

Clean Transport Network in Nigerian Environment: Climatic Issues and Way Forward

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Abstract: There is dire need for adequate planning and digital innovations for developing clean transport networks in African urban communities for better climatic condition and sustainable green environment. This paper examines climatic actions and sustainability perspectives of clean transport network development in Nigeria. Methodology adopted included reconnaissance survey of transport facilities, literature survey, checking of available data and government policy on clean transport network in Nigeria. Other information was also obtained from interview of selected engineers and energy experts in transportation sectors. Finding revealed that there is need to improve on financial capacities and future investments in digital advancements for integrated solutions in infrastructural development, resilient communities and transportation facilities for environmental health and clean transport network. The transportation industry is crucial to meet climate change mitigation goals and the Sustainable Development Goals (SDGs). Because of the expanding demand for transportation from various economic sectors such as industry, energy, health, home, and commercial and other aspects, the demand for transportation is in increasing trend. All issues related to road construction, Public Private Partnerships, traffic management and contract adjudication in transport sector must be carefully resolved. The paper concluded that there is urgent need to strengthen the development of clean transport network in Nigerian environment especially on climate action and sustainability perspectives. The impact of sustainable applications of mobility cannot be over emphasized. Adequate engineering and sustainable green initiatives should be deployed for economic growth and clean transport network in Nigeria.

Keywords: Clean Transport Networks, Development, Environment, Public Private Partnerships, Sustainable Green Initiatives

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1. Introduction

Clean Transport Network is very important in Nigerian Environment and climate action and sustainability Perspectives must be adequately deployment for its implementation. A transportation network refers to an integrated pattern in which routes connect a group of nodes (places of unloading and offloading of cargo). Public transportation is often recognized as one of the better alternatives for reducing the negative environmental impact of urban mobility. Types of transportation networks include road networks, rail networks, air networks and maritime networks. There are a lot of efforts toward adaptive capacity building, reduction of greenhouse gas emissions and climate change impacts.

Climate action entails taking steps to slow or halt climate change and avoid serious long-term environmental damage. Climate has always influenced human social and economic activity and has been a critical issue, especially on natural resources and living things. Transportation and climate change are linked because numerous modes of transportation discharge greenhouse gases, which add to global warming and climate alteration. Because roads are the most often used mode of transportation in Nigeria, they are overused and mistreated.

Nigeria is vastly blessed with many natural resources than many countries of the world but we still had problems of clean transport network traceable to lack of priority, less attention to strategic management and transformational leadership. Most of the available transport systems are not been maintained for optimal use.

The transport system networks in Nigeria have been in a state of constant development and maintenance since Nigerian independence. Climate action, use of substandard materials and lack of integrity among some workers have contributed immensely to the dilapidation of a lot of transport networks. The development of a good transport network will solve problem related to the delays in delivery of raw materials to manufacturing industries, accidents and other security challenges in Nigeria. Climatic action is a major transportation problem but it varies from place to place.

Sustainable transportation is “any mode of transportation that is green and has a low environmental impact. It is also about balancing our current and future needs when it comes to sustainable transportation. Walking, cycling, public transportation, carpooling, car sharing, and green automobiles are all examples of sustainable mobility. Public transportation is often recognized as one of the better alternatives for reducing the negative environmental impact of urban mobility”. Getting the bus, even if it runs on diesel like the bulk of them do, is far superior to driving an electric car or taking a cab.

Sustainable transportation is beneficial since it reduces traffic congestion. There will be fewer traffic bottlenecks because there will be fewer private vehicles on the road. This implies that individuals will be able to go where they need to go more quickly even in densely populated areas. We can also better preserve our natural habitat with more open roads and spaces. The most common definition of sustainability is meeting current needs without jeopardizing future generations' ability to meet their own. It is built on three pillars: economic, environmental, and social factors. Sustainable transportation systems contribute to the environmental, social, and economic well-being of the communities in which they operate.

