

Sustainable Transport, Logistics and Green Mobility

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Abstract

Original Research Article

Sustainable transport, logistics and green mobility are increasingly important for reducing environmental pressures, improving mobility efficiency and supporting economic resilience. This paper examined global trends, African developments, and the state of sustainable transport in Nigeria, major challenges and strategies for advancing cleaner and more integrated mobility. A qualitative research design based on systematic review of scholarly literature, government policies, institutional reports and empirical studies was adopted, covering global, Asian, European, African and Nigerian evidence. The review indicates that electric mobility, renewable energy, multimodal transport, intelligent transport systems and green logistics are expanding globally, while experiences from India, the United Kingdom and Kenya provide relevant approaches involving electric vehicles, rail electrification, and public transport and alternative energy. In Nigeria, rapid urbanisation, road dependence, fossil-fuel use, infrastructure limitations and rising mobility demand continue to constrain sustainable transport development, despite progress in CNG buses, electric mobility, rail and BRT. Key challenges include inadequate transport and logistics infrastructure, dependence on fossil fuels and high emissions, high costs and limited availability of green technologies, weak institutional coordination and limited green-logistics adoption. The paper identifies integrated multimodal infrastructure, cleaner vehicle fleets, alternative energy deployment, digital logistics, sustainable financing and stronger regulatory coordination as priority areas for advancing sustainable mobility. The paper concludes that Nigeria's transition requires coordinated action across transport infrastructure, energy, logistics, technology, financing and governance. These measures provide a basis for developing a more efficient, environmentally responsible and resilient transport and logistics system.

Keywords: Sustainable Transport; Green Logistics; Green Mobility; Decarbonization; Supply Chain Sustainability.

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Introduction

Sustainable transport is an important component of development policy because transport systems influence economic productivity, environmental quality, social inclusion and access to essential services. Road-sector emissions exceeded 6 Gt CO₂ in 2024, about 8 per cent above the 2015 level, while

global electric-car sales exceeded 17 million units and accounted for more than one-fifth of new car sales (International Energy Agency [IEA], 2025). Green logistics also addresses emissions, congestion, energy consumption and waste through improved transportation, warehousing, routing, reverse logistics and supply-chain coordination (Ha,



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2025; Maji et al., 2023). Electric mobility, alternative fuels, intelligent transport systems and multimodal public transport are therefore becoming important components of sustainable mobility (Shah et al., 2021; García Collazos et al., 2024). These developments reflect a broader transition toward transport systems that combine environmental performance, efficiency, accessibility and resilience.

In India, electric vehicles rose from 0.5 per cent of total vehicle sales in 2018 to 7.7 per cent of new vehicle sales in 2024, with more than 6.5 million EVs operating on Indian roads by June 2025 (NITI Aayog, 2025). Electric-vehicle sales reached 2.03 million units in 2024, representing 27 per cent year-on-year growth, while two-wheelers accounted for 59 per cent of EV sales (NITI Aayog, 2025). The PM-eBus Sewa programme is also supporting the deployment of 10,000 electric buses in urban areas, alongside charging and depot infrastructure (Ministry of Housing and Urban Affairs, 2026). India's experience therefore links electric mobility with public financing, charging infrastructure, industrial development and urban transport planning.

The Great Britain recorded 1.729 billion passenger rail journeys in 2024–25, representing a 7.2 per cent increase from the previous year, while 39 per cent of the rail network was electrified and 70 per cent of passenger railway vehicles were electric (Department for Transport, 2025). Passenger rail emissions were estimated at 31 grams of CO_{2e} per passenger-kilometre in 2024–25, a 2 per cent reduction from the previous year, while freight rail emissions stood at 26 grams of CO_{2e} per net tonne-kilometre (Department for Transport, 2025). Government investment has also included £37.8 million for 319 new zero-emission buses across England, with delivery scheduled through spring 2027 (Department for Transport, 2025a). The UK experience highlights the importance of rail electrification, cleaner public buses, multimodal transport and sustained public investment in advancing lower-carbon mobility.

