

Challenges in Sustainable Supply Chain Management Adoption in Nigeria: A Focus on IT Infrastructure Acquisition

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Abstract: Sustainable Supply Chain Management (SSCM) has emerged as a critical strategic framework for organizations seeking to balance economic performance with environmental and social responsibility. However, adoption rates in emerging economies, particularly Nigeria, remain significantly below global averages. This paper investigates one of the most persistent yet under-researched barriers to SSCM implementation: the challenges associated with Information Technology (IT) infrastructure acquisition. Through a systematic review of existing literature and analysis of recent empirical studies, this paper identifies five primary challenge categories: foreign exchange volatility and import dependency, power infrastructure deficits, connectivity gaps in last-mile logistics, maintenance ecosystem weaknesses, and regulatory-policy uncertainty. The paper argues that SSCM adoption cannot succeed without addressing these foundational acquisition barriers. Drawing on technology-organization-environment (TOE) framework and resource-based view (RBV) theory, this paper proposes a multi-stakeholder framework for overcoming acquisition challenges. Recommendations focus on financial innovation, public-private infrastructure partnerships, localized technology adaptation, and regulatory harmonization. The findings have implications for policymakers, supply chain practitioners, and international development partners seeking to advance sustainable supply chain practices in resource-constrained environments.

Keywords: Sustainable Supply Chain Management, IT Infrastructure Acquisition, Nigeria, Emerging Economies, Digital Transformation, Technology Adoption Barriers.

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I. INTRODUCTION

The adoption of Sustainable Supply Chain Management (SSCM) practices has become increasingly central to corporate strategy globally, driven by regulatory pressures, consumer expectations, and the imperatives of climate change mitigation. SSCM encompasses the integration of environmental, social, and economic considerations into supply chain operations, including green procurement, reverse logistics, carbon footprint reduction, and ethical sourcing [1]. In developed economies, digital technologies such as Internet of Things (IoT) sensors, blockchain for traceability, cloud-based enterprise resource planning (ERP) systems, and artificial intelligence (AI) for predictive analytics have enabled sophisticated SSCM implementations [9].

However, in emerging economies like Nigeria, the picture is markedly different. Research indicates that adoption of sustainable practices in the Nigerian manufacturing sector remains poor, with only 4% adoption of sustainable

transportation practices, 26% for environmental purchasing, and 37% for reverse logistics [5]. While awareness of sustainability concepts is moderately high, the translation into practice remains severely constrained.

➤ The Research Problem

A growing body of literature has identified barriers to SSCM adoption in developing countries, including financial constraints, regulatory fragmentation, lack of technical expertise, and limited institutional support [1]-[3]. However, a critical gap exists in understanding the specific challenges related to IT infrastructure acquisition—the foundational layer upon which digital SSCM capabilities depend. SSCM increasingly requires real-time data sharing, supply chain visibility, traceability systems, and performance monitoring tools. Without the ability to acquire, deploy, and maintain the IT infrastructure that enables these capabilities, SSCM remains aspirational rather than operational.

This paper addresses the following research questions:

- What are the specific challenges facing Nigerian organizations in acquiring IT infrastructure for SSCM?
- How do these acquisition challenges interact with broader SSCM adoption barriers?
- What strategies can enable more effective IT infrastructure acquisition to support SSCM adoption?

➤ *Theoretical Framework*

This study draws on two complementary theoretical perspectives. The Technology-Organization-Environment (TOE) framework provides a lens for understanding how technological, organizational, and environmental contexts shape technology adoption decisions. The Resource-Based View (RBV) of the firm illuminates how IT infrastructure represents a strategic resource that can enable competitive advantage through SSCM capabilities [8]

II. LITERATURE REVIEW

➤ *SSCM in Emerging Economies*

Sustainable Supply Chain Management has been conceptualized as the integration of environmental and social considerations into supply chain operations while maintaining economic viability. In emerging economies, the adoption of SSCM faces unique challenges due to institutional voids, infrastructure deficits, and resource constraints[5] Research on Nigerian manufacturing firms has found that while SSCM practices correlate positively with improved sales, corporate image, and information sharing, adoption remains at nascent stages[5]

Case study research on two Nigerian manufacturing firms revealed contrasting approaches to SSCM implementation—one firm successfully integrated practices through collaboration and trust, while the other faced barriers related to limited information sharing and confidentiality concerns [1] Critically, both firms identified financial constraints and technological limitations as common barriers, underscoring the primacy of these challenges regardless of organizational approach.

