EFFECT OF ECO-INNOVATION ON PERFORMANCE OF SMALL AND MEDIUM ENTERPRISES IN NORTH CENTRAL NIGERIA

[1]IBRAHIM, Mohammed Umar
+1Department of Business Adminstration, Federal Polytechnic Ngodo-Isuochi, Abia State
Email:mm.ibrahim@fpi.edu.ng

Abstract
This study examines the effect of green market innovation and green marketing innovation on the performance of small and medium enterprises (SMEs) in North Central Nigeria. Against the backdrop of increasing global emphasis on sustainability, the research explores how eco-innovation practices can enhance SME performance while addressing environmental challenges. Grounded in Joseph Schumpeter's Innovation Theory. A quantitative research design was adopted, with data collected from 345 SMEs using a structured questionnaire designed on a 5-point Likert scale. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the hypothesized relationships. The findings reveal that both green market innovation and green marketing innovation have a significant positive effect on SME performance, highlighting their role in improving resource efficiency, reducing environmental impact, and attracting environmentally conscious consumers. Based on these findings, the study recommends investment in training programs, policy incentives, collaborative networks, targeted marketing strategies, and consumer education to promote the adoption of eco-innovation among SMEs. This research contributes to the literature on sustainable entrepreneurship by providing empirical evidence on the role of eco-innovation in enhancing SME performance in a developing economy context. It also offers practical insights for policymakers, SME owners, and stakeholders seeking to foster sustainable economic development in North Central Nigeria.
Keywords: *Green market innovation, green marketing innovation, SME performance, eco-innovation, sustainability, Innovation Theory.*

Introduction

The present state of small and medium enterprises (SMEs) in North Central Nigeria reflects a mix of opportunities and challenges. SMEs are widely recognized as the backbone of the Nigerian economy, contributing significantly to employment, poverty alleviation, and economic growth (SMEDAN, 2020). However, these enterprises often operate in resource-intensive sectors such as agriculture, manufacturing, and mining, which are associated with environmental degradation, including deforestation, pollution, and waste generation (National Bureau of Statistics, 2021). Despite their economic importance, many SMEs in the region struggle with low productivity, limited access to finance, and inadequate infrastructure, which hinder their ability to compete effectively in the market (Adegbile et al., 2017).

The increasing global emphasis on sustainability and environmental responsibility has created additional pressure for SMEs to adopt eco-friendly practices. However, the adoption of eco-innovation—defined as the development and implementation of new products, processes, or practices that reduce environmental impact while enhancing business performance—remains low among SMEs in the region (Kemp & Pearson, 2007).

The desired state for SMEs in North Central Nigeria is one where they not only contribute to economic growth but also operate in an environmentally sustainable manner. This vision aligns with global sustainability goals, such as the United Nations Sustainable Development Goals (SDGs), which emphasize the importance of responsible consumption and production, climate action, and decent work and economic growth (United Nations, 2015). Achieving this desired state requires SMEs to adopt eco-innovation strategies, such as green market innovation and green marketing innovation, which can enhance their competitiveness, reduce operational costs, and attract environmentally conscious consumers (Dangelico & Pujari, 2010).

Green market innovation involves the creation of environmentally sustainable products or services, while green marketing innovation focuses on promoting these products through sustainable marketing practices (Chen et al., 2006). By adopting these strategies, SMEs can improve their resource efficiency, reduce waste, and align their operations with global sustainability trends. However, the transition to this desired state is hindered by several barriers, including limited awareness of eco-innovation, lack of technical expertise, and inadequate regulatory support (Hojnik & Ruzzier, 2016). Addressing these barriers requires a deeper understanding of how eco-innovation impacts SME performance in the North Central region of Nigeria.

Green market innovation and green marketing innovation are critical drivers of eco innovation. Green market innovation directly influences SME performance by enabling the development of products or services that meet the growing demand for environmentally friendly solutions (Dangelico & Pujari, 2010). SMEs that invest in renewable energy technologies or sustainable agricultural practices can reduce their reliance on non-renewable resources, lower production costs, and gain a competitive edge in the market (Hojnik & Ruzzier, 2016). Similarly, green marketing innovation enhances SME performance by improving brand image, customer loyalty, and market share. By adopting sustainable marketing practices, such as eco-labeling, green advertising, and ethical sourcing, SMEs can differentiate themselves from competitors and appeal to environmentally conscious consumers (Chen et al., 2006). These strategies not only contribute to environmental sustainability but also drive financial performance by increasing sales and profitability (OECD, 2019).

The relationship between eco-innovation and SME performance is particularly relevant in the context of North Central Nigeria, a region characterized by diverse economic activities and significant environmental challenges. The region is home to a large number of SMEs operating in sectors such as agriculture, mining, and manufacturing, which are critical to local economic development but also contribute to environmental degradation (Eze & Ndubisi, 2013). Agricultural SMEs often rely on unsustainable farming practices, such as excessive use of chemical fertilizers and deforestation, which degrade soil quality and reduce biodiversity (National Bureau of Statistics, 2021). Similarly, manufacturing SMEs in the region face challenges related to waste management and energy efficiency, which increase their environmental footprint (Adegbile et al., 2017). By adopting eco-innovation strategies, SMEs in North Central Nigeria can address these environmental challenges while improving their performance.

