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EFFECT OF SUSTAINABLE PROCUREMENT PRACTICES ON SUSTAINABLE PERFORMANCE OF SMALL AND MEDIUM MANUFACTURING ENTERPRISES (SMMES) IN NIGERIA.

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Abstract

Sustainable performance has emerged as a critical determinant for business success in today's globalized economy. This study examines the effects of sustainable procurement practices on sustainable performance of Small and Medium Manufacturing Enterprises (SMMEs) in Nigeria focusing on the integration of economic, social and environmental dimension of sustainability. The Objectives of this study is to identify the sustainable procurement practices of manufacturing SMEs in Nigeria, to assess the key performance indicators for measuring sustainable performance of manufacturing SMEs in Nigeria and to estimate the effect of sustainable procurement practices of manufacturing SMEs in Nigeria on their sustainable performance. Using a quantitative research design, the population of the study consists of 20,736 of Manufacturing SMEs operating in Nigeria with a sample frame of three hundred and seventy-two (372) manufacturing SMEs operating in Kano State. The sample size is one hundred and ninety-one (191) manufacturing SMEs and simple random method was the sampling technique for the study. Data were collected from 268 manufacturing SMEs through structured administered questionnaires with a response rate of 210 valid questionnaires. The techniques of data analysis were Partial Least Squares (PLS) path modelling was employed with the aid of SmartPLS 3.0 software to test the hypotheses. The findings reveal that sustainable procurement practices significantly influence sustainable performance, with Sustainable IT Infrastructure exerting the strongest *effect, followed by Top Management Support and Supplier Collaboration. The study's R^2 value of 0.443 indicates that 44.3% of the variance in sustainable performance can be explained by these predictors. The study contributes to the literature on sustainable procurement and performance, particularly within the context of SMEs in developing economies. The study concludes with practical recommendations for managers and policymakers, emphasizing the need for capacity building, policy support, and strategic investments in sustainable practices.*

Keywords: sustainable procurement practices; Sustainable IT Infrastructure; by Top Management Support; Supplier Collaboration; SMME, Sustainable performance.

1.1 Introduction

Small and medium-sized enterprises (SMEs) contribute significantly to the economic development of most countries (Ismail, 2022). For instance, SMEs account for 65% of jobs and 55% of GDP in high-income economies, while in developing economies, they contribute approximately 70% of employment and 60% of GDP (Zafar & Mustafa, 2017). Among various sectors, manufacturing has played a pivotal role in propelling economic expansion globally. However, it is increasingly evident that manufacturing SMEs are significantly responsible for resource depletion, excessive waste generation, and both water and air pollution on a global scale (de Sousa Jabbour et al., 2020; Ndubisi, Zhai, & Lai, 2021). Consequently, ensuring sustainable economic development necessitates the active participation of SMEs in sustainable production and consumption practices.

To achieve such sustainability, SMEs must consider a combination of critical contextual elements—namely, suitable technological infrastructure, sound organizational practices, and strategically aligned processes (Alraja et al., 2022). Thus, a comprehensive approach is required to explore sustainable performance by integrating the key factors that influence it. According to de Sousa Jabbour et al. (2020), sustainability involves a harmonious balance between financial, social, and environmental dimensions. Therefore, future research must delve into the complex interactions among these dimensions, particularly within the context of Nigerian manufacturing SMEs.

This integrative approach aligns with the **Triple Bottom Line (TBL)** framework, which facilitates the adoption of sustainable business strategies and promotes holistic performance outcomes. Incorporating economic, environmental, and social considerations into decision-making is now widely regarded as fundamental for achieving sustainable business performance (Al Koliby et al., 2017). From a managerial standpoint, sustainability embodies the optimal integration of these three dimensions (Dey et al., 2020). In this regard, corporate sustainable performance (CSP) reflects the long-term competitive advantage realized through financial gains while simultaneously addressing environmental and social impacts without undermining stakeholder interests (Huo, Gu, & Wang, 2019).

Accordingly, sustainable performance is typically assessed across three interdependent dimensions: economic, environmental, and social. Economic performance encompasses both operational and financial metrics. On the operational front, it includes the firm’s ability to reduce input costs, energy consumption, and waste management expenses (Afum et al., 2020b), whereas financial metrics such as profitability, return on investment (ROI), and market share serve as key indicators (Flynn et al., 2010; Yang et al., 2018). Environmental performance, on the other hand, relates to a firm's efficiency in energy conservation, waste reduction, and minimizing the use of environmentally harmful materials (Amui et al., 2017; Han & Huo, 2020; Yusuf et al., 2013). Meanwhile, social performance evaluates a firm's contribution to society beyond profit-making, emphasizing its commitment to corporate social responsibility (CSR) across various stakeholder groups (Afum et al., 2020b; Turban & Greening, 1997). Social sustainability ensures that profit-making activities do not come at the expense of societal well-being (Hussain et al., 2019).

