

Comparative Study of Inland Waterway Management in North-Central and South-South Geo-Political Zones of Nigeria

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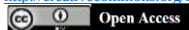
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ABSTRACT

This study provides the empirical comparative analysis of inland waterway management in North-Central and South-South Geo-Political Zones of Nigeria as a critical gap in transport literature. Inland Waterway transport (IWT) in Nigeria with more than 3,000 km of navigable inland waterways presents a strong potential opportunity for decongesting road networks, reduction of costs of logistics and significantly enhance regional integration. However, due to variations in hydrology, institutional capacity, differential security issues, and economic dynamics, management practices differ in these Zones. The study is premised on mixed-method approach through secondary data review, field Observations and relevant informant interviews with 48 stakeholders among officials of NIWA, boat operators, and passengers community leaders across the two zones. Thematic and descriptive method were adopted for data analysis using SPSS version 26 for data entry. Findings showed that the North Central comprised transit terminals in Lokoja, Baro, Idah, Gbajibo, Makurdi on Niger-Benue confluence and are strategic waterway corridors. These terminals are however constrained by infrastructure limitations, seasonal navigation and analog modes of operation. The South-South Zone is characterized by coastal accessibility with densely network of creeks, partial private sector involvement and higher traffic volume. Major constraints in this zone include environmental pollution, multiple regulatory frameworks and insecurity. Major Challenges in the study area among others are funding deficits, low level of digitalization and poor enforcement of safety codes. The study concludes that while the North-Central possesses strategic comparative advantage for national Cargo integration, the South-South has strategic advantage in all-year-round navigation and traffic. This underscores why leveraging digital technology, Public-Private Partnership and specific policies of intervention and relevance could help to open up the economic greatness of IWT in the study area. The paper recommends digital transformation, infrastructure upgrade and harmonized regulatory framework peculiar to each zone with a view to optimize the management processes for economic growth and sustainability in the study area.

Introduction

Ogunleye and Ipingbemi, (2020) have emphasized that the existing literature on Nigeria inland waterway transport largely focused on safety and infrastructure challenges. A major gap is that only few studies have addressed comparison of management systems across zones which could inform specific policy interventions peculiar to the different zones. *Particularly, there exist dearth of recent comparative data on management characteristics, problems and prospects of inland waterway transport in both zones.* Nigeria, with over 10,000 km ranks among the largest navigable inland waterways the world over yet it is largely informal, underutilized and contributes less than 2% to national transport GDP. High freight costs, congestion and frequent accidents is occasioned due to domination of road transport to the detriment of inland waterway transport. Based on the consistent advocacy for multi-modal transport via National Transport Policy 2024, Comparative analysis becomes imperative.

The study area represent two unique hydrological and economic considerations for inland waterway transport. The North-Central inland waterway derived its existence from the Niger and Benue

Rivers with its Confluence at Lokoja in Kogi state. The major terminals are Lokoja, Boro, Idah and Makurdi and links the northern and southern Nigeria as a transit corridor. On the other hand, the south-south zone characterized by a network of rivers, creeks and estuaries with major terminals in Porth court, Calabar, Warri and Yenagoa lies within the Niger Delta region with proximity to oil facilities. These differences in geography shaped their operational processes and distinct management practices. It is in a bid to identifying best practices in line with emerging international standards, challenges and prospects for the harmonization of policy, investment and informed decision-making that this study examines and compares inland waterways management in the study areas.

Literature Review

Conceptual Review

The conceptual review offers a logical structure of connected concepts that help provide a picture or visual display of how ideas in a study relates to one another within the theoretical framework. Transportation system can be defined as the combination of elements and their interactions which produce the demand for travel within a given area and supply of transportation services to satisfy the demand. Transportation systems are referred to as a basic aspect of logistics and planning (Dosunmu, 2022).

Any discourse on transportation development is a direct reference to their infrastructure facilities which are the catalysts that stimulates and underscores their importance to development. This reiterates the critical role, operations and management plays particularly, in the inland waterways system, the absence of which hinders economic development as posited by Nwafor and Onya, (2019). The operations of inland waterways involve diverse concepts that are crucial for achieving and maintaining efficiency, effectiveness and continuous improvement in these areas. According to the United Nations Conference on Trade and Development (UNCTAD, 2022), inland waterway management encapsulates planning, development, regulation, operation and maintenance of waterways and connected infrastructure to ensure safe, efficient and sustainable transport including funding and technological adoption.

