

Adaptive Resilience in Ijò Riverine Architecture: Ephemerality, Materiality, and Ecological Integration as Indigenous Design Logics

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Abstract

The Ijò people of Nigeria's Niger Delta have developed a distinctive riverine architecture through centuries of adaptation to dynamic coastal environments. Although this architectural tradition demonstrates considerable adaptive sophistication, it has received limited scholarly attention, reflecting the broader colonial devaluation of African Indigenous knowledge systems within scholarship, planning, and policy. This paper investigates the adaptive principles embedded in Indigenous Ijò architecture and evaluates their relevance to settlement resilience in dynamic coastal environments. Guided by the Sankofa principle and an Afrocentric framework as its methodological and epistemological orientations, the study adopts a qualitative typological analysis of vernacular built forms across three Ijò riverine settlements. Data were obtained through field observation and photographic documentation in Nembe–Ogbolomabiri and Kinkiamabugo, and from published archival documentation on Ekperiyaigbene Base Camp. Analysis of these data identified three recurring adaptive logics, which were examined for their contributions to settlement resilience and environmental adaptation under unstable coastal conditions. Interpreted through resilience theory, the findings demonstrate the systemic coherence of these Indigenous adaptive strategies and show that they embody principles consistent with what is now formalised as Nature-Based Solutions, predating their contemporary articulation in coastal design and policy discourse. The study concludes that these principles provide valuable insights for designing resilient coastal architecture, particularly in climate-vulnerable regions of sub-Saharan Africa.

Keywords: Ijò Indigenous Architecture, Niger Delta, Coastal Resilience, Temporality, Resilience Theory.

Introduction

Coastal settlements around the world are increasingly exposed to the effects of climate change, including rising sea levels, shoreline erosion, and more frequent flooding from tidal and storm events (IPCC, 2022; Nicholls et al., 2021). Conventional architectural responses are typically categorised into three approaches: avoidance through building elevation;

water exclusion or resistance (controlling/limiting the amount of water entering a building); and water entry or recoverability (allowing water entry but in a way that limits damage to the building interior by careful choice of materials and design (Ameh et al., 2024). Underlying these approaches is a shared belief that settlements should resist, exclude, or remain physically detached from water. In highly dynamic coastal environments, however, this assumption frequently breaks down. Where land is unstable, water levels are unpredictable, and ecological conditions are constantly changing, structures designed for permanence and resistance often prove more vulnerable than those designed for adaptability (Haasnoot et al., 2021).

There is increasing recognition within coastal design and planning scholarship that alternative approaches are needed, specifically those that work with rather than contrary to environmental processes (Cohen-Shacham et al., 2016). However, it is less recognised that such approaches have existed in practice for centuries within indigenous coastal communities and remain largely unstudied and undervalued within mainstream design and planning discourse.

Literature Review

The Niger Delta and the Ijò People

The Niger Delta is one of the most environmentally challenging coastal regions in the world. It spans approximately 70,000 square kilometres in southern Nigeria, comprising tidal creeks, distributary channels, freshwater swamps, and mangrove forests (Uwadiae Oyegun et al., 2023). Much of its surface sits less than two metres above sea level, making it highly sensitive to tidal fluctuations, seasonal flooding, and storm events. Shoreline erosion along parts of the delta coastline has been measured at between three and thirty metres per year, placing it among the highest erosion rates recorded along the West African coast (Ankrah et al., 2023). These natural pressures are compounded by decades of petroleum extraction, which has damaged mangrove cover, disrupted sediment movement and degraded water quality across large parts of the region (Opara & Pavshintsev, 2026). Current projections suggest that the Gulf of Guinea may experience a significant increase in permanently inundated land by 2100, with estimates ranging from 1,458.1 to 4,331.7 km² (Kemgang Ghomsi et al., 2024). The Ijò are among the oldest indigenous inhabitants of the Niger Delta, with a population estimated at between 10 and 14 million, distributed across Bayelsa, Delta, Rivers, and several other states (MINA, 2024). Their settlements are located along creek banks, estuarine edges, and tidal flats: environments that demand constant negotiation with water. Communities are characterised by stilt-based construction, modular building assemblies, and the use of locally available lightweight materials. The waterway is not peripheral to settlement life but central to it, serving as the main

