

GREEN INNOVATION AND SUSTAINABLE PERFORMANCE OF FAST-MOVING CONSUMER GOODS (FMCGS) FIRMS IN AN EMERGING ECONOMY

INOVAÇÃO VERDE E DESEMPENHO SUSTENTÁVEL DE EMPRESAS DE BENS DE CONSUMO DE RÁPIDA MOVIMENTAÇÃO (FMCG) EM UMA ECONOMIA EMERGENTE

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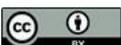
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Abstract

As environmental challenges intensify, fast-moving consumer goods (FMCG) firms in emerging economies are increasingly adopting green innovation to boost sustainability. This study examines how green innovation affects the sustainable performance of fast-moving consumer goods (FMCG) firms operating in an emerging economy. The research involved 861 employees from 3 leading fast-moving consumer goods (FMCG) companies, with each showing different levels of involvement with green innovation. Adopting Yamane's formula, a sample of 273 participants was drawn, while through the stratified random sampling, 248 valid responses were collected using a well-structured questionnaire for data analytics. The findings revealed that green innovation, particularly energy efficiency and resource conservation, enables sustainable performance of firms. Highlighting how pivotal green process innovation and knowledge sharing are in improving the environmental and economic outcomes of resource-constrained firms in emerging markets. The study thus concludes that green innovation is a key driver of the sustainable performance of fast-moving consumer goods (FMCG) firms. As a policy implication, it proffers that firms must adopt supportive green

Resumo

Com a intensificação dos desafios ambientais, as empresas de bens de consumo de massa (FMCG) em economias emergentes estão adotando cada vez mais a inovação verde para impulsionar a sustentabilidade. Este estudo examina como a inovação verde afeta o desempenho sustentável de empresas de bens de consumo de massa (FMCG) que operam em uma economia emergente. A pesquisa envolveu 861 funcionários de 3 empresas líderes de bens de consumo de massa (FMCG), cada uma apresentando diferentes níveis de envolvimento com a inovação verde. Adotando a fórmula de Yamane, uma amostra de 273 participantes foi selecionada, enquanto, por meio de amostragem aleatória estratificada, 248 respostas válidas foram coletadas utilizando um questionário bem estruturado para análise de dados. Os resultados revelaram que a inovação verde, particularmente a eficiência energética e a conservação de recursos, possibilita o desempenho sustentável das empresas. Destaca-se a importância da inovação de processos verdes e do compartilhamento de conhecimento para a melhoria dos resultados ambientais e econômicos de empresas com recursos limitados em mercados emergentes. O estudo conclui, portanto, que a inovação verde é um fator-chave



strategies and policies, along with strengthening their knowledge silos and digital capabilities, as these have been revealed to deliver sustainable performances and a competitive edge.

Keywords: Emerging Economy. Energy Efficiency. Green Innovation. Resource Conservation. Sustainable Performance.

para o desempenho sustentável de empresas de bens de consumo de massa (FMCG). Como implicação política, propõe-se que as empresas adotem estratégias e políticas verdes de apoio, juntamente com o fortalecimento de seus silos de conhecimento e capacidades digitais, visto que estes comprovadamente proporcionam desempenho sustentável e vantagem competitiva.

Palavras-chave: Economia emergente. Eficiência energética. Inovação verde. Conservação de recursos. Desempenho sustentável.

1 INTRODUCTION AND THEORETICAL BACKGROUND

Over the past few decades, the ideas of sustainable performance and green innovation have grown significantly, taking centre stage in both academic research and policy-making agendas (Clark *et al.*, 2001; Jiang & Li, 2022). The late 20th century saw an increase in environmental consciousness as the negative consequences of fast industrialisation such as pollution, deforestation, and overuse of natural resources became more apparent (WCED, 1987; Clark *et al.*, 2001). A defining moment in this trajectory was the landmark 1992 UN Earth Summit held in Rio de Janeiro, which laid the foundations for global environmental governance and called for the integration of ecological priorities into economic planning through instruments like Agenda 21 and the Rio Declaration, both of which outlined global sustainability goals (UN, 1992; Chaswal, 2023). The Brundtland Report Commission defined sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Monyei *et al.*, 2023; WCED, 1987), and it became a widely accepted global goal in response to the Summit's conclusions. Within this framework, green innovation emerged as a critical strategy to decouple economic growth from environmental degradation. While initially driven by regulatory requirements and risk management, green innovation has since evolved into a more proactive and strategic approach, encompassing the design and adoption of environmentally sustainable tools, products, and processes aimed at enhancing both ecological outcomes and long-term business resilience (Mol & Sonnenfeld, 2000; Clark *et al.*, 2001). Ufomba *et al.* (2025a) claims that management is essential in fostering

