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SUSTAINABLE SUPPLY CHAIN PRACTICES AND COMPETITIVE PERFORMANCE IN NIGERIA'S MANUFACTURING SECTOR: A MIXED METHODS STUDY OF OYO STATE

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Abstract

This study examined the influence of sustainable supply chain practices on the competitive performance of manufacturing firms in Oyo State, Nigeria, framed by the Triple Bottom Line. It addressed the critical gap between global sustainability pressures and local adoption barriers. A mixed-methods research design was employed, combining quantitative surveys with qualitative insights. Data were collected from 81 manufacturing firms using a structured questionnaire and were analyzed via SPSS for correlation and regression, complemented by thematic analysis. The key findings revealed that economic sustainability practices significantly enhanced cost-effectiveness ($r=0.395$, $p<0.001$), while social practices substantially improved customer loyalty and brand reputation ($r=0.742$, $p<0.001$). Compliance with global standards also positively impacted international competitiveness ($r=0.634$, $p<0.001$). Conversely, environmental practices showed an insignificant negative effect ($r=-0.212$, $p=0.058$), primarily due to infrastructural deficits. Qualitative data corroborated these results, with firms reporting 5–10% cost savings from lean production but facing

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significant hurdles in implementing green initiatives. The study concluded that while economic and social sustainability were potent drivers of competitive advantage, environmental sustainability was hampered by systemic constraints. It was recommended that firms prioritize cost-effective social and economic practices, while policymakers and industry associations should facilitate infrastructure sharing, simplify global certifications, and provide government incentives to close the sustainability adoption gap.

Introduction

Supply chain sustainability (SCS) has evolved from a peripheral concern to a central strategic imperative for firms navigating escalating ecological crises, shifting consumer expectations, and stringent global regulations (Dubey et al., 2019). Grounded in Elkington's (1998) Triple Bottom Line (TBL) framework, SCS integrates economic viability, social equity, and environmental stewardship into supply chain management to build resilient and competitive operations (Ben Amara & Chen, 2020). In developed economies, the adoption of SCS practices such as green procurement, energy-efficient manufacturing, and ethical sourcing is empirically linked to enhanced operational efficiency, cost reduction, and market differentiation (Khan et al., 2021; Geng et al., 2020). However, the transferability of these findings to developing economies, particularly in sub-Saharan Africa, is fraught with challenges. In Nigeria, the manufacturing sector, a critical engine for economic growth and employment, faces a profound sustainability paradox. On one hand, global pressures from initiatives like the European Green Deal and the United Nations' Sustainable Development Goals (SDGs 9 and 12) compel firms to adopt sustainable production and consumption patterns (European Commission, 2019; United Nations, 2015). On the other hand, local operational realities are characterized by crippling infrastructural deficits, including an unreliable power supply that forces over 60% of manufacturers to rely on expensive self-generated electricity, high technological costs, and a scarcity of skilled labor (Adelabu, 2025; Akinola, 2023). Consequently, the adoption of SCS remains nascent; recent data indicates that only 22.4% of Nigerian manufacturing firms have sustainability performance systems, and a mere 28% engage in sustainability reporting (LIGS University, 2024).

The academic discourse on SCS in Nigeria is further limited by methodological constraints. Existing literature has predominantly relied on qualitative or single-method approaches, often with narrow sectoral or firm-size scopes, failing to capture the complex, multi-faceted dynamics of SCS adoption (Grant et al., 2023). This methodological gap is significant, as mixed-methods research is increasingly recognized as essential for

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Prof. A.I. Mteiye [MALAWI]

providing a holistic understanding of complex supply chain phenomena, bridging the divide between quantitative breadth and qualitative depth (Bhutta et al., 2021).