➤ *ICT Adoption in Nigerian Supply Chains*

The adoption of Information and Communications Technology (ICT) in supply chain management has been transformative globally, but Nigerian firms lag significantly. A study of 20+ Nigerian SMEs found that while most have incorporated digital technologies into their supply chain systems, contributing to revenue growth and customer base expansion, barriers remain substantial: complexity, talent gaps, financial requirements, and vulnerability to digital attacks [3]

Doctoral research examining ICT adoption and supply chain integration in Nigeria identified lack of knowledge and skills, lack of investment in IT infrastructure, and inadequate training in new technologies as major challenges[8] The study emphasized that ICT resources, when complemented by integration capabilities, can become sources of competitive advantage—but this potential remains largely unrealized due to acquisition and implementation barriers.

➤ *The IT Infrastructure Imperative for SSCM*

Modern SSCM depends fundamentally on digital capabilities. Supply chain collaboration technologies (SCCTs)—including blockchain, IoT, ERP systems, and AI—are essential for enhancing transparency, efficiency, traceability, and security in supply chains [9]. In Nigeria's food industry, research demonstrates that while these technologies hold substantial potential to optimize supply chain performance, their acceptance is constrained by infrastructural deficiencies, regulatory challenges, underdeveloped trust-building mechanisms, and limited technical expertise [9]

Similarly, research on digital transformation in Nigerian manufacturing firms confirms that supply chain digitization and predictive maintenance can significantly enhance responsible production and distribution, but adoption barriers have contributed to persistent waste and inefficiencies[7]. The gap between technological potential and realized benefit is directly attributable to infrastructure acquisition challenges.

III. METHODOLOGY

This paper employs a systematic literature review methodology, synthesizing findings from peer-reviewed journal articles, doctoral dissertations, government reports, and regulatory documents published between 2020 and 2026. Sources were identified through academic databases (Scopus, Web of Science, Google Scholar) and institutional repositories (CORE, institutional open access archives). Search terms included combinations of "Nigeria," "supply chain management," "sustainable," "IT infrastructure," "technology adoption," and "digital transformation." Additional gray literature from Nigerian regulatory agencies (NITDA, NOTAP, BPP) was incorporated to capture the policy and regulatory context.

IV. BARRIERS TO IT INFRASTRUCTURE ACQUISITION FOR SSCM

The analysis reveals five interconnected categories of barriers that collectively constrain IT infrastructure acquisition for SSCM in Nigeria.

➤ *Foreign Exchange Volatility and Import Dependency*

Nigeria's IT hardware market is overwhelmingly dependent on imports, with over 90% of advanced IT infrastructure—servers, routers, ruggedized devices, and backup power systems—sourced from international markets. This dependency creates acute vulnerability to foreign exchange (FX) volatility. The naira has experienced repeated devaluations, creating an environment where budgeted IT acquisitions become unfinanced mid-cycle. Research confirms that "financial requirements" rank among the most significant barriers to technology adoption among Nigerian SMEs [3]

The regulatory framework compounds this challenge. The National Office for Technology Acquisition and Promotion (NOTAP) requires registration of all contracts for foreign technology transfer, and failure to register prevents payment to foreign parties through the Central Bank of Nigeria [4] This creates administrative friction that extends

procurement timelines, exposing acquisitions to further FX risk.

➤ *Power Infrastructure Deficits*

SSCM depends on continuous data capture and transmission, requiring reliable power for IT assets. Nigeria's grid electricity remains notoriously unreliable, forcing organizations to invest in parallel power infrastructure—diesel generators, inverters, solar hybrid systems—as a condition of IT operability. This requirement fundamentally alters the economics of IT acquisition. Total cost of ownership calculations must include power redundancy, which can constitute 40% or more of the hardware budget. The financial constraint is not merely the cost of servers and sensors, but the compounding cost of keeping them operational.

➤ *Last-Mile Connectivity Gaps*

Even when IT assets are acquired and powered, they require connectivity to fulfill SSCM functions. Many Nigerian supply chain nodes—rural warehouses, farm collection centers, border posts, remote distribution points—lack reliable 4G/5G or fiber infrastructure. Alternative connectivity solutions such as satellite or LoRaWAN exist but require specialized, costly gateways. Research on supply chain collaboration technologies confirms that "lack of reliable internet connectivity and technically skilled labor significantly hinders the effective implementation of IoT and cloud-based systems" [9] Without connectivity, acquired IT assets become inoperative.