company innovativeness, workforce engagement, and long-term survival as technology continues to transform organisational strategy and business processes. Green innovation and sustainable performance have thus become pivotal concerns in scholarly and policy circles as nations strive to balance economic progress with ecological stewardship (Wang *et al.*, 2022; Majid *et al.*, 2023). Firms in industrial and production sectors are increasingly embedding green innovation into both product and operational strategies, including cleaner technologies, sustainable product–service systems, and eco-efficient supply chains (Hariadi *et al.*, 2023; Esa & Hashim, 2024). Ufomba *et al.* (2025b) contend that innovation contributes to sustainable performance, which reflects an organisation’s capacity to achieve long-term sustainability while maintaining environmental and social responsibility. Green innovation is commonly operationalised using two key indicators: energy efficiency and resource conservation. Enhancements in energy efficiency, such as the implementation of Internet of Things (IoT) solutions or expert systems, can substantially reduce energy use and operational costs (Shi *et al.*, 2020). Meanwhile, resource conservation achieved through material substitution, recycling, and optimised process design strengthens supply chain resilience while reducing raw material consumption and costs (Majid *et al.*, 2023). Green innovation serves as a bridge between environmental ethics and sustainable performance in a variety of industrial situations, including the Fast-Moving Consumer Goods (FMCG) industry. When backed by strong environmental leadership and strategic guidance, it improves social, economic, and environmental results (Wang *et al.*, 2022). According to Larry *et al.* (2024), fast-moving consumer goods (FMCG) companies’ operational performance is enhanced by the successful use of green innovation strategies. Across European economies, adopting resource-efficiency practices such as energy and material savings, waste minimisation, and recycling has been shown to positively influence cost management, firm performance, and product innovation (Majid *et al.*, 2023). In China, differentiated environmental innovation strategies, including energy-saving, pollution-reducing, and regulation-driven initiatives, produce varying effects on sales, employment, and productivity (Biggi *et al.*, 2023). Green innovation has been found to significantly strengthen environmental responsibility and financial performance, particularly under favourable institutional and regulatory conditions (Wang & Liu, 2022). Conversely, in advanced economies like the United States, the approach to green innovation remains complex. Despite technological capability and capital resources, the U.S. government has

historically demonstrated a more cautious stance toward aggressive green innovation policies, primarily due to political polarisation, prioritisation of short-term economic growth, and the influence of traditional energy sectors. This has led to slower federal adoption of stringent green innovation mandates compared to the European Union or China. Nonetheless, private sector initiatives driven by multinational corporations and consumer pressure are increasingly advancing clean technologies and sustainability investments (Environmental Defence Fund, 2024). The U.S. experience, therefore, highlights how policy uncertainty and inconsistent environmental regulation can constrain systematic green innovation, even in technologically advanced economies. Globally, however, investments in green technologies continue to rise, with emerging economies now playing a more substantial role. This represents a growing global agreement that strategic green innovation is essential to attaining sustainability objectives, preserving competitiveness, and guaranteeing the long-term resilience of businesses and economies (Majid *et al.*, 2023). In order to achieve sustainable performance, businesses in the Fast-Moving Consumer Goods (FMCG) industry should ideally include green innovation strategies including resource conservation, waste reduction, and energy efficiency improvements into their operations. In theory, this integration should enable companies to simultaneously enhance profitability, improve environmental stewardship, and strengthen their competitive advantage. Governments, particularly in emerging economies, are also expected to provide enabling environments through supportive policies, tax incentives, and regulatory frameworks that encourage firms to adopt environmentally responsible technologies and business models. When such conditions are in place, green innovation becomes a key driver of industrial sustainability, national competitiveness, and long-term economic growth. However, the reality in many emerging economies, including Nigeria, is far from this ideal. Despite increasing global attention to sustainability, most FMCG companies in Nigeria still operate under traditional production systems that prioritise short-term financial gains over long-term environmental and social goals. Many firms face significant barriers to adopting green innovations, including limited access to green financing, inadequate technological infrastructure, weak regulatory enforcement, and low environmental awareness among both firms and consumers. Additionally, institutional support for green innovation remains fragmented, with minimal coordination between government agencies, industry associations, and research institutions. As a result, sustainability practices are often

adopted superficially more as corporate image-building strategies than as core operational philosophies. The consequences of this gap are multifaceted and far-reaching. Inefficient energy consumption, poor waste management, and excessive resource utilisation continue to escalate production costs and environmental degradation. This not only undermines Nigeria's ability to meet its climate and sustainability commitments but also exposes FMCG firms to reputational risks, regulatory pressures, and diminishing global competitiveness. Furthermore, the sector's ability to contribute to sustainable development goals (SDGs), especially those pertaining to responsible production and consumption, climate action, and industry innovation, is limited by the inability to incorporate green innovation into industrial processes. If unaddressed, these challenges could perpetuate unsustainable growth patterns, jeopardising both business continuity and environmental stability (Ali *et al.*, 2021).