In recent years, there has been mounting global concern over the environmental and societal implications of business activities. The manufacturing segment of SMEs, in particular, is often cited as a major contributor to ecological degradation and socio-economic issues such as substandard working conditions and human rights violations. Therefore, it is increasingly critical for companies in this sector to adopt sustainability-driven practices that safeguard the environment, uphold social responsibilities, and simultaneously enhance core business functions (Al-Nuaimi, Singh, & Harney, 2021).

Against this backdrop, the present study aims to investigate the effects of **sustainable procurement practices** on the **sustainable performance of manufacturing SMEs in Nigeria.** Specifically, the research will examine the key performance indicators used to measure how sustainable procurement contributes to achieving environmental, social, and economic objectives within this sector.

1.1 Objectives of the Study

The aim of this study is to estimate the effects of sustainable procurement practices on the sustainable performance of manufacturing SMEs in Nigeria. Other specific objectives are to:

i. Investigate the effect of Supplier collaboration on sustainable performance of Manufacturing SMEs in Nigeria.

ii. Assess the effect of Top management support on sustainable performance of Manufacturing SMEs in Nigeria.

iii. Evaluate the effects of Sustainable IT infrastructure on sustainable performance of Manufacturing SMEs in Nigeria.

1.2 Hypotheses of the Study

Based on the research objectives, the following hypotheses are proposed:

H_{01}: Supplier collaboration has no significant effects on sustainable performance of Manufacturing SMEs.

$H_{0}2$: Top management support has no significant effects on sustainable performance of Manufacturing SMEs.

$H_{0}3$: Sustainable IT infrastructure has no significant effects on sustainable performance of Manufacturing SMEs.

2. Literature Review

This section provides a review of literature related to employees' performance and employee burnout.

2.1 Concept of Sustainable Performance

Sustainable performance refers to the ability of SMEs to align economic, social, and environmental goals within their operations to achieve long-term success. It extends beyond financial gains to include positive environmental and social contributions, such as reduced waste, improved stakeholder relations, and resource-efficient practices. As Kleindorfer et al. (2005) noted, it also involves proactive risk management and innovation-driven value creation.

Though often used interchangeably, terms like sustainable development, sustainability, and sustainable performance have distinct meanings. Sustainable development focuses on meeting present needs without compromising the future (WCED, 1987), while sustainability refers to the balance of actions across social, environmental, and economic areas (Nangpiire & Theophile Nasse, 2024). Sustainable performance reflects how well these strategies translate into measurable outcomes, often assessed through the Triple Bottom Line (TBL) framework—people, planet, and profit (Elkington, 1998).

This performance is typically measured across three dimensions: **Economic**: financial stability, market growth, and efficiency (Hussain et al., 2018). **Social**: employee well-being, fair practices, and stakeholder engagement (Martinez-Conesa et al., 2017). **Environmental**: waste reduction, energy use, and compliance with environmental standards (Correia, 2019).

In this study, sustainable performance is defined as the balanced achievement of these three dimensions, reflecting SMEs' capacity to create long-term value while aligning with global sustainability expectations such as the SDGs.

2.2 Concept of Sustainable Procurement Practices

Sustainable procurement involves sourcing goods and services with consideration for environmental, social, and ethical impacts, alongside financial value. Unlike traditional procurement, which focuses mainly on cost, quality, and delivery, sustainable procurement supports broader development goals such as environmental protection and social equity (Meehan & Bryde, 2011; Cammarano et al., 2022).

It emphasizes reducing environmental harm, ensuring fair labor conditions, and aligning procurement with long-term sustainability strategies (Adebayo et al., 2024). Walker and Brammer (2009) describe it as a holistic process that integrates economic, environmental, and social dimensions—closely aligned with the Triple Bottom Line framework.

When effectively implemented, sustainable procurement can serve as a strategic advantage, driving innovation, enhancing brand image, and opening access to new markets (Sarkis et al., 2011). For this study, the definitions by Meehan and Bryde (2011) and Walker and Brammer (2009) provide a fitting basis, as they emphasize the integration of sustainability into procurement, which is crucial for SME competitiveness.

2.2.1 Concept of Supplier Collaboration (SC)

Supplier collaboration refers to the management of cooperative relationships between a firm and its key supply chain partners when procuring goods or services. It plays a pivotal role in sustainable procurement by ensuring that suppliers align with environmental, social, and ethical standards. Through joint initiatives, information sharing, and long-term partnerships, firms can achieve mutual sustainability goals, improve resource efficiency, reduce waste, and enhance regulatory compliance (Roehrich et al., 2014; Andalib et al., 2023). Collaborative relationships also support knowledge sharing and innovation, which are critical for enhancing performance and product development (Grekova et al., 2015; Yan & Dooley, 2014). However, successful collaboration requires trust, time, and a willingness to share information and resources from both parties (Chiou et al., 2011; Tanuwijaya et al., 2021). Therefore, for the purpose of this study, **supplier collaboration is defined as the management of collaborative relationships with key supply chain partners when sourcing products or services** (Ali et al.,, 2016).