Theoretical Review: System theory

System theory views inland waterways as complex systems with interconnected components and helps understand how changes in one part affects the entire system. It is applicable to analyze waterways operations, infrastructure management and traffic flow optimization. This improves efficiency, safety and sustainability of inland water transport. This explains why poor jetties and analog systems in one zone for instance affect the overall performance in inland waterway transport. World Bank (2021) posited that global digitalization has improved inland waterway transport by 25-30% through e-ticketing, vessel tracking and automated terminals. Despite this success story, adoption of digitalization in Nigeria is at the lowest ebb. While public-private partnership (ppp) initiative have succeeded in other developing countries, the models are still limited in Nigeria as a result of inconsistency in policy. It should be noted that the system theory is relevant as it stimulates impacts in inland waterways.

Empirical Review

The functions of NIWA are manifold but barely able to function optimally as it depends almost entirely on poor government funding through its grants which consequently affect its performance ratings downward. The use of inland waterways has declined over the years due to its operational constraints. This includes inadequate channel dredging resulting in boat mishaps due to sediment buildup, under funding, insufficient terminal infrastructure and navigation and weak public-private partnership initiative. These physical constraints to navigation in the inland waterways system must be eliminated while multi-modal networking should be encouraged Jones *et al* (2024) recommended adherence to navigation rules, regular vessel maintenance, implementing safety policies among others in their assessment of Tanzanian inland waterways vessels accidents, causes, impacts and mitigation

options. Rivera-Caldeion *et al* (2024) in his review of the concept of sustainable development in (IWT) systems suggested further research that takes cognizance of peculiarity of geography, social, economic and political situation of each basin for sustainable development of the sector. The study of Chilaka (2023) emphasized the negligence suffered from inadequate inland transport policies and Cabotage law linked to the unavailability of upscale cargo for river transportation; discriminating preference for faster modes passenger transport. He concluded that the waterway needs more government supports.

Imorataria *et al* (2023) while studying the operational difficulties faced by waterways challenges in the Niger Delta affecting their ability to contribute to the nation's economic development advocated for supply of sufficient covered speed boats, safety vests as well as boat repair facility and intermittent dredging among a host of other useful recommendations. Eberehukwu (2021) asserted that inland waterways transport in Nigeria is underdeveloped due to low government commitments and poor policy implementation. He suggested the judicious use of budget, employing right manpower, ensuring safety and promoting research and development.

Development of Inland Waterways in Nigeria and the Establishment of Nigerian Inland Waterways Authority (NIWA)

Inland waterways in Nigeria over the years had to contend and compete with the other modes of transport such as roads, railways, airways and pipelines. It used to be a primary source of transportation in the pre-colonial time before 1900. Inland waterway was a major means of fostering economic growth by facilitating trade and commerce particularly for bulky goods through connecting several communities with the aid of Rivers Niger, Benue and Cross River. This links significantly support fishing and agriculture industries providing livelihood for Communities along the waterways. Canoes and boats were the main vehicle used in transporting goods thereby making waterways the backbone of trade and Commerce. In the Colonial period between 1900 and 1960, inland waterways faced stiffer competition because the British Colonial masters gave priority to rail and road transport and developed some infrastructure like ports and wharfs for their preferred modes while neglecting inland waterways. Despite this shortcoming, waterways maintained its status and remained crucial for local trade.

Post-colonial time from 1960 till date, inland waterways despite persistent neglect and absence of worthy investments that caused its decline, it continued to play a crucial role as a mode of transport in moving bulky goods. This long period of negligence by successive governments aggravates the condition of the waterways. Challenges like infrastructure decay e.g shallow channels, limited docking facilities, jetties and locks, poor maintenance and desiltation, encroachment and environmental degradation, funding problem and limited access to modern technology are some of the bottlenecks.