Kenya recorded 9,144 new EV registrations in 2024,

while total EV registrations reached 39,324 by 2025 compared with 1,378 in 2022 (Electric Mobility Association of Kenya [EMAK], 2025; Ministry of Roads and Transport, 2026). In 2024, electric motorcycles accounted for 7.07 per cent of new motorcycle registrations, while the total share of EV registrations reached 3.13 per cent excluding electric bicycles (EMAK, 2025). Kenya has also introduced policy measures supporting investment, institutional coordination, innovation, charging infrastructure and private-sector participation in electric mobility (Ministry of Roads and Transport, 2026). This highlights the relevance of focusing electrification on high-use transport segments while developing suitable financing, infrastructure and regulatory support.

Nigeria faces strong pressures to improve transport and logistics sustainability due to rapid urbanisation, population growth, motorisation and dependence on road-based mobility. Nigeria's population reached approximately 232.7 million in 2024, while transport emissions are associated with population growth, economic activity and fuel choices (World Bank, 2025; Oluwakoya, 2024). Lagos also records severe concentrations of carbon monoxide and particulate matter during peak-period heterogeneous traffic (Akinyemi et al., 2023). Nigeria has introduced 64 CNG buses within a broader programme involving more than 500 CNG buses and 100 electric buses, while rail passengers increased from 594,348 in the third quarter of 2023 to 743,205 in the corresponding quarter of 2024 (Federal Ministry of Information and National Orientation, 2024; National Bureau of Statistics [NBS], 2025). Nigeria's NDC 3.0 identifies BRT and metro expansion as transport mitigation measures and assigns an estimated 16.234 Mt CO_{2e} mitigation potential to the BRT passenger-kilometre target (Federal Republic of Nigeria, 2025). These developments provide a foundation for cleaner and more resilient transport and logistics, while financing, infrastructure, technical capacity and institutional coordination remain important implementation requirements.

Aim

The aim of the paper is to examine sustainable transport, logistics and green mobility in Nigeria.

Objectives

The objectives are to:

- Examine global trends in sustainable transport, logistics and green mobility.
- Assess sustainable transport, logistics and green mobility developments in Africa.
- Examine the state of sustainable transport, logistics and green mobility in Nigeria.
- Identify the major challenges constraining sustainable transport, logistics and green mobility in Nigeria.
- Proposed strategies for advancing sustainable transport, logistics and green mobility in Nigeria.

Conceptual Framework

The conceptual framework for the paper is anchored on the relationship between sustainable transport, green logistics, green mobility, supporting

infrastructure, and institutional policy. From Fig 1, it is evident that sustainable transport represents the broad outcome, encompassing environmentally responsible, economically efficient, socially inclusive and resilient movement of people and goods. Green logistics represents the operational dimension involving cleaner freight movement, energy-efficient warehousing, route optimisation, reverse logistics and environmentally responsible supply-chain practices. Green mobility represents the passenger dimension, incorporating public transport, rail, walking, cycling, electric mobility, shared mobility and alternative fuels. Transport infrastructure provides the physical foundation through roads, railways, ports, terminals, charging facilities, pedestrian facilities and logistics centres. Institutional and regulatory mechanisms provide the enabling environment through standards, incentives, enforcement, investment frameworks, data systems and intergovernmental coordination. The framework therefore assumes that sustainable transport outcomes emerge from the interaction among technology, infrastructure, logistics practices, mobility behaviour and institutional arrangements.

Conceptual relationship:

