Evaluating the Interplay of Green Absorptive Capacity, Digitalization, and Sustainable Sourcing Practices among Agribusiness SMEs

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Abstract

Agribusiness small and medium-sized enterprises (SMEs) in resource-constrained environments face persistent challenges in maintaining supply chain resilience due to infrastructure deficits, limited access to finance, and volatile market conditions. This study investigates the interplay between green absorptive capacity, digitalization, and sustainable sourcing practices in building supply chain resilience among agribusiness SMEs in Nigeria. A quantitative research design was employed, utilizing partial least squares structural equation modeling (PLS-SEM) to analyze data from 412 agribusiness SMEs. The findings reveal that green absorptive capacity significantly mediates the relationship between sustainable sourcing practices and supply chain resilience ($\beta = 0.342$, $p < 0.001$), while digitalization moderates this relationship, with the model achieving 89.4% predictive accuracy. The study contributes a validated framework that integrates dynamic capabilities theory with natural resource-based view, offering practical implications for SME managers, policymakers, and development agencies seeking to enhance supply chain resilience in emerging economies.

Keywords: supply chain resilience, green absorptive capacity, digitalization, sustainable sourcing, agribusiness SMEs

1. Introduction

1.1 Background

The global agribusiness sector faces unprecedented pressures from climate change, resource scarcity, and market volatility, with small and medium-sized enterprises (SMEs) in developing economies bearing disproportionate burdens (Okeke, 2024). Supply chain resilience—defined as the capacity of a supply chain to anticipate, absorb, adapt to, and recover from disruptions—has emerged as a critical strategic imperative for organizational survival and growth. In resource-constrained environments, characterized by inadequate infrastructure, limited financial access, and institutional voids, agribusiness SMEs must navigate unique challenges that differ substantially from those faced by larger corporations in developed economies.

Green absorptive capacity, conceptualized as the organizational capability to acquire, assimilate, transform, and exploit external green knowledge, has been identified as a critical enabler of sustainable supply chain practices. Simultaneously, digitalization—encompassing the adoption of digital technologies for supply chain coordination and decision-making—offers potential pathways for enhancing resilience through improved visibility, forecasting, and responsiveness. Sustainable sourcing practices, including supplier selection based on environmental criteria and collaborative sustainability initiatives, represent proactive strategies that may contribute to both environmental performance and supply chain robustness.

1.2 Problem Statement

Despite growing scholarly attention to supply chain resilience, significant gaps persist in understanding how agribusiness SMEs in resource-constrained environments can effectively build resilience capabilities. Existing research has predominantly focused on large multinational corporations in developed economies, with limited attention to the unique constraints and opportunities facing SMEs in emerging markets. Furthermore, while individual studies have examined green absorptive capacity, digitalization, and sustainable sourcing practices in isolation, no validated framework exists that models their combined and interactive effects on supply chain resilience specifically for resource-constrained agribusiness contexts.

Previous attempts to address SME supply chain resilience have largely employed descriptive approaches or single-variable analyses, failing to capture the complex interdependencies among organizational capabilities, technological adoption, and sustainable practices. Studies by Okeke (2026) have highlighted the importance of digitalization and ESG considerations in supply chain decarbonization, yet the mechanisms through which these factors interact with absorptive capacity in resource-constrained settings remain underexplored. Consequently, SME managers and policymakers lack evidence-based guidance for prioritizing investments and interventions to enhance resilience.

1.3 Objectives of the Study

General objective: To develop and validate a comprehensive framework explaining how green absorptive capacity, digitalization, and sustainable sourcing practices interact to build supply chain resilience among agribusiness SMEs in resource-constrained environments.

Specific objectives:

1. To examine the direct effects of sustainable sourcing practices on supply chain resilience among agribusiness SMEs.
2. To assess the mediating role of green absorptive capacity in the relationship between sustainable sourcing practices and supply chain resilience.
3. To evaluate the moderating effect of digitalization on the relationship between green absorptive capacity and supply chain resilience.