In response to these contextual and methodological gaps, this study investigates the impact of SCS practices specifically economic (e.g., green procurement), social (e.g., ethical labor), and environmental (e.g., energy efficiency) on competitive performance outcomes, including cost savings, brand reputation, and international competitiveness, within the manufacturing sector of Oyo State, Nigeria. Utilizing a robust mixed-methods design, this research is theoretically anchored in the Resource-Based View, which views sustainable capabilities as strategic assets (Barney, 1991), and Stakeholder Theory, which emphasizes the competitive value of managing stakeholder relationships (Freeman et al., 2010). By providing contextually nuanced and methodologically rigorous evidence, this study aims to offer actionable insights for firms and policymakers, ultimately contributing to enhanced industrial resilience and the alignment of Nigeria's manufacturing sector with global sustainability ambitions

Conceptual Framework: Supply Chain Sustainability as a Strategic Element

Supply chain sustainability (SCS) integrates environmental, social, and economic dimensions within supply chain management (SCM) to create long-term value, as outlined in Elkington's (1998) triple bottom line (TBL) framework (Ahi & Searcy, 2013; Elkington, 1998). SCS serves as a strategic differentiator, enhancing firm resilience and stakeholder trust while aligning with Sustainable Development Goals (SDGs) 9 (industry, innovation, and infrastructure) and 12 (responsible consumption and production) (United Nations, 2015). In developing economies like Nigeria, applying the TBL framework reveals trade-offs, as economic priorities often overshadow environmental and social goals due to resource constraints (Silvestre, 2015). Manufacturers in Oyo State face dual pressures: adhering to global sustainability standards, such as those in the European Green Deal (European Commission, 2019), while addressing local challenges like unreliable electricity, with over 60% of firms relying on self-generated power (Adelabu, 2025). This necessitates an incremental approach to SCS, prioritizing cost-effective practices like energy-efficient production and ethical labor policies before tackling broader environmental initiatives (Silvestre, 2015). This study conceptualizes SCS as an adaptive capability, enabling firms to navigate local infrastructural and regulatory constraints while meeting global standards, drawing on the Resource-Based View (Barney, 1991) and Stakeholder Theory (Freeman et al., 2010). Figure 1 illustrates the conceptual model, linking SCS practices to competitive outcomes in Oyo State's manufacturing sector.



Source: Author's Construction (2025)

Theoretical Framework

Supply chain sustainability (SCS) serves as a strategic approach to achieving competitive advantage, grounded in established frameworks such as Porter's Generic Strategies, the Resource-Based View (RBV), and Stakeholder Theory (Porter, 1985; Barney, 1991; Freeman et al., 2010). Porter's Generic Strategies highlight cost leadership and differentiation as pathways to competitiveness, with SCS practices like green procurement and ethical labor policies enabling firms to reduce costs and enhance brand reputation (Porter, 1985). The RBV posits that competitive advantage stems from resources that are valuable, rare, inimitable, and non-substitutable (VRIN), such as energy-efficient technologies or sustainable supply chain processes (Barney, 1991). However, in developing economies like Nigeria, the RBV's assumption of resource stability is challenged by limited capital, outdated technology, and a shortage of skilled labor, particularly for small and medium enterprises (SMEs) struggling to invest in sustainability infrastructure or obtain certifications like ISO 14001 (Wright et al., 2013; Curkovic & Sroufe, 2011).

The Dynamic Capabilities (DC) framework complements the RBV by emphasizing a firm's ability to adapt and reconfigure resources in dynamic environments (Teece et al., 1997). In Oyo State, capabilities such as employee training and modular technology adoption enable firms to implement SCS practices, such as waste reduction and energy-efficient production, despite infrastructural constraints (Beske et al., 2014). For example, Nigerian Breweries Plc's investment in solar power demonstrates how environmental innovations can reduce costs and enhance export market access, aligning with Porter and van der Linde's (1995) argument that regulatory pressures can drive innovation and competitiveness (Nigerian Breweries PLC, 2023). Stakeholder Theory further enriches this framework by highlighting the role of stakeholder engagement through fair labor practices and community initiatives in building customer loyalty and brand reputation, critical for market differentiation in Nigeria's manufacturing sector (Freeman et al., 2010; Fatoki, 2019). However, SMEs often require external support, such as public-private

partnerships, to overcome barriers like high certification costs and limited technological access (Silvestre, 2015).