1.1 Resource-Based View (RBV)

Barney's (1991) Resource-Based View (RBV) is a fundamental theory in strategic management that highlights how businesses stand to achieve and maintain a competitive advantage by utilising distinctive internal resources and capabilities. The RBV argues that for a firm to achieve long-term success, its resources must be strategically valuable, not widely available, difficult for competitors to replicate, and irreplaceable by alternative means. In the context of green innovation, these resources encompass not only physical assets or technologies but also intangible capabilities such as environmental knowledge, organisational routines, and managerial expertise in sustainability practices. When applied to fast-moving consumer goods (FMCG) firms in emerging economies, green innovation emerges as a critical strategic resource that enables these firms to gain a competitive edge over others by developing environmentally friendly products and cleaner production processes. Unlike traditional innovations focused solely on cost reduction or product enhancement, green innovation integrates environmental considerations into the firm's core capabilities, positioning sustainability as a driver of competitive advantage rather than merely a compliance requirement. This internal integration of green practices allows firms to improve operational efficiency, reduce waste, and meet the growing expectations of stakeholders, including consumers, regulators, and investors who increasingly value environmental responsibility. The

application of RBV to green innovation is supported by recent research that finds that fast-moving consumer goods (FMCG) firms that embed environmental capabilities within their strategic resources tend to achieve superior sustainable performance. Chen *et al.* (2020) found that Chinese fast-moving consumer goods (FMCG) firms with strong environmental innovation capabilities outperformed others in both environmental and financial metrics, demonstrating that green innovation can indeed be a rare and valuable asset in emerging markets. Similarly, Hart and Dowell (2011) expanded RBV into the "natural resource-based view," highlighting that capabilities in managing natural resources and ecological challenges can form a unique basis for strategic benefit. This perspective is of great value in less industrialised nations, where firms struggle with increasing environmental pressures but also have the opportunity to develop green competencies that competitors find difficult to imitate. The Resource-Based View, which contends that competitive strength results from having resources that are valuable, distinctive, and difficult to replicate, is supported by González-Moreno *et al.* (2021), who emphasise how firms' environmental capabilities function as crucial strategic resources that improve both their ecological and financial outcomes. Competitive advantage is driven by capabilities. In a similar vein, Li *et al.* (2022) claim that green dynamic capabilities have a significant impact on improving sustainable performance within Chinese fast-moving consumer goods (FMCG) companies. These capabilities represent a firm's capacity to combine, improve, and modify its internal and external resources to address environmental demands. According to Kumar and Rahman (2023), green capabilities are in line with RBV principles, which are essential for attaining better sustainability results in Indian fast-moving consumer goods (FMCG) companies, particularly when backed by learning orientation and senior management commitment. These recent contributions underscore that green innovation, as a bundle of firm-specific capabilities, fosters not only environmental stewardship but also strengthens firms' competitive positions, thus corroborating the RBV framework in relation to sustainable fast-moving consumer goods (FMCG) firms. A useful paradigm for analysing how green innovation helps fast-moving consumer goods (FMCG) companies in emerging nations perform sustainably is the Resource-Based View. By cultivating distinctive environmental capabilities that are hard for competitors to imitate, firms can enhance their economic performance while also meeting environmental and social obligations. This alignment between green innovation and strategic capabilities underpins an

organisation's capacity to achieve and maintain a competitive edge in the dynamic context of emerging markets.

1.2 Objectives of the study

The overarching aim of this study is to assess how green innovation influences sustainable performance within selected fast-moving consumer goods (FMCG) firms. Specifically, the study seeks to:

1. Examine how energy efficiency initiatives influence the sustainable performance of FMCG firms.
2. Determine how resource conservation practices relate to sustainable performance within FMCG firms.

2 UNDERSTANDING THE RELATED LITERATURE

2.1 Green innovation

The global shift to sustainable development has been greatly aided by green innovation, especially in the last five years. This period has witnessed intensified efforts to integrate environmentally friendly technologies and practices across industries to address climate change, enhance resource efficiency, and promote circular economic models. Green innovation extends beyond technological progress to include organisational, social, and policy innovations that support sustainability goals (Horbach *et al.*, 2020). A prominent trend in this area is the rapid development and adoption of renewable energy solutions, particularly Solar-powered, wind, and energy storage systems, which have significantly lowered the cost and improved the scalability of clean energy solutions (IRENA, 2023). Advances in battery technology and grid management, often powered by smart digital innovations, including AI and IoT, have further optimised energy use and distribution, enabling more intelligent and resilient energy systems (Wang *et al.*, 2023). Green innovation is also transforming sectors such as sustainable agriculture, waste reduction, and water management. Approaches like precision farming, the use of biodegradable materials, and wastewater recycling technologies are helping reduce environmental impacts while maintaining economic viability (Kumar *et al.*, 2021).

