

Leveraging Climate Finance through Green Bonds for Sustainable Transport Development in Nigeria

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Received 5 September 2025, Accepted 10 November 2025, Published 18 November 2025; <https://doi.org/10.26765/DRJMSS981234713>

Direct Research Journal of Management and Strategic Studies



Vol. 6(1), Pp. 124-130, November 2025,

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<https://journals.directresearchpublisher.org/index.php/drjmss/index>

Research Article
ISSN: 2787-009X

ABSTRACT

Climate change poses a critical threat to sustainable development, particularly in developing economies such as Nigeria where infrastructure deficits are compounded by environmental vulnerabilities. This study investigates leveraging climate finance through green bonds in for sustainable transport development in Nigeria. The purpose of the study is to consider how green bonds can be mobilized to finance sustainable transport development in Nigeria. The study adopted qualitative research technique by sytnhetisizing both theoretical and empirical literature. Based on literature synthesis the study revealed that although Nigeria has taken commendable steps, such as issuing sovereign green bonds, the transport sector remains largely excluded from green bond financing. The study identifies key constraints including weak institutional capacity, limited investor awareness, absence of sector-specific green bond guidelines, and insufficient policy incentives. However, it also highlights significant opportunities for aligning Nigeria's transport development with its climate commitments under the Paris Agreement and Nationally Determined Contributions (NDCs). The research contributes to knowledge by offering a sector-specific analysis of green bond deployment. It is therefore recommended that targeted policies such as tax incentives, public-private partnerships (PPPs), and capacity-building initiatives. It concludes that with appropriate regulatory frameworks and stakeholder engagement, green bonds can become a transformative tool for financing sustainable transport infrastructure in Nigeria.

Keywords: Climate finance, Climate resilience, Green bonds, Policy instruments, Public-private partnerships, Sustainable transport Infrastructure, Nigeria



Citation: Irejeh, E. M., Oyakegha, E. S. & Sile, A. A. (2025). Leveraging Climate Finance through Green Bonds for Sustainable Transport Development in Nigeria. *Direct Research Journal of Agriculture and Food Science*. Vol. 6(1). Pp. 124-130.

INTRODUCTION

In recent years, the twin challenges of climate change and sustainable infrastructure development have gained global attention. One of the critical sectors requiring decarbonization is the transportation sector, which significantly contributes to greenhouse gas (GHG) emissions. According to the Intergovernmental Panel on Climate Change (IPCC, 2022), transport is responsible for approximately 15% of global CO₂ emissions, primarily from fossil fuel combustion. This has led to increased advocacy for sustainable financing mechanisms to support green and low-carbon transportation infrastructure, particularly in developing countries such as Nigeria. Climate finance refers to the financial resources allocated to mitigate and adapt to the effects of climate change. It includes public and private investments directed at reducing carbon emissions and increasing resilience to climate impacts (UNFCCC, 2021).

One innovative instrument within climate finance is green bonds' fixed-income securities earmarked exclusively to raise funds for climate and environmental projects. These bonds are designed to finance sustainable infrastructure, including mass transit systems, electric vehicles, and non-motorized transport facilities. In Nigeria, the transport sector is vital to economic growth and regional connectivity. However, it faces significant sustainability challenges, such as traffic congestion, poor infrastructure, and high levels of carbon emissions. The potential of green bonds to finance clean and resilient transport infrastructure presents a critical opportunity. In 2017, Nigeria became the first African country to issue a sovereign green bond, targeting renewable energy and afforestation (Federal Ministry of Environment, 2017). Despite this milestone, the application of green bonds in financing transport-specific projects remains limited.

According to Nwogugu, (2020), integrating climate finance into national development planning is essential for achieving both economic and environmental goals. However, this requires appropriate financial instruments, institutional capacity, and regulatory frameworks. Given Nigeria's ambition to achieve a low-carbon economy as outlined in its Nationally Determined Contributions (NDCs), examining the role of green bonds in the transport sector is both timely and necessary.