2.2.2 Concept of Top Management Support (TMS)

Top Management Support (TMS) refers to the active involvement of senior executives in shaping and executing key organizational strategies, particularly those related to sustainability. In SMEs, where resources are often limited, leadership commitment is vital for embedding sustainable procurement into core operations. Carter and Jennings (2004) emphasized that top management's role in setting goals, allocating resources, and promoting a sustainability-oriented culture is crucial to success.

Research shows that top leaders influence mission, vision, shared values, and the ability to overcome implementation challenges (Wanyoike, 2016; Young & Poon, 2013). Their support also enhances organizational efficiency and long-term competitiveness, especially in IT and strategic initiatives (Štemberger et al., 2011; Hsu et al., 2019).

For this study, TMS is defined as the active participation of top executives in transforming sustainability policies into concrete goals, strategies, and actions.

2.2.3 Concept of Sustainable Information Technology Infrastructure (SITI)

Sustainable Information Technology Infrastructure (SITI) refers to the use of technological resources and practices that generate long-term economic, social, and environmental benefits. It supports sustainable procurement by improving operational efficiency, enabling real-time data tracking, and enhancing transparency. Tools like procurement software and digital supply chains help reduce waste, ensure compliance, and align procurement with sustainability goals (Wu et al., 2013).

SITI has economic value through energy savings (Leismann et al., 2013), promotes social inclusion (Jaeger et al., 2012), and reduces environmental impact by minimizing emissions and managing e-waste (Melville, 2010). It includes both technical components (hardware, software) and human factors (expertise, values) (Broadbent & Weill, 1997; Terry, 2000).

For this study, SITI is defined as the application of IT resources and practices that deliver enduring economic, social, and environmental value (Al-Emran & Griffy-Brown, 2023).

2.3 Theoretical Framework for the Study

This study is underpinned by two complementary theories: the **Resource-Based View (RBV)** and **Institutional Theory**. Together, these theories provide a robust foundation for understanding how supplier collaboration, top management support, and sustainable IT infrastructure influence the sustainable performance of small and medium-sized manufacturing enterprises (SMMEs) in Nigeria. While RBV focuses on the internal capabilities and resources that create competitive advantage, Institutional Theory explains how external pressures and organizational legitimacy shape firm behaviors toward sustainability.

2.3.1 Resource-Based View (RBV) Theory

The RBV theory, developed by Penrose (1959) and expanded by Barney (1991), posits that firms achieve superior performance by leveraging valuable, rare, inimitable, and non-substitutable (VRIN) resources. These resources include both tangible (e.g., infrastructure, technology, finance) and intangible (e.g., knowledge, capabilities, skills) assets. In this context, supplier collaboration, top management support, and sustainable IT infrastructure are seen as strategic resources that can drive long-term sustainable performance (Nangpiire & Theophile Nasse, 2023; Andalib et al., 2023). For instance, supplier collaboration facilitates knowledge exchange and innovation, while sustainable IT systems reduce environmental impact and improve operational efficiency (Abbas et al., 2019; Anthony Jr., 2019). Thus, the RBV theory supports the argument that SMEs can gain sustainable competitive advantage by investing in and effectively utilizing these internal capabilities.

2.3.2 Institutional Theory

Institutional Theory emphasizes that organizations are influenced by societal norms, external pressures, and the need for legitimacy (Bruton & Ahlstrom, 2010; Meyer & Rowan, 1977). It introduces the concept of **isomorphism**, where firms adopt similar practices to conform to coercive (regulatory), mimetic (competitive), and normative (professional) pressures (Kauppi, 2013). In the context of this study, top management support is influenced by these institutional pressures, as leaders respond to stakeholder expectations, sustainability trends, and regulatory demands (Dubey et al., 2015; Ma et al., 2021). When top managers champion sustainability, they drive organization-wide change and reinforce legitimacy, motivating employees to adopt sustainable practices aligned with industry and societal standards.

2.3.3 Integrating the Theories

By integrating RBV and Institutional Theory, this study offers a comprehensive lens to examine the drivers of sustainable performance. The RBV explains *what* internal capabilities (e.g., supplier collaboration, IT infrastructure, managerial support) are essential for achieving sustainability, while Institutional Theory explains *why* organizations pursue sustainability due to external pressures and the need for legitimacy. Together, these perspectives highlight that SMMEs must not only develop valuable internal resources but also align with institutional expectations to successfully implement sustainable procurement practices and improve their sustainable performance.