The movement of people, goods, and information from one location to another is referred to as transportation. It is thought to date back to the dawn of time. Humans have long had a yearning to travel from one location to another on the planet. . Technology has evolved different types and ways of transportation over many millennia of human existence.

The structure and flow of transportation systems are commonly compared to networks. Transport networks are classified as spatial networks because their design and evolution are physically constrained, as opposed to non-spatial networks such as social interactions, corporate structure, and biological systems, which are typically constrained by other factors and in which space plays a minor role. The term "network" refers to the set of paths that exist within a node system. A route is a single connection between two nodes in a larger network, and it can also refer to physical routes like highways. In a bigger network, a route is a single link between two nodes. It can be used to describe physical routes such as roads and railroads, in addition to intangible routes such as air and sea corridors. Transportation networks are the outcome of a compromise between the desire to connect as many locations as feasible and the cost and infrastructure

development constraints. Any region's territorial structure is represented as a network that encompasses all of its economic relationships, but more practically as sub-networks that express one dimension. Networks are rarely planned, but rather the result of ongoing developments as new possibilities arise, investments are made, and conditions change. The establishment of networks is the result of a variety of methods, including providing access and mobility to a region, supporting a certain trade corridor, or technology advancements that favour one mode and its network over others.

Nigeria may benefit from specific programs that help the country reduce greenhouse gas emissions while also lowering local air pollution. As the country transitions to a sustainable energy future, this essay examines a variety of issues that must be investigated and handled. These include the full use and development of renewable energy resources, energy efficiency methods, and the adoption of energy conservation measures in a variety of sectors, including industrial, residential, office, and transportation projects. Lowering energy bills for low-income households is one of the many societal benefits of energy efficiency (Oyedepo, 2012).

Digitalization gives people access to a vast network of untapped big data, which has the potential to help society and the environment. The viewpoint encompasses the advantages of digitalization by providing a holistic view of how it might be used to combat climate change and biodiversity issues (Mondejar et al., 2021). The nature of the political economy challenge associated with reaching a global emissions trajectory that is consistent with a climate agreement shifted at the United Nations Framework Convention on Climate Change (UNFCCC21st)'s Conference of the Parties (COP21) (Arndt et al., 2017).

The current study compares Nigeria's economic performance and ecological footprint to other selected variables to determine the country's contribution to the worldwide fight against global warming while operating in a competitive economy. The reason for this is that the economy of the country is heavily reliant on two key sectors, both of which are deemed emission-induced (Udemba, 2020). A decentralized, efficient, and stable energy economy based on local and clean energy sources is required for sustainable development in which the cost of energy products to the economy is reflected in the price paid by the consumer. Nigeria is endowed with abundant fossil fuel and renewable energy resources, as evidenced by numerous studies. The wasteful use of energy in the country is a serious issue. There is no question that Nigeria's current power crisis will continue unless the government diversifies its energy sources and implements innovative technology to reduce energy waste and save money (Oyedepo, 2014).

Clean transportation networks contribute to a more sustainable environment, job creation, household income and savings, national income, household necessities (water and waste management), and civic involvement. The importance of urban informalities in advancing the sustainable city agenda cannot be overstated (Azunre et

al., 2022). Cities shine brightly as beacons of possibility. People are lured to the jobs, services, and facilities concentrated in towns and cities, and a growing proportion of the world population is urban. Planners, financiers, and public administrators face a huge dilemma as urban poverty and inequality rise. These disciplines must be completely rethought to suit the needs of current and future urban populations. Urban plans and investments need to line with science-based aims to avoid climate disasters but rarely do so in most circumstances (Colenbrander and Barau, 2019).

The goal of floodplain management is to maximize the net benefits from the usage of floodplains while reducing the loss of life due to floods. Both land, particularly arable land, and water resources are in short supply around the world. Floodplains are where the most fertile arable land is found. When implementing policies to maximize the optimal use of the river basin's resources as a whole, efforts should be taken to maintain or enhance floodplain productivity (Oyebode, 2018). Climate change was poorly understood, and there was conceptual ambiguity. Participants did not see their travel as contributing to climate change, and many were accustomed to flying. Participants were unwilling to alter their tourism habits to lessen their carbon footprint (Dillimono and Dickinson, 2015).