1.4 Research Questions

1. What is the relationship between sustainable sourcing practices and supply chain resilience among agribusiness SMEs in resource-constrained environments?
2. How does green absorptive capacity mediate the relationship between sustainable sourcing practices and supply chain resilience?
3. To what extent does digitalization moderate the relationship between green absorptive capacity and supply chain resilience?

1.5 Significance of the Study

For practitioners: This study provides agribusiness SME managers with evidence-based guidance for prioritizing capability development and resource allocation to enhance supply chain resilience. The findings offer actionable insights for developing green absorptive capacity and implementing digitalization strategies tailored to resource-constrained contexts.

For policymakers: The research informs policy design by identifying critical enablers and barriers to SME supply chain resilience, supporting the development of targeted interventions in areas such as digital infrastructure, green technology adoption, and supplier development programs.

For academic literature: The study advances theoretical understanding by integrating dynamic capabilities theory and the natural resource-based view to explain resilience-building mechanisms in under-researched SME contexts, contributing to supply chain management, sustainability, and SME literature.

For future researchers: The validated framework provides a foundation for further investigation into resilience mechanisms across different sectors, geographies, and institutional contexts.

1.6 Scope and Limitations

This study focuses on agribusiness SMEs operating in Nigeria, specifically those involved in agricultural production, processing, and distribution. The research is bounded by the following parameters: (a) geographic scope limited to Nigeria; (b) organizational focus on SMEs with 10-250 employees; (c) sectoral concentration on agribusiness; and (d) temporal scope covering 2024-2025 data collection period.

Key limitations include: the cross-sectional design limiting causal inference; reliance on self-reported measures potentially introducing common method bias; and the specific Nigerian context limiting generalizability to other resource-constrained environments. These limitations are addressed through appropriate methodological safeguards and discussed in detail in the limitations section.

2. Literature Review

2.1 Conceptual Review

Supply Chain Resilience: Supply chain resilience refers to the adaptive capability of a supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations (Okeke, 2024). In resource-constrained environments, resilience assumes heightened importance due to limited buffers and heightened vulnerability to external shocks.

Green Absorptive Capacity: Building on Cohen and Levinthal's absorptive capacity concept, green absorptive capacity represents an organization's ability to recognize the value of new green knowledge, assimilate it, and apply it to commercial ends. This capability encompasses four dimensions: acquisition, assimilation, transformation, and exploitation of green knowledge.

Digitalization: Digitalization in supply chain contexts refers to the adoption and integration of digital technologies—including cloud computing, Internet of Things, blockchain, and analytics—to enhance visibility, coordination, and decision-making. For resource-constrained SMEs, digitalization offers opportunities to overcome traditional infrastructure limitations (Okeke, 2026).

Sustainable Sourcing Practices: These encompass supplier selection based on environmental and social criteria, collaborative sustainability initiatives with suppliers, and integration of sustainability requirements into procurement processes.

2.2 Theoretical Framework

This study integrates two complementary theoretical perspectives:

Dynamic Capabilities Theory: Dynamic capabilities theory posits that organizations develop capabilities to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. In the context of this study, green absorptive capacity and digitalization represent dynamic capabilities that enable SMEs to sense and seize opportunities for building supply chain resilience.

Natural Resource-Based View: The natural resource-based view extends the traditional resource-based view by incorporating environmental considerations, suggesting that firms can achieve competitive advantage through environmentally sustainable practices. Sustainable sourcing practices represent strategic resources that may contribute to resilience through enhanced supplier relationships and reduced environmental risks.

2.3 Empirical Review

Okeke (2024) examined sustainable practices and supply chain management effectiveness in African SMEs, finding that sustainable practices positively influenced supply chain performance. However, the study did not examine resilience specifically or the mediating mechanisms through which sustainability practices affect outcomes.

Okeke (2026) investigated decarbonization in emerging economy supply chains, demonstrating that digitalization and ESG considerations interact to influence sustainability outcomes. The study focused on large corporations, leaving SME-specific dynamics unexplored.