Additionally, the circular economy is gaining traction as a comprehensive strategy for minimising waste and encouraging material reuse, supported by digital platforms and increased supply chain transparency (Geissdoerfer *et al.*, 2021). Policy frameworks have been instrumental in driving green innovation. Governments globally are introducing more rigorous environmental policies, including carbon pricing and incentives for eco-friendly technologies, in an effort to fast-track the shift towards more sustainable markets. At the same time, corporate sustainability strategies increasingly view green innovation as a source of competitive advantage, encouraging collaboration among private companies, startups, and research institutions to scale environmentally beneficial solutions (Bocken *et al.*, 2022). However, significant challenges remain, including disparities in access to green technologies, gaps in financing, and the need for stronger international cooperation to ensure inclusive and equitable innovation pathways. For fast-moving consumer goods (FMCG) companies in emerging markets, green innovation has become crucial as they manage the dual challenges of promoting economic growth and minimising environmental damage. These firms are increasingly adopting eco-innovations such as energy-efficient technologies, waste reduction methods, and cleaner production processes to enhance sustainability and competitiveness simultaneously (Horbach *et al.*, 2020). Green innovation is increasingly viewed as a strategic asset that boosts operational efficiency and provides access to international markets with strict environmental requirements, in contrast to traditional methods that were only concerned with regulatory compliance. In order to improve operational efficiency and reduce resource consumption, fast-moving consumer goods (FMCG) companies in emerging economies are progressively implementing digital technologies such as the Internet of Things (IoT), artificial intelligence (AI), and big data analytics. These technologies make it easier to monitor and control energy use and emissions in real time, which lowers costs and improves the environment (Wang *et al.*, 2023). In parallel, firms are embracing circular economy principles by designing products for longer lifecycles, recyclability, and reuse, thereby reducing dependence on finite natural resources and minimising waste generation (Geissdoerfer *et al.*, 2021). However, the widespread adoption of green innovation in these contexts is influenced by factors such as access to finance, technological capabilities, infrastructure quality, and supportive regulatory frameworks. While many governments in emerging markets have introduced environmental regulations and incentives to promote sustainable fast-moving consumer goods (FMCG)

firms, challenges remain in implementation and enforcement. International partnerships and knowledge exchange are, therefore, crucial in enabling firms to overcome these barriers and tailor green technologies to local needs and conditions. Green innovation is increasingly integrated into corporate strategies as fast-moving consumer goods (FMCG) firms recognise its role in enhancing brand reputation, complying with international environmental standards, and achieving operational resilience. By embedding sustainability into core business processes, firms not only mitigate environmental risks but also gain competitive advantages in global value chains (Bocken *et al.*, 2022). Green innovation may represent a transformative pathway for fast-moving consumer goods (FMCG) firms in emerging economies to achieve sustainable industrialisation. Progress depends on synergistic efforts between firms, policymakers, and international stakeholders to create enabling environments that support technology diffusion, capacity building, and investment in green solutions.

2.2 Energy efficiency

In response to growing environmental issues and the pursuit of sustainable development goals, there is an increasing need worldwide to improve energy efficiency. The creation and use of innovative technologies and procedures that lessen their negative effects on the environment is known as "green innovation," and it has become a key factor in improving energy efficiency in a number of different economic sectors. Chen *et al.* (2024) provide robust evidence through a panel data analysis of 72 countries spanning 1996 to 2017, demonstrating that the effectiveness of green innovation in reducing energy intensity is contingent upon the quality of national institutions. Their findings suggest that countries with strong governance, effective regulatory enforcement, and institutional transparency are better equipped to translate green technological advancements into tangible improvements in energy efficiency. This underscores the critical role of policy environments that support innovation diffusion and regulatory compliance in achieving energy-saving outcomes. Urban environments offer a complex yet fertile context for exploring this relationship. Guo *et al.* (2024) found a nonlinear U-shaped association between green innovation and total factor energy efficiency (TFEE) using data from 284 Chinese towns.

Their study suggests that, initially, adopting green innovation may lead to temporary inefficiencies and increased costs. However, once a certain threshold is crossed, these innovations begin to deliver significant improvements in energy efficiency. These insights highlight the importance of recognising temporal delays and scale effects when formulating policy and investment strategies for urban sustainability transitions. The potential of green innovation to increase energy efficiency is further enhanced by the quickly growing digital economy. Dong *et al.* (2024) emphasise how digital infrastructure, such as big data analytics, smart grids, and AI-driven energy management systems, can optimise energy use and make it easier to integrate renewable energy sources. Their research, which is based on data from Chinese provinces, demonstrates that digitalisation accelerates the transition to low-carbon energy systems by increasing the returns on green investments. The connection between digital innovation and lowering carbon emissions in Chinese businesses is examined by Liu *et al.* (2025) and Ranpara (2025). Their study revealed that companies integrating green and digital innovations, particularly artificial intelligence, achieve significantly greater improvements in both energy efficiency and emissions reduction. However, the authors caution against the “energy rebound effect”, wherein improved efficiency may inadvertently lead to increased overall consumption unless accompanied by appropriate regulatory safeguards.

2.3 Resource conservation

Resource conservation, traditionally defined as the prudent management of natural assets to prevent depletion, has taken on renewed urgency in light of escalating global environmental degradation and the climate crisis. Green innovation, which involves the creation and adoption of new technologies, products, and processes designed to minimise environmental impact, has become a crucial strategy for improving resource efficiency and supporting sustainable development. When effectively aligned, these approaches offer a compelling pathway towards ecological balance and long-term resilience. Central to this integration is the concept of process and product innovations that prioritise environmental outcomes. Research confirms that green innovation significantly enhances environmental performance, with process innovations exerting a particularly strong influence on resource conservation indicators such as energy intensity and reductions in material inputs (Xie *et al.*, 2024). These innovations enable firms and