3. Materials and methods

The methodology adopted included a reconnaissance survey of transport facilities, a literature survey, a checking of available data and government policy on clean transport network in Nigeria. Other information was also obtained from the interviews of over fifty engineers and twenty energy experts in transportation sectors. Figure 1 indicates typical traffic congestion in Nigeria whereas Figure 2 presents the relationship between climate change and relevant resources.



Figure 1: Typical traffic congestion in Nigeria

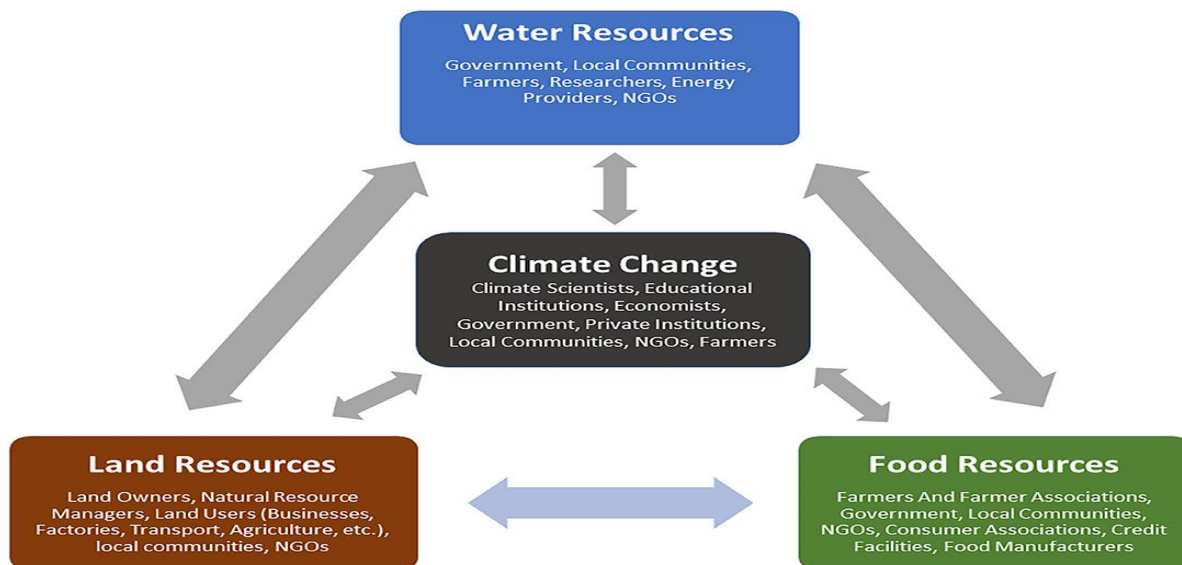


Figure 2: Relationship between climate change and relevant resources

4. Results and discussion

4.1. Transportation network types

Transportation networks are configured differently depending on the mode they represent:

Air transport networks: Such networks are usually built in a nodal hierarchy around a hub-and-spoke structure, emphasizing the importance of nodes (airports) in air networks (Wang et al., 2014). The amount of traffic

(passengers and freight) and the level of connectivity handled by a node determine its relevance (links to other nodes). A hierarchy of flows exists, ranging from regional (short-distance feeders) to international (long-distance feeders) (inter-hub). Air transportation networks are particularly sensitive to interruptions at major hubs due to their high degree of rubbing, but disturbances at lesser hubs will have a limited impact (Mohammadi et al., 2019).

Maritime transportation systems: Such networks have a tangled nodal hierarchy, implying that services are

distributed in a circular fashion (Deshpande and Pfohl, 2012).

