

EFFECT OF GREEN FINANCE ON WASTE PROCESSING AND RECYCLING (A COST BENEFIT FOR SMES IN KOGI STATE)

1. IDACHABA Joseph Stephen;² EGBUNU, Audu Dangana;³ Sule Ja'afaru GARBA & ⁴ AGADA Ojoma Goodness^{1, 2, 3&4} Department of Business Administration, Prince Abubakar University, Ayingba..makojidachaba@gmail.com.+2348034637789 a.dangana@yahoo.com 2,³ sulegarbajaafaru01@gmail.com +2348103018221, ekojaojoma05@gmail.com +2348101158251

ABSTRACT

Small and Medium-Sized Enterprises (SMEs) are vital to both economic development and environmental sustainability. However, their adoption of waste processing and recycling (WPR) practices is often hindered by limited access to financing tailored for sustainable initiatives. This study examines the impact of green finance—specifically green bonds and green loans—on WPR among SMEs in Kogi State, Nigeria, with an emphasis on cost-benefit outcomes. Adopting a quantitative research design, data were gathered from 268 SMEs through structured questionnaires and analyzed using descriptive statistics and multiple regression analysis. The findings indicate that green bonds ($\beta = 0.228$) and green loans ($\beta = 0.542$) significantly and positively influence the adoption of WPR initiatives. These results suggest that green finance not only supports environmental stewardship but also contributes to the long-term financial viability of SMEs. Accordingly, the study recommends that the Kogi State government and financial institutions implement supportive measures—such as tax incentives and co-financing arrangements—to enhance access to green finance. It further encourages the development of sustainable finance networks to strengthen eco-friendly practices within the SME sector.

Keywords: Green finance, green bonds, green loans, waste processing and recycling

INTRODUCTION

Green finance refers to financial instruments and investments that support environmentally sustainable outcomes, particularly those aimed at reducing carbon emissions, improving energy efficiency, and promoting the use of renewable energy sources (UNEP, 2016). The concept gained significant global recognition following the 2015 Paris Agreement, which emphasized climate change mitigation through innovative financial mechanisms and environmentally responsible investments. In Nigeria, green finance has gained traction over the past decade as part of the nation's commitment to sustainable development and the achievement of the United Nations Sustainable Development Goals (SDGs). In 2012, the Central Bank of Nigeria (CBN) introduced the Nigerian Sustainable Banking Principles (NSBP) to guide financial institutions in integrating sustainability into their core operations (CBN, 2012). A major milestone in the development of green finance in Nigeria occurred in 2017, when the Federal Government issued its first sovereign green bond worth ₦10.69 billion to finance renewable energy and afforestation projects (Deloitte, 2018). While green bonds have gained more visibility, green loans are gradually being adopted, with institutions such as the Bank of Industry (BOI) providing credit facilities for energy-efficient technologies and waste-to-wealth projects targeted at SMEs (BOI, 2020).

Green finance has served as a catalyst for promoting environmentally sustainable entrepreneurship among SMEs, particularly in sectors such as clean energy, waste management, recycling, and agriculture. In Kogi State, where agriculture and agro-processing SMEs are predominant, instruments like green loans and green bonds have facilitated the adoption of technologies such as solar-powered irrigation systems, biogas utilization, and eco-friendly packaging solutions (Okafor & Jimoh, 2021). Institutions like the Bank of Industry, in collaboration with microfinance banks and initiatives such as the Nigeria Electrification Project (NEP), have extended low-interest financing to SMEs undertaking off-grid renewable energy projects (World Bank, 2021). Green finance has also enhanced resource efficiency by supporting SMEs involved in waste recycling and processing, thereby contributing to employment generation, income diversification, and environmental sustainability in local communities (Adeleke & Dauda, 2022).