Statement of the Problem

Despite the potential benefits of eco-innovation, its adoption among SMEs in North Central Nigeria remains limited due to several barriers. One major barrier is the lack of awareness and understanding of eco-innovation among SME owners and managers (Adegbile et al., 2017). Many SMEs in the region are unaware of the environmental and economic benefits of eco-innovation or lack the technical expertise to implement such strategies (Hojnik & Ruzzier, 2016). Additionally, the high cost of adopting eco-innovation practices, such as investing in renewable energy technologies or sustainable production processes, poses a significant challenge for SMEs with limited financial resources (OECD, 2019). Furthermore, the absence of supportive policies and regulatory frameworks at the national and regional levels discourages SMEs from adopting eco-innovation practices (Eze & Ndubisi, 2013). The lack of incentives, such as tax breaks or grants, for SMEs that invest in eco-innovation limits their ability to transition to more sustainable business models (Adegbile et al., 2017). Addressing these barriers requires a concerted effort from policymakers, industry stakeholders, and SME owners to create an enabling environment for eco-innovation adoption.

Despite the growing body of literature on eco-innovation and its impact on business performance, there is a significant research gap regarding its specific effects on small and medium enterprises (SMEs) in North Central Nigeria. While studies such as those by Hojnik and Ruzzier (2016) and Dangelico and Pujari (2010) have explored the role of green market innovation and green marketing innovation in enhancing firm performance, these studies predominantly focus on developed economies and large corporations, leaving a dearth of context-specific research on SMEs in developing regions like North

Central Nigeria. Additionally, Adegbile et al. (2017) highlight the challenges SMEs face in adopting eco-innovation, such as limited resources and lack of awareness, but do not provide empirical evidence on how these challenges manifest in the Nigerian context or how they impact SME performance. Furthermore, while Chen et al. (2006) emphasizes the importance of eco-innovation in driving competitive advantage, there is limited

Objectives of the Study

The main objective of the study is to examine the effect of eco innovation on Performance of SMEs in North Central Nigeria. The study will be guided by the following specific objectives;

1. To measure the effect of green market innovation on the performance of SMEs in North Central Nigeria.
2. To measure the effect of green marketing innovation on the performance of SMEs in North Central Nigeria.

LITERATURE REVIEW

Eco Innovation

Kemp and Pearson. (2017) defines eco-innovation as the development and application of new ideas, products, processes, or practices that contribute to environmental sustainability by reducing environmental impacts, optimizing resource use, and fostering a transition toward a circular economy. It encompasses technological advancements, such as renewable energy systems or energy-efficient manufacturing processes, as well as non-technological changes, including eco-friendly business models or policy frameworks that incentivize sustainable practices. Eco-innovation is not limited to incremental improvements but also includes radical shifts in how societies produce and consume, aiming to decouple economic growth from environmental degradation. By integrating ecological considerations into innovation processes, eco-innovation seeks to address global challenges like climate change, biodiversity loss, and resource scarcity, while simultaneously creating economic and social value

Porter and van der Linde, (2016). Posits that eco-innovation is a driver of competitive advantage and market transformation. In this context, eco-innovation is seen as a strategic tool for businesses to differentiate themselves by offering sustainable products or services that meet the growing demand for environmentally responsible solutions. This approach aligns with the concept of "green growth," where innovation spurs economic development while preserving natural capital. For example, companies that invest in eco-design creating products with minimal environmental footprints can tap into new markets and attract environmentally conscious consumers. This definition highlights the dual role of eco-innovation in fostering environmental stewardship and enabling businesses to thrive in a rapidly evolving global economy.

Carrillo-Hermosilla et al. (2010) conceptualize eco-innovation as a holistic approach that integrates environmental, economic, and social dimensions. This perspective highlights the importance of collaboration among stakeholders, including businesses, governments, and communities, to co-create solutions that balance ecological integrity with economic viability and social equity, for instance, eco-innovation may involve the development of green supply chains, where companies work together to minimize waste and emissions across the entire production cycle. This systemic view underscores the interconnectedness of environmental and societal challenges, advocating for innovations that are not only technologically advanced but also socially inclusive and ethically grounded.

In this study, co-innovation, refers to the development and implementation of new or significantly improved products, processes, organizational methods, or business models that reduce environmental impacts while providing economic and social benefits. It encompasses innovations that enhance resource efficiency, lower emissions, and promote sustainability across industries and sectors. Rooted in ecological modernization and sustainability transitions theories, eco-innovation integrates technological, regulatory, and behavioral changes to address environmental challenges. Scholars emphasize its multidimensional

nature, involving technological advancements, systemic shifts, and policy interventions that drive the transition toward a more sustainable economy.