Networks of roads: Hierarchical meshes, each serving a distinct scale, make up such networks. They do not have any physical nodes, but they do have established pathways with known capacity (Hu et al., 2014). Local streets just connect adjacent activities to a larger framework, but an interstate highway system is designed to connect a nation or a big region. Road networks are not particularly sensitive to disruptions due to their mesh structure unless the disruption is large-scale (e.g., a significant snowstorm or hurricane) or impacts a vital connector such as bridges or tunnels. When a high-level connection is closed, traffic is forced to use lower-level connections, which may not be able to handle the demand (Adat et al., 2018).

Rail networks: Networks of railroads Intermodal yards, train and transit terminals are nodes in these networks, which form a linear nodal hierarchy. They are assigned usage times during which grouped units circulate due to the fixed character of their pathways and capacity. Complex rail and transit networks, on the other hand, have a mesh-like structure that makes them more resilient to disturbances than linear train networks.

Increased efforts to reduce greenhouse gas emissions and increase resilience and adaptive capacity to climate-related impacts are referred to as climate action. Transportation and climate change are linked because numerous modes of transportation emit greenhouse gases that contribute to global warming and climate change (Chapman, 2007).

Transportation is without a doubt one of the most important aspects of Nigeria's current economic development. Historically, traffic shifted from waterways to trains, then to roads, and finally to airways after WWII. Each alteration had ramifications for commodities flow patterns, regional commerce, and Nigeria's economic development (Onokala and Olajide, 2020; Oyebode, 2019; Watson et al., 2017; Dorninger et al., 2021).

In order to sustain Nigeria's social and economic growth and enable her to compete effectively in worldwide markets in the twenty-first century, an integrated transportation system for Nigeria must take into

account the country's geostrategic location (Akpa et al., 2016). Nigeria is rich in mineral and agricultural resources, both of which are diverse based on the three most common ecological zones. In comparison to many other countries in the region, Nigeria's economy has been booming (Bamire and Amujoyegbe, 2005; Oyebode, 2020; Babanyara et al., 2010).

Nigeria's current population is around 167 million people, out of a total world population of 7 billion. Both the rural and urban sections of the country are seeing rapid population growth. As a result, demand for transportation is strong and expanding, and supply is often insufficient. With greater economic development, this trend is likely to continue (Matemilola, 2017; Atun et al., 2015).

People in villages, towns, and cities use numerous modes of transportation to get around in order accomplishing their social and economic tasks on a regular basis. The progress of transportation has always been intertwined with the development of society. In order to sustain Nigeria's growth and development, an integrated transportation system must take into account the country's geostrategic location (Onokala and Olajide, 2020).

4.2. Infrastructure development in Nigeria's ports and inland waterways

The River Niger and River Benue, which divide Nigeria into east, west, and north parts, are the country's principal inland rivers. Lokoja, in Kogi State, is where the two rivers meet (Adojoh and Dada, 2015; Okoroji, 2018). The importance of interior waterways and seaports in Nigeria's economic development will grow, resulting in the expansion, decline, or disappearance of several ports along the country's coasts and rivers as the pattern of trade inside the country and with the rest of the globe changes. It will also help reduce the heavy number of road transportation of goods and persons. Figure 3 gave environmental and economic indicators. Figure 4: Transport need, environmental degradation and other parameters.