Recognizing the inland waterway potential for economic growth a body to oversee its operations and management called the Nigerian Inland Waterways Authority (NIWA) was established by Decree 13 of 1997. The body was primarily mandated by the Federal Government of Nigeria to regulate and make the waterways navigable with a view to ensure it realized its full potentials, make the transport safe and contribute to the economic well-being of the adjoining Communities along its routes. However, for NIWA to realize its mandate, its operations and management must function properly. It must rise above the inadequacies of operational logistics to be efficiently and effectively navigable.

This must have informed the statement credited to Kruse (2013) that “government are refocusing attention on the development of inland rivers and coast, and NIWA, as the apex management body of Nigeria's waterways, remains the government's policy objective to restructure that sector”. This is expected to preserve the ecological balance and promote responsible use of our water resources. This objective essentially was premised on the believe that the inland waterways sector in Nigeria can contribute significantly to the Country's economic development (NIWA, 2020).

Study Area

North-Central Geo-political Zone is comprised of Benue, Kogi, Kwara, Nasarawa, Niger and Plateau States including Abuja, the Federal Capital. It is located between Latitudes 7°N - 10°N and Longitude 4°E - 10°E. It covers an area of 296,894 Km², about 32% of Nigeria's land area and the largest zone in land mass. The topography is mostly Guinea Savanna Plains with Jos Plateau as main highland of height 1,200m - 1,800m. The hydrology consist of several river systems with Rivers Niger and Benue as major. River Niger flows 550 km through Niger and Kogi States with Lokoja terminal as the major port. River Benue flows 470 km through Benue and Nasarawa States with many tributaries. The climate type is Tropical Savanna. The Geology is basement complex rocks, sedimentary basins and Volcanic rocks. The vegetation is substantially Guinea Savanna with Riparian forest along river banks and montane grassland on the plateau. The Zone has over 60 million Projected Populations in 2022 with diverse ethnic nationality such as Hausa-Fulani, Nupe, Yoruba, Tiv, Idoma, Igala, Gbagyi, Berom, Eggon etc. The identified terminal points into the zone are Lokoja, Baro, Idah, and Gbagibo, Makurdi on Rivers Niger and Benue.

The South-South Geo-political zone comprises Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers States, and lies between 4°N - 6°N and Longitude 5°E - 8°E. It is characterized by dense network of Creeks, estuaries and Coastal waters. The climate is equatorial with all year-round navigability. The major terminals are Calabar, Port Harcourt, Warri, and Yenagoa