economies to produce more with fewer resources, thereby aligning productivity with ecological objectives. The success of green innovation in driving conservation outcomes is strongly influenced by institutional and regulatory frameworks. Chen *et al.* (2024) demonstrate that the impact of green technological initiatives on energy efficiency is markedly greater in contexts where institutional quality, such as regulatory enforcement and governance stability, is high. This finding highlights the importance of supportive policy environments in translating innovation into tangible conservation benefits. Abul Hassan *et al.* (2025) found that in resource-rich countries, particularly those with high rents from oil and minerals, green innovation contributes to a reduced ecological footprint by enabling more sustainable utilisation of these resources without undermining economic performance. Resource conservation and green innovation are mutually reinforcing pillars of sustainable development. Green innovation not only enhances environmental outcomes but also increases the efficiency and sustainability of natural resource use. When embedded within robust institutions and supported by adaptive regulatory systems, green technologies have the potential to transform consumption patterns, lower ecological footprints, and foster the emergence of a regenerative economy (Abul Hassan *et al.* 2025).

2.4 Sustainable performance

Sustainable performance reflects an organisation's ability to achieve long-term success by aligning economic progress with environmental care and social accountability. Sustainable performance adopts a more comprehensive perspective by integrating financial results with broader environmental and social factors, in contrast to traditional performance metrics that mainly concentrate on immediate financial rewards. By emphasising the connections between profitability, resource management, and social equality, this all-encompassing approach harmonises business strategy with international sustainability frameworks like the United Nations Sustainable Development Goals (Friede *et al.*, 2015). Digital advancements have become essential tools for tracking and enhancing sustainability indicators, particularly blockchain, artificial intelligence (AI), and the Internet of Things (IoT). These technologies facilitate real-time data capture and precise reporting, enhancing accountability and empowering organisations to respond rapidly to sustainability challenges (Fraga-Lamas & Fernandez-Carames, 2024).

Simultaneously, the adoption of circular economy models centred on resource reuse, recycling, and regeneration has gained momentum among firms seeking to reduce waste and ecological impact. Effective stakeholder engagement is also essential. Firms that embrace a stakeholder-oriented approach engaging employees, customers, communities and shareholders tend to cultivate trust, enhance reputation and deliver superior long-term outcomes compared to those focused solely on shareholder returns (Freeman *et al.*, 2022; Geissdoerfer *et al.*, 2020; Resources, Conservation & Recycling, 2023). Sustainability reporting standards are evolving to reflect these shifts. Aligning sustainability reporting standards is a major responsibility of the International Sustainability Standards Board (ISSB) and organisations like the Sustainability Accounting Standards Board (SASB) and the Global Reporting Initiative (GRI). Their initiatives are intended to improve uniformity, increase openness, and give stakeholders clear and helpful information so they may make educated decisions (ISSB, 2024). Onyekwelu *et al.* (2021), in their study, the authors emphasise that social media plays a diverse and important role in securing long-term business success. They contend that since social media platforms boost overall productivity and bolster a company's competitive edge, business executives should include them into their operations. Similarly, Monyei *et al.* (2021) explore how strategic agility improves sustainable performance among micro-enterprises in Southeastern Nigeria, showing that adaptive operational strategies help micro-businesses maintain alignment with sustainability goals amid institutional and economic instability. Put differently, sustainable performance and green innovation are closely related. One of the main forces behind sustainable performance is green innovation, which is the creation and application of novel goods, procedures, or business models that greatly reduce their negative effects on the environment while generating social and economic benefit. Furthermore, green innovation often yields operational efficiencies and cost savings, enhancing economic resilience whilst supporting environmental goals. The synergy between digital tools and green innovation facilitates transparent reporting and accountability, boosting stakeholder trust and enabling firms to meet evolving sustainability expectations. Integrating green innovation within stakeholder-oriented strategies not only enhances social performance by engaging diverse stakeholders but also encourages collaborative action on sustainability challenges (Freeman *et al.*, 2022). The growing emphasis on ESG criteria reflects this shift, as investors seek credible commitments to environmental responsibility and innovative solutions. Finally, evolving

standards such as those from the ISSB increasingly recognise green innovation as a fundamental driver of corporate sustainability. Standardised disclosure of green initiatives and associated outcomes enables benchmarking and motivates continuous improvement in environmental performance (ISSB, 2024). In regions such as Africa and South Asia, aligning green innovation with local priorities such as energy access, job creation, and community resilience is vital for inclusive and enduring development. Sustainable performance thus represents not just a universal corporate objective, but a context-sensitive process of harmonising global imperatives with regional realities to ensure equitable and lasting progress.

2.5 Empirical review

A study by Padilla-Lozano *et al.* (2024) investigated the relationship between green innovation and competitiveness among Ecuadorian fast-moving consumer goods (FMCG) companies. The purpose of the study was to investigate how green innovation affects corporate competitiveness. Several hundred SMEs made up the entire population covered. Purposive and convenience sampling were used as sample methods across industries. The abstract did not provide a complete description of the sample size. The main statistical approach used in the study was structural equation modelling, or SEM. The results showed a significant positive correlation between green innovation practices and competitiveness metrics; however, the summary did not provide particular coefficients or p-values. The study came to the conclusion that competitive advantage is greatly increased by ethical green innovation. Stakeholder participation and environmental management systems should be strengthened, according to the research.

