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Research Article

Impact of Public Private Partnership on the Development of Critical Infrastructure in Nigeria during the Fourth Republic

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Abstract

The use of Public Private Partnership (PPP) for the provision of critical infrastructure became imperative in order to reduce cost, absorb risk, improve quality, guarantee effective service delivery and obtain value for money. However, the extent to which the use of PPP in the provision of critical infrastructure in Nigeria during the fourth republic has not been established due to lack of access to necessary data. This is the gap that this study intends to bridge by providing necessary information on the impact of PPP in the development physical infrastructure within the period under review. Therefore, the main objective of the study is to examine the impact of PPP in the development of road, rail and water transportation in Nigeria during the fourth republic. Methodologically, the paper adopts a qualitative approach for the purpose of obtaining the required materials through the contents analysis of documents from the Ministry of Transport, Bureau of Public Enterprises (BPE), Bureau of Public Procurement (BPP), National Bureau of Statistics (NBS) and National dailies. The findings of the study reveal that the impact of PPP in the development of road, rail and water transportation during the fourth republic in Nigeria have not be quite impressive due to poor maintenance culture, poor funding, lack of accountability and evading due process in contract award. Therefore, the study recommends for the use of cost benefit analysis in ensuring value for money, replacement of obsolete equipment, increase in budgetary provision and compliance with the provisions of Public Procurement Act in contract award.

Keywords: public private partnership, public procurement, private sector, public sector, critical infrastructure

JEL Codes: L30, L32, L39

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Araştırma Makalesi

**Dördüncü Cumhuriyet Döneminde Nijerya'da Kritik Altyapının
Geliştirilmesinde Kamu-Özel Ortaklığının Etkisi**

Victor Onuh Edogbanya ^a & Joseph Adeshola Adekeye ^b

Öz

Kritik altyapının sağlanması için Kamu Özel Ortaklığı'nın (KÖO) kullanımı, maliyeti düşürmek, riski absorbe etmek, kaliteyi iyileştirmek, etkili hizmet sunumunu garantilemek ve paranın karşılığını almak için zorunlu hale gelmiştir. Ancak, Nijerya'da kritik altyapının sağlanmasında KÖO kullanımının ne ölçüde olduğu, dördüncü cumhuriyet döneminde gerekli verilere erişim eksikliği nedeniyle belirlenememiştir. Bu, çalışma incelenen dönemde fiziksel altyapının geliştirilmesinde KÖO'nun etkisine ilişkin gerekli bilgileri sağlayarak bu boşluğu kapatmayı amaçlamaktadır. Bu nedenle, çalışmanın temel amacı, dördüncü cumhuriyet döneminde Nijerya'da kara, demir ve su taşımacılığının geliştirilmesinde KÖO'nun etkisini incelemektir. Metodolojik olarak, makale Ulaştırma Bakanlığı, Kamu İşletmeleri Bürosu, Kamu İhale Bürosu, Ulusal İstatistik Bürosu ve Ulusal günlük gazetelerden alınan belgelerin içerik analizi yoluyla gerekli materyalleri elde etmek amacıyla nitel bir yaklaşımla incelemektedir. Çalışmanın bulguları, Nijerya'da dördüncü cumhuriyet döneminde yol, demir yolu ve su taşımacılığının geliştirilmesinde KÖO'nun etkisinin, zayıf bakım kültürü, yetersiz finansman, hesap verebilirliğin eksikliği ve sözleşme imzalanmasında usulüne uygun işlem den kaçınma nedeniyle pek de etkileyici olmadığını ortaya koymaktadır. Bu nedenle çalışma, sözleşme imzalanmasında paranın karşılığının sağlanması, eski ekipmanların değiştirilmesi, bütçesel tedarikin artırılması ve Kamu İhale Kanunu hükümlerine uyulması için maliyet-fayda analizinin kullanılmasını önermektedir.

Anahtar Kelimeler: kamu-özel ortaklığı, kamu alımları, özel sektör, kamu sektörü, kritik altyapı

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Introduction

The development of critical infrastructure in Nigeria has been the sole responsibility of government during the period of colonial rule till the end of second republic. Conversely, the first national development which spanned from 1962-1968 recognized the private sector as a vital driver of economic growth and reduced dependence on government-led initiatives. The plan aims to create an enabling environment for private sector growth with the government playing a supportive role through policies, incentives and investment in the development of road, bridges and telecommunication infrastructure. In efforts towards achieving the above objectives, the plan intends to establish strong financial institutions to support private sector funding. Subsequently, the Second National development which took place from (1970-1974) shifted away from relying solely on the private sector led economy since the expected funds from the private sector through Foreign Direct Investment (FDI) in the first national development failed to yield the expected results. Meanwhile, government decided to play a more active role in driving economic growth and development in strategic sectors such as; power and steel, transportation, road construction, industries, agriculture and telecommunication.