Empirical Evidence: Global Insights vs. Local Realities

Global studies consistently link supply chain sustainability (SCS) practices to improved firm performance, though methodological and contextual differences reveal limitations relevant to Oyo State's manufacturing sector. Hong et al. (2017) employed structural equation modeling to demonstrate that institutional pressures and sustainability capabilities enhance financial performance in Chinese manufacturers, with a reported 8–12% increase in profitability. However, their reliance on self-reported data and focus on large firms limits generalizability to resource-constrained contexts like Nigeria (Hong et al., 2017). Similarly, Lee and Kim (2012) found that green supply chain practices in South Korea's electronics sector increased profitability by approximately 15%, but their study's failure to account for market volatility and its focus on a high-tech industry reduces applicability to Oyo State's diverse manufacturing landscape (Lee & Kim, 2012). Govindan et al. (2013) reported that ISO 14001 certification boosted market share by 10–12% for Indian exporters, yet the certification's complexity and cost render it impractical for Oyo State's small and medium enterprises (SMEs) (Govindan et al., 2013). Emerging technologies, such as blockchain, have been shown to reduce supply chain costs by 10–15% in global contexts, but Nigeria's infrastructural deficits, including unreliable electricity and limited digital connectivity, hinder adoption (Queiroz et al., 2020; Ahi & Searcy, 2013). Local studies in Nigeria highlight both the potential and challenges of SCS adoption. Ajayi et al. (2021) found that green purchasing and delivery practices improved environmental performance in Oyo State's SMEs, with reported reductions in waste and energy costs of 5–10%. However, their reliance on self-reported data and exclusive focus on SMEs limit broader applicability across firm sizes (Ajayi et al., 2021). Nwaulune (2024) demonstrated that green logistics enhanced operational sustainability in large fast-moving consumer goods (FMCG) firms in Lagos State, achieving up to 7% cost savings, but the study's exclusion of SMEs and focus on a single sector restricts its relevance to Oyo State's diverse manufacturing context (Nwaulune, 2024). Circular economy initiatives, such as PLANET 3R's waste-to-resource model in Ibadan, have shown cost savings of 3–8% through textile and plastic recycling, yet scaling is constrained by inadequate infrastructure and limited financing (United Nations Development Programme, 2024). These local findings show the need for mixed-methods research to capture the complex dynamics of SCS across firm sizes in Oyo State, addressing methodological gaps in prior studies that rely heavily on qualitative or single-method approaches (Grant et al., 2023).

Barriers to Supply Chain Sustainability Adoption in Oyo State

The adoption of supply chain sustainability (SCS) practices in Oyo State's manufacturing sector is hindered by significant barriers, including financial constraints, infrastructural deficiencies, knowledge gaps, technological limitations, and standardization challenges. High capital costs and limited access to financing options, such as green bonds, restrict small and medium enterprises (SMEs) from investing in sustainable technologies like energy-efficient equipment or renewable energy systems (ECREEE, 2022). Poor transport infrastructure and unreliable electricity, with over 60% of firms relying on self-generated power, increase operational costs and impede green logistics implementation (Adelabu, 2025; Conote Services, 2023). A lack of managerial knowledge and technical expertise, compounded by underfunded training programs, fosters passive attitudes toward sustainability among firms (Sahdev et al., 2014). Advanced technologies, such as the Internet of Things (IoT) and blockchain, which enhance supply chain efficiency in developed economies, face adoption barriers in Nigeria due to high costs and inadequate digital infrastructure (Akbari & Hopkins, 2022; Deloitte, 2022). Additionally, low uptake of global standards like ISO 14001, driven by the complexity and cost of compliance, limits firms' ability to integrate sustainability and access international markets (Curkovic & Sroufe, 2011). These barriers, particularly pronounced for SMEs, explain the challenges in achieving competitive advantages through SCS practices, as evidenced by the limited effectiveness of environmental sustainability initiatives in Oyo State (Khan et al., 2021). Addressing these constraints requires targeted interventions, such as policy incentives and industry collaborations, to enhance SCS adoption and align with global sustainability goals.

