
Research

Assessing the Impact of Innovation on Sustainable Business Performance: Evidence from Nigerian Manufacturing Firms

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Abstract: This study investigated the impact of green innovation on sustainable business performance among manufacturing firms in Nigeria. Despite growing awareness of environmental responsibility, limited empirical evidence exists on how innovation influences sustainability outcomes in the Nigerian manufacturing sector. The study aimed to assess the effect of green innovation on the economic, environmental, and social dimensions of business performance, and to examine how firm characteristics such as size and technology adoption influence this relationship. A quantitative research design was employed using data collected through structured questionnaires from five major manufacturing firms: Dangote Cement Plc, Nestlé Nigeria Plc, Unilever Nigeria Plc, Cadbury Nigeria Plc, and Nigerian Breweries Plc. Out of fifty questionnaires distributed, forty-two valid responses were analyzed using Partial Least Squares Structural Equation Modeling. The findings revealed that green innovation had a significant positive effect on sustainable business performance, and that firm-specific characteristics strengthened this relationship. The study concludes that green innovation enhances profitability, operational efficiency, and environmental accountability. It recommends that manufacturing firms invest in clean technologies and integrate sustainability measures into their strategies, while policymakers should promote supportive regulations and incentives to foster innovation-driven sustainability.

Keywords: Environmental Management, Firm Characteristics, Green Innovation, Manufacturing Sector, Sustainable Performance.

1. Introduction

The world is witnessing an increasing demand for environmentally responsible production and consumption. Manufacturing firms are under pressure to improve

productivity while reducing environmental harm. Green innovation, which involves developing new products, processes, and practices that minimise pollution and resource waste, has become central to sustainable development. Studies in developed countries have shown that adopting green innovation can lead to lower production costs, improved brand image, and stronger competitiveness (Ogiemwonyi, 2023; Zhang et al., 2023). In Africa, many industries are beginning to understand that environmental responsibility is not only a moral duty but also a business strategy that can enhance long-term performance. However, African firms often face challenges such as limited capital, weak infrastructure, and low technological capability, which slow down the adoption of green practices (Ren et al., 2025). In Nigeria, where manufacturing contributes significantly to employment and economic growth, firms must address growing concerns about waste, emissions, and inefficient use of resources. Understanding how green innovation affects sustainable business performance in this context is therefore crucial.

Despite the global focus on sustainability, there is still little evidence on how green innovation affects business outcomes in Nigeria. Many Nigerian manufacturing firms have started introducing cleaner technologies and eco-friendly production systems, but the real impact of these initiatives on their overall performance is not well-documented. Prior studies in other developing regions show that firms that invest in eco-innovation often enjoy better financial results and stakeholder trust (Larbi-Siaw et al., 2022). However, few Nigerian studies have examined whether these relationships hold in the local context, where electricity shortages, high production costs, and regulatory instability often discourage innovation (Adeola & Evans, 2020). This lack of empirical evidence makes it difficult for managers and policymakers to understand whether green innovation truly leads to sustainable business performance in the Nigerian manufacturing sector.

The present study is important both academically and practically. Academically, it contributes to the growing literature on green innovation by focusing on a developing economy where studies are still limited. It also helps explain how innovation supports sustainability through three major aspects of performance: economic, environmental, and social. Empirical research has shown that sustainable business performance goes beyond profit, as it includes reducing environmental damage and promoting social well-being (Abbas & Sagsan, 2020). Practically, the study provides guidance for Nigerian manufacturing firms seeking to remain competitive while complying with environmental standards. The findings will also support government agencies and policymakers in

designing industrial policies that encourage innovation while protecting the environment. By linking green innovation with sustainable outcomes, the study offers insights that can help both private and public actors promote responsible industrial growth in Nigeria.

This study has two main objectives. The first objective is to assess the effect of green innovation practices on the sustainable business performance of manufacturing firms in Nigeria, focusing on economic, environmental, and social performance indicators. The second objective is to examine how firm-specific characteristics such as size and level of technology adoption influence the relationship between green innovation and sustainable business performance among Nigerian manufacturing firms. These objectives are specific, measurable, achievable, relevant, and time-bound. They are designed to provide clear answers about how innovation contributes to sustainability in the Nigerian industrial environment.