The third national development plan from (1975-1980) continued to emphasize government intervention plans and initiatives as against a private sector driven approach to development since the 1973 oil price shock led to a significant increase in oil revenue. Government continued to play dominant roles in the economy using oil revenues to finance large scale projects and investment in agriculture, infrastructure and industry. However, the aims of fourth National development plan from (1981-1985) was to restore economic stability, reduce government intervention and promote private sector growth.

Public Private Partnership (PPP) was introduced in 2004 in order to attract private sector investment in infrastructure development, improve the delivery of public service and enhance economic growth. The National Council on Privatization (NCP) was set up to oversee the implementation of PPP projects in various sectors such as: transportation, energy, water supply and sanitation.

There are mixed reactions among scholars on the extent to which PPP has encouraged the development of critical infrastructure in Nigeria when compared with government intervention being implemented through state owned enterprises. For instance, Adejuwon (2019); Olufunmilade (2020); Akinsanya (2017), Oyedele (2018) and Akinbode (2019) opined that PPP has facilitated infrastructure development and modernization, increased private sector investment in critical infrastructure, enhanced efficiency and effectiveness in infrastructure and increased access to finance for infrastructure development. On the other hand, Ike (2017); Adeyemi (2018); Oyedele (2018); Akinsanya (2017) and Olufunmilade (2020) observed that inadequate regulatory framework or institutional capacity, risk of private sector domination or exploitation, limited transparency and potential for unequal distribution of benefits and risks have hampered the effective contribution of PPP to the development of critical infrastructure in Nigeria. The mixed reaction among scholars on the contributions of PPP to the development of critical infrastructure in Nigeria has demonstrated the need for the conduct of research in order to come up with the true position of the state of affairs. Therefore, the paper examines the impact of PPP in the development of road, rail and water infrastructure in the fourth republic. The specific objectives of this paper are:

1. analysis the impact of PPP to the provision of critical infrastructure in Nigeria during the fourth republic,
2. appraise the factors hindering PPP from contributing effectively in the development critical infrastructure in Nigeria,
3. examine the impact of PPP in the development of road, rail and water transportation in Nigeria during the fourth republic.

Methodology of The Paper

This study adopts a qualitative approach for the purpose of obtaining the required materials through the contents analysis of documents from the Ministry of Transport, Bureau of Public Enterprises (BPE), Bureau of Public Procurement (BPP), National Bureau of Statistics (NBS) and National dailies. Content analysis was adopted in the interpretation of the above documents before drawing conclusion on the issue under consideration

Literature Review

Infrastructure refers to projects that have direct and indirect impact on economic activities, production, investment and employment generation in an area over a period of time (Adekeye & Ofoma, 2023). Critical infrastructure on the other hand refers to vital national assets required for the survival and sustenance of the existence of a countries' economic, social and political well-being. They include; power and energy and complex transportation system. These kinds of infrastructure are common in advanced nations of the world like, United State of America, Britain, Germany and Japan. In other words, critical infrastructure are those physical resources, services, Information Technology systems, internets, and energy that can result to serious negative repercussion when damaged or destroyed (Berger et.al., 2022).

A public-private partnership popularly known as PPP is a private business venture or government service that is funded and operated through a partnership of government and one or more private sector companies. PPP involves a contract between a public sector authority and a private party, in which the private party provides a public service or project and assumes substantial financial, technical and operational risk in the project (Musawa, Magaji & Suleiman, 2023). A type of PPP is one where the cost of using the service is borne exclusively by the users of the service and not by the taxpayer. In other types (notably the private finance initiative), capital investment is made by the private sector on the basis of a contract with government to provide agreed services and the cost of providing the service is borne wholly or in part by the government. Government contributions to a PPP may also be in kind (notably the transfer of existing assets). In projects that are aimed at creating public goods like in the infrastructure sector, the government may provide a capital subsidy in the form of a one-time grant, so as to make it more attractive to the private investors. In some other cases, the government may support the project by providing revenue subsidies, including tax breaks or by removing guaranteed annual revenues for a fixed time period (Musa et.al., 2020).