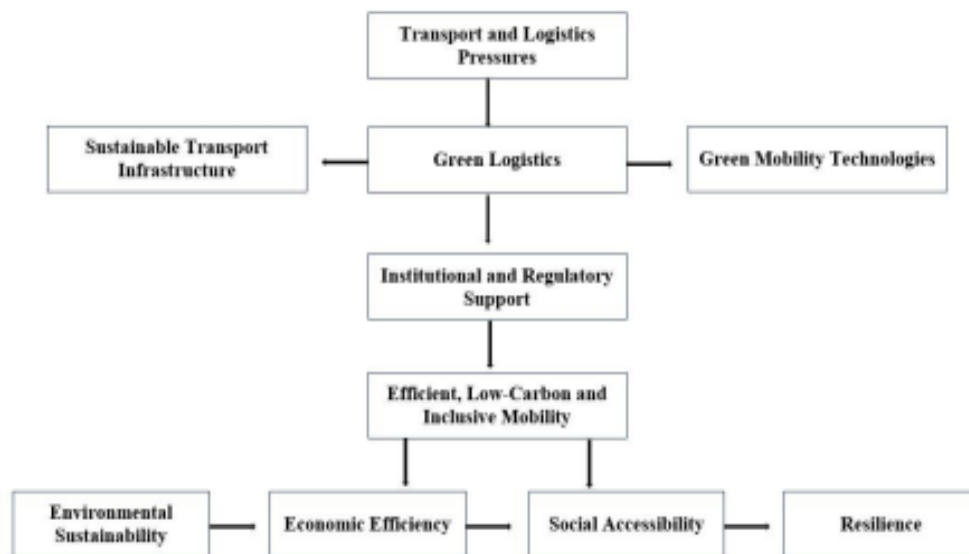


Fig 1: Conceptual Relationship for Achieving Sustainable Mobility Source: Author's Construct, 2026.

Methodology

The paper adopted a qualitative research design based on a systematic review of relevant scholarly literature, government policies, institutional reports and empirical studies on sustainable transport, logistics and green mobility. Relevant literature was identified from academic databases and official publications covering global, Asian, European, African and Nigerian contexts, with emphasis on recent evidence relating to transport decarbonisation, electric mobility, alternative fuels, green logistics, sustainable infrastructure and regulatory frameworks. The reviewed materials were screened for relevance to the objectives of the paper, while sources with limited relevance or insufficient information were excluded. Data were extracted and analysed thematically to identify patterns. This approach provided a structured basis for synthesising existing evidence and developing policy-oriented conclusions and recommendations for sustainable transport, logistics and green mobility in Nigeria.

Global Trends in Sustainable Transport, Logistics and Green Mobility

The global transport systems are undergoing a gradual transition from conventional mobility models toward integrated approaches that combine efficiency, decarbonisation and accessibility. In this instance, the avoid-shift-improve framework remains influential, with emphasis placed on reducing unnecessary travel, shifting journeys toward sustainable modes and improving vehicle and fuel technologies (Turan et al., 2024). Furthermore, sustainable transport requires assessment across environmental, economic and social dimensions rather than concentration on emissions alone (Montoya-Torres et al., 2023). Global transport planning is consequently moving toward multimodality, public transport integration, active mobility and data-supported decision-making (Vandycke & Viegas, 2022). These trends reflect growing recognition that vehicle technology alone

does not resolve congestion, accessibility or land-use problems. The emerging approach therefore treats mobility as a system rather than as a collection of individual transport modes.

Electrification represents one of the most visible global trends in green mobility. Global electric-car sales exceeded 17 million units in 2024, while electric vehicles accounted for more than 20 per cent of new car sales (IEA, 2025a). China accounted for almost two thirds of global electric-car sales during the year, highlighting the geographical concentration of electric-mobility expansion (IEA, 2025b). Electric buses are also receiving increasing attention as cities seek to decarbonise mass transit, although charging schedules, battery capacity and fleet management remain important operational considerations (Coppola & Lobo, 2022). The expansion of electric mobility is therefore accompanied by growing requirements for charging infrastructure, grid capacity, battery management and electricity-system planning. The global trend is shifting from experimentation with electric vehicles toward questions of large-scale system integration. Thus, transport authorities are increasingly required to coordinate vehicle deployment with energy and infrastructure planning.