The issuance of green bonds in Nigeria has opened new financing channels for SMEs engaged in clean energy and sustainable agricultural practices. In areas such as Lokoja, Kabba, and Okene, several SMEs have incorporated solar energy and bio-waste recycling into their business models with support from development finance institutions (Akinyele & Lawal, 2022). Furthermore, training and awareness programs funded through green finance initiatives have equipped entrepreneurs with the skills needed to implement sustainability practices in their operations. Despite these advances, many SME operators in Kogi State remain unaware of available green finance opportunities (Oni & Adewale, 2023). Challenges also persist in the regulatory framework, which remains underdeveloped and sometimes unclear regarding green financial instruments such as bonds and loans. Moreover, collateral requirements continue to limit access to green loans for SMEs lacking fixed assets (Nwachukwu, 2022), and many entrepreneurs face difficulties in designing and presenting bankable green projects that align with financiers' expectations.

Although the literature on green finance and its contribution to sustainable development is expanding, a significant empirical gap persists regarding its direct impact on small and medium-sized enterprises (SMEs), particularly in developing countries such as Nigeria. Existing research has predominantly concentrated on the deployment of green finance in large-scale infrastructure projects or within more advanced economies (Bhattacharya & Romani, 2016; Tolliver et al., 2019), often neglecting the distinct challenges and opportunities encountered by SMEs in rural and subnational contexts. Furthermore, while studies by Hyun et al. (2020) and Chiesa and Barua (2019) have assessed the broader environmental implications of green bonds, they fall short of addressing how these instruments influence cost-efficiency and resource recovery for SMEs involved in waste processing and recycling. Similarly, research on green loans by Gupta and Singh (2021) and Nkwonta and Obi (2021) has largely examined SME sustainability in general terms, without disaggregating the specific cost-benefit outcomes related to waste management practices

This study addresses a critical empirical gap by evaluating the cost-benefit impact of green finance instruments—specifically green bonds and green loans—on waste processing and recycling among SMEs in Kogi State, Nigeria. It extends the Resource-Based View (RBV) theory to the intersection of environmental sustainability and finance in a localized, underexplored context. The research contributes to the literature by offering empirical insights into how green finance tools, despite being underutilized or poorly aligned with SME capacities, can be harnessed as valuable, rare, inimitable, and non-substitutable (VRIN) resources to

foster competitive advantage and long-term sustainability. By focusing on Kogi State, the study also addresses the geographic bias of existing research, which often centers on Nigeria's urban hubs or national-level initiatives. In doing so, it provides a nuanced understanding of how green finance can be localized to help SMEs overcome barriers to sustainable waste management and transition toward circular economy practices in sub-Saharan Africa.

The study is guided by the following research questions: How do green bonds influence the adoption of waste processing and recycling initiatives by SMEs in Kogi State? What is the impact of green loans on the cost-benefit dynamics of waste processing and recycling among SMEs in Kogi State?

Accordingly, the specific objectives are: to examine the effect of green bonds on the adoption of waste processing and recycling projects by SMEs in Kogi State. to analyze the impact of green loans on the cost-benefit dynamics of waste processing and recycling initiatives for SMEs in Kogi State.

The following null hypotheses were formulated: H_{01} : Green bonds have no significant impact on the cost-benefit analysis of waste processing and recycling for SMEs in Kogi State. H_{02} : Green loans have no significant impact on the cost-benefit analysis of waste processing and recycling for SMEs in Kogi State.

REVIEW OF RELATED LITERATURE

Concept of Green Finance

Green finance encompasses financial instruments and services designed to support environmental sustainability by integrating ecological considerations into financing decisions made by stakeholders such as consumers, producers, investors, and financial institutions. While it includes climate finance, green finance also addresses broader environmental objectives, including pollution reduction, biodiversity conservation, and water sanitation (OECD, 2020). Key instruments under green finance include green bonds, green loans, venture capital, and sustainability grants, all of which facilitate environmentally responsible economic growth. For Small and Medium-Sized Enterprises (SMEs), green finance has emerged as a crucial enabler for investing in waste processing and recycling (WPR) initiatives. These initiatives are vital for enhancing resource efficiency, minimizing environmental impact, and promoting long-term business sustainability. Green bonds, for example, provide SMEs with access to long-term, low-cost capital that can be used to develop or expand recycling facilities, procure waste processing equipment, or implement clean technologies for waste-to-resource conversion (ICMA, 2021). Similarly, green loans typically offer more favorable conditions than conventional loans—such as reduced interest rates or extended repayment periods—conditional upon achieving specific environmental performance metrics (LMA, 2019). These incentives encourage SMEs to engage in waste segregation, treatment, and recycling activities that contribute to both environmental protection and improved business performance.