2.4 Review of Empirical Studies

Several empirical studies have examined the influence of sustainable procurement dimensions—such as top management support, supplier collaboration, and sustainable IT infrastructure—on firm performance across various contexts. For instance, Nangpiire et al (2024) investigated the relationship between top management support and SME performance in Ghana using a sample of 317 managers analyzed via Smart PLS 4.0. The findings revealed a moderately significant and positive impact of top management support on performance. Similarly, Astana et al, (2024), in a study of 50 construction firms in Bali, Indonesia, found that top management support and project risk mitigation significantly influenced construction project performance. In the context of IT, Ananga (2024) reported a significant impact of technology infrastructure on the business performance of commercial banks in Kenya, based on data from 138 top managers using SPSS analysis. Likewise, Maulani et al. (2021) found that IT resources significantly enhanced innovation performance in higher education institutions in Indonesia, confirming the strategic role of IT in institutional development.

Supplier collaboration has also emerged as a critical enabler of sustainable performance. Andalib et al (2023) demonstrated that supplier collaboration positively influenced environmental and economic performance in Iranian industrial firms. Baah et al (2022) confirmed that supply chain collaboration significantly predicts both environmental and financial outcomes using PLS-SEM. Similarly, Riofiandi and Tarigan (2022), through a study of 88 manufacturing firms in Java, Indonesia, found that supplier collaboration significantly enhanced company performance through improved lean practices and inventory control. Furthermore, Tarigan et al (2020), using data from 206 Chinese manufacturing firms, revealed that green supplier collaboration positively impacts financial and environmental performance by enhancing information sharing. Collectively, these studies underscore the relevance of collaborative partnerships, executive support, and digital infrastructure in driving sustainable procurement and firm-level performance outcomes.

Synthesis of Empirical Studies

Empirical evidence consistently highlights the vital roles of top management support, supplier collaboration, and sustainable IT infrastructure in driving sustainable performance. Studies such as Nangpiire et al. (2024) and Astana et al. (2024) emphasize that leadership commitment is essential for translating sustainability goals into actionable strategies, reflecting Institutional Theory's view of management as a legitimizing force for sustainability.

Similarly, research by Mwalili (2024) and Maulani et al. (2021) shows that sustainable IT infrastructure—such as data systems and procurement software—enhances efficiency, innovation, and long-term value. This supports the Resource-Based View (RBV), which sees IT as a strategic internal resource.

Supplier collaboration also emerges as a key enabler, with studies like Andalib et al. (2023), Baah et al. (2022), and Riofiandi & Tarigan (2022) linking it to improved financial and environmental outcomes. Collaboration fosters joint innovation and goal alignment, while practices like green innovation mediate these benefits (Tarigan et al., 2020).

Together, these studies validate the relevance of RBV and Institutional Theory in sustainable procurement. However, the dynamics within Nigerian manufacturing SMEs remain underexplored—an important gap this study seeks to fill.

3. Methodology

This study employed a cross-sectional descriptive survey design to gather data from respondents at a single point in time. This design was appropriate as it enabled the collection of accurate, systematic, and factual data without influencing participant responses (Swain, 2008; Yusuf et.al.,2024).

The target population comprised 20,736 manufacturing SMEs in Nigeria, with a focus on those in Kano State due to its commercial relevance and high SME concentration (SMEDAN, 2021). Based on the 372 registered manufacturing SMEs in Kano (KACCIMA, 2024), the required sample size was determined using Krejcie and Morgan's (1970) table, resulting in 191 SMEs. To accommodate possible non-responses, a 40% buffer was added, yielding a final sample size of 268 SMEs.

A simple random sampling technique was adopted to ensure impartiality, using Microsoft Excel for selection (Saunders et al., 2023). Data was collected via a self-administered questionnaire, distributed to SME owner-managers. The questionnaire, organized into five sections (A–E), included demographic questions and items measuring the study variables using a 5-point Likert scale. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to analyze the data.

3.1 Measurement of Variables

To measure the study variables, validated and widely adopted scales were employed, each tailored to reflect the dimensions of **sustainable procurement practices** and **sustainable performance**. Specifically, **Sustainable Performance** was measured across its three core dimensions—**economic, social, and environmental**—using twenty-one (21) items adapted from **Venkatraman and Nayak (2015)**. **Supplier Collaboration** was assessed using six (6) items derived from **Riofiandi and Tarigan (2022)**, while **Top Management Support** was measured by four (4) items adapted from **Nangpiire et al. (2023)**. Similarly, **Sustainable IT Infrastructure** was captured using four (4) items also adapted from **Nangpiire et al. (2023)**.

To ensure content validity and refine the instrument for clarity and relevance, a **pilot test** was conducted with **26 managers/owners of SMEs in Kaduna State**, in line with the **10% rule of thumb** for pilot studies as suggested by **Connelly (2008)**. Feedback from the pilot test was used to make minor adjustments to the questionnaire where necessary.

