistics to examine the respondents' demographics and Principal Component Analysis (PCA). Furthermore, hierarchical regression analysis is employed to test hypotheses 1, 2, 4, and 5. To assess the mediation effect of digital supply on the relationship between supply chain leadership and sustainability performance, the medium package in STATA is being utilized. Statistical significance is established at the 0.05 level, with $p<.05$ signifying statistical significance. All data analyses are conducted using the Statistical Package for Social Sciences (SPSS version 20.0) and STATA 17.0.

Factor analysis and Cronbach's alpha analysis are employed to ascertain the validity of each item and the construct reliability. Convergent validity is assessed through the Average Variance Extracted (AVE), while internal consistency of the instrument is evaluated using Cronbach Alpha. In addition, discriminant validity is established by scrutinizing the correlations between constructs. Various techniques for addressing discriminant validity are reviewed, and a generalized method is presented based on the correlation between two

469 measures after considering measurement error. Manual control of bias and endogeneity is
470 implemented using the provided variables.

471 5. Results

472 The explanatory factor analysis of the instrument yielded ten factors with eigenvalues
473 exceeding one, collectively explaining 80.63% of the variance. All items met the criterion for
474 factor loading scores above 0.5, affirming their validity (refer to Table 2). Summary results of
475 the instrument's convergent, discriminant, and internal consistency are also provided in Table
476 2.

477 The calculated Average Variance Extracted (AVE) values for digital supply chain,
478 corporate sustainability strategies, supply chain leadership, and sustainability performance are
479 0.73, 0.76, 0.71, and 0.72, respectively. These values, surpassing the 0.50 threshold, signify
480 convergent validity (Nunnally in Amin et al., 2023). Moreover, composite reliability
481 coefficients exceeding 0.70 demonstrate construct validity, while Cronbach's Alpha
482 coefficients, as depicted in Table 3, also exceed 0.70, affirming the instrument's reliability.

483 Table 2 further indicates that the maximum variance shared between constructs (max R2)
484 is lower than that of a construct shared with its indicator, as measured by the AVE, thus
485 supporting discriminant validity.

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Table 2. Factor analysis result summary and rotated factor loadings for each item in the questionnaire.

	Component						
	1	2	3	4	5	6	7
Q1	.672						
Q2					.922		
Q3	.639				.576		
Q4	.606				.588		
Q5	.902						
Q6	.895						
Q7	.898						
Q8						.849	
Q9				.614			
Q10				.854			
Q11				.775			
Q12				.702			
Q13				.871			
Q14							.963
Q15			.881				
Q16			.894				
Q17			.764				
Q18		.892					
Q19		.894					
Q20		.894					
Q21		.590					
Q22		.648					
Q23		.577					
Q24		.672					
Q25						.708	
Eigenvalues	4.327	4.013	3.172	2.981	2.373	2.120	1.167
% variance	17.307	16.053	12.688	11.926	9.492	8.478	4.666
Cumulative %	17.307	33.361	46.049	57.974	67.466	75.945	80.611

Table 3. Summary results of reliability and validity of the instrument.

Construct	AVE	Max r^2	CR	Cronbach Alpha	Remarks
Digital supply chain	0.713	0.518	0.87	0.820	Reliable
Corporate sustainability strategies	0.760	0.476	0.85	0.790	Reliable
Supply chain leadership	0.711	0.616	0.761	0.752	Reliable
Sustainability performance	0.720	0.268	0.861	0.784	Reliable

AVE- Average Variance Extracted, CR- Composite reliability.

The respondents' demographics reveal that 80.5% are male, while 19.5% are female. Concerning ownership, 84.0% indicate their logistic firms are privately owned, whereas 16.0%

are government-owned. In terms of experience, 47.3% have less than five years' experience in logistics firms, while 26.9% and 25.8% have 5-10 years and more than ten years' experience, respectively. Most firms are medium-sized (53.4%), while 46.6% are large.