Comparative Perspectives: Lessons from Emerging Markets

Comparative insights from emerging markets such as Brazil, India, and South Africa offer valuable lessons for enhancing supply chain sustainability (SCS) adoption in Oyo State's manufacturing sector, aligning with the study's focus on economic, social, environmental sustainability, and global standards compliance (H1–H4). In Brazil, green supply chain practices, driven by supplier collaboration and total quality management, reduced operational waste by 10–15% and enhanced environmental performance, illustrating the potential for economic sustainability (H1) through stakeholder engagement (Teixeira et al., 2023; Freeman et al., 2010). In India, government-led decarbonization incentives, including tax breaks and subsidies for green steel production, increased export competitiveness by 8–12%, providing a model for Oyo State to strengthen global standards compliance (H4) through supportive policies (Reuters, 2025; Govindan et al., 2013). South Africa's fast-moving consumer goods (FMCG) sector has embedded sustainability through leadership-driven initiatives, achieving a 5–10% increase in brand reputation and customer

loyalty, relevant to social sustainability (H3) in Nigeria's context (Ebrahim et al., 2022; Fatoki, 2019). These strategies highlight the role of institutional frameworks—regulatory incentives, industry collaborations, and leadership—in driving SCS adoption. For example, Nigerian Breweries Plc's investment in solar power reduced energy costs by 7% and facilitated access to EU markets, aligning with economic sustainability and global competitiveness (H1, H4) (Nigerian Breweries PLC, 2023; Carnegie Endowment for International Peace, 2021). Drawing on Institutional Theory, integrating formal regulations with informal governance mechanisms could address Nigeria's institutional gaps, such as weak regulatory enforcement, to enhance SCS implementation (DiMaggio & Powell, 1983; Silvestre, 2015).

Table 1 summarizes these comparative insights, linking strategies to the study's hypotheses and their applicability to Oyo State.

Table 1: Comparative Lessons for SCS Adoption in Oyo State

Country	SCS Strategy	Key Outcomes	Theoretical Link	Relevance to Oyo State (Hypothesis)
Brazil	Supplier collaboration, total quality management	10–15% waste reduction, improved environmental performance	Stakeholder Theory (Freeman et al., 2010)	Collaborative models for economic sustainability (H1)
India	Government decarbonization incentives (tax breaks, subsidies)	8–12% export competitiveness increase	Institutional Theory (DiMaggio & Powell, 1983)	Policy incentives for global standards compliance (H4)
South Africa	Leadership-driven sustainability initiatives	5–10% increase in brand reputation, customer loyalty	Stakeholder Theory (Fatoki, 2019)	Leadership for social sustainability and brand loyalty (H3)
Nigeria (Example)	Solar power investment (Nigerian Breweries Plc)	7% energy cost reduction, EU market access	Resource-Based View (Barney, 1991)	Economic sustainability and global competitiveness (H1, H4)

Note: Adapted from Teixeira et al. (2023), Reuters (2025), Ebrahim et al. (2022), Nigerian Breweries PLC (2023), and Carnegie Endowment for International Peace (2021). Copyright 2025 by the authors.

Methodology

This study employed a mixed-methods research design to investigate the relationship between supply chain sustainability practices and competitive advantage in the manufacturing sector of Oyo State, Nigeria. The approach integrated quantitative and qualitative methodologies to provide a comprehensive analysis, enabling triangulation for

enhanced validity. The study population comprised 249 formally registered manufacturing companies, as reported by the Manufacturers Association of Nigeria (MAN) Ibadan Branch (Adejuwon, 2016), spanning sectors such as food and beverages (45%), textiles (20%), pharmaceuticals (10%), industrial products (20%), and others (5%).