Green logistics is another major global development, particularly as supply chains face growing pressure to reduce carbon emissions while maintaining delivery performance. Evidence covering global economies reports a significant relationship between logistics performance and ecological footprint, indicating that more efficient logistics systems are associated with improved environmental outcomes (Ha, 2025a). Furthermore, digitalisation is increasingly integrated into logistics through tracking systems, intelligent routing, warehouse automation and data-driven supply-chain coordination (Pi, 2025a). Evidence from OECD countries shows that digitalisation and renewable energy use improve logistics eco-efficiency, while dependence on non-renewable energy has adverse effects (Sikder et al., 2024).

Greenlogistics is therefore moving toward integrated management in which technology, energy, transport operations and environmental performance are considered together. This trend is particularly relevant to urban freight, where last-mile deliveries contribute to congestion, noise and local air pollution.

Alternative fuels are also gaining attention as countries diversify the technological pathways for transport decarbonisation. Furthermore, electricity, hydrogen, biofuels, natural gas, ammonia, alcohol-based fuels and synthetic fuels are among the major alternatives being assessed for sustainable logistics (García Collazos et al., 2024a). Renewable electricity is becoming particularly important because the environmental performance of electric transport depends partly on the carbon intensity of the electricity used for charging. In addition, renewable-powered electric-vehicle charging identifies solar, wind, hydropower, energy storage and smart charging as complementary components of low-carbon mobility systems (Shah et al., 2021a). Hydrogen is also being investigated for heavy-duty and long-distance transport where battery-electric systems face range and payload constraints (Moktadir & Ren, 2024). The global trend therefore reflects technological diversification rather than dependence on a single alternative fuel. Countries are increasingly assessing alternative energy pathways according to vehicle categories, infrastructure requirements and energy-system characteristics.

Digitalisation and intelligent transport systems represent another important global trend because mobility systems increasingly depend on real-time information and automated decision support. Internet-of-Things systems are being applied to logistics monitoring, route management, vehicle tracking and supply-chain coordination (Mejjaoui, 2022). Furthermore, Mobility-as-a-Service frameworks are also being examined as mechanisms for integrating multiple transport modes through unified information and payment systems (Coppola & Lobo, 2022a). Digitalisation is also associated with sustainable logistics through improved

resource allocation and eco-efficiency (Pi, 2025b). These technologies improve the capacity of transport authorities and logistics operators to monitor demand, manage congestion and optimise fleet utilisation. Their effectiveness nevertheless depends on reliable connectivity, institutional capacity, data governance and user adoption. Digital transformation therefore needs to be accompanied by investment in infrastructure, skills and appropriate governance arrangements.

Sustainable Transport, Logistics and Green Mobility in Africa

Africa's transport transition is strongly influenced by rapid urbanisation, rising mobility demand, infrastructure deficits and the predominance of road-based transport. A 2024 bibliometric review of African sustainable-transport research identified 238 Scopus indexed articles and highlighted social sustainability, ICT, non-motorised transport and transport-related disaster risks as important research gaps (Agyei et al., 2024). The continent also faces substantial road-safety pressures, with African countries accounting for a disproportionately high share of global road traffic fatalities relative to their vehicle ownership (World Health Organization [WHO], 2023). African cities are therefore confronted simultaneously with mobility, safety, environmental and infrastructure challenges. The sustainable transport agenda increasingly focuses on public transport, walking, cycling, rail and cleaner vehicle technologies. Regional approaches are also becoming more important as trade integration increases cross-border freight demand.

Urban rail is receiving renewed attention as African cities seek alternatives to highly congested road-based transport systems. The World Bank has identified existing railway corridors in cities including Lagos, Nairobi and Maputo as potential foundations for more sustainable passenger mobility (World Bank, 2024a). Rail-based systems offer opportunities for moving large passenger volumes

while reducing dependence on individual motorised transport. Furthermore, African urban transport projects increasingly integrate rail, BRT, walking and other modes within broader metropolitan mobility systems (World Bank, 2024b). The development of Dakar's electric BRT further demonstrates the growing presence of zero-emission mass transit on the continent (World Bank, 2024c). These developments show a gradual shift from isolated infrastructure projects toward integrated public transport systems.

Financing, maintenance, governance and network integration remain central considerations for long-term performance.