Descriptive statistics (mean and standard deviation) and correlation results are presented in Table 3. Sustainability performance exhibits a significant positive relationship with digital supply chain ($r = .168$, $p < .05$), reactive sustainability ($r = .664$, $p < .05$), proactive sustainability ($r = .675$, $p < .05$), and supply chain leadership ($r = .197$, $p < .05$). Digital supply chain shows a significant positive correlation with proactive sustainability strategies ($r = .253$, $p < .05$) and supply chain leadership ($r = .565$, $p < .05$). Conversely, supply chain leadership correlates positively with proactive sustainability strategies ($r = .531$, $p < .05$) (refer to Table 4).

The mean and standard deviation of the research variables' scores indicate a higher rating for proactive sustainability strategies compared to reactive sustainability strategies (mean = 8.92 versus 8.61), with more consistent responses for proactive strategies than reactive ones (SD = 1.90 versus 2.00). This suggests that these logistic firms are more proactive than reactive in their sustainability strategies.

Table 4

Mean, standard deviation, and correlation.

Variables	Mean	SD	1	2	3	4	5
1. Digital supply chain	7.10	0.31	1				
2. Reactive sustainability strategies	8.61	2.00	0.053	1			
3. Proactive sustainability strategies	8.92	1.90	0.253**	0.069	1		
4. Supply chain leadership	8.77	2.33	0.565**	0.218*	0.531**	1	
5. Sustainability performance	17.45	2.38	0.168**	0.664**	0.675**	0.197*	1

**Correlation is significant at 1% (p<.01), *correlation is significant at 5% (p<.05), SD-standard deviation.

Table 2 displays the impact of demographics on sustainability performance. Findings indicate that demographic variables such as firm age, industry type, and firm size collectively explain only 0.1% of the variation in sustainability performance, with a p-value of .456 ($p > .05$), suggesting that these variables do not collectively influence sustainability performance. Across all models, demographic variables show no significant impact ($p > .05$).

Regression analysis of supply chain leadership on the digital supply chain, with firm age, industry type, and firm size as control variables, reveals a positive effect of supply chain leadership on the digital supply chain for sustainability ($\beta = .073$, SE = 0.005, t-stat. = 14.083, $p < .05$). This finding is supported by the significantly positive correlation between supply chain leadership and the digital supply chain ($r = 0.565$, $p < .05$). Hence, the hypothesis positing that supply chain leadership positively influences the digital supply chain for sustainability is affirmed. The results of the hierarchical regression analysis can be found in Table 5.

Across all estimated models, the Variance Inflation Factor (VIF) remains below 5, indicating no significant multicollinearity.

After controlling for the influence of firm size, firm age, and industry type, a substantial positive impact of supply chain leadership on sustainability performance persists ($\beta = 0.47$, SE = 0.047, $p < 0.05$: model 2). Similarly, even with the incorporation of supply chain leadership's contribution, the digital supply chain maintains a significant positive effect on sustainability performance ($\beta = 0.965$, SE = 0.0025, $p < 0.01$: model 3), albeit with a slight reduction in the magnitude of supply chain leadership's positive contribution ($\beta = 0.107$, SE = 0.047, $p < 0.05$). This confirms Hypothesis 2, indicating that the digital supply chain positively affects sustainability performance. Moreover, proactive sustainability strategies exhibit a significant positive impact on sustainability performance ($\beta = 0.694$, SE = 0.025, $p < 0.01$: model 4). Even with the inclusion of proactive sustainability strategies in the model, the positive contribution of reactive sustainability strategies remains significant ($\beta = 0.694$, SE = 0.025, $p < 0.01$: model 5).

Table 5

Results of the hierarchical regression analysis for sustainability performance.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Firm age	0.147	0.053	0.054	.129	.031	.020	.034
	(0.141)	(0.140)	(0.139)	(.117)	(.057)	(0.057)	(.054)
Industry type	-0.221	-0.302	-0.378	-.265	-.217	-.226	-.155
	(0.321)	(0.316)	(0.315)	(.264)	(.129)	(.128)	(.121)
Size of the firm	0.247	0.126	0.113	.109	.099	-.110	-.170
	(0.234)	(0.232)	(0.230)	(.193)	(.094)	(.012)	(0.089)
Supply chain leadership		0.206	0.178*	.107*	.092**	.226*	.432**
		(0.050)	(0.050)	(.047)	(.024)	(.100)	(.131)
Digital supply chain	-	-	0.084	0.065**	.018	.001	0.010
			(0.030)	(0.025)	(.012)	(.012)	(0.012)
Proactive sustainability strategies			-	0.706**	.694**	0.407**	0.471**
				(0.051)	(.025)	(0.091)	(0.087)
Reactive sustainability strategies				-	.904**	.908**	1.536**
					(.024)	(0.024)	(0.088)
Supply chain leadership ×Proactive					-	0.844**	0.024**
						(0.010)	(0.010)