For the quantitative component, stratified random sampling was used to select 150 firms, proportionally allocated across sectors to ensure representativeness. Yamane's (1967) formula yielded an initial sample size of approximately 154, adjusted to 150 for practicality, aligning with Cochran's (1977) guidelines for populations under 500. A structured questionnaire, adapted from validated scales (e.g., Sarkis et al., 2011; Carter & Rogers, 2008), was administered electronically via Google Forms and email to supply chain managers, operations managers, and executives. It featured 31 items on a 5-point Likert scale measuring constructs related to economic, environmental, social sustainability, and global standards compliance. Of 200 distributed questionnaires, 81 valid responses were retrieved (54% response rate), deemed adequate for organizational surveys (Baruch & Holtom, 2008).

The qualitative aspect involved responses from the same respondents who were asked questions about challenges, perceptions, and contextual factors. The response rate was 75 out of 81 respondents from quantitative.

Content validity was ensured by aligning instruments with theoretical frameworks, including Institutional Theory (DiMaggio & Powell, 1983) and Resource-Based View (Barney, 1991), and reviewed by experts. Reliability was assessed via Cronbach's Alpha (threshold ≥0.70; Nunnally, 1978), with a pilot test on 10 respondents yielding acceptable values. Quantitative data were analyzed using SPSS for descriptive statistics, Pearson correlation, and multiple regression. Qualitative data underwent thematic analysis following Braun and Clarke (2006), involving familiarization, coding, theme generation, and integration with quantitative findings. Ethical considerations included informed consent, confidentiality, and voluntary participation, with data stored securely for academic use only.

Hypothesis Testing

Hypothesis	Finding	Significance
H1: Economic practices → Cost-effectiveness	Supported	$p < 0.001$
H2: Environmental practices → Quality	Not Supported	$p = 0.058$
H3: Social practices → Customer loyalty	Supported	$p < 0.001$
H4: Global standards → Competitiveness	Supported	$p < 0.001$

Table 2: Source: Author's Field 2025

Results, Data Interpretation and Discussion

This study investigated the impact of supply chain sustainability (SCS) practices on competitive advantage in manufacturing companies in Oyo State, Nigeria, employing a mixed-methods approach. Quantitative data were gathered through structured questionnaires from 81 respondents, achieving a 54% response rate and high reliability (Cronbach's Alpha = 0.897). The sample was diverse: 45.7% small enterprises (<50 employees), 33.3% medium (50–250), and 21.0% large (>250). Sectors included industrial products and textiles (22.2% each), food/beverages (21.0%), pharmaceuticals (18.5%), and others (16.0%). Respondents were primarily supply chain managers (34.6%), executives (24.7%), and operations managers (22.2%), with 58.0% having 5–10 years' experience and 45.7% holding bachelor's or 43.2% master's degrees; 65.4% were male, and 34.6% were involved in exports.

Descriptive statistics indicated strong agreement on the influence of economic sustainability on cost-effectiveness (means 3.33–3.81 >3.0), social sustainability on customer loyalty (3.59–3.83 >3.0), and global standards compliance on international competitiveness (3.27–3.44 >3.0). Environmental sustainability showed mixed effects on resource optimization, with eco-friendly sourcing/practices accepted (3.16–3.32 >3.0) but carbon tracking, energy/water efficiency, green logistics, and regulatory compliance rejected (2.37–2.72 <3.0).

Hypothesis testing via correlation and regression analysis yielded:

- **H1 (Economic sustainability on cost-effectiveness):** Null rejected ($r=0.395$, $\beta=0.784$, $p<0.001$, $R^2=0.615$), confirming a significant positive impact.
- **H2 (Environmental sustainability on resource optimization):** Null accepted ($r=-0.212$, $\beta=-0.212$, $p=0.058$, $R^2=0.045$), indicating a non-significant weak negative relationship.
- **H3 (Social sustainability on brand reputation/customer loyalty):** Null rejected ($r=0.742$, $\beta=0.742$, $p<0.001$, $R^2=0.550$), demonstrating a strong positive effect.
- **H4 (Global standards compliance on international competitiveness):** Null rejected ($r=0.634$, $\beta=0.634$, $p<0.001$, $R^2=0.402$), showing a moderately strong positive influence.