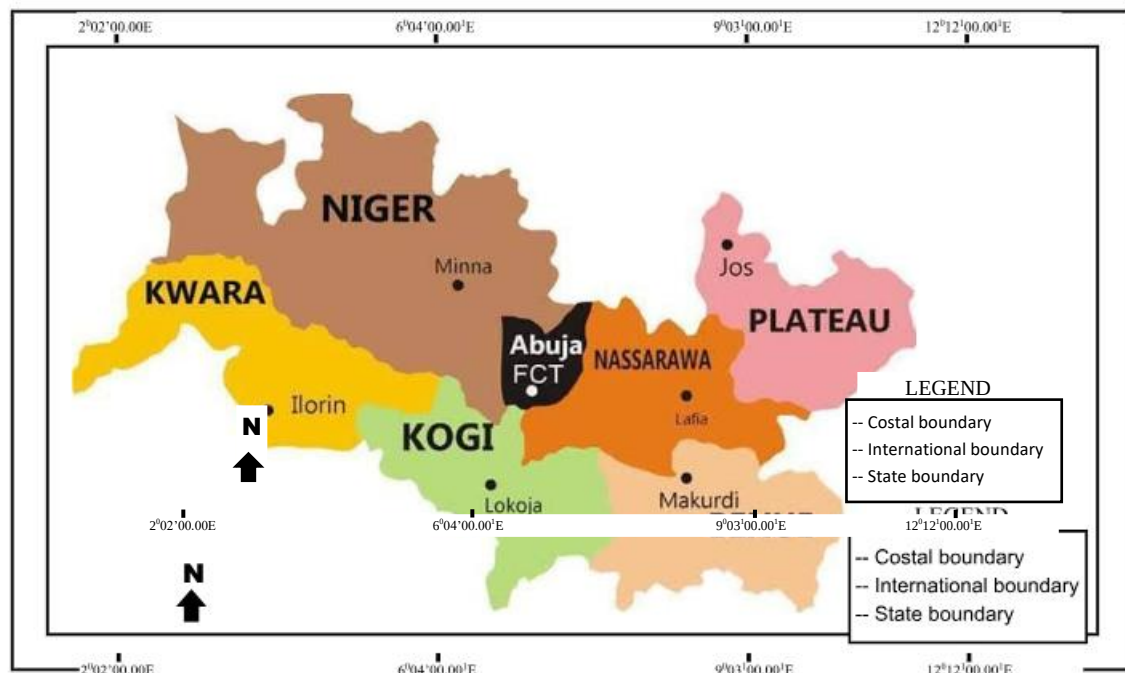


Figure 1: Map of North-Central Geo-political Zone of Nigeria.

Source: ResearchGate

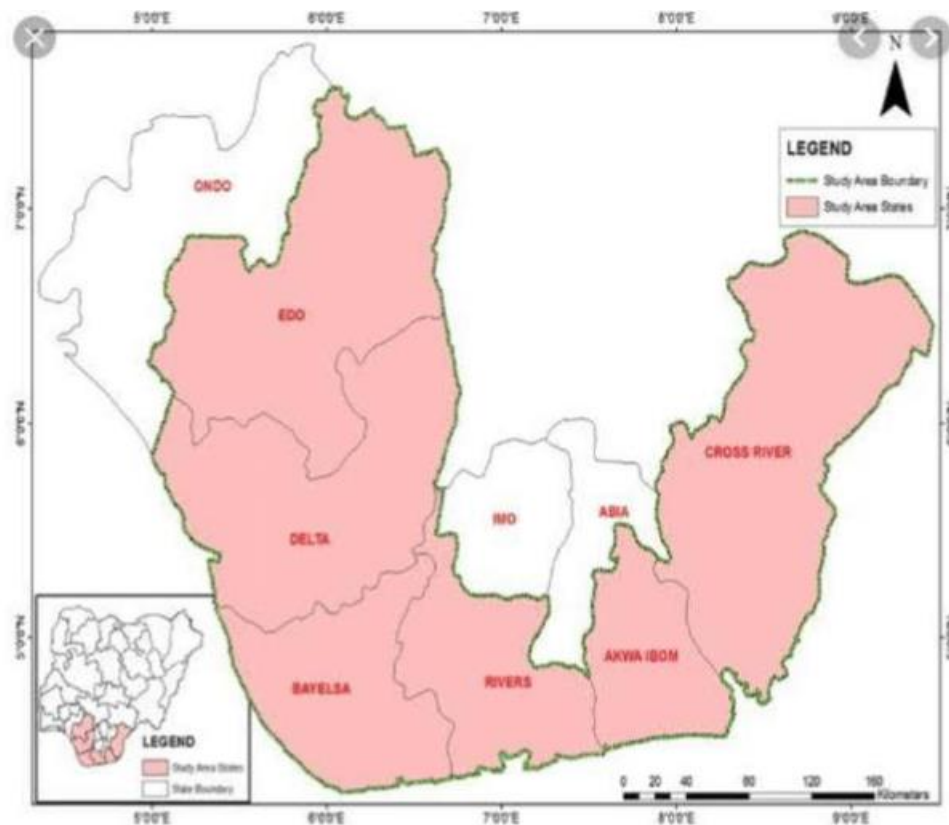


Figure 2: Map of South-South Geo-political Zone of Nigeria.

Source: ResearchGate

Materials and Methods

Research Design

This study was essentially predicated on descriptive and qualitative design.

Sources of Data

Both Primary and secondary data were employed in the study Coupled with field Observation. The primary data was based on key informant interview with 15 officials of the National Inland Waterways Authority (NIWA), 23 boat operators and 10 Community leaders in the two zones. The Field Observation was centred on Lokoja and Port Harcourt terminals being the most prominent in each of the Zones.

Method of Analysis

In order to identify differences and similarities in the management characteristics, challenges and prospects, data were synthesized within the precinct of thematic analysis and descriptive comparison as this is most suitable for the study of this nature. The thematic area is anchored on transport policy, infrastructure and Regional development.