Rong *et al.* (2025) conducted a study on green-focused entrepreneurial direction capability and entrepreneurial success in services sectors across emerging economies. The study aimed to assess mediation effects. The total population included numerous SMEs from multiple emerging countries. The sampling technique was unspecified but likely convenience/purposive. Sample size not explicitly stated. Statistical tools employed mediation analysis and regression models. The findings showed that the impact of green entrepreneurial orientation on success is somewhat mediated by green innovation capability (β and p-values not in abstract). The study concluded that fostering a green

mindset enhances innovation capability and performance. The study recommended the adoption of policies supporting entrepreneurial orientation in green entrepreneurship.

Junejo *et al.* (2025) investigated how big data-driven supply chains, green supply chain management, green knowledge sharing, and green innovation affected the sustainable performance of SMEs in developing nations. The research aimed to assess the role each of these factors plays in driving sustainability outcomes. The study focused on a population consisting entirely of SMEs operating in the selected country. Sampling technique used surveys with purposive selection. Sample size unspecified in abstract. Statistical tools employed multivariate analysis (likely SEM/regression). The findings showed that green innovation and knowledge exchange had a major positive impact on sustainable performance. The study concluded that integrated GSCM and data-driven approaches enhance SME sustainability. The study recommended the adoption of capacity building in green knowledge and digital tools.

Maturan *et al.* (2025) investigated a study on trends and opportunities in sustainable high-tech manufacturing firms in an emerging economy. The study aimed to identify technological and socioeconomic trends. The total population was 181 publications. The selection technique involved database searches and screening for relevance. The sample size was 181 journal articles. Analysis employed a systematic review with a quantitative summary of trends (e.g., reduction metrics). The results revealed that adoption of AI, digital twins, and blockchain led to a 30% reduction in energy and 20% less waste in the case firms. The study concluded that technological integration is key to sustainable performance. The study recommended that firms should always address social and policy gaps, most especially in emerging regions.

A study on innovation for a greener future: A meta-analysis of the influence on environmental performance investigating the consequences of green innovation variants was carried out by Miao *et al.* in 2024. The study aimed to quantify effects on environmental performance. The total population was 80 empirical studies. Sampling technique included literature screening and statistical inclusion criteria. The sample size was 80 studies. A thorough meta-analysis was conducted using statistical methods (CMA software). The findings showed that environmental performance was positively and significantly impacted by overall green innovation (GI), green product innovation (GPRI), and green process innovation (GPCI), with GPCI having a greater impact than GPRI. According to the study's findings, green innovation significantly enhances

environmental results; the impact is influenced by sector type and the degree of national development. The study recommended that firms should adopt policy incentives which will promote process innovation in emerging economies.

3 METHODOLOGY

This research employed a quantitative design to explore the link between green innovation and sustainable performance among selected fast-moving consumer goods (FMCG) firms based in Aba, Nigeria (an emerging economy context). The target population comprised 861 employees drawn from three major fast-moving consumer goods (FMCG) firms recognised for their market prominence and commitment to industrial sustainability: PZ Cussons Plc (205 employees), Tonimas Nigeria Limited (231 employees), and Unilever Nigeria Plc (425 employees). These companies were purposively selected due to their significance within the consumer goods sector and their varying degrees of engagement with green innovation strategies, thereby offering diverse perspectives on sustainable performance outcomes. The study used Yamane's (1967) method, which is well known for its efficacy in survey research with finite populations, to guarantee a statistically sound and suitable sample size. 273 respondents were found to be the final sample size using a 95% confidence level and a 5% margin of error. Within the confines of the research population, this sampling strategy guaranteed the collection of trustworthy and broadly applicable data. The main tool used to obtain the data was a structured questionnaire. It was thoughtfully created to encompass important aspects of green innovation, such as environmentally friendly product design, sustainable process enhancements, and environmental management techniques. Of the 273 questionnaires distributed, 248 were completed and returned in a usable format, representing a high response rate of approximately 91.2%. This strong level of participation enhances the reliability of the dataset and reflects respondents' engagement with the research topic. Spearman's Rank Correlation and descriptive statistics were used to analyse the data. The respondents' demographics were summarised using descriptive analysis, and the suggested connections between green innovation techniques and several sustainable performance metrics were investigated using the Spearman Rank Correlation test.

Table 1*Study Population of the Firms*

S/N	Firm	Population
1.	PZ Cussons Plc	205
2.	Tonimas Nigeria Limited	231
3.	Unilever Nigeria Plc	425
	Total	861

4 ANALYSES OF DATA

This section presents the analysis of the survey data in relation to the core variables, focusing on how green innovation influences the sustainable performance of selected fast-moving consumer goods (FMCG) firms in an emerging economy.