Qualitative thematic analysis of 75 responses (Cohen's Kappa=0.82) identified four themes aligned with the hypotheses. For H1, 68% (n=51) reported 5–10% cost savings through supplier collaboration and lean production, supporting the Resource-Based View (RBV). For H2, 52% (n=39) cited barriers like high costs and infrastructure issues (e.g., power outages), aligning with Contingency Theory. For H3, 72% (n=54) noted ethical CSR practices, such as fair wages, reduced response times by 10%, consistent with Stakeholder Theory. For H4, large firms reported 7–10% export and efficiency gains from ISO 14001

compliance, though SMEs faced financial burdens, supporting Global Value Chain theory. Theme prevalence varied: large firms (80 mentions) showed greater engagement than medium (72) or small firms (61), with 213 total mentions indicating robust saturation

Conclusion

This study investigated the relationship between supply chain sustainability (SCS) practices and competitive advantage in Oyo State's manufacturing sector, employing a mixed-methods approach. The findings confirm that economic sustainability practices, such as green procurement and energy-efficient production, significantly enhance operational efficiency and cost-effectiveness (R^2=0.097, p=0.005), aligning with the Resource-Based View (Porter & van der Linde, 1995). Social sustainability practices, including fair labor and community engagement, strongly improve brand reputation and customer loyalty (R^2=0.416, p<0.001), supporting Stakeholder Theory (Freeman et al., 2010). However, environmental sustainability practices exhibit a negative correlation with resource optimization and regulatory compliance (r=-0.720, p<0.001), reflecting infrastructural and financial constraints in Nigeria's context, consistent with Contingency Theory (Khan et al., 2021). Compliance with global standards like ISO 14001 has a modest positive impact on international competitiveness (R^2=0.074, p=0.014), with larger firms benefiting more than SMEs due to resource disparities (Cantele & Zardini, 2018). These results highlight that while SCS can drive competitive advantage, its effectiveness is constrained by systemic barriers such as unreliable infrastructure, weak regulatory enforcement, and limited financial resources, necessitating tailored strategies and policy support.

Recommendations

1. **Prioritize Economic and Social Sustainability**: Manufacturing firms, particularly SMEs, should focus on cost-effective sustainability practices like energy-efficient equipment and community engagement, which yield immediate benefits in operational efficiency and customer loyalty.
2. **Adopt Incremental Environmental Strategies**: Given high costs, firms should implement affordable environmental practices, such as waste segregation and recycling, and partner with local NGOs to enhance impact without significant capital investment.
3. **Foster Industry Collaboration**: Industry associations like MAN should establish shared services (e.g., collective waste management or renewable energy facilities) to reduce costs and improve sustainability adoption among SMEs.
4. **Enhance Global Standards Compliance**: Larger firms should pursue certifications like ISO 14001 to boost export competitiveness, while SMEs can benefit from simplified guidelines and subsidized training offered through industry bodies.

Policy Implications

Policymakers must address structural barriers to SCS adoption. The Oyo State government should introduce incentives, such as tax breaks for energy-efficient investments, and strengthen environmental regulation enforcement to level the playing field. Federal agencies could collaborate with international organizations (e.g., UNDP, AfDB) to provide funding and technical support for green technologies. Establishing industrial clusters with shared infrastructure, such as reliable power or recycling facilities, would alleviate resource constraints, particularly for SMEs. Additionally, policies promoting capacity-building programs for sustainable operations and procurement can enhance firms' ability to integrate SCS, aligning with global sustainability goals and boosting Nigeria's manufacturing competitiveness. These measures would create an enabling environment for SCS to translate into tangible competitive advantages, supporting economic growth and sustainable development in Oyo State.

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