Green Market Innovation

Adegbite and Oladipo (2021) conceptualize green market innovation as the development of sustainable products and processes that reduce environmental impact throughout their lifecycle. This involves integrating environmental concerns into product design, production, and distribution to minimize negative effects on the environment, for instance, companies might focus on creating products with sustainable packaging or using renewable energy sources in manufacturing. Such innovations not only appeal to environmentally conscious consumers but also contribute to long-term sustainability by reducing waste and pollution.

According to Smith and Brown (2020) green market innovation emphasizes the adoption of eco-friendly practices across all stages of marketing activities. This includes modifying goods and services to be more environmentally friendly, changing production processes to reduce resource consumption, and promoting these changes effectively. By focusing on eco-efficiency and minimizing adverse environmental impacts through strategies like recycling or reusing materials, businesses can enhance their brand reputation while contributing positively to environmental conservation.

This study define green market innovation means creating and selling new or improved products, services, or business models that are better for the environment while still meeting customer needs. This could include using eco-friendly materials, reducing waste, or designing products that last longer and can be recycled. Companies pursue green innovation not only to help the planet but also to attract environmentally conscious customers and follow government regulations. It's a way for businesses to stay competitive while promoting sustainability and reducing their impact on nature.

Green Marketing Innovation

Green marketing innovation refers to the development and implementation of marketing strategies that integrate environmental sustainability into product promotion, distribution, and customer engagement. This concept involves adopting eco-friendly branding, sustainable advertising campaigns, and responsible consumer education to align with the growing demand for environmentally conscious products ,by incorporating green values into their marketing mix, firms enhance their brand reputation, gain competitive advantage, and foster long-term customer loyalty. This perspective emphasizes the role of businesses in shaping consumer behavior towards sustainable consumption through ethical marketing practices (Roh et al. 2022).

According to (Kumar, 2015) green marketing innovation is the process of designing, promoting, and distributing products and services that minimize environmental impact while meeting consumer needs. It involves the use of biodegradable packaging, energy-efficient production methods, and sustainable product designs to differentiate offerings in the marketplace Companies engaged in green marketing innovation often leverage eco-labels, carbon footprint disclosures, and environmental certifications to communicate their commitment to sustainability. This conceptualization highlights the importance of product differentiation and transparency in driving consumer trust and market success in the green economy.

This study adopts the definition of Roh et al. (2022) that define green marketing innovation refers to the development and implementation of marketing strategies that integrate environmental sustainability into product promotion, distribution, and customer engagement. This concept involves adopting eco-friendly branding, sustainable advertising campaigns, and responsible consumer education to align with the growing demand for environmentally conscious products ,by incorporating green values into their marketing mix, firms enhance their brand reputation, gain competitive advantage, and foster long-term customer loyalty. This perspective emphasizes the role of businesses in shaping consumer behavior towards sustainable consumption through ethical marketing practices

SMEs Performance

Kaplan and Norton (2016) define SME performance through the lens of financial growth and profitability, emphasizing metrics such as revenue growth, profitability, return on investment, and cash flow stability. This perspective views SMEs as entities that must generate sustainable income, maintain financial resilience, and expand their market share to ensure long-term viability. Financial performance is seen as a critical determinant of success, with effective financial management, access to credit, and investment in cost-efficient production processes being key drivers of growth. This definition postulates that SMEs with strong financial health are better positioned to withstand market fluctuations, invest in expansion opportunities, and achieve competitive advantage. It underscores the importance of financial indicators as benchmarks for evaluating SME performance and guiding strategic decision-making.

O'Regan and Ghobadian (2014) conceptualize SME performance in terms of operational efficiency and innovation capacity, focusing on the optimization of business processes and the adoption of modern technologies. This perspective views SMEs as dynamic entities that must streamline supply chain operations, enhance productivity, and innovate to maintain market relevance. Key performance indicators include production efficiency, product quality, customer retention, and adaptability to market trends. The perspective suggests that SMEs that prioritize process innovation and digital transformation are more likely to achieve operational excellence and customer satisfaction. It highlights the role of continuous improvement and knowledge management in driving competitiveness, positioning operational efficiency and innovation as critical pillars of SME success.

This study adopts the definition of Kaplan and Norton (2016) that define SME performance as the financial growth and profitability, emphasizing metrics such as revenue growth, profitability, return on investment, and cash flow stability. This perspective views SMEs as entities that must generate sustainable income, maintain financial resilience, and expand their market share to ensure long-term viability. Financial performance is seen as a critical determinant of success, with effective financial management, access to credit, and investment in cost-efficient production processes being key drivers of growth. This definition postulates that SMEs with strong financial health are better positioned to withstand market fluctuations, invest in expansion opportunities, and achieve competitive advantage. It underscores the importance of financial indicators as benchmarks for evaluating SME performance and guiding strategic decision-making.