Prior research on green absorptive capacity has established its role in environmental innovation and performance but has not examined its potential mediating role in resilience building. Similarly, digitalization literature has documented positive effects on supply chain performance but has not evaluated its moderating role in resilience contexts.

2.4 Research Gap

No validated framework exists that specifically models the combined and interactive effects of green absorptive capacity, digitalization, and sustainable sourcing practices on supply chain resilience among agribusiness SMEs in resource-constrained environments. This study fills this gap by developing and empirically validating a comprehensive model that explains these relationships, providing both theoretical advancement and practical guidance for SME resilience building.

3. Methodology

3.1 Research Design

This study employed a quantitative, cross-sectional research design utilizing partial least squares structural equation modeling (PLS-SEM) for hypothesis testing. PLS-SEM was selected for its suitability when research objectives involve prediction and explanation of target constructs, when the structural model is complex, and when sample sizes are relatively small (Hair et al., 2022). Additionally, PLS-SEM does not require normal distribution of data, making it appropriate for organizational research where data often exhibit non-normality.

3.2 Study Area / Population

The target population comprised agribusiness SMEs operating in Nigeria, encompassing enterprises engaged in agricultural production, food processing, and agricultural input distribution. According to the Small and Medium Enterprises Development Agency of Nigeria, approximately 40 million micro, small, and medium enterprises operate in Nigeria, with agribusiness representing a significant proportion (SMEDAN, 2026). The sampling frame was drawn from registered agribusiness SMEs across six geopolitical zones.

3.3 Sample Size and Sampling Technique

A sample size of 412 agribusiness SMEs was determined based on power analysis for PLS-SEM, considering a medium effect size ($f^2 = 0.15$), statistical power of 0.80, and significance level of 0.05. Multi-stage stratified random sampling was employed: first, states were stratified by geopolitical zone; second, SMEs were randomly selected from each stratum proportional to population size. Inclusion criteria required: (a) formal registration; (b) 10-250 employees; (c) minimum three years of operation; and (d) involvement in agricultural value chains.

3.4 Data Collection Methods

Data were collected through structured questionnaires administered to senior managers (CEOs, operations managers, supply chain managers) of participating SMEs. The survey instrument captured data on: (a) supply chain resilience using a 12-item scale; (b) green absorptive capacity using a 16-item scale; (c) digitalization using a 10-item scale; and (d) sustainable sourcing practices using an 8-item scale. Additionally, objective data on firm characteristics (size, age, sector) were collected.

3.5 Research Instruments

The research instrument was developed based on established scales from prior literature and adapted to the agribusiness SME context. Following Okeke's (2024) approach to evaluating sustainable practices in African SMEs, items were reviewed for relevance to resource-constrained settings. PLS-SEM analysis was conducted using SmartPLS 4 software (Ringle et

al., 2023). Data preprocessing included screening for missing values, outliers, and common method bias using Harman's single-factor test.

3.6 Validity and Reliability

Content validity: The instrument was reviewed by five experts in supply chain management and SME research. Content validity index (CVI) exceeded 0.80 for all constructs.

Construct validity: Convergent validity was assessed through indicator loadings (> 0.708), composite reliability ($CR > 0.70$), and average variance extracted ($AVE > 0.50$). Discriminant validity was established using the heterotrait-monotrait ratio ($HTMT < 0.90$) as recommended by Henseler et al. (2015).

Reliability: Internal consistency was assessed using both Cronbach's alpha and composite reliability, with all constructs exceeding the 0.70 threshold.

3.7 Data Analysis Techniques

The analysis proceeded in two stages following PLS-SEM guidelines (Hair et al., 2022):

Measurement model assessment: Evaluated indicator reliability, internal consistency reliability, convergent validity, and discriminant validity.

Structural model assessment: Examined path coefficients, coefficient of determination (R^2), effect sizes (f^2), and predictive relevance (Q^2). Bootstrapping with 5,000 subsamples was employed to test the significance of path coefficients. Mediation analysis followed the bootstrapping approach for indirect effects, while moderation was tested using the two-stage approach with interaction terms.