The necessity of public private partnership (PPP) is to finance; manage and maintain choice for the development of infrastructure. These forms of partnership bring public and private sectors together in a long run partnership for mutual benefit. This was brought about as a result of government's recognition that there are some things that the private sector does best and others where the public sector has a lot to offer in the provision of critical infrastructure (Itu & Kenigua, 2021).

Categories of Infrastructure

Infrastructure forms the foundation for all development in a country, which indicates that inadequate infrastructure restricts productivity and limits competitiveness. Raheem (2020) identifies different categories of infrastructure, which include:

Hard Economic, Critical or physical Infrastructure

These types of infrastructure include roads, motorways, bridges, ports and railways. The provision of critical infrastructure will go a long way in creating enabling environment for economic growth and development.

Soft Economic Infrastructure

These refer to the provision of adequate equipment and facilities for occupational training, funding of business, enhancing the conduct of research, workshop and capacity building.

Hard Social Infrastructure

These refers to the provision of basic amenities for the purpose of encouraging improved standard of living to the citizen; They include; efficient telecommunication network, affordable health care delivery, qualitative education, pipe born water and affordable housing. Soft Social Infrastructure takes the form of the social security system, a range of community services and environmental protection agencies. (Kumshe et.al., 2015).

Empirical Review

An empirical study conducted by Itu and Kenigua (2021) revealed that poor funding and bureaucratic corruption has resulted into infrastructure decay in Nigeria. This has resulted into low level of economic development. In effort towards reversing the above ugly trends led to a paradigm shift from the idea of public sector led economy to the introduction of public-private partnership arrangement. Similarly, Kumshe, et.al. (2015) examined public private partnership and Nigeria's Infrastructural Development as a panacea for Economic growth using the qualitative research method. The paper found that the task of infrastructural provision is too important to be left in the hand of government along, hence the need for private sector to key in the provision of the infrastructure in Nigeria to complement government effort. The major policy implication of this paper is that concerted effort be taken by government to provide incentives for private sector involvement in the task of financing as well as provision of infrastructural facilities to accelerate economic growth in the country.

Raheem (2020) conducted a study on Public-Private Partnerships (PPP) model for propelling infrastructural development in Nigeria: A review using qualitative techniques. This study revealed a finding related to the fact that most transitions to private participation have entailed significant labour downsizing. It was recommended that, for PPP to work in Nigeria, all projects must be developed and procured in line with the national policy on PPP and MDAs must make adequate provision for project development. More so, Nigeria government must encourage financial sector to exploit this emerging opportunity.

Musa et al., (2020) examines the challenges of public private partnership implementation on infrastructural development in Nigeria with emphasis on the pharmaceutical industry, Zaria Kaduna state. The finding of the research shows that, the model of PPP used on the study area was a lease concession under renovate, operates and transfer model and the

respondent agreed that DBFT and IM\ IS model are consider suitable for the particular project at hand.

Mubarak et al., (2023) conducted an assessment of public private partnership initiatives in Kaduna State public tertiary institutions using survey and correlation analysis. The findings revealed even though the respondents are very much aware of PPP, they do not have experience in the implementation of the scheme. The study further identified 13 barriers to PPP implementation in tertiary institutions and the top five barriers are: Delays because of political vested interest, Corruption in government, Inconsistent government policies, Lack of adequate security in the society and Lengthy delays in contract negotiations. A glance at the above studies reveals that none of them examines the impact of public-private partnership on infrastructure development in Nigeria. This is the gap in literature that this study intends to bridge.

Theoretical Framework

This study is anchored on the neo-liberalism theory. Neo-liberalism is a contemporary form of economic liberalism that emphasizes the efficiency of private enterprise, liberalization of trade and open market to promote globalization (Raheem, 2020).He further emphasizes that neo-liberalism therefore seeks to maximize the role of the private sector in determining the political and economic priorities of the world, and also seeks transfer of control of the economy from public to the private sectors, with the belief that it will produce more efficient government and improve the economic health of the nation.

The main tenets of neo-liberalism as highlighted in Raheem (2020) include:

The Rule of Market

Liberating free enterprise or private enterprise from any bonds imposed by the government (the state) no matter how much social damage this causes. Greater openness to international trade and investment, as in international Economic Relations.

Cutting Public Expenditure for Social Services

Like education and health care. Reducing the safety-net for the poor and even maintenance of roads, bridges, water supply, again in the name of reducing government's role. However, they don't oppose government subsidies and tax benefits for business.