transportation route, a source of sustenance and construction materials, and the basis for spatial organisation (Brisibe, 2014). Although there is a building tradition in the Niger Delta uniquely adapted to its challenging coastal environment as can be seen in fishing camps, the architecture of the Ijo people continues to be insufficiently studied. In planning and policy documents, these communities are typically described as informal or vulnerable, framed as problems rather than sources of knowledge (Dorted, 2026; Onitiju, 2023). This is attributed to the wide scale epistemicide guaranteed by colonial legacy throughout the continent (Khumalo & Baloyi, 2017). The result is visible across the Niger Delta, where the contemporary construction methods and imported building materials, ill-suited to local conditions and often economically inaccessible to residents, are increasingly supplanting vernacular building traditions (Brisibe, 2016; Olaniyi et al., 2020).

Research Approach

This paper approaches Ijo riverine architecture as a body of knowledge accumulated, tested and refined over centuries of direct environmental experience; that deserves to be studied on its own terms and examined for its contemporary relevance.

The study is guided by the Sankofa principle, drawn from Akan thought and formalised in African-centred scholarship (Asante, 2003; Bangura, 2011). Sankofa holds that retrieving knowledge from the past is essential for addressing present and future challenges. This paper treats the architectural intelligence embedded in Ijo practice as retrievable and relevant, adopting an African-centred perspective that values indigenous knowledge on its own terms while engaging with external frameworks where useful (Bangura, 2011; Chilisa, 2012)

Resilience Theory, particularly the panarchy framework of Gunderson & Holling, (2002) and the articulation of adaptive capacity by Folke et al., (2010), is used in this paper as an analytical lens to examine the three logics of Ijo architectural practice highlighted in the paper. It provides a theoretical vocabulary for demonstrating that the characteristics of Ijo architecture are not accidental or necessarily economically determined but constitute a coherent adaptive system. Nature-Based Solutions (NbS), as defined by Cohen-Shacham et al., (2016) and elaborated in recent coastal applications by Friess et al., (2022), serve as the contemporary design and policy framework toward which the retrieved principles are directed.

Research Gap, Aim, and Paper Structure

Historically within the field of environmental sciences, studies of the Niger Delta have largely concentrated on petroleum extraction, ecological degradation, and political conflict (Babatunde, 2020; Bamidele & Erameh, 2023; Elum et al., 2016). The architectural and spatial dimensions of indigenous settlement in the region have not received comparable

attention. There are very few studies that examine how indigenous African communities developed architectural responses to coastal environmental challenges, and fewer still that consider how those responses might inform contemporary design practice.

Against this background, this study investigates the adaptive principles embedded within indigenous Ijo architecture and examines their relevance to contemporary resilience and Nature-Based Solutions discourse. Through the analysis of selected riverine settlements and fishing communities, the study seeks to identify the architectural logics that have enabled Ijo communities to persist within dynamic coastal environments and to explore their implications for climate-responsive design.

Research Objectives

- To identify the adaptive principles embedded within indigenous Ijo architecture.
- To analyse the contribution of these principles to resilience within the Niger Delta's dynamic coastal environment.
- To assess their relevance to contemporary Nature-Based Solutions and climate-responsive coastal design.

Research Question

To achieve these objectives, this study seeks to answer the following question: How do the adaptive design logics of indigenous Ijo riverine architecture function as a historical antecedent to Nature-Based Solutions, and what could they offer contemporary climate-responsive coastal design?

Theoretical Framework

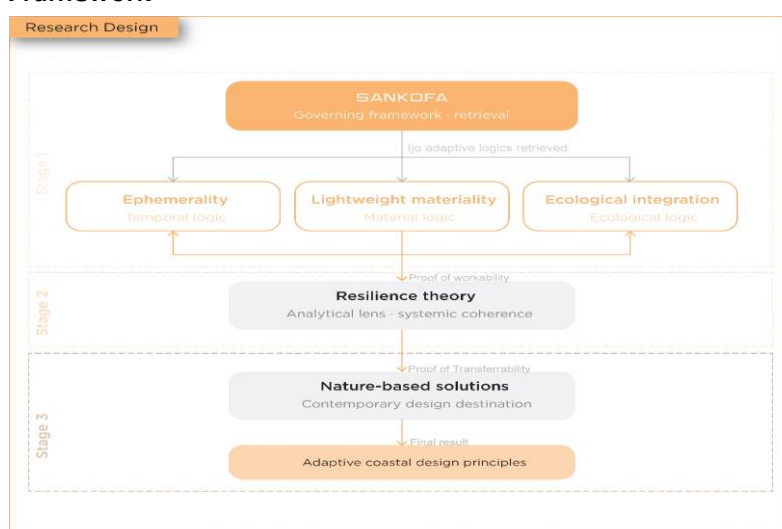


Figure 1: Theoretical Framework Diagram designed by Author (2026)