African studies also record increasing interest in sustainable freight transportation as regional trade expands. The implementation of the African Continental Free Trade Area is expected to increase intra-African freight demand substantially, making freight efficiency and environmental management increasingly important (African Development Bank [AfDB], 2024). Furthermore, sustainable freight transportation in Africa identifies greenhouse gas emissions, noise emissions and accident risk among the major sustainability concerns affecting freight operations (African Development Bank, 2024a). Logistics performance is also increasingly linked with environmental quality across African economies, with empirical evidence indicating that improvements in logistics efficiency support better transport-environment outcomes (Ha, 2025b). Sustainable freight development therefore requires attention to roads, ports, railways, logistics hubs, vehicle fleets and cross-border procedures. The continental trade agenda strengthens the need to integrate logistics efficiency with environmental performance. Greater coordination across transport corridors would also support the environmental objectives of expanding intra-African trade.

Electric mobility is emerging as another important component of Africa's sustainable transport transition. African countries are exploring electric

buses, electric motorcycles, electric cars and other forms of low-emission mobility, although adoption levels differ considerably across countries. The African energy and transport transition identifies electric and hydrogen propulsion as promising alternatives while emphasising infrastructure, energy availability and policy requirements (García Collazos et al., 2024b). Dakar provides a notable example through its fully electric BRT system, which entered operation in the early 2020s and was designed to serve high-demand urban corridors (World Bank, 2024d). African transport policy discussions are also increasingly addressing green mobility finance, private-sector participation, smart infrastructure and multimodal connectivity (AfDB, 2024a). The pace of adoption nevertheless remains dependent on electricity reliability, financing, vehicle costs and technical capacity. These conditions make locally appropriate technology selection particularly important for African cities.

Climate resilience has also become central to African transport planning because flooding, extreme weather, weak infrastructure and rapid urban growth threaten transport continuity. Evidence from Accra, for example, links recurrent flooding and fragile infrastructure with mobility disruption and urban vulnerability (Amoako & Frimpong-Boamah, 2022). Furthermore, the World Bank's African urban resilience programme emphasises integrated climate-smart urban and mobility planning, resilient infrastructure and new investment mechanisms (World Bank, 2024e). Transport carbon-efficiency assessments covering 40 African countries report low average carbon efficiency and substantial potential for emissions reduction through improvements in management and technology (African Development Bank, 2024b). African sustainable mobility therefore requires both mitigation and adaptation. Roads, bridges, railways, ports and public transport systems need designs that address environmental risks alongside conventional transport demand. Such an approach strengthens the relationship between green mobility and long-term infrastructure resilience.

State of Sustainable Transport, Logistics and Green Mobility in Nigeria

Nigeria's transport system remains heavily dependent on road transportation despite continuing investments in rail, waterways and other modes. Rapid urbanisation has increased passenger and freight demand, while road congestion, vehicle emissions and infrastructure deficiencies continue to affect mobility efficiency. It is estimated that Nigeria's transport-sector emissions have been influenced by population growth, economic activity and fuel choices (Oluwakoya, 2024a). Another assessment of Nigeria's transport sector recorded approximately 44.45 million tonnes of CO₂ emissions and identified energy intensity, population, economic activity and energy structure as important factors affecting decoupling (Ibhadode & Etin-Osa, 2024). The scale of these pressure places transport sustainability at the centre of Nigeria's climate and development agenda. The National Transport Policy also provides a policy framework for developing a more coordinated national transport system (Federal Ministry of Transportation, 2021).

Public transport is gradually receiving greater attention through BRT, rail, CNG and electric-mobility initiatives. Lagos has established BRT infrastructure that has supported mass movement and reduced public transport costs for substantial numbers of passengers (World Bank, 2024f). Rail passenger activity has also increased, with NBS recording 743,205 rail passengers during the third quarter of 2024 compared with 594,348 during the same quarter of 2023 (NBS, 2025a). The Federal Government has simultaneously expanded CNG-powered buses as part of the response to transport costs and fuel dependence (State House, 2024). These developments indicate a gradual diversification of Nigeria's transport-energy mix. The sustainability implications nevertheless depend on fleet efficiency, infrastructure quality, operational reliability and the environmental characteristics of the energy sources used. Public transport expansion therefore requires integration with urban planning and other sustainable mobility measures.