The study covers selected manufacturing firms operating in major industrial zones in Nigeria. It concentrates on firms that have introduced some form of green innovation in their production or management systems within the last two years. The research focuses on the manufacturing sector because it is one of the largest contributors to Nigeria's environmental footprint and also a major source of economic growth. Service industries and non-manufacturing sectors are excluded from the study. The study also relies on data collected through structured questionnaires and secondary sources, which may limit the scope of analysis. Despite these limitations, the study provides reliable evidence that can inform policy and guide firms towards more sustainable practices.

2. Literature Review

Conceptual Review

Green innovation refers to the creation and adoption of products, processes, or organisational practices that reduce environmental harm while improving efficiency and competitiveness. It involves technological and managerial efforts aimed at minimising waste, conserving energy, and encouraging cleaner production (Ogiemwonyi, 2023; Ren et al., 2025). In the manufacturing sector, green innovation includes eco-friendly product designs, recycling systems, and the use of renewable energy in production processes (Olaleye et al., 2025). In this study, green innovation represents the degree to which firms integrate environmental considerations into their operations.

Sustainable business performance refers to the ability of firms to achieve long-term economic success while fulfilling environmental and social responsibilities. It covers three

major dimensions: economic viability, environmental responsibility, and social accountability (Abbas & Sagsan, 2020). Sustainable performance, therefore, extends beyond financial outcomes to include the reduction of environmental risks and the promotion of community welfare (Ogiemwonyi, 2023). Other relevant constructs include firm characteristics such as size and technology adoption, which may influence how green innovation contributes to overall business performance. Clearly defining these variables provides a foundation for understanding the pathways through which innovation drives sustainability in Nigerian manufacturing firms.

Theoretical Framework

The study is guided by two complementary theories: the Natural Resource-Based View and the Triple Bottom Line framework. The Natural Resource-Based View (NRBV) builds on the Resource-Based View of the firm and argues that firms gain a lasting competitive advantage by developing capabilities that reduce environmental impact (Hart, 1995). The NRBV emphasises strategies such as pollution prevention, product stewardship, and sustainable development, which enable firms to enhance performance while conserving natural resources (Hart & Dowell, 2011). Within this study, the NRBV supports the idea that green innovation is a strategic capability that allows firms to improve efficiency, strengthen reputation, and reduce ecological risk.

The Triple Bottom Line (TBL) framework proposed by Elkington (1997) expands performance measurement beyond profit to include social and environmental outcomes. It asserts that organisations must achieve balance among profit, planet, and people to be truly sustainable. The TBL framework directly informs the dependent variable of this study because it captures the multidimensional nature of sustainable performance. When combined, the NRBV explains the internal capability that drives green innovation, while the TBL explains how such innovation manifests in economic, social, and environmental outcomes. Together, these theories provide a comprehensive understanding of how firms achieve sustainability through innovation.

Empirical Review

Empirical research between 2019 and 2025 shows growing interest in the relationship between green innovation and business performance. Ogiemwonyi (2023) reported that green innovation significantly improved competitive advantage and operational efficiency among small and medium-sized enterprises. Ren et al. (2025) found that digital transformation combined with green manufacturing capabilities enhanced

sustainable performance among African firms. Maziriri and Maramura (2022) observed a positive relationship between green product and process innovation and business growth among manufacturing firms in South Africa.

Larbi-Siaw et al. (2022) established that institutional support strengthened the positive link between green innovation and firm performance in developing economies. Zhang et al. (2023) discovered that digital transformation magnified the effect of innovation on competitiveness among Chinese manufacturing firms. Adeola and Evans (2020) demonstrated that renewable energy adoption improved sustainable performance within Nigerian industries. Olaleye et al. (2025) reported that green supply-chain integration and innovation jointly enhanced environmental and economic outcomes in Nigerian agro-based manufacturing firms.

Abbas and Sagsan (2020) found that innovation capabilities significantly contributed to organisational sustainability by enhancing both financial and non-financial outcomes. Li et al. (2024) concluded that while green innovation improved environmental results, its financial benefits were sometimes delayed due to the high initial investment cost. Ren et al. (2025) emphasised that contextual factors such as firm size, technology level, and regulatory support influenced how green innovation affected performance in emerging economies. These studies collectively confirm a generally positive relationship between green innovation and sustainable business performance, although variations exist depending on firm context, industry type, and resource capacity.