Sankofa Framework

The Sankofa principle originates in Akan thought and holds that retrieving knowledge from the past is not only valid but necessary for addressing present and future challenges. As a research methodology, it has been formalised within African-centred scholarly traditions by Bangura (2011), whose articulation of African-centred research methodologies establishes that African knowledge systems possess their own internal logic, validity, and intellectual lineage, independent of external validation. Asante's Afrocentric framework further argues that African phenomena must be studied from positions that centre African agency and experience rather than measuring them against externally derived standards (2003).

Applied to this study, the framework legitimises the examination of Ijò architectural practice as a scholarly endeavour worthy of serious analysis. Furthermore, it establishes the direction of inquiry, moving backwards into accumulated indigenous practice and forward into contemporary application. The use of Sankofa as a governing framework also aims to reinforce the critique that the neglect of Ijò architectural knowledge within mainstream scholarship is a consequence of epistemological hierarchies produced by colonial history, in which African knowledge systems were systematically devalued in favour of imported models (Asante, 2003; Bangura, 2011). Centring Sankofa at the foundation of this study is a deliberate methodological response to that history.

Resilience Theory

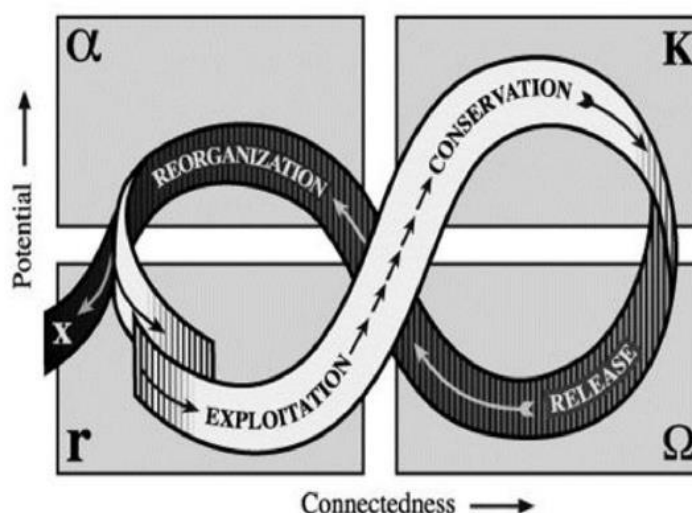


Figure 2: Two-dimensional representation of the adaptive cycle as originally conceived by Gunderson and Holling (2002)

Resilience Theory provides the analytical vocabulary through which the adaptive logic of Ijo architecture is examined and demonstrated. (Holling, 1973) foundational formulation defines resilience not as the capacity to return to a prior state following disturbance, but as the capacity of a system to absorb disturbance, reorganise, and continue functioning. This distinction is critical. It supports the idea that Ijo architecture is not resilient because it remains unchanged under environmental stress, but is resilient because it is structured to accommodate continuous change without loss of systemic function.

Gunderson & Holling (2002) adaptive cycle model elaborates on this through four phases: growth (r), conservation (k), release (Ω), and reorganisation (α), arguing that resilient systems require the capacity to move productively through all four phases. Systems that become rigidly fixed in the conservation phase, maximising stability at the expense of flexibility, become brittle and vulnerable to catastrophic failure under perturbation. Applied to vernacular architecture, this reframes building practices characterised by short material lifespans, cyclical reconstruction, and incremental adjustment as systemic properties that enable settlements to persist through environmental disturbance (see fig. 8).

Folke et al., (2010) extend this argument by identifying adaptive capacity as comprising the ability to live with change and uncertainty, nurture diversity for reorganisation, combine different knowledge types, and create opportunities for self-organisation. Each of these capacities, as the empirical analysis demonstrates, has an organisational or material correlate in Ijo building practice. Walker et al. (2004) further introduce the concept of modularity, the degree to which a system is composed of loosely coupled, replaceable components; as a key resilience property. This is also directly relevant to the material and structural logic of Ijo construction as will be shown in the result section of this paper.