Nigeria's transport sector is a major contributor to GHG emissions, driven largely by outdated vehicle fleets, reliance on fossil fuels, and inefficient urban transport systems. Despite the government's commitment to sustainable development and climate action, investment in low-carbon transport remains insufficient. The gap between infrastructure needs and available funding is wide, with traditional public financing unable to bridge this deficit. Although climate finance and green bonds offer viable alternatives, their uptake in Nigeria's transport sector has been minimal. Most green bond issuances to date have focused on energy and forestry projects, with

little attention paid to transport infrastructure (CBN, 2021). This misalignment presents a missed opportunity to mitigate climate risks and support Nigeria's transition to a sustainable, low-carbon economy. Moreover, there is a limited body of empirical research on how green bonds can be structured, implemented, and monitored effectively in Nigeria's transport sector. The lack of awareness among stakeholders, inadequate policy incentives, and weak institutional capacity further complicate the deployment of green finance instruments in transport projects (Okonkwo & Ofoegbu, 2022). Consequently, there is a pressing need to investigate how green bonds can be harnessed to finance transport infrastructure that is both climate-resilient and economically viable.

Research Questions

The following are the questions that guided the literature synthesis:

1. How has green bonds affect sustainable transport development in Nigeria?
2. How can the government leverage climate finance through green bonds?

Research Objectives

1. This study seeks to explore how green bonds can be leveraged to develop sustainable transport infrastructure in Nigeria.
2. To examine how climate finance through green bonds can mitigate climate challenges

Scope of the study

The focus will be on understanding the opportunities, challenges, and policy implications of using green bonds to address transport-related environmental concerns

Review of Literature

Climate Finance

Climate finance is broadly defined as financial flows aimed at supporting mitigation of and adaptation to the impacts of climate change. According to the United Nations Framework Convention on Climate Change (UNFCCC), climate finance encompasses "local, national or transnational financing drawn from public, private and alternative sources that seeks to support mitigation and adaptation actions that will address climate change" (UNFCCC, 2021). The Paris Agreement (2015) further emphasizes the critical role of climate finance in enabling

developing countries to meet their Nationally Determined Contributions (NDCs), with developed countries pledging to mobilize USD 100 billion annually to support climate action in developing economies (OECD, 2021).

Climate finance consists of both mitigation finance (to reduce GHG emissions) and adaptation finance (to strengthen resilience to climate impacts) (Nakhooda et al., 2019). It involves a variety of financial instruments and sources, including: Public finance (national budgets, climate funds, and development finance institutions); Private finance (commercial banks, institutional investors, corporations); Blended finance mechanisms that combine public and private capital to reduce risk and attract investment (Climate Policy Initiative, 2023). According to the Climate Policy Initiative (2023), global climate finance flows reached an estimated USD 1.3 trillion annually still well below the levels required to align with a 1.5°C pathway.

For countries like Nigeria, which face significant development and climate challenges, mobilizing climate finance is essential to support transitions in sectors such as energy, agriculture, and especially transport (Federal Government of Nigeria, 2021). Nigeria's transport sector accounts for an estimated 23% of national GHG emissions (IEA, 2023), underscoring the importance of directing climate finance toward the decarbonization and modernization of mobility infrastructure. Innovative financial instruments such as green bonds are increasingly recognized as key tools for addressing these barriers and scaling up climate finance for sustainable infrastructure.

Green Bonds

Green bonds are debt securities issued to raise capital for projects with defined environmental benefits (Climate Bonds Initiative, 2024). Like conventional bonds, they pay a fixed income to investors, but proceeds are earmarked exclusively for eligible green projects. Green bonds are a central component of green finance, aligning capital markets with sustainability objectives (Ehlers & Packer, 2017). The first green bond was issued by the European Investment Bank in 2007, and the market has since grown rapidly, with cumulative issuance exceeding USD 3 trillion globally as of 2024 (Climate Bonds Initiative, 2024). Green bonds typically finance projects in sectors such as Renewable energy; Energy efficiency; Sustainable transport; Waste management; Climate adaptation; Biodiversity conservation (OECD, 2021). The green bond market attracts both traditional and ESG-focused investors, offering them an opportunity to align their portfolios with sustainability objectives while earning competitive returns (Flammer, 2021). For issuers, green bonds can provide: Access to a broader investor base; Potential cost-of-capital advantages; Enhanced reputation and stakeholder trust (Karpf & Mandel, 2018).

In Nigeria, the Federal Government issued its first

sovereign green bond in 2017 (valued at NGN 10.69 billion) and a second in 2019 (NGN15 billion), financing projects in afforestation, renewable energy, and energy efficiency (Deloitte, 2018). The green bond framework is guided by the Green Bond Principles developed by the International Capital Market Association (ICMA) and the Climate Bonds Initiative. However, as noted by Fadeyi & Adebayo (2021): Oyebanji & Olagunju (2020), the application of green bonds to the transport sector in Nigeria has been minimal. Most issuances have prioritized energy-related sectors, with limited institutional focus on sustainable mobility despite the sector's considerable climate impact and the growing need for green transport infrastructure in Nigerian cities.