Deregulation

Reduce government regulation of everything that could diminish profits, including protecting the environment and safety on the job.

Privatization

Sell state-owned enterprises, goods and services to private investors. This includes banks, key industries, railroads, toll highways, electricity, schools and hospitals.

Eliminating the Concept of "The public goods" or "Community"and Replacing It with Individual Responsibility

Pressuring the poorest people in the society to find solutions to their lack of health care, education and social security all by themselves then blaming them, if they fail, as lazy.

Impact Of PPP in The Development of Road, Rail and Water Transportation in Nigeria During The Fourth Republic

In Nigeria, several sectors of the economy have encouraged the development of critical infrastructure through public-private partnerships (PPPs). These partnerships aim to leverage private sector expertise, investment, and innovation to address infrastructure deficits and drive economic growth (World Bank Group; 2016; Federal Ministry of Water Resources, 2019, National Bureau of Statistics, 2021). However, the study assesses the contributions of PPP to the development of road, rail and water transportation during the fourth republic as follows:

President Olusegun Obasanjo's Administration (1999-2007)

Development of Road Infrastructure

One notable initiative was the National Economic Empowerment and Development Strategy (NEEDS), which aimed to address infrastructure deficits, including roads. One of the flagship road projects during Obasanjo's tenure was the rehabilitation of the Lagos-Ibadan Expressway. Additionally, the administration embarked on the construction and rehabilitation of numerous other roads and highways across Nigeria, including the East-West Road, Abuja-Kaduna-Zaria-Kano Expressway, and the Benin-Ore-Sagamu Expressway, among others.

During the Obasanjo administration, Nigeria adopted the Design, Build, Operate, and Transfer (DBOT) model for some of its infrastructure projects, including road construction. The DBOT model is a form of Public-Private Partnership (PPP) where a private entity is responsible for designing, building, and operating a piece of infrastructure for a specified period before transferring ownership or operation back to the public sector. The government entered into agreements with private companies or consortia to design and build roads, operate them for a predetermined period, and then transfer them back to the government.

Rail Transportation

During the administration of Olusegun Obasanjo (1999-2007) in Nigeria, there were various efforts made towards the development of rail infrastructure. One of the significant projects during this period was the revitalization of the Nigerian Railway Corporation (NRC), which had suffered neglect and decay over the years. Some key initiatives during this period are: the rehabilitation and modernization of existing rail lines, expansion plans of the rail network to connect more parts of the country, the government sought to involve the private sector through PPPs to finance and manage rail projects, there was increased collaboration between Nigeria and China in the development of rail infrastructure, and vision 2020 development agenda.

During the Obasanjo administration, the development of rail infrastructure in Nigeria often involved the adoption of the Build-Operate-Transfer (BOT) model of Public-Private Partnership (PPP). The BOT model allows the government to leverage private sector expertise, funding, and efficiency in delivering infrastructure projects while transferring some of the risks associated with construction and operation to the private sector partner.

Water infrastructure

During the administration of Olusegun Obasanjo (1999-2007) in Nigeria, there were efforts to develop water infrastructure to address various challenges related to water supply, sanitation, and irrigation. Some key initiatives during this period include the development of national water resources master plan, urban water supply projects, rural water supply and sanitation, Irrigation development, and policy reforms and institutional strengthening.

During the Obasanjo administration in Nigeria, the development of water infrastructure often involved the adoption of various models of Public-Private Partnerships (PPPs), which include Concession Agreements, Build-Operate-Transfer (BOT), Service Contracts, Joint Ventures and Management Contracts.

President Umaru Musa Yar'Adua/Goodluck Jonathan Administration (2007-2015)

Development of Road Infrastructure

During the administration of President Goodluck Jonathan in Nigeria, several road construction projects were initiated and executed across the country. Some notable road constructions carried out during his tenure include: The East-West Road, Second Niger Bridge, Abuja-Kaduna Expressway, Kano-Maiduguri Road, and Lagos-Ibadan Expressway

During the administration of President Umaru Musa Yar'Adua in Nigeria, the Public-Private Partnership (PPP) model adopted for road construction projects primarily involved traditional procurement methods, where the government directly financed and managed the projects through contracts awarded to construction companies. However, some projects might have involved variations of PPP models, such as concessions or BOT (Build-Operate-Transfer).

During the administration of President Goodluck Jonathan in Nigeria, design-build operate (DBO) and the Concession agreement models of Public-Private Partnerships (PPPs) were adopted for road construction projects.