Empirical Review

Green Market Innovation and SMEs Performance

Adegbite and Oladipo (2021) examined the relationship between eco-friendly business practices and SME performance in Lagos State. Using a quantitative research design, they surveyed 300 SMEs across the manufacturing and service industries. The population comprised registered SMEs in Lagos, and a sample of 150 firms was selected through stratified random sampling to ensure representation from different sectors. Findings revealed that SMEs integrating green market innovation experienced increased profitability, enhanced brand reputation, and improved customer loyalty.

Smith and Brown (2020) found that SMEs adopting eco-friendly products and sustainable production methods experienced increased financial performance, enhanced market competitiveness, and improved brand reputation. Using a quantitative research design, their study surveyed 300 SMEs across manufacturing and service industries. The population consisted of SMEs in urban and semi-urban regions, with a sample of 150 firms selected through stratified random sampling to ensure representation across different sectors. Findings revealed that green market innovation led to higher customer loyalty, increased market share, and cost savings from reduced resource consumption.

Both studies by Adegbite and Oladipo (2021) and Smith and Brown (2020) provide valuable insights into the impact of green market innovation on SME performance; however, they have certain methodological and geographical limitations. In terms of location, Adegbite and Oladipo (2021) focused solely on Lagos State, which, while economically significant, may not fully represent the diverse challenges and

opportunities faced by SMEs in other Nigerian regions, particularly rural areas where resource constraints and regulatory enforcement differ. Similarly, Smith and Brown (2020) generalized their findings across urban and semi-urban areas without considering rural SMEs, which may have distinct barriers to green innovation adoption. Methodologically, both studies employed a quantitative research design and stratified random sampling, ensuring sectoral representation but potentially overlooking deeper insights into the motivations and constraints of SMEs that qualitative approaches could provide.

Green Marketing Innovation and SMEs Performance

Roh et al. (2022) examined the impact of internal green activities on firms' environmental performance, with a focus on green marketing innovation, green supply chain management, and green innovation. Using structural equation modeling (SEM) and survey data from 452 South Korean firms, the study validated several key relationships within green business strategies. The findings confirmed that green managerial innovation and intellectual property rights significantly influence green supply chain management, while both green supply chain management and intellectual property rights positively impact green innovation. The study established the moderating role of green marketing innovation in strengthening the relationship between green innovation and environmental performance. These results underscore the importance of integrating intellectual property rights, supply chain sustainability, and green marketing strategies to optimize environmental outcomes. The study contributes to the clean production and environmental management literature by demonstrating how firms can strategically utilize internal green initiatives to enhance resource efficiency and environmental sustainability.

Kumar (2015) explored green marketing innovations in small Indian firms, emphasizing their role in shaping the green identity of these enterprises. The study employed qualitative data collection through interviews with marketing managers responsible for green product strategies. Through this analysis, six key categories of green marketing innovations were identified: marketing compliance, marketing strategic partnership, marketing environmental commitment, marketing green team, marketing benchmarking, and marketing (environmental) ethical behavior. The findings suggest that green marketing innovations in small firms are increasingly driven by compliance with environmental standards, commitment to sustainability, and proactive leadership. This study highlights the evolving nature of marketing decisions, demonstrating that contemporary green marketing innovations extend beyond traditional product-market frameworks to include broader strategic initiatives that enhance environmental responsibility and competitive positioning.

Both studies by Roh et al. (2022) and Kumar (2015) offer valuable contributions to the understanding of green marketing innovation, yet they have notable geographical and methodological limitations. Roh et al. (2022) focused on South Korean firms, limiting the generalizability of findings to SMEs or firms in developing economies where regulatory and financial conditions differ. While the study's use of Structural Equation Modeling (SEM) provided robust statistical validation, its reliance on survey data may introduce response bias and overlook industry-specific variations in green innovation adoption. Conversely, Kumar (2015) employed a qualitative approach to explore green marketing innovations in small Indian firms, offering in-depth insights but lacking statistical validation for broader applicability. Additionally, the absence of a clear sampling technique and defined sample size weakens the study's reliability and replicability. While Roh et al. (2022) provided a structured analysis of green business strategies, Kumar (2015) took a more exploratory approach without quantitative support. A mixed-methods approach combining statistical validation with qualitative insights could offer a more comprehensive understanding of green market innovation across diverse business environments.