Table 2*Responses on Energy Efficiency on Sustainable Performance*

S/N	STATEMENT	SA	A	U	D	SD	Total
a.	Our company has adopted energy-efficient technologies that have contributed to cost savings and operational efficiency.	114	118	6	7	3	248
b.	Implementing energy-saving practices in our production process has improved our overall environmental performance.	136	96	6	6	4	248
c.	Energy-efficient initiatives in our firm have positively influenced our brand image and market competitiveness	126	98	8	7	9	248
d.	Reducing energy consumption in our operations has helped us comply with environmental regulations and standards	123	92	4	3	6	248
e.	Investments in energy-efficient systems have supported long-term sustainability goals in our company.	183	57	2	2	4	248
	Total	682	461	26	25	26	1240
	Average Total	139	94	5	5	5	248
	Percentage	56	38	2	2	2	100

Source: Field Survey, 2025

Table 2 shows that an average of 139(56%) respondents selected 'Strongly Agree,' 94(38%) respondents choose 'Agree,' 5(2%) respondents remained Undecided,' 5(2%) respondents selected 'Disagree,' and 5(2%) respondents choose 'Strongly Disagree' regarding energy efficiency on sustainable performance.

Table 3*Responses on Resource Conservation on Sustainable Performance*

S/N	STATEMENT	SA	A	U	D	SD	Total
a.	Our company actively reduces raw material waste, which has led to improved cost-effectiveness and production efficiency.	166	64	5	7	6	248
b.	We have implemented measures to conserve water and other natural resources, contributing to our environmental sustainability goals.	189	46	8	4	1	248
c.	Resource conservation practices in our operations have enhanced our compliance with sustainability regulations and industry standards	175	61	8	2	2	248
d.	By optimising the use of materials and resources, our company has minimised environmental impact without compromising productivity.	147	83	3	7	8	248
e.	Efficient resource management has played a significant role in improving our company's long-term sustainable performance.	142	98	2	1	5	248
	Total	819	352	26	21	22	1240
	Average Total	164	71	5	4	4	248
	Percentage	67	29	2	1	1	100

Source: Field Survey, 2025

Table 3 illustrates that an average of 164(67%) respondents selected 'Strongly Agree,' 71(29%) respondents choose 'Agree,' 5(2%) respondents remained 'Undecided' 4(1%) respondents selected 'Disagree,' and 4(1%) respondents choose 'Strongly Disagree' regarding resource conservation on sustainable performance.

4.1 Test of hypotheses

As outlined in Chapter One, the three hypotheses were tested using Spearman's Rank Correlation Coefficient, conducted through Version 23 of the Statistical Package for the Social Sciences (SPSS).

4.1.1 Test of hypothesis one

H₀: Energy Efficiency does not affect Sustainable Performance.

Table 4
Correlations 1

			Effect Efficiency	Sustainable Performance
Spearman's rho	Effect Efficiency	Correlation Coefficient	1.000	.835**
		Sig. (2-tailed)	.	.000
		N	248	248
	Sustainable Performance	Correlation Coefficient	.835**	1.000
		Sig. (2-tailed)	.000	.
		N	248	248

** . Correlation is significant at the 0.01 level (2-tailed).

4.1.2 Interpretation of result

The correlation coefficient in Table 4 above is 0.835, and the p-value is 0.000 ($p < 0.05$). The alternative hypothesis is accepted and the null hypothesis is rejected since the p-value is less than the 0.05 significance level. According to the Spearman Rank Correlation analysis, sustainable performance is significantly improved by energy efficiency.

4.1.3 Test of hypothesis two

H₀₂: Resource Conservation does not affect Sustainable Performance.

Table 5
Correlations

			Resource Conservation	Sustainable Performance
Spearman's rho	Resource Conservation	Correlation Coefficient	1.000	.991**
		Sig. (2-tailed)	.	.000
		N	248	248
	Sustainable Performance	Correlation Coefficient	.991**	1.000
		Sig. (2-tailed)	.000	.
		N	248	248

** . Correlation is significant at the 0.01 level (2-tailed).

4.1.4 Interpretation of result

The correlation coefficient in Table 5 is 0.991, with a p-value of 0.000 ($p < 0.05$). The null hypothesis is rejected and the alternative hypothesis is accepted since the p-value is less than the 0.05 level of significance. According to the Spearman Rank Correlation analysis, sustainable performance is significantly improved by resource conservation.

4.2 Discussion of findings

The Spearman Rank Correlation test revealed that energy efficiency significantly affects sustainable performance. The result aligns closely with the findings of Miao *et al.* (2024), which showed that green process innovation, which often involves enhancing energy efficiency, exerts a stronger impact on environmental performance than green product innovation. This reinforces the assertion that operational changes aimed at reducing energy consumption yield measurable improvements in sustainability metrics. Additionally, Junejo *et al.* (2025) offer supplementary evidence by highlighting the importance of big-data-driven supply chain management and green information exchange in promoting sustainable performance, which naturally entails optimising energy use across activities. In line with previous research by Zhang *et al.* (2017), which highlighted the synergistic relationship between information systems and green practices in Fast-Moving Consumer Goods (FMCG) companies, the integration of digital tools and green capabilities appears to catalyse achieving energy-efficient outcomes. The idea that energy efficiency initiatives, as part of larger green strategies, not only improve environmental metrics but also enhance overall firm viability is supported by Padilla-Lozano *et al.* (2024), who also highlight the strategic value of adopting green innovation for competitiveness in the Ecuadorian fast-moving consumer goods (FMCG) firms sector. This is further strengthened by Rong *et al.* (2025), who demonstrate that green entrepreneurial orientation positively influences success via enhanced innovation capability, a pathway that plausibly includes energy-efficient practices. Overall, the intersection of energy efficiency and sustainable performance is well-supported in both theoretical and empirical literature. The positive correlation revealed by the Spearman test is consistent with the broader body of evidence suggesting that energy efficiency is both a critical component and a performance lever in sustainable business practices. These

findings collectively advocate for stronger institutional and policy support for energy-efficient innovations, particularly in FMCG contexts and emerging markets, echoing recommendations from both meta-analytical and systematic reviews (Maturan *et al.*, 2025; Miao *et al.*, 2024).