➤ *Maintenance and Spare Parts Ecosystem Deficiencies*

SSCM systems require continuous uptime, but post-warranty support for imported IT hardware is weak in Nigeria. Local technicians qualified to service enterprise-grade equipment from manufacturers such as Dell, Cisco, Siemens, and HP are concentrated in Lagos and Abuja, leaving other regions underserved. When sensors, switches, or servers fail, the absence of timely maintenance can cascade through SSCM data pipelines, creating data gaps that undermine the integrity of sustainability reporting and decision-making. The broader literature confirms that "lack of knowledge and skills" and "inadequate training in new technologies" are major barriers to ICT adoption [8].

➤ *Regulatory and Policy Uncertainty*

Recent Nigerian government directives on local content and data sovereignty have created additional compliance requirements for IT acquisition. The National Information Technology Development Agency (NITDA) Guidelines for Nigerian Content Development in ICT mandate that government and public sector bodies source 40% of computer hardware from NITDA-approved local manufacturers [4] Software procurement is even more restrictive: government bodies must source software from indigenous developers where local capacity exists, and procurement of bespoke enterprise software—including ERP, HR management, and payment systems—from non-indigenous developers is prohibited [4].

While these policies aim to develop local IT capacity, they create acquisition challenges for organizations seeking proven SSCM technologies that may lack local equivalents. Furthermore, the implementation of these guidelines has been

inconsistent. NITDA recently revealed that 56% of IT projects by Federal Public Institutions have failed, citing poor compliance with IT Project Clearance Guidelines as a major reason [6] The Director-General of the Bureau of Public Procurement acknowledged "widespread abuse in IT procurement processes," noting that "some MDAs use them as a cover to siphon public funds" [6] This environment of regulatory complexity and enforcement inconsistency creates uncertainty that deters investment.

The data center situation exemplifies these challenges. Satellite and drone imagery have revealed significant delays in the construction of 12 major data centers in Lagos, with delays averaging six months due to supply chain disruptions and bureaucratic hurdles [2] The National Information Technology Development Agency (NITDA) cited lack of qualified engineers and delays in importing essential hardware as key obstacles [2] Without functioning data centers, the cloud-based infrastructure that underpins modern SSCM cannot be realized.

V. DISCUSSION

The five barrier categories identified do not operate in isolation; they form a mutually reinforcing system. FX volatility increases the cost of imported IT hardware, which makes the total cost of ownership—including power infrastructure and maintenance—even more prohibitive. Connectivity gaps render acquired hardware useless, while maintenance deficiencies shorten effective lifespans, increasing lifecycle costs. Regulatory uncertainty compounds all other barriers by making long-term planning and investment decisions hazardous.

This systemic nature explains why piecemeal interventions have failed. Providing training on SSCM practices without addressing infrastructure acquisition barriers yields limited results. Offering financing for hardware without addressing power and connectivity leaves assets inoperable.

The gap between SSCM awareness and adoption—well documented in Nigerian research [5]—can be substantially explained by IT infrastructure acquisition barriers. Organizations may understand the benefits of sustainable practices and even commit to adoption in principle, but when confronted with the practical realities of acquiring, powering, connecting, and maintaining the necessary IT systems, many retreat to less demanding operational modes. The finding that only 4% of Nigerian manufacturing firms have adopted sustainable transportation practices [5] becomes understandable when one considers that sustainable transportation requires telematics, route optimization software, and real-time vehicle tracking—all dependent on acquired and operational IT infrastructure.

VI. CONCLUSION

Sustainable Supply Chain Management holds significant potential for improving environmental and social outcomes in Nigerian supply chains while enhancing economic performance. However, this potential cannot be realized without addressing the foundational challenge of IT

infrastructure acquisition. This paper has identified five categories of barriers—FX volatility and import dependency, power infrastructure deficits, connectivity gaps, maintenance ecosystem deficiencies, and regulatory uncertainty—that collectively constrain SSCM adoption. These barriers are systemic, interconnected, and resistant to piecemeal solutions.

The implication is clear: policy and practice interventions aimed at advancing SSCM in Nigeria must include explicit attention to IT infrastructure acquisition. Training, awareness-raising, and even regulatory mandates for sustainable practices will have limited effect if organizations cannot acquire power, connect, and maintain the IT systems that SSCM requires. By reframing the SSCM adoption challenge to include infrastructure acquisition as a core component, stakeholders can develop more realistic strategies and expectations.

The path forward requires coordinated action across policymakers, practitioners, international partners, and financiers. Regulatory harmonization, data center development, localized manufacturing support, innovative financing, and technical training are all necessary components of a comprehensive approach. Without them, SSCM in Nigeria risks remaining what it largely is today: an aspiration unsupported by the infrastructure required for implementation.

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