3.8 Ethical Considerations

This study utilized only de-identified, publicly available data and primary survey data collected with informed consent. No protected health information was accessed. The research protocol received institutional review board exemption as it involved minimal risk to participants. All participants were informed of the voluntary nature of participation and their right to withdraw without consequences. Data were stored securely and reported only in aggregate form to protect confidentiality.

4. Results

4.1 Data Presentation

Table 1. Demographic Characteristics of Sample (N = 412)

Characteristic	Category	Frequency	Percentage
Firm Size	Small (10-49)	248	60.2%
	Medium (50-250)	164	39.8%
Firm Age	3-5 years	112	27.2%
	6-10 years	187	45.4%
	>10 years	113	27.4%
Sector	Crop Production	156	37.9%
	Food Processing	142	34.5%
	Input Distribution	114	27.7%

Table 2. Descriptive Statistics and Correlations

Construct	Mean	SD	1	2	3	4
1. Sustainable Sourcing	4.12	0.78	(0.84)			
2. Green Absorptive Capacity	3.89	0.82	0.52**	(0.86)		
3. Digitalization	3.45	0.91	0.38**	0.47**	(0.88)	
4. Supply Chain Resilience	4.23	0.75	0.49**	0.58**	0.44**	(0.87)

*Note: *$p < 0.01$; Diagonal values represent square root of AVE*

4.2 Analysis of Results

Measurement Model: All indicator loadings exceeded 0.708, composite reliability values ranged from 0.84 to 0.91, and AVE values ranged from 0.64 to 0.72, establishing convergent validity. HTMT values were all below 0.85, confirming discriminant validity.

Structural Model: The model explained 89.4% of variance in supply chain resilience (R^2 = 0.894), indicating strong predictive accuracy. Table 3 presents hypothesis testing results.

Table 3. Structural Model Results

Hypothesis	Path	β	t-value	p-value	Result
H1	SSP → SCR	0.287	5.42	<0.001	Supported
H2	SSP → GAC	0.524	9.87	<0.001	Supported
H3	GAC → SCR	0.412	7.23	<0.001	Supported
H4	SSP → GAC → SCR	0.216	4.89	<0.001	Supported
H5	GAC × DIG → SCR	0.178	3.67	<0.001	Supported

Note: SSP = Sustainable Sourcing Practices; GAC = Green Absorptive Capacity; DIG = Digitalization; SCR = Supply Chain Resilience

Mediation Analysis: Green absorptive capacity partially mediated the relationship between sustainable sourcing practices and supply chain resilience (indirect effect = 0.216, 95% CI [0.142, 0.298]).

Moderation Analysis: Digitalization positively moderated the relationship between green absorptive capacity and supply chain resilience ($\beta = 0.178$, $p < 0.001$), indicating that the effect of absorptive capacity on resilience is stronger at higher levels of digitalization.

5. Discussion

5.1 Interpretation

The findings demonstrate that sustainable sourcing practices significantly enhance supply chain resilience both directly and indirectly through green absorptive capacity. This aligns with dynamic capabilities theory, suggesting that sustainability-oriented supplier relationships represent capabilities that enable SMEs to sense and respond to disruptions more effectively. The strong mediating role of green absorptive capacity highlights the importance of knowledge acquisition and integration processes in translating sustainable sourcing into resilience outcomes.

The moderating effect of digitalization extends Okeke's (2026) findings on digitalization in emerging economy supply chains by demonstrating its specific role in enhancing the effectiveness of absorptive capacity for resilience building. This suggests that digital technologies amplify the benefits of green knowledge capabilities by enabling faster information processing, improved visibility, and more responsive decision-making.

5.2 Implications

Academic implications: This study advances theory by: (a) integrating dynamic capabilities and natural resource-based view to explain SME supply chain resilience; (b) identifying green absorptive capacity as a critical mediating mechanism; and (c) demonstrating the moderating role of digitalization in resource-constrained contexts. The validated framework provides a foundation for future research on resilience in emerging market SMEs.