Theoretical Framework

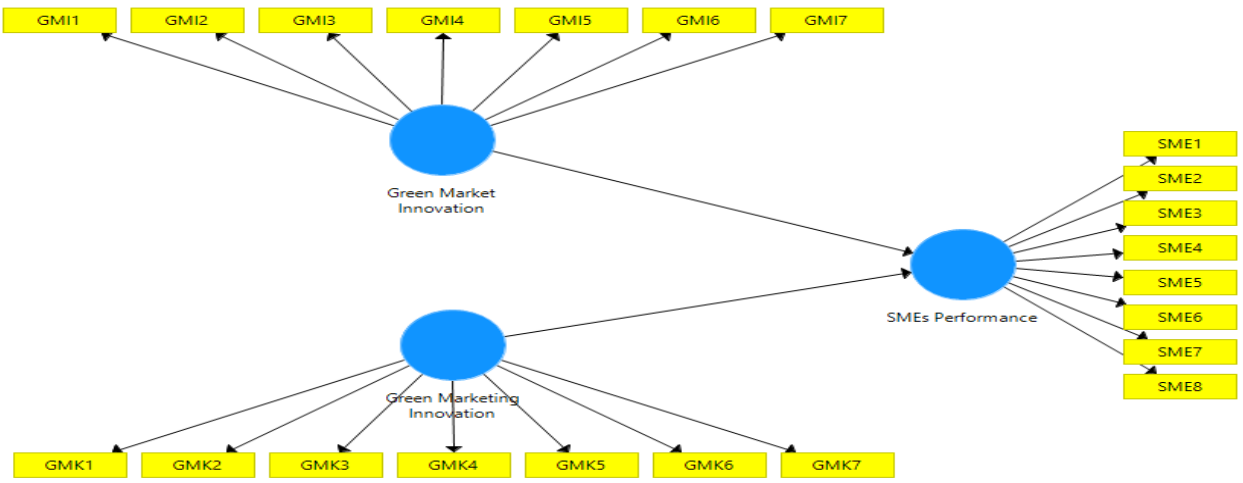
The theoretical framework for this study is anchored in Joseph Schumpeter's Innovation Theory, which posits that innovation is the primary driver of economic development and competitive advantage in businesses. Schumpeter (1934) defined innovation as the introduction of new products, processes, markets, organizational methods, or sources of supply, which he referred to as the "gales of creative destruction." According to Schumpeter, innovation disrupts existing markets and creates new

opportunities for firms to gain a competitive edge, improve performance, and achieve long-term sustainability. This theory is particularly relevant to the study of eco-innovation, as it emphasizes the transformative role of innovation in addressing environmental challenges while enhancing business performance.

In the context of this study, Schumpeter's Innovation Theory provides a robust foundation for understanding how green market innovation and green marketing innovation influence the performance of SMEs in North Central Nigeria. Green market innovation aligns with Schumpeter's concept of product innovation, as it involves the development of environmentally sustainable products or services that meet the growing demand for eco-friendly solutions. By introducing such innovations, SMEs can differentiate themselves from competitors, reduce their environmental footprint, and tap into new markets, thereby improving their performance (Dangelico & Pujari, 2010). Similarly, green marketing innovation reflects Schumpeter's idea of market innovation, as it focuses on promoting sustainable products through innovative marketing strategies, such as eco-labeling, green advertising, and ethical sourcing. These strategies enable SMEs to attract environmentally conscious consumers, enhance brand reputation, and increase market share, all of which contribute to improved performance (Chen et al., 2006).

METHODOLOGY

This study adopts a descriptive research design to investigate the effect of eco-innovation on the performance of small and medium enterprises (SMEs) in North Central Nigeria. The population for the study includes SMEs operating in the six states of North Central Nigeria—Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau—as well as the Federal Capital Territory (FCT). A sample size of 345 SMEs will be selected using a stratified random sampling technique to ensure representation across key sectors such as agriculture, manufacturing, and services. Data will be collected using a structured questionnaire designed with a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), to measure variables such as green market innovation, green marketing innovation, and SME performance. The questionnaire items will be adapted from validated instruments used in prior studies to ensure reliability and validity. For data analysis, the study will employ Structural Equation Modeling using Partial Least Squares (SEM-PLS), a robust analytical tool suitable for examining complex relationships between multiple variables and testing hypotheses. SEM-PLS will enable the assessment of both the measurement model (to validate constructs) and the structural model (to test the relationships between eco-innovation and SME performance). This methodological approach ensures a comprehensive and rigorous examination of the research objectives, providing reliable and actionable insights into the impact of eco-innovation on SME performance in the region.



RESULTS AND DISCUSSION

Assessment of Measurement Model

Indicators' Loadings

The table of loadings presented reflects the strength and relevance of the individual items (indicators) in their respective constructs, namely green market innovation (GMI), SMEs Performance (SME), and green marketing innovation (GRI). These loadings, which result from a Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis, provide a crucial understanding of the relationship between the indicators and their latent variables.

Table 1; Loadings

GMI1	**0.834**		
GMI2	**0.713**		
GMI3	**0.821**		
GMI4	**0.818**		
GMI5	**0.806**		
GMI6	**0.805**		
GMI7	**0.795**		
GMK1		**0.892**	
GMK2		**0.849**	
GMK3		**0.840**	
GMK4		**0.791**	
GMK5		**0.734**	
GMK6		**0.853**	
GMK7		**0.842**	
SME1			**0.827**
SME2			**0.737**
SME3			**0.814**
SME4			**0.767**
SME5			**0.820**
SME6			**0.843**
SME7			**0.802**
SME8			**0.756**

Source: SEMPLS 2025

Green market innovation (GMI): The GMI values range from 0.713 to 0.834, indicating varying levels of effectiveness in green market innovation among the assessed items. GMI1 has the highest value at 0.834, suggesting it is the most effective or impactful indicator of green market innovation, while GMI2 has the lowest value at 0.713, indicating it may require further improvement or focus to enhance its effectiveness.