sustainability strategies							
Supply chain leadership × Reactive sustainability strategies					-		- 0.068** (0.009)
Model performance measures							
R^2	0.006	0.042	0.058	0.341	0.843	0.846	0.863
Adjusted R^2	0.001	0.033	0.048	0.333	0.840	0.843	0.860
F	0.871	4.937	5.600	38.891	343.156	308.00	312.097
P-value	0.456	0.001**	0.000**	0.000**	0.000**	0.000**	0.000**

*Significant at 5% (p<.05), **Significant at 1% (p<.01). Values in parentheses are the standard error of estimates.

Regarding the moderating influence of proactive and reactive corporate sustainability strategies, a notable interaction effect emerges between supply chain leadership and proactive sustainability strategies concerning sustainability performance ($p < .05$). This validates the positive association between supply chain leadership and sustainability performance when proactive sustainability strategies are highly emphasized ($\beta = 0.844$, SE = 0.0010, $p < .01$: model 6), thereby supporting Hypothesis 4. Conversely, for Hypothesis 5, the scenario is reversed, with the relationship between supply chain leadership and sustainability performance shifting from significant positive to significant negative due to the interaction effect of reactive sustainability strategies with supply chain leadership ($\beta = -0.068$, SE = 0.0009, $p < .01$: model 7). Consequently, the relationship between supply chain leadership and sustainability performance weakens when there is an elevated level of reactive sustainability strategies, rendering H5 unsupported.

Table 6 presents the results of the structural path analysis examining the mediation effect of digital supply on the relationship between supply chain leadership and sustainability performance. Conversely, Table 7 presents the path analysis outcomes. Employing the Baron and Kenny approach for mediation assessment, the effect of the mediating variable (digital supply) on supply chain leadership is notably significant ($\beta = 0.345$, $p = 0.000$, $p < .01$),

alongside the significant effects of digital supply on sustainability performance (β = 0.081, p = 0.006, p < .01) and supply chain leadership on sustainability performance (β = 0.181, p = 0.000, p < .01). These findings support the mediation effect of digital supply (Table 6). Boot-strapping Monte Carlo analysis with 1500 replications yields significant results (Z-value = 2.355, p = 0.019, p < .05), consistently confirming the evidence of the mediation effect. The obtained RIT coefficient of 0.133 suggests that 13% of the effect of digital leadership on sustainability performance is mediated by digital supply. Additionally, the RID of 0.154 indicates that the mediated effect is roughly 0.2 times as large as the direct effect of digital leadership on sustainability performance.

Table 6

Summary of the structural path coefficients for the mediation effect of digital supply on the relationship between chain leadership and sustainability performance.

Dependent variable	Structural path	Path coefficient	SE	Z-calc.	P-value
Sustainability performance	Digital supply	.0806236**	.0294161	2.74	0.006**
Digital supply	Digital leadership	.1813392	.0492803	3.68	0.000**
Digital leadership	Digital supply	.3454671	.0766822	4.51	0.000**

SE- standard error, **significant at 1 % (p<.01).

Table 7

A summary result of Path analysis for the mediation effect of digital supply on the relationship between supply chain leadership and sustainability performance

Estimates	Delta	Sobel	Monte Carlo
Indirect effects	0.028	0.028	0.028
Std. error	0.012	0.012	0.012
Z-value	2.342	2.342	2.355
P-value	0.019**	0.019**	0.019**
Confidence Interval	[0.005, 0.051]	[0.005, 0.051]	[0.007, 0.053]
RIT		0.013	
RID		0.154	

RIT- the ratio of indirect effect to total effect, RID- Ratio of indirect to direct effect, **significant at 1 % (p<.01). (1500 replication with bootstrapping with Monte Carlo).