A comprehensive cost-benefit analysis is essential to determine the viability of such initiatives. This evaluation encompasses direct costs—such as capital investments in technology, employee training, maintenance, and

regulatory compliance—as well as indirect costs (Boardman et al., 2018). Conversely, benefits include revenue from the sale of recycled materials, cost savings from reduced raw material consumption, increased efficiency in waste disposal, and potential access to tax incentives for adopting green practices. The U.S. Environmental Protection Agency (2020) estimates that effective recycling strategies can reduce SMEs' raw material costs by up to 30%, enhancing operational efficiency and profitability. WPR investments demand significant commitments in infrastructure, technology, and human capital. Profitability is often influenced by operational scale, the type of waste processed, and market demand for recycled products. Technological innovations—such as pyrolysis for converting plastics to fuel, composting for organic waste, and advanced material recovery for electronic waste—offer SMEs the opportunity to both reduce their ecological footprint and create new revenue streams (UNEP, 2018). Green finance helps close the funding gap that often prevents SMEs from accessing these capital-intensive solutions. Access to green bonds and loans enables SMEs to pursue large-scale environmental projects that might otherwise remain unattainable.

These investments deliver long-term financial returns by generating new income, reducing disposal costs, and enhancing brand value (World Bank, 2021). Moreover, supporting SME waste management through green finance contributes to broader economic and environmental goals. It helps lower operational costs, boost resource efficiency, and ensure compliance with environmental regulations, all of which strengthen SME competitiveness and financial sustainability (European Commission, 2022). Aligning operations with international sustainability standards also attracts environmentally conscious investors and customers. Furthermore, green finance fosters innovation by motivating SMEs to develop circular business models and technologies—such as the production of recycled raw materials or the implementation of waste-to-energy systems—that open new markets and generate employment opportunities (Gaddy et al., 2017).

Green bonds

Green bonds are specialized debt instruments issued to raise capital exclusively for projects that deliver environmental benefits. According to the International Capital Market Association (ICMA, 2021), these bonds are designed to finance initiatives that advance environmental objectives such as reducing greenhouse gas emissions, improving energy efficiency, and promoting sustainable waste management. For Small and Medium-Sized Enterprises (SMEs), green bonds offer vital funding for a wide range of waste processing and recycling (WPR) activities—including the development of recycling infrastructure, adoption of waste-to-energy systems, and implementation of waste segregation and treatment technologies. A key advantage of green bonds for SMEs is enhanced access to capital. Traditionally, SMEs encounter barriers to conventional financing due to perceived credit risk, inadequate collateral, and limited financial resources. Green bonds offer an alternative financing route by attracting a growing pool of environmentally conscious investors, including institutional investors and impact-focused funds seeking sustainable investment vehicles (OECD, 2020). This expanded access to capital empowers SMEs to pursue large-scale environmental projects that would otherwise be financially unattainable. For instance, an SME in Kogi State might utilize proceeds from green bond issuance to establish a plastic waste recycling plant—enabling the procurement of advanced machinery, expansion of processing capacity, and enhancement of operational efficiency.