Green marketing innovation (GMK): The GMK values range from 0.734 to 0.892, showing a generally strong performance in green production practices. GMK1 stands out with a value of 0.892, indicating it is the most effective indicator in this category, while GMK5 has the lowest value at 0.734, which may suggest that there are opportunities for improvement in that specific area.

Small and Medium-Sized Enterprises (SME) Performance: The SME performance values range from 0.756 to 0.843, reflecting varying degrees of success among SMEs in implementing sustainable practices. SME6 has the highest performance score at 0.843, indicating strong overall performance related to sustainable practices, while SME4 has the lowest at 0.767, suggesting potential areas for development.

Table 1 highlights that while there are strong indicators of both green market innovation and green production, there is variability in their effectiveness across different items and SMEs. This suggests that

targeted strategies may be necessary to enhance specific areas of green innovation and production to improve overall SME performance in sustainability initiatives.

Validity and Reliability

The results presented in Table 2 indicate the validity and reliability of the measurement models for green market innovation, SMEs Performance, and green marketing innovation. These metrics are crucial in assessing the consistency and quality of the constructs used in this study.

Table 2: Table 2: Validity and Reliability

	CRONBACH'S ALPHA	RHO_A	COMPOSITE RELIABILITY	AVERAGE VARIANCE EXTRACTED (AVE)
GREEN MARKET INNOVATION	**0.906**	**0.912**	**0.925**	**0.639**
GREEN MARKETING INNOVATION	**0.924**	**0.927**	**0.939**	**0.689**
SMES PERFORMANCE	**0.917**	**0.921**	**0.933**	**0.635**

Source: SEMPLS 2025

Cronbach's Alpha measures internal consistency, with values above 0.7 generally indicating acceptable reliability. All constructs in the table exceed this threshold, with green marketing innovation having the highest value at 0.924, followed closely by green market innovation at 0.906 and SMEs Performance at 0.917. This suggests that the items within each construct are highly correlated and measure the same underlying concept effectively.

Similar to Cronbach's Alpha, Rho_A is another measure of internal consistency that can provide additional insights into the reliability of a construct. The values for all three constructs are also above 0.9, indicating excellent reliability. Green marketing innovation again leads with a value of 0.927, suggesting it has the strongest internal consistency among the constructs.

Composite Reliability assesses the overall reliability of a construct by considering both the individual item loadings and their error variances. All constructs demonstrate high composite reliability values, with green marketing innovation at 0.939 being the highest, followed by green market innovation at 0.925 and SMEs Performance at 0.933. Values above 0.7 indicate that the constructs reliably measure their respective concepts.

Convergent Validity

Average Variance Extracted (AVE) measures the amount of variance captured by a construct relative to the amount of variance due to measurement error. Values above 0.5 are considered acceptable, indicating that a construct explains more than half of its variance through its indicators. In this table, Green marketing innovation has an AVE of 0.689, which is strong, while Green market innovation and SMEs Performance have AVEs of 0.639 and 0.635 respectively, indicating they also meet the acceptable threshold but are slightly lower than Green marketing innovation.

Discriminant Validity

The Heterotrait-Monotrait (HTMT) ratio is a measure of discriminant validity, which assesses the extent to which a construct is truly distinct from other constructs by comparing the correlations between different constructs (heterotrait) with the correlations within the same construct (monotrait). A rule of thumb for HTMT is that values should be below 0.90 for concepts that are distinct from each other (Henseler, Ringle, & Sarstedt, 2015.

Table 3: HTMT

	GREEN MARKET INNOVATION	GREEN MARKETING INNOVATION
GREEN MARKET INNOVATION		
GREEN MARKETING INNOVATION	**0.931**	
SMES PERFORMANCE	0.874	0.882

Source: SEMPLS 2025

The HTMT value green market innovation and green marketing innovation is 0.931, indicating a very strong positive correlation. This suggests that organizations that excel in Green market innovation are likely to also excel in Green marketing innovation. The high correlation implies that these two constructs share significant overlap in their underlying dimensions, which may reflect a comprehensive approach to sustainability in product development and production processes.

The HTMT value of 0.874 indicates a strong positive relationship between Green market innovation and SMEs performance. This suggests that improvements in Green market innovation are associated with better performance outcomes for SMEs, highlighting the importance of sustainable practices in enhancing business success.