Furthermore, to confirm the reliability and validity of the constructs, the study conducted **Assessment of the Measurement Model** (including indicator reliability, internal consistency reliability, convergent and discriminant validity), as well as **Assessment of the Structural Model**, using **PLS-SEM.** These assessments ensured the robustness and statistical soundness of the measurement tools and the hypothesized relationships among constructs.

4.0 Results and Discussion

Out of the 268 distributed structured questionnaires, 227 were returned, representing a response rate of 84.7%. However, upon review, 17 responses were deemed invalid due to incomplete data or failure to meet the inclusion criteria. This response rate exceeds the minimum sample size of 191 suggested by the Krejcie & Morgan (1977) for determining sample size. Therefore, the 210 valid responses are appropriate for analysis and discussion.

4.1 Assessment of Measurement Model

This study assessed the measurement model using criteria for reflective constructs, including composite reliability, convergent validity, and discriminant validity (Hair et al., 2017). As recommended by Hulland (1999), indicators with loadings between 0.40 and 0.70 were considered for removal only if it improved composite reliability. However, indicators with loadings below 0.40 were deleted, while those above 0.40 were retained to ensure content validity (Hair et al., 2011). The results are presented in Figure 4.1 and Table 4.10.

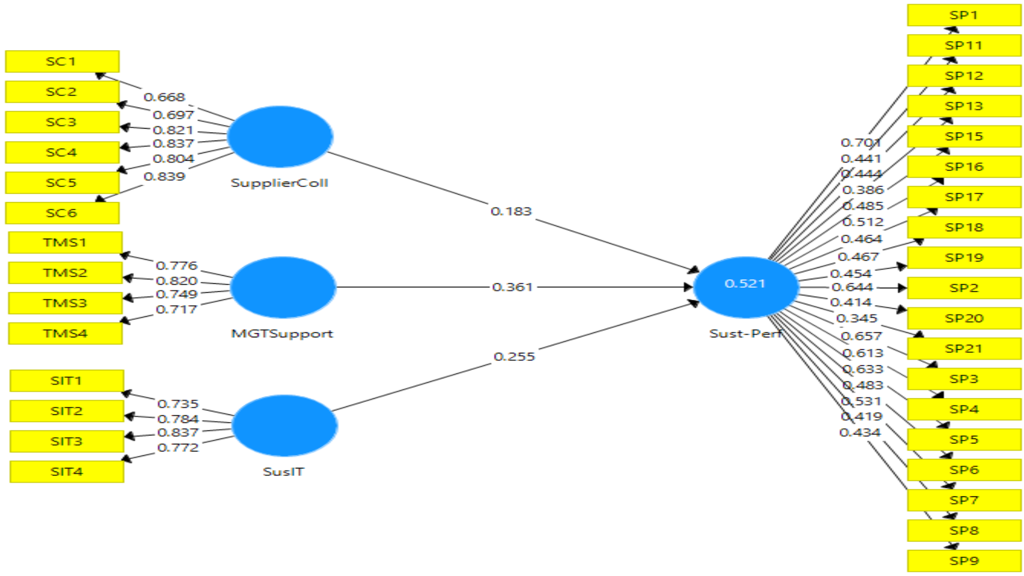

Figure: 4.1 Measurement Model
Source: Researcher (2025)

4.1.1 Reliability and Validity Assessment

In empirical research, internal consistency, reliability, and validity are essential for ensuring the accuracy and robustness of measurement instruments. These metrics are particularly important when using multi-item scales to measure latent constructs, such as Top Management Support (MGTSupport), Supplier Collaboration (SupplierColl), Sustainable IT Infrastructure (SusIT), and Sustainable Performance (Sust-Perf). Internal consistency is assessed using Cronbach's Alpha, while construct reliability and validity are evaluated using Composite Reliability, rho_A, and Average Variance Extracted (AVE). The results are summarized in Table 4.1.

Table 4.1.1 Internal consistency reliability and validity

Construct	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
MGTSupport	0.766	0.776	0.850	0.587
SupplierColl	0.839	0.852	0.886	0.612
SusIT	0.789	0.798	0.863	0.613
Sust-Perf	0.843	0.829	0.841	0.592

Source: Researcher (2025)

In Table 4.1.1, Cronbach's Alpha values range from 0.766 to 0.843, exceeding the recommended threshold of 0.70 (Nunnally, 1978), indicating good internal consistency for all constructs. Higher values of Cronbach's Alpha suggest that the items reliably measure their respective constructs—namely, MGTSupport, SupplierColl, SusIT, and Sust-Perf.

The rho_A values (0.776 to 0.852) and composite reliability scores (0.841 to 0.886) also exceed the accepted benchmark of 0.70 (Hair et al., 2010), further confirming the reliability and internal consistency of the measurement model.

For convergent validity, the Average Variance Extracted (AVE) values range from 0.587 to 0.613, surpassing the minimum threshold of 0.50 (Fornell & Larcker, 1981). These results indicate that each construct explains more than half of the variance in its indicators, thus confirming adequate convergent validity.