Beyond addressing financial constraints, green bonds stimulate technological innovation by encouraging SMEs to invest in research and development (R&D) and adopt cutting-edge waste management practices. Funds raised through bond issuance can support the exploration and deployment of high-efficiency sorting systems, automated recycling technologies, and other advanced waste-processing solutions that increase the quantity and quality of recoverable materials (Gaddy et al., 2017). These innovations not only divert more waste from landfills but also improve the environmental and economic performance of SMEs. The environmental impact of green bond-financed WPR initiatives is significant. Such projects contribute to regional sustainability goals—particularly in areas like Kogi State—by reducing landfill dependence, lowering carbon emissions, and conserving natural resources through improved material recovery (European Commission, 2022). In parallel, the economic benefits are considerable. SMEs can generate new revenue streams by monetizing recycled materials and by-products, while simultaneously enhancing resource efficiency and operational resilience. These improvements can lead to increased profitability and long-term business growth (World Bank, 2021).

However, the effectiveness of green bonds in driving sustainable waste management among SMEs is heavily influenced by the policy environment. Supportive government interventions—such as tax incentives for green bond issuers, subsidies for green technology adoption, and streamlined regulatory processes—can significantly enhance both the appeal and accessibility of green bonds for SMEs (OECD, 2020). Establishing an enabling institutional framework is thus essential for promoting SME participation in green finance and fostering the broader transition to sustainable business practices at the local level.

Green Loans

Green loans are financial instruments explicitly designed to fund projects with verifiable environmental benefits. According to the Loan Market Association (LMA, 2019), a green loan is one where the proceeds are exclusively allocated to finance or refinance, wholly or partially, new or existing projects that support environmentally sustainable objectives. For small and medium-sized enterprises (SMEs), these loans represent a viable alternative to traditional financing by addressing the financial constraints often associated with sustainable project implementation. The cost-benefit dynamics of waste processing and recycling projects are significantly shaped by access to green loans. Establishing waste management systems typically involves substantial upfront investments, including the acquisition of equipment, technology, and training. Green loans ease these capital burdens by providing accessible, purpose-driven funding, thereby improving the feasibility and economic attractiveness of such initiatives. The availability of concessional interest rates and flexible repayment terms often associated with green loans further reduces financial pressure on SMEs, allowing them to channel more resources into productive operations (U.S. Environmental Protection Agency [EPA], 2020).

Moreover, green loans enable SMEs to unlock new revenue opportunities through the transformation of waste into valuable outputs such as recycled materials, compost, or renewable energy. This contributes to improved profitability and resource efficiency. The World Bank (2021) underscores that sustainable waste management practices not only enhance environmental outcomes but also drive economic performance by expanding

markets for recycled goods and services. Operational efficiency also benefits from the capital made available through green loans. These funds empower SMEs to invest in modern, energy-efficient machinery and advanced recycling technologies that streamline operations and increase throughput. For instance, automated sorting systems or modular waste-to-energy solutions can reduce labor intensity and operational costs while boosting recycling rates (European Commission, 2022). In addition, access to green finance encourages SMEs to pursue innovation through research and development. This fosters the creation of novel waste processing techniques and enhances the potential for technological advancements in waste-to-resource conversion (Gaddy et al., 2017).

Environmentally, green loan-supported initiatives offer substantial benefits. These include a reduction in landfill use, mitigation of greenhouse gas emissions, and improved resource conservation—all critical components of circular economy models (UNEP, 2018). In the context of Kogi State, Nigeria, the environmental gains from such projects are closely linked to economic sustainability. As SMEs adopt greener practices, they position themselves to attract environmentally conscious consumers and investors, enhancing brand reputation and expanding market competitiveness (OECD, 2020). However, the effectiveness of green loans in driving sustainable waste management among SMEs in Kogi State is contingent on the presence of an enabling policy environment. Policymakers must take proactive steps to facilitate access to green finance through regulatory support, financial incentives, and awareness campaigns. Strategic interventions such as tax reliefs for green investments, simplified loan application processes, and targeted capacity-building programs can significantly improve adoption rates (OECD, 2020).