Characteristics of Inland Waterway Management in the Study Area

The North-Central Geo-political zone is a strategic transit hub as it serves as a natural transit Corridor that links northern and southern Nigeria taking advantage of the Niger – Benue Confluence at Lokoja being a strategic terminal in the Zone. Navigability is however based on seasonal operations due to low water levels in the dry season consequently limiting navigation to 6-7 months (April to October) within the year. Operations in inland waterways in the zone are largely analog with very little private sector involvement. In other words, their operations are dominated by government through NIWA. As a result of this situation, inadequacy of infrastructure persist as jetties are dilapidated, navigation aids are in short-fall while Cargo handling equipment are lacking coupled with the absence of real-time digital

systems. In consequence inland waterways in the zone is bedeviled by low volume of traffic as movement is primarily passenger and agricultural produce with minimal level of freight movement.

The South-South with greater network density have better infrastructure because some terminals like Port Harcourt have concrete jetties, despite the fact that many rural jetties in the zone are also poor. The presence of the private sector is dominantly due to the availability of strong private boat operators and most importantly the significant participation of oil companies in the sector including partial digital tracking. High traffic volume is experienced in this zone due to all-year-round navigability that supports high passenger, large cache of Cargo and movement of oil servicing boat. However, there is complex regulatory framework owing to the overlapping functions between the Nigerian Inland Waterways Authority (NIWA), Nigerian Ports Authority (NPA), Nigeria Maritime Safety Agency (NIMASA) and waterway agencies of the states in the Zone. The Zone contends with serious security and environmental management issues such as piracy, cultism and oil spillage that causes pollution and damage to the ecosystem in the Zone.

Challenges of Inland Waterway Management in the Study Area.

The North-Central Geo-political Zone which grapples with little or no database have serious infrastructural deficit, as such incidence of dilapidated jetties abound in addition to poor navigational aids. Funding problem is central due to poor budgetary allocation to NIWA, while operations is largely analog. The enforcement of safety code remains substantially weak which is a sign of poor regulatory framework in place. Moreover, cases of overloading of boats remains a prominent matter resulting in recurrent boat mishaps. Low water level in the dry season and significant level of erosion is a major problem.

In the South-South Geo-political Zone where there is fragmented data across the agencies, while the bigger terminals are reasonably infrastructure-compliant, the rural jetties are poor with increasing problems of siltation of Creeks. Although, there is partial digitalization in urban terminals, revenue leakages and issue of multiple taxation is experienced. Conflict of interest exist in the Zone because of the multiplicity of agencies that tends to work at cross-roads. While water pollution and water hyacinth is predominant, the Zone grapples with piracy, cultism and kidnapping for ransom (Field survey, 2025). However, it must be noted that dearth of data, abysmally poor stakeholder coordination and low level of sensitization of the public about their operations is critical to both Zones.

Economic Prospects of Inland Waterway in the Study Area

The North-Central inland waterway has the potential to decongest Abuja-Lagos and Abuja-Port Harcourt roads by the use of Lokoja terminal for moving Cargo. This enhances national integration. Since the Zone is known for significant agricultural produce, the linkage of Benue, Christened “food basket” of the nation to southern market will be improved and sustained. This will optimize agricultural trade and increase their revenue base. The Zone remains a good site for tourism in particular, the Confluence of Rivers Niger and Benue enables river cruises.

The South-South is the hub of oil and gas logistics through efficient personnel movement and materials transit to the various offshore facilities. Feeder services from Lagos and Onne ports to Delta and Bayelsa engenders port decongestion. The flourishing fishery businesses and eco-tourism in their mangroves and Coastal Communities boost its economy significantly. This aggravates the degree of employment generation (Author’s Analysis, 2025). According to NIWA, (2021), an estimated 500,000 direct and indirect jobs can be created if the sector developed to its full capacity. In addition, digitalization for both zones can increase revenue by 40% and reduce accidents by 50% (United Nations Conference for Trade and Development, UNCTAD, 2022).

International Best Practices of Inland Waterways Compared

This comparison is expected to navigate the direction to international best practices from the current state of its operations and management in Nigeria in relation to what operates elsewhere in the international arena. This comparative analysis is a general overview of what obtains in Netherlands, which is considered to have a well-developed Waterways network in relation to its developing stage in Nigeria. Various European countries, United States, and China have developed more robust inland waterways transport systems and recognize its socio-economic and environmental benefits (Williamson *et al.*, 2020; Miciula and Wojtaszek 2019).