The HTMT value of 0.882 also reflects a strong positive correlation between Green marketing innovation and SMEs performance. This indicates that as SMEs adopt more sustainable production practices, their overall performance tends to improve as well

Assessment of Structural Model

Hypotheses Test

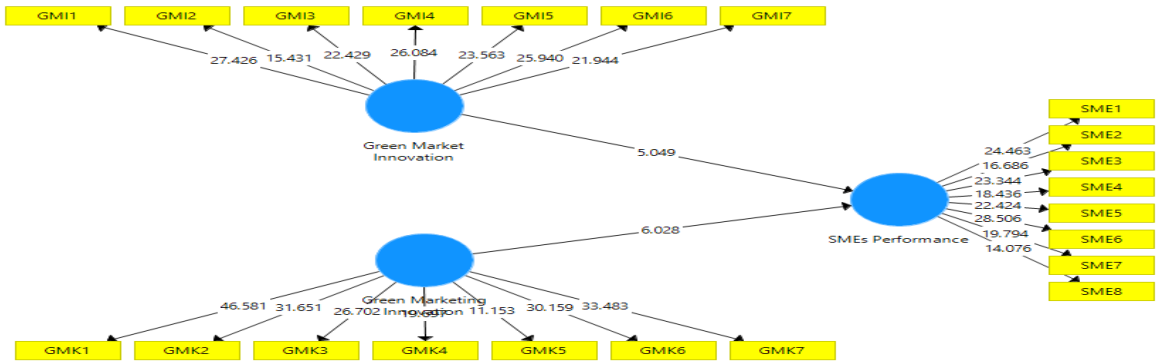
The table of path coefficients presented provides critical information regarding the relationships between the constructs in this study, namely Green market innovation, Green marketing innovation, and SMEs Performance. These relationships are assessed using the Original Sample (O) values, T Statistics, and P Values to determine the significance and strength of these pathways.

Table 4: Path Coefficient

	Original Sample (O)	T Statistics (|O/STDEV|)	P Values	Decisions
Green market innovation -> SME Performance	0.774	5.102	0.000	Rejected
Green marketing innovation -> SME Performance	0.076	6.051	0.000	Rejected

The original sample estimate (O) is 0.774, indicating a strong positive effect of Green market innovation on SME performance. The T-statistic is 5.102, which is significantly higher than the common threshold of 1.96 for statistical significance in a two-tailed test, suggesting that this relationship is statistically significant. The p-value is 0.000, which is well below the conventional alpha level of 0.05, confirming that we can reject the null hypothesis. This indicates that there is a significant positive impact of Green market innovation on the performance of SMEs.

The original sample estimate (O) here is 0.076, which suggests a very weak positive effect of Green marketing innovation on SME performance. The T-statistic is 6.051, indicating that this relationship is also statistically significant. The p-value is again 0.000, allowing us to reject the null hypothesis. However, despite the statistical significance, the effect size (0.076) is considerably smaller than that of Green market innovation, indicating that while Green marketing innovation does have a positive effect on SME performance, it is much weaker compared to Green market innovation.



Coefficient of Determinations

The R Square and Adjusted R Square values are key metrics in assessing the explanatory power of your model. In this study, these values indicate how well the independent variables (Green marketing innovation and Green market innovation) explain the variation in the dependent variable (SMEs Performance).

Table 5: R square

	R Square	**R Square Adjusted**
SME Performance	0.711	0.709

R Square (0.711) value indicates that approximately 71.1% of the variance in SME performance can be explained by the independent variables included in the model (in this case, Green market innovation and Green marketing innovation). This is a relatively high value, suggesting that the model has a strong explanatory power and that these factors significantly contribute to understanding variations in SME performance.

The adjusted R square value accounts for the number of predictors in the model and adjusts the R square value accordingly. An adjusted R square of 0.709 indicates that when considering the number of independent variables, approximately 70.9% of the variance in SME performance is still explained. This slight decrease from the R square value suggests that while the model remains robust, some variability may not be fully accounted for by the predictors included.

Both R Square and Adjusted R Square values indicate a strong relationship between the independent variables (Green market innovation and Green marketing innovation) and SME performance. The model effectively explains a significant portion of the variance in performance outcomes, highlighting the importance of these sustainable practices for enhancing business success among SMEs in North Central Nigeria. This suggests that further investments in green innovations could lead to improved performance metrics, making a compelling case for SMEs to adopt sustainable strategies.

Effect Size

The f Square values, also known as effect sizes, indicate the extent to which each independent variable contributes to the explained variance in the dependent variable, which in this case is SMEs Performance. The f Square values help in assessing the impact of removing an independent variable from the model.

Table 6: f Square

	SME Performance
Green market innovation	0.149
Green marketing innovation	0.98

The f-square values presented in the table indicate the effect sizes of two independent variables—Green market innovation and Green marketing innovation—on the dependent variable, SME Performance.

Green market innovation ($f^2 = 0.149$): This value suggests a small to medium effect size according to Cohen's conventions, where values of 0.02, 0.15, and 0.35 are typically interpreted as small, medium, and large effect sizes, respectively. An f^2 of 0.149 indicates that Green market innovation has a meaningful impact on SME performance, although it is not as strong as it could be. This suggests that while improvements in Green market innovation can positively influence performance metrics for SMEs, there may be other factors at play that also significantly affect performance.