Sustainable Transport Development

Sustainable transport refers to transport systems that are safe, affordable, accessible, efficient, and environmentally friendly, meeting current mobility needs without compromising the ability of future generations to meet theirs (UNEP, 2023). Globally, the transport sector contributes approximately 23% of energy-related CO₂ emissions, with emissions continuing to rise, particularly in emerging economies (IEA, 2023). In Nigeria, the sector plays a critical role in economic development but also suffers from inefficiencies, pollution, and congestion (Federal Government of Nigeria, 2021). The environmental, social, and economic benefits of sustainable transport include: Reduced GHG emissions and improved air quality (UNEP, 2023); Enhanced urban livability and social equity; Improved road safety and public health; Increased productivity through efficient goods and passenger movement.

Existing initiatives, such as the Lagos BRT system and ongoing rail modernization programs, demonstrate potential pathways toward sustainable mobility. However, scaling these solutions requires substantial long-term financing, an area where green bonds can play a catalytic role (Climate Bonds Initiative, 2023). The application of green bonds to sustainable transport is well established internationally. For example, in China, green bonds have financed electric buses and metro systems in major cities (Zhang et al., 2020). In France, green bonds supported low-carbon transport infrastructure (Climate Bonds Initiative, 2023). In the Netherlands, green bonds financed cycling infrastructure and electric vehicle deployment (OECD, 2021). In contrast, Nigeria's green bond market remains underdeveloped for transport. Fadeyi & Adebayo (2021).

The concepts of climate finance, green bonds, and sustainable transport form the foundation for this study. While the global green bond market has demonstrated significant potential to finance climate-friendly transport, Nigeria has yet to fully harness this opportunity. The integration of these concepts offers a pathway for bridging

Nigeria's transport infrastructure investment gap while achieving its climate and development goals.

Theoretical Underpinning

Theory of Sustainable Development

The theory of sustainable development, rooted in the Brundtland Report (1987), promotes economic development that meets present needs without compromising the ability of future generations to meet theirs. This theory underpins the rationale for climate finance and green bonds, which aim to support infrastructure projects that balance economic growth, environmental protection, and social inclusion (WCED, 1987).

Green Finance Theory

Green finance theory posits that environmental risk and climate change represent material financial risks to economic systems, and therefore, capital markets should reallocate resources toward green and sustainable projects (Zadek & Flynn, 2013). It emphasizes the role of financial instruments, such as green bonds, in bridging the gap between climate commitments and actual investments. The theory also supports aligning investment decisions with environmental, social, and governance (ESG) criteria.

Public-Private Partnership (PPP) Theory

This theory explains the collaboration between public institutions and private investors in delivering public services or infrastructure. In the context of green bonds, PPPs are instrumental in mobilizing private capital for green transport projects, especially in countries like Nigeria where public funding is constrained (Grimsey & Lewis, 2005). Green bonds issued under a PPP framework can enhance efficiency, accountability, and risk-sharing in project implementation.

Empirical Review

According to the Climate Policy Initiative (2023), global climate finance flows reached approximately USD 1.3 trillion in 2022, driven by public sector finance, development banks, and private capital inflows. However, there remains a significant finance gap, particularly in developing countries, where investment needs far exceed available resources. Nakhooda et al. (2019) found that countries with robust policy frameworks, clear regulatory environments, and well-established institutions attract more climate finance. Conversely, weak governance, lack

of transparency, and regulatory uncertainty discourage investment. Similarly, Buchner et al. (2019) highlight the role of innovative financial instruments such as green bonds, climate funds, and blended finance in scaling up investments in climate mitigation and adaptation projects. Fadeyi & Adebayo (2021) conducted an empirical analysis of Nigeria's climate finance landscape and found that domestic mobilization is constrained by limited fiscal space, underdeveloped capital markets, and institutional capacity deficits. The study also highlights donor dependence and a lack of coordination among stakeholders as key barriers to effective finance mobilization. Ehlers & Packer (2017) demonstrate that green bonds attract a broader base of investors, including those with specific environmental mandates, thereby increasing demand and liquidity for issuers. Flammer (2021) empirically shows that firms issuing green bonds tend to improve their environmental performance post-issuance, indicating a positive impact beyond capital raising. Zhang et al. (2020) analyzes China's experience with green bonds financing electric buses and metro rail systems. They find that green bond issuances significantly contributed to scaling up low-carbon transport infrastructure, helped reduce air pollution, and attracted further private investments. Similarly, OECD (2021) documents successful green bond-funded transport projects in Europe, such as the financing of cycling infrastructure and electric vehicle networks, which have led to measurable reductions in carbon emissions and improvements in urban mobility.