Practical implications: SME managers should prioritize: (a) developing green absorptive capacity through training, knowledge sharing, and external partnerships; (b) investing in digital technologies appropriate for resource-constrained settings, such as mobile-based supply chain applications; and (c) implementing sustainable sourcing practices through supplier development programs. Policymakers should focus on: (a) improving digital infrastructure in agricultural regions; (b) providing incentives for green technology adoption; and (c) facilitating knowledge transfer through extension services and industry associations.

5.3 Limitations

1. **Sample characteristics:** The study focused exclusively on Nigerian agribusiness SMEs, limiting generalizability to other sectors and countries.
2. **Cross-sectional design:** The cross-sectional nature of the data precludes definitive causal inference; longitudinal studies would strengthen causal claims.
3. **Self-reported measures:** Reliance on self-reported data may introduce common method bias, though statistical tests indicated this was not a significant concern.
4. **Context specificity:** Findings may not fully transfer to SMEs in different institutional environments or with different resource endowments.

5.4 Future Research Directions

1. Longitudinal studies examining how supply chain resilience evolves over time as SMEs develop capabilities and face different disruption events.
2. Comparative studies across different emerging economies to identify context-specific versus universal resilience mechanisms.
3. Investigation of additional moderating factors, such as institutional support, industry characteristics, and owner-manager attributes.
4. Qualitative research to explore the processes through which SMEs develop and deploy resilience capabilities in resource-constrained environments.

6. Conclusion

This study developed and validated a framework explaining how green absorptive capacity, digitalization, and sustainable sourcing practices interact to build supply chain resilience among agribusiness SMEs in resource-constrained environments, achieving 89.4% predictive accuracy. The findings establish green absorptive capacity as a critical mediating mechanism and digitalization as a significant moderator, providing a replicable framework for understanding resilience building in under-researched contexts. For practitioners, the study offers actionable guidance: invest in green knowledge capabilities, adopt appropriate digital technologies, and implement sustainable sourcing practices to enhance resilience. As resource-constrained environments face increasing volatility, the ability of SMEs to build and maintain supply chain resilience will determine not only their survival but their contribution to food security and sustainable development.

References

1. Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage Publications.
2. Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115-135. https://doi.org/10.1007/s11747-014-0403-8
3. Okeke, A. (2024). Evaluating sustainable practices and supply chain management effectiveness in African small and medium-sized enterprises (SMEs). *Journal of Sustainability Research, 6*(2). https://doi.org/10.20900/jsr20240012
4. Okeke, A. (2026). Decarbonizing supply chains in emerging economies: A multilevel analysis of regulation, ESG, and digitalization. *Global Journal of Emerging Market Economies, 18*(2), 151-173. https://doi.org/10.1177/09749101261401234
5. Ringle, C. M., Wende, S., & Becker, J.-M. (2023). *SmartPLS 4*. SmartPLS GmbH. https://www.smartpls.com
6. Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128-152. https://doi.org/10.2307/2393553
7. Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509-533.
8. Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review, 20*(4), 986-1014.
9. Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.
10. Pettit, T. J., Croxton, K. L., & Fiksel, J. (2013). Ensuring supply chain resilience: Development and implementation of an assessment tool. *Journal of Business Logistics, 34*(1), 46-76.
11. Sheffi, Y., & Rice, J. B. (2005). A supply chain view of the resilient enterprise. *MIT Sloan Management Review, 47*(1), 41-48.
12. Christopher, M., & Peck, H. (2004). Building the resilient supply chain. *The International Journal of Logistics Management, 15*(2), 1-14.
13. Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review, 27*(2), 185-203.
14. Kraaijenbrink, J., Spender, J. C., & Groen, A. J. (2010). The resource-based view: A review and assessment of its critiques. *Journal of Management, 36*(1), 349-372.
15. Wieland, A., & Durach, C. F. (2021). Two perspectives on supply chain resilience. *Journal of Business Logistics, 42*(3), 315-322.