Nigeria's logistics sector is also beginning to incorporate green practices, although adoption remains limited across firms. A study of logistics managers in Bauchi found that about two-thirds were aware of the environmental effects of logistics operations, while only about one-fifth had undertaken green-logistics initiatives (Maji et al., 2023a). Esangbedo et al. (2024) further establish that infrastructure quality has an important relationship with sustainability and logistics performance, particularly where roads and energy systems are inadequate. Digitisation is emerging as another area of development, with Nigerian logistics firms adopting information technologies to improve economic, environmental and social dimensions of logistics performance (Adeniran et al., 2024). The evidence suggests that green logistics in Nigeria is moving from awareness toward gradual operational adoption. However, implementation remains limited across firms, locations and logistics activities. Greater integration of sustainability criteria into freight, warehousing and supply-chain management therefore remains necessary.

Nigeria's green mobility policy environment is also expanding through climate commitments, alternative-fuel programmes and emerging electric-mobility initiatives. Nigeria's NDC 3.0 includes modal shift through BRT and metro development and assigns a quantified mitigation potential to expanded BRT passenger kilometres (Federal Republic of Nigeria, 2025a). Charging infrastructure, affordability, fossil-fuel dependence and unequal access to energy are major barriers, while opportunities are associated with government support and renewable energy (Etin-Osa & Etin-Osa, 2024). The Federal Government's CNG programme and planned deployment of electric buses provide practical examples of the emerging transition toward cleaner mobility (Federal Ministry of Information and National Orientation, 2024a). These initiatives provide a starting point for broader transport decarbonisation. Their long-term performance depends on financing, infrastructure, technical capacity, regulatory coordination and public acceptance.

Challenges of Sustainable Transport, Logistics and Green Mobility in Nigeria Inadequate Transport and Logistics Infrastructure

Inadequate infrastructure remains one of the most important constraints on sustainable transport and logistics development in Nigeria, as poor road conditions, limited intermodal facilities, insufficient pedestrian infrastructure, inadequate charging facilities and weak logistics infrastructure increase travel time, operating costs and energy consumption. Infrastructure quality also affects the relationship between organisational sustainability and logistics performance, with poor roads and unreliable energy constraining sustainability outcomes among Nigerian logistics firms (Esangbedo et al., 2024a), while physical conditions of non-motorised transport infrastructure in Surulere, Lagos, affect facilities supporting walking and other non-motorised modes (Agunloye et al., 2026). Nigerian freight logistics studies similarly identify poor technological infrastructure as an important obstacle to eco-innovation adoption (Tob-Ogu et al., 2018). These deficiencies affect passenger transport, freight movement and green-technology deployment simultaneously, requiring infrastructure planning that integrates road, rail, public transport, logistics, walking, cycling and charging requirements.

Dependence on Fossil Fuels and High Transport Emissions

Dependence on petrol and diesel remains a major challenge to Nigeria's transition toward lower-carbon mobility, with the transport-sector sustainability assessment covering 1988–2019 identifying energy intensity, economic activity, population and energy structure as factors constraining decoupling between economic growth and transport emissions (Ibhádode & Etin-Osa, 2024a). Analysis of Lagos commercial vehicles estimated daily emissions of approximately 23,684 kg CO₂-equivalent across selected routes, highlighting the value of route- and vehicle-specific emissions measurement (Oluwakoya, 2025). Traffic conditions in Lagos are also associated with severe pollution levels for carbon

monoxide and PM_{2.5} during peak periods (Akinyemi et al., 2023a). Continued reliance on conventional fuels therefore has environmental and public-health implications, while electricity generation, fuel supply and infrastructure also influence overall transport carbon performance and the transition toward cleaner fuels, efficient fleets, public transport and non-motorised mobility.