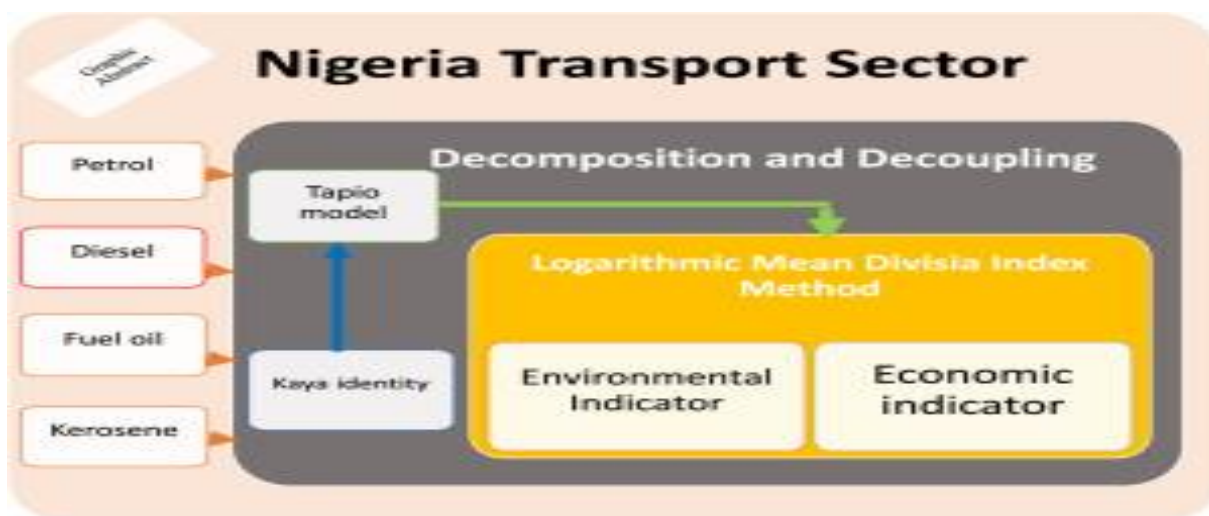


Figure 3: Environmental and economic indicators for Nigerian Transport Sector

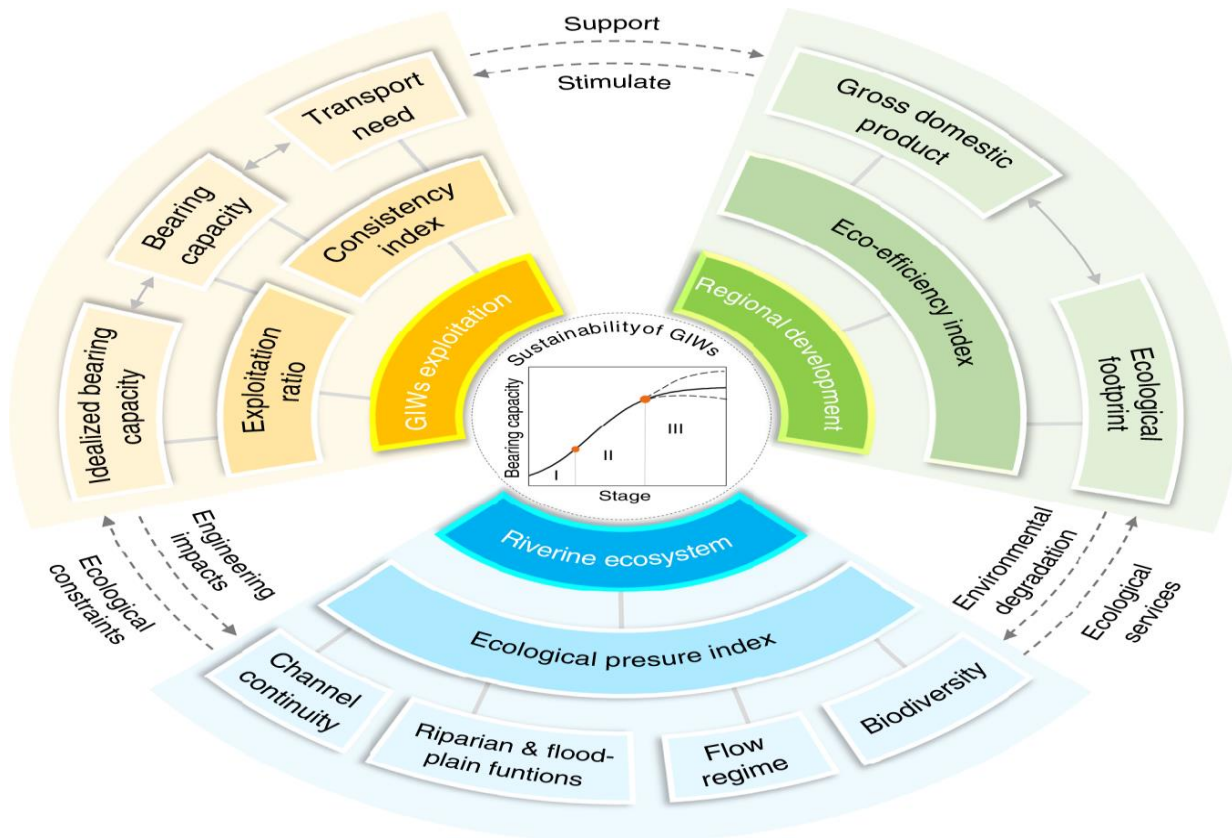


Figure 4: Transport need, environmental degradation and other parameters



Figure 5: Causes and effects of greenhouse gas emission and other environmental issues

4.3. Nigerian railway transportation infrastructure development

The expansion of the railway transport will contribute to Nigeria's overall economic development by allowing the development of agricultural exports in all sections of the country, including cocoa in the west, groundnuts and cotton in the north, and palm produces in the southeast, among other things.

4.4. Nigerian air transportation infrastructure development

The development of airways sector in Nigeria, which started in the postcolonial phase of the country's infrastructure development, is currently in progress, with projects like the upgrading of Enugu airport and others to international airport status, as well as the building of new airports. The importance and inevitable role of air transportation in the movement of people and goods across the country will contribute significantly to Nigeria's development due to its inherent advantage of speed in a situation where large spatial disparities in resource endowment and production exist, as they do in Nigeria.

4.5. Nigerian road transportation infrastructure development

Roads connect the majority of the country. Road construction encourages population movement from the hinterlands to the new transportation lines, resulting in a ribbon-like concentration of towns and villages on both sides of the new highways. Drivers, mechanics, spare parts sellers, vulcanizers, petrol stations, car washes, and other associated businesses all find work on the roads.

4.6. Benefits of the clean transport network in the Nigerian environment

The benefits of the clean transport networks are as follows:

- Creates jobs
- Provides safer transportation
- Emits less pollution
- Promotes health
- Decreases congestion
- Conserves land
- Saves money and time.