4.1.2 Discriminant Validity

Discriminant validity tests whether constructs that are supposed to be distinct are indeed distinct from one another. In this study, discriminant validity is assessed using the Fornell-Larcker criterion and the Heterotrait-Monotrait ratio (HTMT).

Table 4.1.2 Discriminant validity Using Fornell and Lacker criterion

Construct	MGTSupport	SupplierColl	SusIT	Sust-Perf
MGTSupport	0.766			
SupplierColl	0.714	0.782		
SusIT	0.704	0.621	0.783	
Sust-Perf	0.615	0.562	0.602	0.541

Source: Researcher (2025)

In Table 4.1.2, discriminant validity is evaluated using the Fornell-Larcker criterion, which compares the square root of the Average Variance Extracted (AVE) for each construct with the inter-construct correlations. The diagonal values (in bold) represent the square roots of the AVEs, while the off-diagonal elements show the correlations between constructs. According to Fornell and Larcker (1981) and Hair et al. (2017), discriminant validity is established when a construct's AVE square root exceeds its correlations with other constructs.

For instance, the square root of the AVE for MGTSupport is 0.766, which is greater than its correlations with SupplierColl (0.714), SusIT (0.704), and Sust-Perf (0.615), indicating satisfactory discriminant validity. Likewise, the diagonal values for SupplierColl, SusIT, and Sust-Perf are each higher than their respective inter-construct correlations. These results confirm that all constructs in the model are conceptually distinct and measure unique latent variables.

Table 4.1.3 Discriminant validity Using HTMT ratio

Construct	MGTSupport	SupplierColl	SusIT	Sust-Perf
MGTSupport				
SupplierColl	0.867			
SusIT	0.872	0.758		
Sust-Perf	0.527	0.491	0.501	

Source: Researcher (2025)

Table 4.1.3 presents HTMT values for assessing discriminant validity. Most values are below the 0.85 threshold (Henseler et al., 2015), except for MGTSupport–SusIT (0.872) and MGTSupport–SupplierColl (0.867), which are slightly higher but still within the acceptable 0.90 limit (Hair et al., 2017). Other pairs, such as Sust-Perf–SupplierColl (0.491) and SusIT–Sust-Perf (0.501), show clear discriminant validity.

4.2.0 Assessment of Structural Equation Model

PLS-SEM structural model assessment focuses on the model's ability to explain variance in the dependent variables. Once reliability and validity are confirmed, key evaluation metrics include the coefficients of determination (R^2), path coefficients, effect sizes (f^2), predictive relevance (Q^2), and q^2 effect sizes. Results are shown in Figure 4.2 and Table 4.1.4.

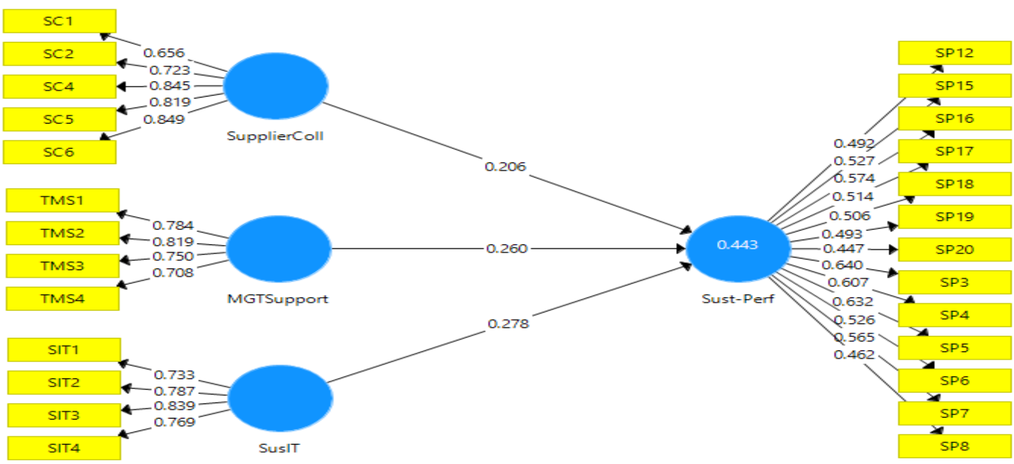

Figure: 4.2 Structural Equation Model
Source: Researcher (2025)

4.2.1 Coefficients of Determination (R^2 Values)

The R^2 value, also known as the coefficient of determination, represents the proportion of variance in the dependent variable that can be explained by the independent variables in a model. It is a measure of the model's explanatory power, with higher values indicating that more of the variance in the dependent variable is accounted for by the model. The result if presented in table 4.15.