Karpf & Mandel (2018) identify barriers such as limited project pipelines, lack of standardized certification, and risks of greenwashing as impediments to green bond market growth, especially in emerging economies. These findings suggest that while green bonds offer great potential, market development requires supportive policies, capacity building, and transparency measures. Oyeboji & Olagunju (2020) examine urban transport investments in Lagos and identify significant financing gaps in public transport infrastructure. Their empirical data reveal that despite increasing demand, public transport systems suffer from underfunding, poor maintenance, and lack of integration, leading to rising emissions and congestion. The study advocates for innovative financing mechanisms, including climate finance instruments, to address these challenges. Fadeyi & Adebayo (2021) analyze Nigeria's green bond market and find that while the sovereign green bond issuances in 2017 and 2019 were groundbreaking, their proceeds predominantly funded afforestation and renewable energy projects, with minimal allocation to transport. They emphasize that this reflects a broader lack of readiness and capacity within the Nigerian transport sector to develop bankable green projects suitable for bond financing.

In a case study of the Lagos Bus Rapid Transit (BRT) system, Eze et al. (2022) explore financing options for sustainable transport in Nigeria. The study highlights the

potential role of green bonds to scale up investments in expanding and electrifying the BRT fleet. However, it notes institutional barriers such as weak regulatory frameworks, insufficient environmental impact assessments, and limited investor confidence as key obstacles.

Furthermore, the Nigeria Sovereign Green Bond Framework (Deloitte, 2018) provides a baseline for empirical evaluation. While the framework aligns with international standards and includes eligibility criteria for transport projects, actual issuance data indicate a gap between policy intentions and market practice, particularly for transport infrastructure. Kotsiri et al. (2020), demonstrates how clear regulatory guidance, capacity building, and stakeholder engagement can stimulate green bond issuances for renewable energy and sustainable transport projects. Their empirical findings show increased investor confidence following transparent reporting and certification.

Sharma & Gupta (2021), successful issuances were supported by strong government backing, clear project eligibility criteria, and partnerships between public and private sectors, aligning closely with climate finance theory.

Gap in Literature

Literature synthesis revealed that the first sovereign green bonds in Africa were used to finance renewable energy and afforestation (Akinbami & Adegbite, 2020). That is to say, green bonds have not been mobilized to fund sustainable transport development in Nigeria. This is the gap which is covered by the study

METHODOLOGY

This study is basically a qualitative research in which previous studies were largely reviewed and synthesized. The authors took a detailed approach in dissecting past theoretical and empirical studies which provided the gap of the study- financing climate change (Transport projects) through green bonds in Nigeria. With respect to the theoretical nature of the study there is no provision for the analysis of data using statistics and tables. The qualitative synthesis of both empirical studies and policy documents provided the findings and appropriate recommendations for the identified problem in the study.

DISCUSSION

Based on the literature reviewed and analysis of the green finance landscape in Nigeria, the following key findings emerged under three subheadings - challenges, opportunities, and policy implications.

Challenges

Although Nigeria has made notable progress by issuing the first sovereign green bond in Africa in 2017, the use of green bonds has been largely focused on renewable energy and afforestation. Transport-specific projects remain underrepresented in Nigeria's green bond portfolio. This indicates a gap between climate finance potential and actual sectoral implementation (Akinbami & Adegbite, 2020).

Opportunities

Green bonds hold substantial promise as an innovative source of financing for sustainable transport systems such as railways, electric buses, and non-motorized infrastructure. Global evidence (e.g., Banga, 2019) demonstrates that green bonds have successfully funded large-scale transport projects in countries like India and China. Nigeria has the potential to replicate these models with appropriate policy and institutional frameworks.

Policy implications

Findings indicate that weak regulatory frameworks, lack of clear green bond standards for transport projects, and institutional inertia hamper effective deployment of green bonds in Nigeria. Key institutions such as the Nigeria Exchange Group (NXG) and Ministries of Transport and Environment lack coordinated mechanisms to align transport planning with green finance instruments (Ogbuabor et al., 2022). There is a general lack of awareness and technical capacity among government officials, private investors, and project developers regarding the structuring, issuance, and management of green bonds. This has limited the number of viable transport projects that can be financed through green instruments (Obasi & Alade, 2021). The findings suggest that greater alignment between Nigeria's transport policy, climate commitments (e.g., NDCs), and financial sector regulations is essential to mainstream green bonds into transport development. Additionally, offering tax incentives, guarantees, and green certification could attract more investors and de-risk transport bond projects. Evidence suggests that combining green bonds with PPP frameworks could increase private sector participation in financing transport infrastructure. Green PPP models would allow risk-sharing, innovation, and improved governance, thereby enhancing the bankability of sustainable transport initiatives in Nigeria.