5. Conclusion and recommendation

There is an urgent need to strengthen the development of clean transport network in Nigerian environment, especially from climate action and sustainability perspectives. The impact of sustainable applications of mobility cannot be overemphasized. Adequate engineering and sustainable green initiatives should be deployed for economic growth and clean transport network in Nigeria. Roads are also critical for the country's effective tourism activities. Nigeria's road transportation growth should constantly outpace supply. This is because road transportation is seen as a stimulant for regional/national, urban, and rural growth. Great improvement in the freight efficiency, public transportation increase, enhancement of electric vehicle infrastructure, utilization of green construction, maximization of smart growth, integration of land use, and promotion of green highways and support for bike-friendly communities are ways for the achievement of greener transportation.

The following recommendations will be of immense benefit.

- Environmental law can be put in place for the achievement of cleaner transport.
- Allocation and monitoring of funds devoted to road maintenance, environmental and general transport networks in Nigeria.
- Enforcing policies that prevent citizens from deteriorating of transport networks and preventing people from putting their solid wastes into drainages.
- Introduction of more transport networks to avoid congestions.
- Awareness campaign on general benefits of transport network.

- Ensure that standard practices are strictly adhered to on all construction projects.
- Creating awareness of necessary way forward among infrastructure maintenance companies.
- Ensuring health, safety and security in all projects for environmental sustainability.
- Empowering and strengthening regulatory bodies to ensure that all public procurement funds are vetted and accounted for regularly.
- Adequate priority, implementation strategies and supervision should be given to all projects.

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