Table 4. 2.1 Coefficients of Determination (R^2 values)

Construct	R Square
Sust-Perf	0.443

Source: Researcher (2025)

In Table 4.15, the R^2 value for Sustainable Performance (Sust-Perf) is 0.443, indicating that 44.3% of its variance is explained by SupplierColl, MGTSupport, and SusIT. This reflects moderate explanatory power, suggesting these factors are important drivers of sustainable performance among manufacturing SMEs. However, 55.7% of the variance remains unexplained, implying that additional factors outside the model may also play a role.

4.2.2 Size and Significance of the Path Coefficients

Path coefficients show the strength and direction of relationships in the structural model. Their size indicates the importance of predictors, while p-values and t-statistics confirm significance. Results are presented in Table 4.2.2.

Table 4.2.2 Size and Significance of the Path Coefficients

Hypotheses	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Decision
SupplierColl -> Sust-Perf	0.211	0.068	3.037	0.003	Rejected
MGTSupport -> Sust-Perf	0.258	0.082	3.181	0.002	Rejected
SusIT -> Sust-Perf	0.288	0.08	3.47	0.001	Rejected

In Table 4.2.2, the path from Supplier Collaboration (SupplierColl) to Sustainable Performance (Sust-Perf) shows a coefficient of 0.211, with a t-statistic of 3.037 and a p-value of 0.003, indicating a statistically significant relationship. Similarly, Top Management Support (MGTSupport) has a significant effect on Sustainable Performance ($\beta = 0.258$, $t = 3.181$, $p = 0.002$). Sustainable IT Infrastructure (SusIT) shows the strongest effect ($\beta = 0.288$, $t = 3.470$, $p = 0.001$), also statistically significant.

All three paths show significant positive relationships, and therefore, the null hypotheses H_{01}, H_{02}, and H_{03} are rejected. These results confirm that Supplier Collaboration, Top Management Support, and Sustainable IT Infrastructure significantly influence Sustainable Performance, with SusIT having the greatest impact.

4.2.3 Effect Size (F^2)

The f^2 effect size evaluates the practical significance of each independent variable by measuring the change in R^2 when that variable is excluded from the model. According to Cohen (1988), values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively. Results are shown in Table 4.17.

Table 4.2.3: Effect Size (F2)

Construct	Sust-Perf	Effect Size
MGTSupport	0.041	Small
SupplierColl	0.037	Small
SusIT	0.057	Small

Source: Researcher (2024)

In Table 4.2.3, all f^2 effect sizes for the independent variables are categorized as small, indicating limited individual impact on Sustainable Performance (Sust-Perf). Top Management Support (0.041), Supplier Collaboration (0.037), and Sustainable IT Infrastructure (0.057) each contribute modestly, with SusIT showing the highest, yet still small, effect. These results suggest that while each factor influences sustainable performance, their effects are not strong in isolation. Future research should consider additional variables to better explain sustainability outcomes among manufacturing SMEs.

4.2.4 Predictive Relevance (Q^2)

Predictive relevance (Q^2) assesses a model's ability to predict the values of endogenous constructs. Calculated using the Stone-Geisser Q^2 statistic, values greater than zero indicate that the model has predictive relevance. This confirms the model's usefulness in explaining variance in the dependent variable. Results are shown in Table 4.2.4.

Table 4.2.4, Predictive Relevance (Q2),

Construct	SSO	SSE	Q^2 (=1-SSE/SSO)
MGTSupport	1052	1052	
SupplierColl	1315	1315	
SusIT	1052	1052	
Sust-Perf	3419	3144.639	0.28

Source: Researcher (2024)

In Table 4.2.4, the Q^2 value for Sustainable Performance (Sust-Perf) is 0.28, indicating moderate predictive relevance. This suggests the model has reasonable predictive accuracy in explaining sustainable performance based on SupplierColl, MGTSupport, and SusIT. As exogenous variables, MGTSupport, SupplierColl, and SusIT do not have Q^2 values, since predictive relevance applies only to endogenous constructs.

4.2.5 Importance-Performance Map Analysis (IPMA)

The Importance-Performance Map Analysis (IPMA) offers deeper insights into how each construct affects Sustainable Performance (Sust-Perf) by evaluating both their importance and performance. This helps identify which factors have the greatest impact and how effectively they are performing. Results are shown in Table 4.2.5.