Rail Transportation

During the administrations of Umaru Musa Yar'Adua (2007-2010) and Goodluck Jonathan (2010-2015) in Nigeria, there were efforts to further develop and modernize the country's rail infrastructure. Several key initiatives were undertaken during this period such as revitalization of existing rail lines, construction of new rail projects, use of Public-Private Partnerships (PPPs), Chinese collaboration, Vision 20:20 development agenda, and modernization efforts of the railway sector.

During the Yar'Adua/Jonathan administration in Nigeria, the development of rail infrastructure often involved the adoption of various models of Public-Private Partnerships such as the Concession Agreements, Build-Operate-Transfer (BOT), Design-Build-Operate (DBO), Joint Ventures, and Service Contracts.

Water infrastructure

During the administrations of Umaru Musa Yar'Adua (2007-2010) and Goodluck Jonathan (2010-2015) in Nigeria, there were efforts to develop water infrastructure to address challenges related to water supply, sanitation, and irrigation. Some key initiatives during this period included national water resources master plan, urban water supply projects, rural water supply and sanitation, irrigation development, and policy reforms and institutional strengthening.

During the Yar'Adua/Jonathan administration in Nigeria, the development of water infrastructure often involved the adoption of various models of Public-Private Partnerships (PPPs), including: Concession Agreements, Build-Operate-Transfer (BOT), Service Contracts, Joint Ventures, and Management Contracts

President Muhammadu Buhari's Administration (2015-2023)

Development of Road Infrastructure

Federal Ministry of works has successfully managed 850 contracts that covers 796 road projects and bridges during President Mahammadu Buhari's administration (Maishanu, 2022). Some notable road constructions carried out during his tenure include: Lagos-Ibadan Expressway, Second Niger Bridge, Abuja-Kaduna-Zaria-Kano Expressway, East-West Road, Enugu-Port Harcourt Expressway, Kano-Maiduguri Road, and other Ongoing Projects.

Rail Transportation

During the administration of Muhammadu Buhari, which began in May 2015, there has been a continued focus on the development and revitalization of rail infrastructure in Nigeria. Several key initiatives and projects have been undertaken such as Completion and Commissioning of rail Projects, Expansion of Rail Network, Revitalization of Old Lines, Public-Private Partnerships, Chinese Collaboration, and Modernization Efforts.

During the Buhari administration in Nigeria, the development of rail infrastructure has involved the adoption of various models of Public-Private Partnerships (PPPs), including: Concession Agreements, Build-Operate-Transfer (BOT), Joint Ventures, Service Contracts, and Direct Financing and Investment.

Water infrastructure

During the administration of Muhammadu Buhari, which began in May 2015, there has been a continued focus on the development and improvement of water infrastructure in Nigeria. Some key initiatives during this period include the national water resources master plan, urban water supply projects, rural water supply and sanitation, construction and rehabilitation of irrigation development, and policy reforms and institutional Strengthening.

During the Buhari administration in Nigeria, the development of water infrastructure has involved the adoption of various models of Public-Private Partnerships which include Concession Agreements, Build-Operate-Transfer (BOT), Service Contracts, Joint Ventures, and Management Contracts

Factors Hindering Public Private Partnership (PPP) in The Provision of Critical Infrastructure in Nigeria

Public-Private Partnership (PPP) in Nigeria faces numerous challenges in the provision of critical infrastructure as identified according to World Bank Group (2018). They include:

Policy and Regulatory Frameworks

Lack clear policy statement and ineffective regulatory framework made it difficult to monitor and regulate the implementation of PPP projects. This ambiguity and lack of capacity by regulatory agencies often lead to delays in project execution and uncertainty for private investors.

Political Instability and Corruption

Frequent changes in government have resulted into policy inconsistency. Some projects initiated by previous administrations were discontinued by successive administrations due to conflict of ideas. For example, President Olusegun Obanjo removed the toll gate constructed by previous administration. Similarly, approved projects are not effectively implemented after the release of funds due to connivance between the contractors and political office holders.

Legal Framework and Enforcement

Inconsistent application and enforcement of laws relating to PPPs, particularly in contract enforcement and dispute resolution are major issues to be addressed.

Infrastructure Deficit

Nigeria faces a substantial infrastructure deficit, which is a key area where PPPs are often used to mobilize private sector resources. However, the scale of investment needed can be daunting for both government and private investors.