Cost-Benefit Dynamics of Waste Processing and Recycling Initiatives for SMEs

Cost-benefit analysis is a critical tool for strategic decision-making among Small and Medium-Sized Enterprises (SMEs) considering investments in waste processing and recycling (WPR). This analytical approach involves evaluating the upfront capital investment required to establish waste management systems against the anticipated long-term economic and environmental returns. Initial expenditures typically include the purchase of equipment, adoption of appropriate technologies, and training of personnel (United Nations Environment Programme [UNEP], 2018). For resource-constrained SMEs, these investments—ranging from waste collection vehicles and sorting machinery to composting units and small-scale recycling plants—can represent a significant financial burden. In addition to capital costs, SMEs must account for recurrent operational expenses such as labor, energy, equipment maintenance, and adherence to environmental regulations. Despite these ongoing financial commitments, effective WPR systems can yield considerable long-term savings and efficiency gains. For instance, by reducing the volume of waste directed to landfills, recycling efforts help decrease disposal fees and mitigate the risk of incurring regulatory fines or environmental penalties.

Furthermore, integrating recycled materials into production processes reduces dependence on virgin raw materials, thereby lowering input costs and enhancing resource efficiency (U.S. Environmental Protection Agency [EPA], 2020). Many recyclable materials—such as plastics, metals, paper, and glass—also hold market value and can be sold to recycling firms or industrial users, generating additional revenue streams.

These financial gains contribute to the long-term sustainability and resilience of SMEs engaged in recycling initiatives (Gaddy et al., 2017). For example, a food processing SME may invest in an on-site composting facility to convert organic waste into nutrient-rich compost. Although the initial capital outlay may be considerable, the enterprise stands to benefit through reduced waste disposal costs and potential revenue from compost sales to local agricultural producers. Beyond direct financial returns, the adoption of environmentally responsible practices can enhance the firm's reputation, appeal to environmentally conscious consumers, and provide a competitive edge in an increasingly sustainability-driven market landscape.

Theoretical Review: Resource-Based View (RBV) Theory

The Resource-Based View (RBV) theory offers a strategic lens for understanding how green finance enhances the internal capabilities of small and medium-sized enterprises (SMEs) in Kogi State, Nigeria, particularly in waste processing and recycling. As articulated by Barney (1991), firms attain sustainable competitive advantage when they possess resources that are valuable, rare, inimitable, and non-substitutable (VRIN). Green finance instruments—such as green bonds and green loans serve not merely as funding sources but as strategic enablers that help SMEs acquire or develop eco-innovative technologies like solar waste treatment systems, recycling machines, and biodegradable packaging, which can reduce costs and increase regulatory compliance (Hart & Dowell, 2011).

These capabilities, once developed, often become rare and difficult to imitate, particularly when they involve local expertise, technical know-how, or intellectual property, as noted by Hart (1995) and Wernerfelt (1984). Additionally, the eco-solutions fostered through green finance are often non-substitutable, given their dual economic and environmental benefits (Priem & Butler, 2001). Therefore, green finance, through the RBV lens, is seen as a critical driver for SMEs in building competitive, cost-effective, and sustainable waste management strategies. These innovations not only advance environmental performance but also contribute to economic value creation, including lower costs, new revenue streams, and improved brand equity (Adeleke & Dauda, 2022).

Empirical Review

Gupta and Singh (2021) explored the role of green loans in facilitating SME waste management in India through a mixed-methods approach, combining survey data and financial analysis. Their findings indicated that green loans helped SMEs reduce waste disposal costs by 25% and improve recycling capacity by 20%. However, a key limitation was the restricted access to green loans for smaller SMEs, especially those lacking robust financial records. While the study underscored the importance of broader accessibility and continued financial support beyond initial loan disbursement, it placed limited focus on the long-term environmental sustainability of these initiatives.

Building on this, Nkwonta and Obi (2021) investigated similar dynamics within Nigeria by examining how green loans influence the implementation and cost-benefit outcomes of waste recycling among SMEs. Using

qualitative interviews and cost-benefit analysis, they found that SMEs benefiting from green loans experienced a 20% increase in waste processing efficiency and a 30% reduction in disposal costs. However, many SMEs struggled with loan repayments due to irregular waste supply chains. The authors recommended more flexible repayment terms and stronger integration of SMEs into formal waste collection systems, though the study fell short of proposing tailored strategies for sector-specific challenges.