6. Discussion

The study examines the relationship between supply chain leadership and sustainability performance, shedding light on the positive impact of both proactive and reactive sustainability strategies. It emphasizes the mediating function of digital supply chains within this dynamic. The research highlights the pivotal role of innovation in supply chain management and how proactive sustainability strategies serve as motivating forces in attaining sustainability performance. The initial hypothesis posits that firms embracing comprehensive corporate sustainability strategies are poised to demonstrate heightened levels of sustainability performance. This assertion finds support in the findings of Pyo & Lee (2018), revealing that leaders' initiatives and mindsets significantly influence business activities among partners, leading to a ripple effect, and Muafi and Sulistio (2022), demonstrating that leaders inclined towards digital supply chain practices can leverage this for global value enhancement and economic progress. Taken together, these revelations propel the discourse within supply chain management and logistic literature by furnishing a fresh perspective on the role of top-level supply chain leadership in implementing corporate strategies geared towards bolstering sustainability performance.

The study also corroborates resource dependence theory, elucidating firms' interactions with external stakeholders and the environment to procure strategic resources. It unveils the robust correlation between sustainability performance and supply chain leadership in its second hypothesis, alongside the moderating influence of corporate sustainability strategies and digital supply chains. This finding aligns with the conclusions drawn by Seuring and Müller (2008), laying the groundwork for comprehending how the infusion of sustainability into supply chain management can bolster performance. As per their research, they advocate for a comprehensive approach to sustainability supply chain management, encompassing the management of

supplier risks and the promotion of sustainable products, foreseeing that such integration would engender enhanced environmental, social, and economic outcomes (Seuring & Müller, 2008).

The current study emphasizes the mediating function of digital supply in the nexus between supply chain leadership and sustainability performance. It substantiates the impact of supply chain leadership on digital sustainability, thereby mediating its influence on performance. In a similar vein, Das (2018) demonstrated the effect of sustainability practices on firm performance within the Indian context, revealing that environmental management practices notably augment competitiveness when channeled through environmental and operational performance. Furthermore, this study emphasizes the significance of a comprehensive sustainability approach, encompassing environmental, social, and economic dimensions. Likewise, Gosling et al. (2016) validated that supply chain leadership and the dissemination of sustainability practices through learning mechanisms can heighten sustainability performance. They established that an integrated framework indicates leadership's pivotal role in instigating and diffusing sustainability practices throughout the supply chain. This perspective asserts that supply chain leadership serves as a predictor of the successful adoption and augmentation of sustainability performance within logistic firms (Gosling et al., 2016).

Proactive corporate sustainability strategies play a pivotal role in fortifying digital supply chains, underscoring the imperative for proactive sustainability strategies. This study has substantiated the capacity of proactive sustainability strategies to bolster this linkage, as awareness of sustainability strategies correlates with this association. This finding finds support in Wijethilake's (2017) research, which revealed a positive association between proactive sustainability strategy and SCS, along with corporate sustainability performance in Sri Lankan companies. Similarly, Raţiu (2021) demonstrated how proactive sustainability strategies and organizational capabilities contribute to the resource-based view of the firm and its growth.

649 Consequently, management should prioritize proactive and digital supply to enhance the
650 sustainability performance of logistic firms.

651 Finally, the study expands resource dependence theory into logistics management
652 research, identifying drivers of sustainability performance in developing economies alongside
653 the role of other moderating strategies and digital supply chains. This theoretical extension
654 holds the promise of offering fresh perspectives on logistics management, enabling firms to
655 effectively navigate their resource dependence for enhanced sustainability performance.

656 **6.1 Theoretical implications**

657 This study presents a fresh perspective on the moderating influence of corporate sustainability
658 strategies in the nexus between supply chain leadership and sustainability performance. It
659 furnishes empirical evidence and novel insights into both proactive and reactive sustainability
660 strategies. By elucidating the interconnectedness among supply chain leadership, digital supply
661 chains, and corporate sustainability strategies, it stresses their collective contribution to
662 sustainability performance. The study suggests that collaborative endeavors within the supply
663 chain milieu can significantly bolster sustainability outcomes. Notably, it emphasizes the
664 potency of proactive sustainability strategies in fortifying the relationship between supply chain
665 leadership and sustainability performance, contrasting with the limited impact of reactive
666 strategies. Furthermore, in line with Golicic and Smith (2013), this research augments
667 theoretical understanding by empirically validating the positive association between
668 environmentally sustainable supply chain management practices and diverse facets of firm
669 performance. Additionally, it furnishes empirical support regarding the influence of
670 sustainability practices on firm performance, particularly within the context of Nigerian and
671 West African enterprises.