Research Gap

Although many studies have explored the relationship between green innovation and performance, significant gaps remain. First, few studies have examined all three dimensions of sustainability-economic, environmental, and social-together in the Nigerian manufacturing context. Second, limited research has investigated how firm-specific characteristics, such as size and technology adoption, influence the link between green innovation and business performance. Third, most existing evidence is drawn from Asia and developed economies, which limits its relevance to Nigeria's institutional and infrastructural conditions. This study fills these gaps by providing new empirical evidence on how green innovation affects the sustainable performance of Nigerian manufacturing firms while considering firm characteristics as moderating factors.

3. Methodology

The study adopted a quantitative research design using a structured survey because it allows the collection of numerical data suitable for statistical analysis and hypothesis testing. This approach was appropriate for examining the relationship between green innovation and sustainable business performance among Nigerian manufacturing firms, where measurable variables are involved.

The population comprised all registered manufacturing firms in Nigeria as listed by the Manufacturers Association of Nigeria (2024). These firms operate in major industrial hubs such as Lagos, Ogun, Rivers, and Anambra States, which account for most of the country's manufacturing activity. From this population, five firms were purposively selected: Dangote Cement Plc, Nestlé Nigeria Plc, Unilever Nigeria Plc, Cadbury Nigeria Plc, and Nigerian Breweries Plc. The firms were chosen because of their established environmental and innovation practices, which align with the study's objectives.

Primary data were collected through a structured questionnaire adapted from validated scales in previous studies by Chen et al. (2020) and Abbas and Sagsan (2020). The questionnaire covered green innovation and sustainable business performance measured on a five-point Likert scale. Fifty questionnaires were distributed to senior and middle management staff involved in production and environmental operations, and forty-two valid responses were retrieved. Secondary data, such as sustainability reports and industry reviews, were also used to supplement the primary data.

Content and construct validity were ensured through expert review and alignment with prior literature. A pilot test was conducted with ten respondents, and reliability was confirmed using Cronbach's alpha values above 0.70 (Hair et al., 2022). This confirmed the internal consistency of the instrument.

Data were analysed using descriptive statistics such as means and standard deviations to summarise responses, and Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed for hypothesis testing. PLS-SEM was chosen because it is effective for analysing relationships between latent variables with small sample sizes (Hair et al., 2022). This method allowed the study to estimate the direct effect of green innovation on sustainable business performance and to assess the moderating role of firm characteristics.

4. Data Analysis and Discussion

A total of fifty questionnaires were distributed to staff members across the five selected manufacturing firms: Dangote Cement Plc, Nestlé Nigeria Plc, Unilever Nigeria Plc, Cadbury Nigeria Plc, and Nigerian Breweries Plc. Forty-five questionnaires were returned, of which forty-two were valid after data screening for completeness and consistency. The valid responses were used for the final analysis, representing an effective response rate of 84 per cent, which was considered adequate for statistical testing and model estimation.

Table 1: Descriptive Statistics of Key Variables

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Green Innovation	42	4.21	0.48	3.25	4.88
Sustainable Business Performance	42	4.15	0.52	3.18	4.87
Economic Performance	42	4.23	0.50	3.12	4.91
Environmental Performance	42	4.07	0.56	3.01	4.80
Social Performance	42	4.13	0.49	3.26	4.91

The descriptive results in Table 1 show that respondents generally agreed that their firms practise green innovation at a high level (mean = 4.21). Sustainable business performance also scored highly (mean = 4.15), suggesting that manufacturing firms that integrate environmental innovation tend to experience improvements in overall performance. Economic performance recorded the highest sub-mean (4.23), followed by social performance (4.13) and environmental performance (4.07). This suggests that while firms are achieving better financial outcomes through efficiency and resource management, environmental results remain relatively lower due to cost and technological challenges associated with green processes.

Table 2: Regression Results for Green Innovation and Sustainable Business Performance

The structural model was specified to estimate the causal relationships among the latent constructs. The hypothesised model was expressed as:

$$SBP = \beta_1 GI + \beta_2 (GI \times FC) + \zeta$$

where SBP denotes Sustainable Business Performance, GI represents Green Innovation, FC indicates Firm Characteristics as a moderator, β_1 and β_2 are the path

coefficients, and ζ is the disturbance term. The model assumes a direct positive effect of green innovation on sustainable business performance and a positive moderating influence of firm characteristics.