Turning to green bonds, Hyun et al. (2020) conducted a global panel data analysis to assess how environmental performance influences green bond pricing. The results revealed that green bonds with higher environmental scores attracted lower yields, indicating that investors are willing to accept reduced returns in exchange for supporting more environmentally responsible projects. The study stressed the need for more robust and transparent environmental performance metrics to encourage market participation but also highlighted the potential limitations of using global data, as it may overlook regional market differences and local implementation contexts.

Complementing this, Chiesa and Barua (2019) focused specifically on the waste management and recycling sectors within the global green bond market. Through econometric analysis, they found that green bonds significantly increased funding availability while also lowering financing costs for environmentally focused projects. The researchers advocated for policy incentives such as tax breaks and subsidies—to sustain the growth of green bond markets. However, the study acknowledged a gap in evaluating the direct environmental outcomes of the financed projects, calling for more rigorous monitoring and impact assessment frameworks.

METHODOLOGY

The study used a survey research design to quantitatively examine the impact of green finance on waste processing and recycling among SMEs in Kogi State, Nigeria. Based on SMEDAN/NBS (2021), the population was 938,740 SMEs. A sample size of 280 was determined using Yamane’s formula, and questionnaires were proportionally distributed across Kogi East, Central, and West using stratified random sampling. A total of 268 valid responses were analyzed. Data were collected using a structured five-point Likert scale questionnaire and analyzed with SPSS version 20.0 through descriptive statistics and multiple regression to test hypotheses and identify relationships. The methodology ensured statistical validity and broad regional representation.

Model Specification

$$WPR = \alpha + \beta_1GB_1 + \beta_2GL_2 + e \text{ -----}1$$

Where α = Vertical Intercept

WPR = Dependent variable i.e. waste processing and recycling cost benefit for SMEs

(GB)- Green bonds

(GL) - Green loans

e =Error terms or residual.

$\beta_1 - \beta_2$ = Slope of the coefficients

DATA ANALYSIS AND DISCUSSION OF FINDINGS

Table .1 Regression Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.644 ^a	.414	.410	1.104

a. Predictors: (Constant), GL, GB

The correlation coefficient (R = 0.644) indicates a moderately strong positive relationship between green finance (green bonds and green loans) and the cost-benefit outcomes of waste processing and recycling. An R Square value of 0.414 shows that 41.4% of the variation in cost-benefit performance among SMEs can be attributed to access to green finance, highlighting its importance in promoting sustainable waste management. The adjusted R Square (0.410) further confirms the model's reliability, while the standard error (1.104) suggests an acceptable level of prediction accuracy.

Table .2 : ANOVA

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	226.620	2	113.310	93.018	.000 ^b
	Residual	320.376	263	1.218		
	Total	546.996	265			

a. Dependent Variable: WPR

b. Predictors: (Constant), GL, GB

The regression sum of squares is 226.620, and the residual sum of squares is 320.376, resulting in a total sum of squares of 546.996. The F-statistic is 93.018, with a p-value of 0.000, which is below the 0.05 threshold, indicating statistical significance. This confirms that the combined effect of green bonds and green loans significantly influences the cost-benefit outcomes of waste processing and recycling among SMEs. Therefore, green finance is crucial in helping SMEs in Kogi State adopt economically viable and environmentally sustainable waste management practices.

Table .3 Coefficients

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

	(Constant)	5.496	.524		10.492	.000
1	GB	.110	.024	.228	4.650	.000
	GL	.445	.040	.542	11.029	.000

a. Dependent Variable: WPR

Test of Hypotheses

Multiple regression analysis was used to test the formulated hypotheses:

H₀₁: Green bonds do not significantly affect the adoption of waste processing and recycling projects by SMEs in Kogi State.

H₀₁₁: Green loans have no significant impact on the cost-benefit analysis of waste processing and recycling for SMEs in Kogi State.