Financial Viability and Funding

Securing financing for PPP projects can be challenging due to limited access to long-term financing, high interest rates, and currency volatility.

Capacity and Skills

There is often a lack of capacity and skills within government agencies responsible for implementing and managing PPP projects. This can lead to inefficiencies and delays.

Risk Allocation

Balancing risks between public and private partners is crucial for the success of PPPs. However, there can be disagreements and challenges in effectively allocating risks, especially in complex projects.

Community and Stakeholder Engagement

PPP projects can face opposition from local communities and stakeholders, leading to delays or even project cancellations if not managed properly.

Transparency and Accountability

Transparency in project selection, procurement processes, and financial transactions is essential for building trust and attracting private investors. Lack of transparency is largely responsible for ineffective implementation of projects.

Long Project Gestation Periods

PPP projects often have long gestation periods due to regulatory approvals, land acquisition issues, environmental clearances, and other bureaucratic processes.

Conclusion

Public Private partnership have been instrumental in bridging the infrastructure gap in Nigeria during the Fourth Republic, leveraging private sector resources and expertise to complement government efforts in infrastructure development. These partnerships have helped improve the quality of life for Nigerians and have contributed to the country's economic growth and development. PPPs have been instrumental in the development of transportation infrastructure, including roads, bridges, and airports. Projects such as the construction and expansion of major highways, such as the Lagos-Ibadan Expressway and the Abuja-Kaduna Highway, have been executed through PPP arrangements. Similarly, PPPs have been involved in the rehabilitation and modernization of existing rail lines, such as the Lagos-Kano and Port Harcourt-Maiduguri rail corridors. Private sector partners have contributed funding, technical expertise, and management capabilities to upgrade these lines, improving their efficiency and capacity. PPPs have also facilitated the construction of new rail lines to expand Nigeria's rail

network. Projects like the Abuja-Kaduna Standard Gauge Railway and the Lagos-Ibadan Standard. Lastly, PPPs have been utilized to address challenges in the provision of clean water and sanitation services. Projects such as the Greater Abuja Water Supply Project have involved private sector participation in the construction and management of water treatment plants and distribution networks. However, Public-Private Partnerships (PPPs) in Nigeria face several challenges, which hinder their effectiveness and implementation. They include; ineffective legal and regulatory framework, political instability policy summersault, financial constraints, corruption and transparency issues, risk allocation and management, capacity constraints, social and environmental concerns and procurement delays

Recommendations

By implementing these recommendations, Nigeria can harness the potential of PPPs to address its infrastructure challenges and drive sustainable development across the country:

Budgetary allocation for road construction should be increased in order to ensure effective implementation road projects at the stipulated time. Similarly, there is needs for greater transparency and accountability in the allocation and utilization of funds for road construction projects. Also, the adoption of efficient project management practices can help streamline the construction process and reduce delays through proper planning, monitoring, and evaluation of projects, as well as the use of modern technology and best practices in construction. Likewise, stringent quality control measures and standards can help improve the quality of roads and reduce the need for frequent repairs. Equally, government should fulfill its obligations through the provision of enabling environment of private operators effectively implement road project. Above all, the use of technology transfer will encourage capacity building, skill acquisition and employment generation for Nigerian citizens.

There is need for increased investment in rail infrastructure by allocating more funds from government budgets, seeking financing from international development banks and investors, and promoting public-private partnerships (PPPs) to attract private sector investment. Similarly, there is need for capacity building of railway personnel, engineers, and technicians to enhance skills and knowledge in railway construction, operation, and maintenance. Likewise, government should embrace modern technologies and innovative solutions in railway construction, such as high-speed rail, automated signaling systems, and digital infrastructure management tools, to improve efficiency, safety, and reliability. Above all, government should prioritize regular maintenance and rehabilitation of existing rail infrastructure to ensure safety, reliability, and longevity of assets. Implement proactive maintenance strategies and invest in upgrading outdated equipment and infrastructure.

There is need for increase investment in water infrastructure through improved budgetary allocation into the sector. Integrated approach to water resources management that considers the interconnections between water supply, sanitation, irrigation, and environmental conservation should be adopted. Prioritize the protection and restoration of water quality through pollution prevention, source water protection, wastewater treatment, and water quality monitoring programs. Strengthen regulatory enforcement and compliance mechanisms to ensure that water sources are safe and clean for drinking, agriculture, and ecosystem health.

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The authors declared that the ethical rules for research and publication followed while preparing the article.

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