Model	Independent Variable	Beta (β)	t-value	p-value	R ²
1	Green Innovation → Sustainable Business Performance	0.684	8.912	0.000	0.468
2	Firm Characteristics (Moderator)	0.241	2.105	0.041	0.526

The regression analysis was conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM). Model 1 shows that green innovation has a strong positive and statistically significant effect on sustainable business performance ($\beta = 0.684$, $p < 0.001$). This means that a one-unit increase in green innovation corresponds to a 68 per cent improvement in sustainable performance among Nigerian manufacturing firms. Model 2 reveals that firm-specific characteristics, such as size and level of technology adoption, significantly moderate this relationship ($\beta = 0.241$, $p < 0.05$). The coefficient of determination ($R^2 = 0.526$) indicates that 52.6 per cent of the variance in sustainable business performance is explained by green innovation and firm characteristics.

These findings align with the first objective, which was to assess the effect of green innovation on sustainable business performance. The results support the argument from the Natural Resource-Based View that environmental innovation provides firms with strategic advantages that enhance performance through efficiency and resource optimisation (Hart, 1995). They also support the Triple Bottom Line framework by demonstrating that innovation influences economic, environmental, and social outcomes simultaneously (Elkington, 1997). The findings are consistent with those of Ogiemwonyi (2023) and Ren et al. (2025), who reported that green innovation positively influences firm competitiveness and sustainability. However, the results differ slightly from those of Li et al. (2024), who found that strategic green innovations may initially reduce financial returns due to implementation costs. This difference suggests that Nigerian firms may be achieving both financial and environmental gains simultaneously due to increased stakeholder pressure and policy incentives encouraging eco-friendly practices.

The second objective examined the moderating effect of firm-specific characteristics on the relationship between green innovation and sustainable business performance. The positive moderation observed indicates that larger firms with higher

technological capabilities benefit more from green innovation. This finding supports the argument by Larbi-Siaw et al. (2022) that institutional support and firm resources strengthen the effectiveness of innovation strategies in developing economies. It also extends existing knowledge by showing that the strength of this relationship depends on firm capacity and context, an aspect that has been underexplored in previous Nigerian studies.

Overall, the results demonstrate that green innovation significantly contributes to sustainable performance across multiple dimensions. Firms that adopt cleaner technologies and eco-efficient practices experience better operational efficiency, improved public image, and enhanced profitability. These findings validate the assumptions of both the Natural Resource-Based View and the Triple Bottom Line framework and confirm that sustainability-oriented innovation is an essential driver of long-term business success in the Nigerian manufacturing sector.

5. Conclusion and Recommendations

Conclusion

The study concluded that green innovation significantly enhances sustainable business performance among Nigerian manufacturing firms. The results showed that firms adopting eco-friendly technologies and innovative production processes experience higher levels of economic efficiency, improved environmental responsibility, and stronger social engagement. Green innovation was found to be a major predictor of sustainable performance, demonstrating that environmentally oriented practices not only improve profitability but also strengthen reputation and compliance with global sustainability standards. The findings further revealed that firm-specific characteristics, such as size and level of technological advancement, influence how effectively innovation translates into performance gains. These results confirm the assumptions of the Natural Resource-Based View and the Triple Bottom Line theory by showing that innovation is both a strategic capability and a pathway towards balanced sustainability.

Recommendations: Manufacturing firms should integrate green innovation into their strategic operations by investing in cleaner production technologies, renewable energy systems, and waste reduction initiatives. Management should also include sustainability indicators in performance evaluations to measure the long-term impact of innovation on firm growth and efficiency. Industry associations can further support this by organising training and awareness programmes on eco-efficient manufacturing.

Government agencies and policymakers should strengthen technological infrastructure and create enabling policies that promote green innovation across the manufacturing sector. Financial incentives such as tax relief and grants should be offered to firms adopting environmentally friendly practices. Firms should also collaborate with research institutions and universities to enhance their technological capacity and share knowledge on sustainable innovations.

Suggestions for Further Research

Future studies could expand the scope of this research by including a larger number of manufacturing firms across different regions of Nigeria. Longitudinal studies are also recommended to examine the long-term effects of green innovation on firm competitiveness and environmental performance. In addition, qualitative research could explore managerial perceptions, barriers, and policy implications related to green innovation adoption.

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