High Cost and Limited Availability of Green Technologies

The cost of acquiring cleaner vehicles, charging systems, batteries, renewable-energy equipment and digital logistics technologies represents another barrier to sustainable transport development, while affordability remains a major obstacle to electric-vehicle adoption in Nigeria alongside charging infrastructure and energy-access limitations (Etin-Osa & Etin-Osa, 2024a). International evidence on zero-emission transportation similarly identifies the high cost of clean transport technologies as a critical barrier to green logistics development (Moktadir & Ren, 2024a). Fleet-renewal studies also associate the transition toward electric heavy-duty transport with substantial changes in fleet costs and infrastructure requirements (Alarcón et al., 2023a). These cost pressures are particularly relevant for small logistics firms and informal transport operators with limited access to long-term finance, making local manufacturing, leasing arrangements, concessional finance and targeted incentives relevant mechanisms for reducing the initial investment burden.

Weak Institutional Coordination and Regulatory Implementation

Fragmented institutional responsibilities affect sustainable transport development in Nigeria because transport policy involves federal, state and local authorities alongside agencies responsible for roads, railways, energy, environment, vehicle standards and urban planning. The Federal Ministry of

Transportation has emphasised coordinated policy implementation for developing an efficient and sustainable transport system (Federal Ministry of Transportation, 2024), while Nigerian freight-logistics evidence identifies regulatory and institutional factors among the conditions affecting eco-innovation and sustainable logistics adoption (Tob-Ogu et al., 2018a). International evidence also links green transport performance with institutional pressures and organizational capabilities within transport and logistics firms (Sharma et al., 2023). Weak coordination therefore creates gaps between policy formulation and practical implementation, requiring consistent standards, coordinated investment decisions, reliable enforcement, clearly defined institutional responsibilities and stronger monitoring of transport sustainability outcomes.

Limited Green Logistics Adoption and Environmental Awareness

Green logistics adoption remains relatively limited among Nigerian logistics operators despite growing awareness of environmental impacts, with evidence from Bauchi showing that approximately two-thirds of surveyed logistics managers understood the environmental effects of logistics activities, while only about one-fifth had implemented green-logistics initiatives (Maji et al., 2023b). Nigerian freight logistics evidence also identifies unavailable funds, uncertainty concerning financial benefits, weak technological infrastructure and reluctance toward eco-innovation as important barriers (Tob-Ogu et al., 2018b). Green supply-chain performance is further associated with organizational integration and green innovation among Nigerian firms (Badalona et al., 2024). Awareness therefore requires complementary financial, technological and managerial support to translate environmental objectives into operational practices involving green procurement, route optimization, reverse logistics, fleet management and environmental reporting.

Strategies for Advancing Sustainable Transport, Logistics and Green Mobility in Nigeria

Develop Integrated and Multimodal Sustainable Transport Infrastructure

Nigeria needs an integrated transport-infrastructure programme linking road, rail, BRT, waterways, walking, cycling and logistics facilities within coordinated urban and national mobility plans, supported by the National Transport Policy and stronger implementation across transport modes (Federal Ministry of Transportation, 2021a). Evidence from African cities associates rail and integrated mass-transit systems with reduced congestion and cleaner urban mobility, while sustainable transport literature emphasises multimodality and coordinated planning (World Bank, 2024g; Epicoco & Falagario, 2022). Transport investment therefore needs to prioritise high-capacity public transport, efficient freight corridors, pedestrian and cycling facilities, and stronger connections among passenger transport, freight distribution and land-use development.

Accelerate Cleaner Vehicle Fleets and Alternative Energy Deployment

Nigeria needs a structured transition toward cleaner vehicle fleets supported by CNG, electricity, renewable energy and other context-appropriate alternative fuels, with the Federal Government's CNG bus deployment providing an existing platform for lower-emission public transport (State House, 2024a). Nigeria's electric-vehicle transition also requires charging infrastructure, supportive policy, localised technology and renewable-energy integration, while renewable-powered charging, smart charging and energy storage support improved environmental performance (Etin-Osa & Etin-Osa, 2024b; Shah et al., 2021b). A phased fleet-modernisation programme covering public buses, commercial vehicles, motorcycles and logistics fleets should therefore accompany local assembly, maintenance capacity and expanded clean-fuel infrastructure.