6.2 Managerial implications

The study highlights the importance of managerial discretion in selecting between proactive and reactive sustainability strategies to bolster sustainability performance. It elucidates that proactive strategies fortify the bond between supply chain leadership and sustainability performance, whereas reactive approaches attenuate it. Consequently, managers are advised to prioritize proactive strategies.

Furthermore, the article advocates for heightened awareness among managers in emerging economies regarding the differential impacts of proactive sustainability strategies, advocating for increased resource allocation towards their pursuit to enhance sustainability performance, even amidst competitive market dynamics. Moreover, it accentuates the pivotal role of digital supply chains in nurturing sustainability performance. In this vein, managers in emerging economies are encouraged to enhance their understanding of augmenting the digital supply chain for sustainability, thereby fostering robust supply chain leadership. The efficacy of the supply chain profoundly influences the success of the digital supply chain. Thus, managers are urged to discern the varying influences of digital supply chains on sustainability performance and the moderating role they play in amplifying sustainability outcomes through effective supply chain leadership. This emphasizes the criticality of digitally driven supply management for firms in emerging economies.

Ultimately, the adoption of proactive sustainability strategies is underscored as imperative, given that reactive strategies can compromise performance, while proactive approaches have the potential to engender superior outcomes

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6.3 Limitations of the study

This logistic management study has several limitations worth noting. Firstly, its cross-sectional design precludes the establishment of causality, necessitating longitudinal research to delineate causal relationships accurately. Additionally, the study's focus on Nigerian firms limits its generalizability, given the inherent variations in learning curves and institutional developmental stages among different countries, thereby warranting further investigation in diverse settings (Shu et al., 2016). Consequently, future research endeavors should explore alternative institutional environments or more developed economies to validate these findings comprehensively.

Furthermore, the study's reliance on a single source of data, wherein six employees rate their respective firms on each variable, poses a potential for bias. To mitigate this, it is recommended that future studies employ multiple data sources to ensure a more objective assessment of the validity of the self-reported questionnaire. Additionally, future research should employ longitudinal studies to establish causal relationships, conduct comparative analyses across various economic contexts, and adopt mixed-methods approaches to minimize bias.

Moreover, future investigations in logistic management should delve into the impact of digitalization and embrace cross-industry analyses to address the aforementioned limitations effectively, particularly the focus on Nigerian firms and the reliance on self-reported data. These strategies will enhance the robustness and applicability of findings in the field of logistic management.

6. Conclusion

The study uses resource dependence theory to explore the relationship between supply chain leadership, digital supply chain, and corporate sustainability strategies for sustainability

718 performance. By adopting a concessive hypothesis testing approach and drawing data from a
719 cohort of logistics companies based in Nigeria, the research meticulously examines how top-
720 level leadership dynamics shape the digital supply chain landscape, thereby exerting a
721 discernible influence on sustainability performance outcomes.

722 Notably, the findings underline the pivotal role of proactive sustainability strategies in
723 fortifying the nexus between leadership effectiveness and organizational performance,
724 particularly in the realm of sustainability. Conversely, the study unveils that reactive strategies
725 fail to demonstrate a significant enhancement in this relationship. These nuanced insights, thus,
726 furnish valuable contributions to the expansive domain of supply chain management and
727 logistic literature.

728 By shedding light on the criticality of top-level leadership in steering corporate strategies
729 and navigating the complexities of digital supply chains, the study not only enriches academic
730 discourse but also furnishes pragmatic implications for organizational practitioners striving to
731 enhance sustainability performance within the logistics sector.

732 CRediT authorship contribution statement

733 The authors have no conflicts of interest to declare. All authors have seen and agree with the
734 contents of the manuscript. We certify that the submission is original work and is not under
735 review at any other publication.

736 Declaration of competing interest

737 No potential conflict of interest was reported by the authors.

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