The second hypothesis's outcome demonstrated that resource conservation had a major impact on sustainable performance. This outcome is consistent with research like Junejo *et al.* (2025), which showed that green innovation practices and integrated green supply chain management (GSCM), both of which entail the preservation of natural resources, have a positive impact on the sustainable performance of FMCG companies in developing nations. Their findings suggest that firms that proactively manage resources, reduce waste, and optimise inputs tend to exhibit better environmental and economic outcomes. In a similar vein, Miao *et al.*'s study from 2024 confirms that green process innovation greatly enhances environmental performance and is closely related to resource conservation through lower material and energy inputs. Their results also demonstrate that operational strategies that prioritise efficiency and conservation typically result in higher sustainability returns, as evidenced by the larger impact of green process innovation over product innovation. These insights support the idea that resource conservation is not simply a compliance measure but a strategic lever for improved performance. The systematic review by Maturan *et al.* (2025) also supports this relationship by documenting how the adoption of technologies such as AI, blockchain, and digital twins in sustainable manufacturing has led to measurable reductions in energy use and waste, indicating that technology-enabled resource conservation directly contributes to sustainability outcomes. These technological advancements act as enablers of smarter resource use, enhancing firms' capacity to balance economic and environmental objectives.

5 CONCLUSION

The study concluded that green innovation practices, particularly those centred on energy efficiency and resource conservation, exert a strong positive influence on sustainable performance. This finding underscores that firms, especially fast-moving consumer goods (FMCG) firms in emerging economies, can significantly enhance both their environmental outcomes and competitive advantage by adopting eco-friendly

operational and strategic approaches. The integration of green capabilities, underpinned by active stakeholder engagement and the strategic use of digital technologies, is vital for achieving long-term sustainability. By embedding sustainability into their innovation systems and corporate culture, fast-moving consumer goods (FMCG) firms can not only reduce ecological footprints but also strengthen resilience, drive market growth, and contribute meaningfully to global environmental objectives.

5.1 Recommendations

Governments and regulatory bodies in emerging economies should develop robust policy frameworks that actively encourage green innovation among fast-moving consumer goods (FMCG) firms. Such frameworks should incorporate a mix of financial incentives, including tax breaks, green innovation grants, low-interest financing, and subsidies to support the adoption of environmentally sustainable technologies and practices. These measures can help to alleviate the financial pressures associated with transitioning to greener operations and promote wider uptake of resource conservation and energy-efficient strategies across the FMCG sector. In parallel, regulatory reforms should define clear environmental performance standards and formally recognise fast-moving consumer goods (FMCG) firms that demonstrate leadership in sustainability. Policies should also support green certification schemes, helping these firms align with international environmental standards and improving their access to global markets. By embedding sustainability principles within national industrial strategies, governments can nurture a more resilient, innovation-driven green economy. From an organisational perspective, fast-moving consumer goods (FMCG) firms should prioritise investment in capacity building related to green knowledge and digital technologies. This entails putting in place training courses on energy efficiency, sustainable supply chain management, environmental management, and the use of digital tools like blockchain, artificial intelligence (AI), and the Internet of Things (IoT). These programs should be included into businesses' learning and innovation systems for long-term efficacy. Collaborations with universities, research institutions, and industry associations can further provide access to up-to-date expertise and emerging technological advancements. To promote ongoing development and environmental responsibility, fast-moving consumer goods (FMCG) companies should also embrace

data-driven decision-making procedures and use green performance indicators. In addition to increasing operational effectiveness, building such internal capabilities would bolster adherence to environmental laws and response to changing market needs, establishing sustainability as a major source of economic advantage. Finally, Nigeria can draw lessons from the policy inconsistencies observed in the U.S. by maintaining long-term political commitment to green industrialisation. Stable and predictable environmental policies, supported by consistent enforcement and inter-institutional coordination, will encourage private sector confidence, attract foreign investment, and ensure that green innovation becomes an integral pillar of national economic transformation.

5.2 Suggestions for further study

The long-term impact of green innovation on the sustainable performance of fast-moving consumer goods (FMCG) companies should be investigated in future studies, with a focus on customer-related results. Further research is required to determine how these activities impact consumer happiness, loyalty, and purchasing behaviour, even if current studies generally show a positive association between green innovation and sustainability performance. Further understanding of how green initiatives can be successfully matched with consumer expectations and market dynamics within the FMCG sector will come from conducting industry-specific and long-term studies.

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Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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