Wang *et al.* (2020) identified the most representative inland waterways in the world according to their bearing capacity and socio-economic index, being the basins of the world Rhine, Volga, Yangtze, Pearl and Amazon which top the list. But these are in European, Asian countries and Americas. Developing countries like India, Indonesia, Nigeria and Nepal, among others have documented the state of their waterways, the challenges and possible solutions for its development (Achmadi *et al.* 2018 and Trivedi *et al.*, 2021). The bases for the comparison will focus on the following: infrastructure and facilities, efficiency and productivity, safety and security, environmental and economic impacts and regulatory framework.

1. **Infrastructure and Facilities:** - The navigable waterway of Nigeria is approximately 3,000 kilometers far less than the Netherlands with over 6,000 kilometers. The navigable waterways network of the Netherlands in spite of its vast and wide spread is better maintained highly funded and operates with cutting edge modern facilities while its operations are essentially digitalized. Its efficient cargo handling facilities and advanced lock systems enable it to compare favourably with the best around the world. In terms of Infrastructural development, Nigeria's waterways network is still developing and will require concerted efforts and peer review mechanism with relevant countries with history of operational advantage like the Netherlands. Infrastructure is essential for developing any means of transport for IWT is critical the improvement of navigate waterways with sufficient depth, traffic channels, signal buoys, locks, bridges and well-connected ports (Bil and Nachtmann 2021; Nguyen and Nguyen 2020). It is necessary to create financial frameworks and identify strategies for investment such as public private partnerships (PPP) with the participation of private and public stakeholders (Jiang *et al.*, 2018; Miloslavskaya and Plotnikova, 2018; Nguyen and Nguyen, 2020). These strategies should include waterways maintenance funds and capital investment for infrastructure construction (Nguyen and Nguyen 2020). Considering that the development of waterway infrastructure will improve connectivity between urban areas and strategic regions that can serve as logistics centres and help maintain connections with other transportation modes (Cempirek and Cejko, 2017; Vilarinho *et al.*, 2019).

2. **Efficiency and Productivity:** - Compared to Nigeria, the waterway system of Netherlands is well organized and its operations are streamlined and highly mechanized. The network is not only intermodal, it is containerized. Containerization permits major economies of scale and lower costs of freight (Brooks, 2000). According to Cullinane *et al.*, 2000, containerization is achieved by the use of vessels with increasingly large capacities. In particular, combined containerized maritime services with high-capacity inland services gain the position of principal load center when they control a large hinterland as identified by Robinson, 2002 and Notteboom, 2004. This mode of operations enhanced the efficiency and productivity of waterway network of Netherlands ahead of Nigeria whose operational modalities can be said to be underdeveloped.

3. **Safety and Security:** - The Netherlands placed higher premium on safety and security in contrast to Nigeria as it put necessary measures in place in terms of zero tolerance for accidents in its operational mechanisms. In Nigeria, there has been a serious concern about the threats to life and properties on transit through the incessant cases of oil theft, piracy, armed robbery and other security issues. These arrays of safety and security challenges make it increasingly difficult for operators to have

total reliance on Nigeria's Inland waterways. The Netherlands focuses significantly on its waterways safety and security including the protection of its environment.

4. Environmental Impact: - Sustainability and environmental considerations remain one of the cardinal principles of operations in the Netherlands based on its adherence to strict environmental laws and regulations. The protection and promotion of ecological compliant practices is seen to be primary in its modus-operandi compared to Nigeria, where economic considerations are pivotal. The Netherlands prioritized the reduction of emissions by promoting greener logistics and waterways health practices. This is against frequent environmental impact of oil spills, pollution and destruction of habitat so prevalent in Nigeria. Other necessary environmental regulations that include integrated ecological strategies such as emission reduction and implementing subsidies related to environmental sustainability are a priority (Barros Cavalcante *et al*, 2020; Vilarinho *et al*, 2019).