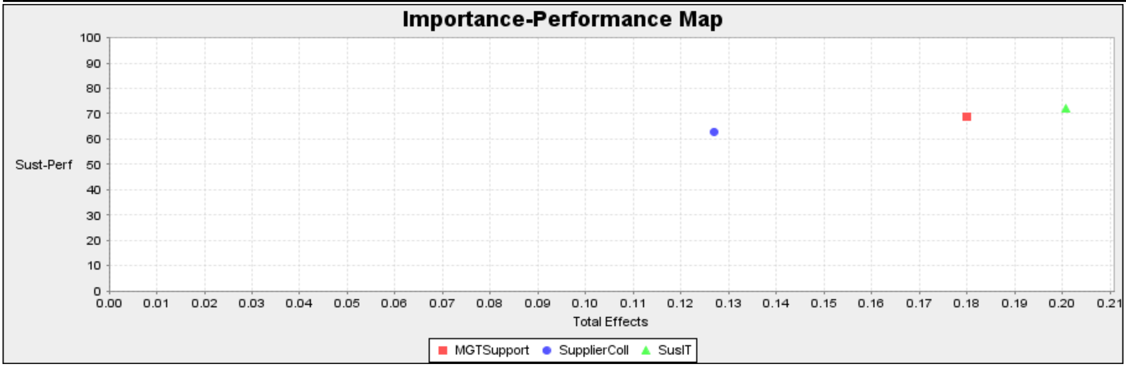

Figure 4.2.5 Importance Performance Map,
Source: Researcher (2024)

Figure 4.2.5 presents the Total Effects and Performance results from the IPMA. Sustainable IT Infrastructure (SusIT) has the highest total effect (0.201), indicating it is the most influential factor in driving Sustainable Performance (Sust-Perf). Top Management Support (MGTSupport) follows with a total effect of 0.180, and Supplier Collaboration (SupplierColl) with 0.127, showing comparatively lower impact.

In terms of performance (on a 0–100 scale), SusIT again leads with a score of 72, followed by SupplierColl (68.9) and MGTSupport (62.8). These findings suggest that while all three factors positively influence sustainable performance, SusIT is both the most impactful and best-performing driver among the constructs.

4.3.0 Discussion of Findings

This study explored how Supplier Collaboration, Top Management Support, and Sustainable IT Infrastructure influence Sustainable Performance among manufacturing SMEs in Nigeria. The results show that all three factors have significant positive effects, leading to the rejection of the null hypotheses (H_{01}, H_{02}, and H_{03}).

Supplier Collaboration, though statistically significant, showed a relatively small effect (0.127). This suggests that while partnerships with suppliers are beneficial for sustainability, Nigerian SMEs may face limitations such as weak supplier networks or limited resources that reduce the full potential of such collaborations. This is inline with the findings of Tarigan et al (2020),

Top Management Support had a stronger effect (0.180), highlighting the critical role of leadership in promoting sustainable practices. This is consistent with earlier studies emphasizing the importance of management involvement in setting strategic direction and fostering a sustainability-oriented culture. However, the effect size was somewhat lower than reported in studies from more developed economies, likely due to resource constraints in the Nigerian SME context. The study corroborates the findings of Nangpiire et al (2024)

Sustainable IT Infrastructure had the strongest impact (0.201), suggesting that digital technologies are a key driver of sustainability performance. Tools like cloud systems, energy-efficient IT, and digital supply chain platforms help SMEs overcome structural challenges and improve efficiency and transparency. This finding reflects the growing importance of digital transformation in emerging markets. The study is in tandem with the findings of Maulani et al. (2021)

Overall, the study confirms that leadership, collaboration, and digital infrastructure are important for improving sustainable performance in SMEs. It also highlights the need for an integrated approach that combines these elements to drive long-term sustainability outcomes. Future research should consider how factors like industry type and policy environment may further influence these relationships.

Conclusion and Recommendations

This study explored the effects of Supplier Collaboration, Top Management Support, and Sustainable IT Infrastructure on the sustainable performance of manufacturing SMEs in Nigeria. The findings revealed that all three factors significantly influence sustainable performance, with Sustainable IT Infrastructure having the strongest impact. This highlights the critical role of digital technologies in driving environmental and operational improvements.

Top Management Support also proved important, confirming that leadership commitment is essential for embedding sustainability into organizational strategies. Supplier Collaboration, while significant, showed a smaller effect, possibly due to limited integration, resource constraints, or weak supplier networks common in developing economies.

For managers, the study suggests prioritizing investment in digital tools, strengthening leadership commitment to sustainability, and building more effective supplier partnerships. Theoretically, the findings support the Resource-Based View and Institutional Theory, showing that internal capabilities and leadership drive sustainability outcomes.

However, the study's cross-sectional design and focus on a single region limit broader application. Future research should consider longitudinal approaches, sectoral comparisons, and mixed methods to deepen understanding and generalize findings.

Recommendations

Based on the findings, the following recommendations are proposed:

1. **Enhance Supplier Collaboration**: SME managers should initiate long-term supplier development programs, establish clear sustainability KPIs, and promote joint problem-solving initiatives that foster co-innovation and alignment with sustainability objectives.
2. **Strengthen Top Management Commitment**: Sustainability must be integrated into strategic planning and leadership development programs. Senior executives should champion green procurement and create an internal culture that rewards sustainable practices.
3. **Invest in Sustainable IT Infrastructure**: SMEs should adopt IT tools that support environmental performance monitoring, life cycle cost analysis, and supply chain traceability. Government agencies should offer financial incentives, grants, or tax credits to support IT adoption.

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