Promote Green Logistics through Digitalisation and Supply-Chain Innovation

Nigeria needs to strengthen green logistics through digital freight management, route optimisation, fleet monitoring, warehouse efficiency, reverse logistics and environmentally responsible procurement, with evidence linking organisational sustainability and logistics performance where adequate infrastructure exists (Esangbedo et al., 2024b). Digital technologies also support the economic, environmental and social dimensions of logistics sustainability, while digitalisation and renewable-energy use improve logistics eco-efficiency through more efficient resource utilisation (Adeniran et al., 2024a; Pi, 2025c). Government agencies therefore need to promote digital fleet and freight-management systems, integrate green procurement standards into public-sector contracts and establish a national green logistics framework covering emissions monitoring, fleet efficiency, warehouse energy management and sustainable freight operations.

Strengthen Sustainable Transport Governance, Financing and Regulatory Coordination

Nigeria needs stronger institutional coordination, sustainable transport financing and consistent environmental standards, with NDC 3.0 providing a strategic basis for expanding mass-transit modal shift and reducing transport emissions (Federal Republic of Nigeria, 2025b). African transport policy evidence highlights private-sector participation, innovative financing, integrated infrastructure and coordinated institutional action, while green-logistics evidence associates regulatory pressure, organisational capacity and strategic collaboration with sustainable-practice adoption (AfDB, 2024b; Sharma et al., 2023a). A sustainable transport financing and monitoring framework should therefore integrate government budgets, development finance, climate finance, private investment and public-private partnerships while establishing measurable standards and indicators for emissions, modal shift, fleet

efficiency, public-transport use and green-logistics adoption.

Conclusion

Sustainable transport, logistics and green mobility are increasingly important for environmental sustainability, mobility efficiency and economic resilience. Global and African developments show expanding electric mobility, renewable energy, intelligent transport systems, green logistics, rail and multimodal public transport. Nigeria has introduced CNG buses, electric mobility, rail, BRT and climate-oriented transport initiatives, although infrastructure deficits, fossil-fuel dependence, technology costs, limited green logistics adoption and institutional coordination challenges remain. These require unified transport infrastructure, cleaner energy, fleet modernisation, digital logistics and effective governance.

Nigeria's sustainable mobility transition depends on coordinated policy, investment, technology, infrastructure and institutional action. Stronger federal, state and local coordination, private-sector participation and innovative financing would support cleaner transport infrastructure and technology. Sustainable transport planning also requires standards for emissions, fleet efficiency, public-transport use and green logistics. Integrated planning, cleaner energy, digitalisation, green logistics and effective regulation provide the foundation for a more efficient, environmentally responsible and resilient Nigerian transport system.

Recommendations

1. The Federal Government of Nigeria should establish an Integrated Sustainable Transport Investment Programme linking rail, BRT, waterways, roads, pedestrian facilities, cycling infrastructure, logistics hubs and intermodal terminals within coordinated national and metropolitan transport plans.
2. The Federal Government of Nigeria should

implement a phased CleanFleet Modernisation Programme covering CNG, electric and other lower-emission vehicles, supported by charging and refuelling infrastructure, vehicle financing, local assembly, maintenance facilities and technical-skills development.

3. The Federal Ministry of Transportation, in collaboration with relevant agencies, should establish a National Green Logistics Framework covering fleet efficiency, digital route optimisation, warehouse energy management, green procurement, reverse logistics, emissions reporting and sustainable freight operations.

4. Federal and state transport authorities should strengthen institutional coordination and regulatory enforcement through common sustainability standards, integrated transport databases, emissions monitoring, environmental performance indicators and clearly defined responsibilities across government institutions.

5. The Federal Government should expand sustainable transport financing through public-private partnerships, climate finance and development-finance instruments to reduce the investment burden associated with clean transport infrastructure, electric mobility, public transport systems, rail development and green logistics technologies.

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