5. Economic Impact: - Both Netherlands and Nigeria's inland waterways contribute significantly to their country's economy. However, the Netherlands registered its strong presence in logistics, trade and investment and commerce which engenders its high level of productivity, efficiency and innovation. Whereas, Nigeria is still bedeviled by high level of corruption, inefficiency and Infrastructural decay. Policies that promote economic incentives and regulate the operational and economic activities of IWT should be addressed, especially in shared basins (Barros Cavalcante *et al*, 2020; Malkus *et al*, 2020; Nguyen and Nguyen 2020; Niedzielski *et al*, 2021).

6. Regulatory Framework: - Regulatory framework is an essential instrument that helps to manage and control the operations of the inland waterways to achieve its desired objectives. It is instructive to observe that both Nigeria and the Netherlands institute legal frameworks through regulations and laws for improved performance. In the Netherlands, its advanced and enforceable regulatory framework makes its Inland waterways effective. This is because the laws are not ambiguous in wordings, implementation and enforcement. The clarity and comprehensiveness of its regulations create an enabling environment for operators vouch for its predictability and thus, reliability. However, some of the Nigerian regulations are vague, inconsistent and mostly not being enforced to the letter which consequently creates uncertainty. This impact significantly on its operations. Some of the challenges of IWT in Latin America include smuggling and illicit activities and lack of harmonized international regulations (Sanchez, 2024).

Table 1

Summary of International Best Practices of International Waterways Transport (IWT)

Country	Best practice
China	Strong and sustained support for IWT development from the government is needed: a) For infrastructure investment, such as in China's case study, helped grow the IWT within the country. b) National plan, as in the case for China and India, having a strategic vision.
European union	For waterways that are international, regional cooperation is important. For example, the common classification for inland waterway as shown by the European union case study. The example of ECMT/UNICECE classification shows some of the benefits of achieving and maintaining a regional inland waterways classification.
Latin America	Synchronization is key for all aspects of the IWT ecosystem. This includes the improvement of infrastructure and fairways, the standardization of vessels, and the classification of waterways.
India	Strong institutions with clear roles and responsibilities are needed for coordinated development of IWT. Centralized agency, such as India's IWAI, can help to further IWT promotion and facilitation. Also, infrastructure development plus government vision

Source: Economic and Social Commission for Asia and the Pacific (ESCAP, 2022)

Conclusion

This study have undergone the comparison of inland waterway management in the study area and their associated features. The outcome reveals that their operations are largely dependent on their geographic features and economic drivers which shaped their continued existence and distinct zonal characteristics. While the North-Central enjoys its strategic location as the integration hub to advantage, it is underutilized with the accompanied under investments and problem of seasonality. The South-South as the revenue hub has natural comparative advantage that facilitated high traffic volume but insecurity and regulatory imbalance is the bane in the Zone. The operations of analog systems is common to both zones as well as poor funding models. An approach that takes cognizance of zonal peculiarities but under a nationally coordinated effort is needed to exploit their economic potentials. Upgraded infrastructure, public-private partnership initiative and deliberate policy on digitalization and automation is a recipe for the improvement and sustainability of inland waterway transport in the study area. This novel comparative framework which is data-driven will contribute to policy relevance as it aligns with Nigeria's National Transport policy 2024.

Recommendations

These recommendations are made based on the findings of this study;

- i. Urgent need to evolve harmonized master plan that recognizes and reflects zonal peculiarities of the two zones becomes imperative.
- ii. Attention should be paid to infrastructural face lift to upgraded facilities through installation of functional navigational aids, dredging and rehabilitation of jetties especially, using Lokoja and Port Harcourt Port terminals as a pilot scheme for digitalization and automation. In essence, the traditional analog systems should be gradually phased out by employing e-ticketing, tracking of vessels and initiation of digital manifest in the study area. In addition Engaging in the PPP formula and funding model will upscale infrastructure and improve security.
- iii. Conflicting interest particularly in the South-South should be brought to the lowest ebb through streamlining of the roles of NIWA, NIMASA and State agencies and their laws in order to bring about harmonious relationships as opposed to one-size-fits-all policy.

A digital-based surveillance system is a necessity in the South-South zone as well as the enforcement of safety codes that is digitally monitored is sacrosanct in the North-Central zone. This will enable the study area to enjoy water-tight security in the stride for digital transformation.

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