The model's constant (intercept) is 5.496, representing the baseline level of waste processing and recycling when green finance inputs are absent. The unstandardized coefficient for green bonds is 0.110 (p = .000), indicating a statistically significant positive effect. A one-unit increase in green bond utilization corresponds to a 0.110 unit increase in waste processing and recycling activities, with a moderate standardized effect (β = 0.228). For green loans, the unstandardized coefficient is 0.445 (p = .000), also statistically significant. This suggests that a one-unit increase in green loan access results in a 0.445 unit improvement in waste processing and recycling, with a strong standardized effect (β = 0.542).

Discussion of Findings

The regression analysis reveals that both green bonds and green loans significantly and positively influence waste processing and recycling (WPR) among small and medium-sized enterprises (SMEs) in Kogi State, Nigeria. Specifically, green loans exhibit a stronger impact, with a higher standardized beta coefficient (β = 0.542) compared to green bonds (β = 0.228). These findings are consistent with previous empirical studies and align with the theoretical framework of the Resource-Based View (RBV), which emphasizes the strategic use of valuable, rare, inimitable, and non-substitutable (VRIN) resources for sustained competitive advantage (Barney, 1991). The significant effect of green bonds supports the work of Hyun et al. (2020) and Chiesa & Barua (2019), who argued that green bonds can enhance environmental performance by providing long-term capital for sustainability-oriented projects. The result affirms that when SMEs in Kogi State have access to green bond financing, they are more likely to invest in waste processing and recycling technologies, which yield economic and environmental benefits. Although the influence is moderate, it reflects the growing relevance of capital markets in supporting green transitions at the SME level. More notably, the stronger impact of green loans on WPR is in line with the findings of Gupta & Singh (2021) and Nkwonta & Obi (2021), who emphasized that tailored loan products for sustainability projects are essential to SME development, particularly in emerging economies. The accessibility, flexibility, and direct link of green loans to operational investments likely make them more practical and impactful for SMEs seeking to reduce waste and enhance

cost efficiency. This financial support enables them to acquire waste segregation equipment, adopt recycling technologies, and implement circular economy practices.

From an RBV perspective, the findings illustrate that green finance instruments—particularly green loans—can serve as strategic resources that meet the VRIN criteria. These financial tools empower SMEs to develop capabilities in sustainable waste management that are not easily imitated or substituted by competitors, thus contributing to long-term economic and environmental sustainability (Hart & Dowell, 2011). By leveraging these financial resources, SMEs in Kogi State can transform waste from a cost center into a source of resource recovery and competitive differentiation.

CONCLUSION AND RECOMMENDATIONS

The findings revealed that both green bonds and green loans significantly contribute to improved waste management practices among SMEs, with green loans having a more substantial impact. This outcome underscores the critical role that accessible and targeted financial instruments play in promoting environmental sustainability and cost efficiency. Anchored on the Resource-Based View (RBV) theory, the results support the view that green finance acts as a valuable internal resource, enabling SMEs to develop capabilities that are rare, inimitable, and non-substitutable—especially in adopting eco-friendly technologies and waste recycling initiatives. These sustainable practices not only reduce environmental impact but also enhance operational performance and long-term competitiveness. The study therefore recommends the following:

- i. The study recommended that regulatory bodies and financial markets in Nigeria should develop frameworks that make it easier for SMEs to access green bonds, possibly through pooled SME bonds or micro-green bond schemes tailored to smaller enterprises. Capacity-building efforts should also be targeted at educating SMEs on how to structure projects that qualify for such funding.
- ii. The study also recommended that banks and development finance institutions should create SME-friendly green loan products with flexible terms, minimal collateral requirements, and targeted support for waste processing and recycling technologies. This will deepen adoption and multiply the environmental and economic benefits.