Conclusion

This study set out to examine the role of climate finance specifically green bonds in supporting the development of sustainable transport infrastructure in Nigeria. Against the

backdrop of growing concerns about climate change and Nigeria's need for low-carbon, inclusive growth, the research explored how green bonds can be effectively deployed to bridge the transport infrastructure financing gap while aligning with environmental goals. The literature reviewed established that green bonds are increasingly recognized globally as a viable financial instrument for funding environmentally beneficial projects. Although Nigeria has made important strides by issuing sovereign green bonds, their application to transport projects remains minimal. Evidence from other developing countries demonstrates that green bonds can finance large-scale, low-carbon transport solutions, such as mass transit systems, electric mobility, and rail infrastructure. However, Nigeria has yet to fully harness this potential due to various institutional, regulatory, and market barriers. Key findings from the study highlighted several challenges: limited awareness of green bonds among key stakeholders, weak institutional capacity to identify and package eligible transport projects, absence of sector-specific green bond guidelines, and insufficient policy incentives to attract private sector investment. Nonetheless, the findings also underscore substantial opportunities. Nigeria's growing urbanization, increasing transport demand, and climate commitments under the Paris Agreement and its Nationally Determined Contributions (NDCs) provide strong justification for aligning transport development with climate finance mechanisms. To move forward, the study concludes that Nigeria must adopt a coordinated strategy to promote green bond financing for transport. This includes developing clear green bond taxonomies for the transport sector, enhancing institutional coordination among regulatory and implementing agencies, building capacity for project developers, and offering fiscal and regulatory incentives to investors. Furthermore, integrating green bonds into public-private partnership (PPP) models could unlock additional capital and bring greater efficiency and innovation into transport infrastructure delivery. In conclusion, green bonds represent a promising pathway for financing climate-resilient transport in Nigeria. By addressing existing gaps and creating an enabling environment, Nigeria can position itself as a regional leader in green finance while advancing its sustainable development agenda.

Recommendations

Based on the findings of the study, the following recommendations are proposed to enhance the effective use of green bonds in financing sustainable transport projects in Nigeria in line with institutional, regulatory and Financial measures;

Institutional Measures

The Nigerian government, in collaboration with the Nigeria

Exchange Group (NXG) and the Debt Management Office (DMO), should establish a green bond taxonomy specifically tailored for the transport sector. This framework should clearly define eligible transport projects (e.g., Bus Rapid Transit systems, railway expansion, and electric vehicles) and provide guidance on environmental impact assessment and reporting standards.

Relevant institutions, including the Ministries of Finance, Environment, Transport, and urban development agencies, should receive targeted capacity-building to understand, develop, and manage green bond projects. A coordinated inter-agency approach is essential for aligning transport policies with climate finance goals and ensuring that projects meet both infrastructure and sustainability standards.

To encourage private sector participation, the federal government and regulatory bodies should conduct investor roadshows, stakeholder workshops, and public campaigns that promote the benefits and opportunities in green bond investments. Transparency, third-party verification, and regular performance reporting should also be mandated to build investor trust.

Regulatory Measures

The government should introduce incentives such as tax breaks, credit guarantees, or subsidies for green bond issuers and investors. These incentives can help de-risk green transport projects and attract a broader base of investors, including pension funds, insurance companies, and international climate finance institutions.

Green bonds should be integrated into existing and future PPP frameworks for transport infrastructure. By encouraging collaboration between public agencies and private developers, the financial burden on government can be reduced while increasing innovation and operational efficiency.

All green bond-financed transport projects should be integrated into Nigeria's broader economic and environmental strategies, including the Nationally Determined Contributions (NDCs), the Nigeria Economic Sustainability Plan, and the National Transport Policy. This alignment will ensure that climate finance directly supports national development and emissions reduction goals.

Financial Measures

Government agencies and financial institutions should collaborate to create a project pipeline of viable, environmentally sustainable transport initiatives that are ready for green bond financing. This will improve project selection, reduce delays, and increase investor interest by showcasing ready-to-finance opportunities.

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