Green marketing innovation ($f^2 = 0.98$): This value indicates a very large effect size, suggesting that Green marketing innovation has a substantial impact on SME performance. An f^2 of 0.98 implies that this variable explains a significant portion of the variance in SME performance outcomes. This strong effect size indicates that enhancing green production practices can lead to considerable improvements in how SMEs perform, highlighting its critical role in driving business success.

Multicollinearity test

The Variance Inflation Factor (VIF) is a measure used to detect multicollinearity in a regression model. Multicollinearity occurs when two or more independent variables are highly correlated, which can distort the estimated coefficients and compromise the statistical significance of the variables. VIF values above 10 are typically considered indicative of high multicollinearity, while values between 5 and 10 suggest moderate multicollinearity (Hair et al., 2017).

In Table 7, the VIF values for both Green market innovation and Green marketing innovationare 2.25. These values are well below the threshold of 10, indicating that there is no significant multicollinearity among the independent variables in the model. This suggests that Green market innovation and Green marketing innovation are sufficiently distinct from each other and do not exhibit problematic levels of correlation that would affect the stability and interpretability of the regression coefficients.

Table 7: Inner VIF

	SMEs Performance
Green market innovation	2.25
Green marketing innovation	2.25

The low VIF values indicate that the estimation of the effects of Green market innovation and Green marketing innovation on SMEs Performance is reliable. The absence of multicollinearity enhances the confidence in the results obtained from the regression analysis, ensuring that the relationships between the variables are accurately represented.

CONCLUSION AND RECOMMENDATIONS

This study sought to analyze the impact of green market innovation and green marketing innovation on the performance of SMEs in North Central Nigeria. By employing a quantitative survey design and utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) for data analysis, the study provided comprehensive insights into the relationships between these eco-innovation practices and SME performance. The findings revealed a significant positive impact of both green market innovation and green marketing innovation on SME performance. The high path coefficients and large effect sizes for these variables underscore their critical role in fostering a sustainable and competitive business environment. Green market innovation enables SMEs to develop environmentally friendly products that meet consumer demand, while green marketing innovation helps them effectively communicate their sustainability efforts, thereby enhancing brand reputation and market share. These findings align with Schumpeter's Innovation Theory, which emphasizes the transformative role of innovation in driving economic growth and competitive advantage.

Based on the findings of this study, the following recommendations are proposed to enhance the adoption and effectiveness of green market innovation and green marketing innovation among SMEs in North Central Nigeria:

1. Investment in Training and Capacity Building: SMEs should invest in training programs focused on green market innovation and green marketing innovation. These programs can help business owners and employees understand the principles of sustainability, the benefits of eco-friendly products, and the strategies for effectively marketing them. Workshops, seminars, and partnerships with educational institutions or industry experts can facilitate knowledge transfer and skill development, enabling SMEs to implement these innovations more effectively.
2. Policy Support and Incentives: Policymakers should develop and promote incentives for SMEs that adopt green market and marketing innovations. This could include financial subsidies, tax breaks, or grants aimed at reducing the initial costs associated with transitioning to sustainable practices. Additionally, governments should create a supportive regulatory framework that encourages eco-innovation, such as policies that promote eco-labeling, sustainable sourcing, and environmental certifications. These measures can motivate more SMEs to embrace green practices and enhance their competitiveness.
3. Collaboration and Networking: Encouraging collaboration among SMEs can lead to shared resources, knowledge, and best practices in green innovation. Establishing networks or associations focused on sustainability can facilitate partnerships that enable smaller enterprises to pool resources for research and development of eco-friendly products and marketing strategies. Collaborative efforts can also help SMEs overcome resource constraints and achieve economies of scale, making it easier to implement and sustain green innovations.
4. Targeted Marketing Strategies: SMEs should develop targeted marketing strategies that emphasize the environmental benefits of their green products. Utilizing eco-labeling, transparent communication about sustainability efforts, and engaging storytelling can help attract environmentally conscious consumers. By effectively marketing their commitment to sustainability, SMEs can enhance brand loyalty, differentiate themselves in a competitive marketplace, and build stronger relationships with stakeholders who prioritize environmental responsibility.
5. Awareness Campaigns and Consumer Education: Governments, industry associations, and NGOs should launch awareness campaigns to educate consumers about the benefits of green products and the importance of supporting sustainable businesses. By increasing consumer demand for eco-friendly products, these campaigns can create a market-driven incentive for SMEs to adopt green market and marketing innovations. Additionally, SMEs should engage in consumer education initiatives to highlight the environmental and social value of their products, fostering a culture of sustainability among their customer base.

In conclusion, the adoption of green market innovation and green marketing innovation presents a significant opportunity for SMEs in North Central Nigeria to enhance their performance, reduce their environmental impact, and contribute to sustainable economic development. By implementing the recommendations outlined above, SMEs, policymakers, and other stakeholders can work together to create an enabling environment for eco-innovation, ensuring that SMEs remain competitive and resilient in an increasingly sustainability-focused global economy. This study contributes to the growing body of literature on eco-innovation and provides actionable insights for promoting sustainable entrepreneurship in the region

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