REFERENCES

- Adeleke, O., & Dauda, B. (2022). Green entrepreneurship and resource recovery in Nigeria: A study of waste management SMEs. *Journal of Environmental Sustainability*, 14(2), 45–57.
- Akinyele, R., & Lawal, A. (2022). The impact of green loans on SME development in North-Central Nigeria. *African Journal of Sustainable Finance*, 3(1), 77–91.
- Bank of Industry. (2020). *Annual report on green projects and sustainable lending*. BOI Publications.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
- Bhattacharya, A., & Romani, M. (2016). *Financing sustainable infrastructure*. Brookings Institution.

- Boardman, A. E., Greenberg, D. H., Vining, A. R., & Weimer, D. L. (2018). *Cost-benefit analysis: Concepts and practice* (5th ed.). Cambridge University Press.
- Central Bank of Nigeria. (2012). *Nigerian sustainable banking principles (NSBP)*. <https://www.cbn.gov.ng>
- Chiesa, M., & Barua, S. (2019). The surge of green bonds. *Journal of Sustainable Finance & Investment*, 9(1), 14–24.
- Deloitte. (2018). *Green bonds: Nigeria's trailblazing step towards sustainable finance*. Deloitte Africa Insights.
- European Commission. (2022). *Green finance: Supporting the transition to a sustainable economy*.
- Gaddy, B. E., Sivaram, V., Jones, T. B., & Wayman, L. (2017). Venture capital and cleantech: The wrong model for energy innovation. *Energy Policy*, 102, 385–395. <https://doi.org/10.1016/j.enpol.2016.12.035>
- Gupta, R., & Singh, M. (2021). Green loans as a tool for SME waste management in India. *Indian Journal of Green Economics*, 12(2), 95–115.
- Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review*, 20(4), 986–1014.
- Hart, S. L., & Dowell, G. (2011). Invited editorial: A natural-resource-based view of the firm. *Journal of Management*, 37(5), 1464–1479.
- Hyun, S., Park, D., & Tian, S. (2020). The price of going green: The role of greenness in green bond markets. *Accounting & Finance*, 60(1), 73–100. <https://doi.org/10.1111/acfi.12513>
- International Capital Market Association. (2021). *Green bond principles: Voluntary process guidelines for issuing green bonds*. <https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/green-bond-principles-gbp/>
- Loan Market Association. (2019). *Green loan principles: Supporting environmentally sustainable economic activity*. <https://www.lma.eu.com/>
- Nkwonta, A., & Obi, C. (2021). Green finance and SME waste recycling initiatives: The role of green loans in Nigeria. *African Journal of Environmental Economics*, 9(4), 110–130.
- Nwachukwu, C. (2022). Challenges of financing green SMEs in Sub-Saharan Africa. *International Review of Business Economics*, 6(2), 94–109.
- Okafor, L., & Jimoh, M. (2021). Green finance and SME sustainability in Kogi State. *Nigerian Journal of Small Business and Entrepreneurship*, 8(4), 122–138.
- Oni, F., & Adewale, T. (2023). Awareness and accessibility of green finance among rural SMEs in Nigeria. *Journal of Development Finance*, 9(3), 59–70.
- Organisation for Economic Co-operation and Development. (2020). *Green finance and investment*. <https://www.oecd.org/environment/green-finance-and-investment/>
- Priem, R. L., & Butler, J. E. (2001). Is the resource-based “view” a useful perspective for strategic management research? *Academy of Management Review*, 26(1), 22–40.
- Tolliver, C., Keeley, A. R., & Managi, S. (2019). Green bonds for sustainable development. *Environmental Research Letters*, 14(10), 105008.
- U.S. Environmental Protection Agency. (2020). *Sustainable materials management: The road ahead*. <https://www.epa.gov/smm>

United Nations Environment Programme. (2016). *Definitions and concepts: Green finance* (Inquiry Working Paper 16/13).

United Nations Environment Programme. (2018). *The state of plastics: World Environment Day outlook*.
<https://www.unep.org/>

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180.

World Bank. (2021a). *Financing for climate: The World Bank's approach to green finance*.
<https://www.worldbank.org/en/topic/climatechange>

World Bank. (2021b). *Nigeria Electrification Project (NEP): Annual progress report*. World Bank Group.