Recent research within the field also reinforced the relevance of these concepts to coastal and deltaic settlement contexts. (Haasnoot et al., 2021) argue that adaptive thinking, designing for flexibility and adjustment over time rather than for a fixed optimal outcome, represents the most viable approach to long-term coastal planning under climate uncertainty.

Nature-Based Solutions

Nature-based Solutions (NbS) refer to approaches inspired by natural processes that address societal challenges and provide ecological benefits (Cohen-Shacham et al., 2016). In coastal contexts, NbS emphasises the protective functions of natural systems like mangroves, salt marshes, and coral reefs over hard-engineering interventions (Friess et al., 2022). For example, mangrove forests act as a buffer between land and sea, dampening wave energy and stabilising the foreshore, while increasing biodiversity through their root shading (Lovelock et al., 2024; Snedaker & Snedaker, 1984).

In this study, NbS is not retroactively attributed to Ijò communities; rather, the researcher aims to use it as a contemporary framework to recognise practices that have long been present in their native/indigenous architecture.

The Relationship between the Three Frameworks

The three frameworks are distinct and should not be considered as parallel alternatives. Their relationship is both sequential and cumulative. Sankofa establishes the scholarly validity and necessity of retrieving Ijò architectural knowledge, shaping the orientation of the entire study. Resilience Theory offers analytical tools to examine the retrieved knowledge, demonstrating that the three logics of Ijò architecture form a coherent adaptive system rather than a set of contingent responses to poverty or environmental constraints. Nature-based Solutions (NbS) provide the contemporary design and policy context for the transfer of the retrieved and analysed principles, thereby linking centuries-old indigenous practices to current frameworks for coastal resilience.

Methodology

Research Design

This study adopts a qualitative study design to investigate and abstract key principles from Ijò vernacular architecture. A qualitative approach is uniquely suited for this inquiry, as it allows for an in-depth, contextual exploration of localized socio-cultural realities and environmental mismatches that quantitative metrics fail to capture.

The study is structured as a typological analysis, examining three Ijò riverine settlements across the Niger Delta region. Two settlements, Nembe- Ogbolomabiri and Kinkiamabugo in Nembe L.G.A., Bayelsa State, were documented through direct field observation, while an additional settlement; Ekperiyaigbene base camp, Bayelsa State, was analysed through existing scholarly and archival documentation. The selected case studies were chosen for their continued retention of indigenous Ijò spatial, material, and socio-cultural practices within riverine environments. Although the settlements do not represent the full diversity of Ijò cultural expressions across the Niger Delta, they provide relevant comparative contexts for identifying recurring adaptive architectural patterns.

Data Sources and Analytical Process

Data are drawn from direct field observations, visual and photographic documentation, and secondary literature, and triangulated to ensure that spatial observations are contextualised within broader ecological and socio-cultural accounts (Groat & Wang, 2013). The analytical process follows the three-stage logic of the Sankofa framework: retrieval of architectural characteristics through field observation and literature; analysis of these characteristics through Resilience theory to demonstrate their systemic coherence; and

transfer of the analysed principles into contemporary coastal design discourse through Nature-based Solutions (NbS). This process yields three interrelated adaptive logics: ephemerality, lightweight materiality, and ecological integration, which structure the remaining part of the paper.

Ethical Considerations and Limitations

Field observations were conducted with awareness of community sensitivities, and no identifiable personal data was collected. No formal community engagement or interviews were undertaken; the data consist solely of observational notes, photographs, and archival materials.

As a qualitative study, this research does not employ quantitative environmental modelling; conclusions about hydrodynamic behaviour are drawn from spatial and ecological inference rather than measured data, with the intention of developing a conceptual framework rather than prescriptive directives.

Findings and Analysis

The analysis reveals a unique building tradition whose spatial, material, and ecological characteristics are neither arbitrary nor economically determined, but constitute a coherent system of environmental adaptation. Through the Sankofa framework, three interrelated logics are retrieved from this tradition: ephemerality, lightweight materiality, and ecological integration; each is examined below for both their observed spatial and material expression and their function as a collective adaptive strategy. The findings go further to prove that the logics are not mutually exclusive, but that they operate simultaneously and reinforce one another within the built fabric of the settlements.

The Temporal Logic: Ephemerality as Adaptive Strategy



Figure 3: Image showing dwellings in Kinkiamabugo fishing port

Source: Author

What Is Observed

The most immediately visible characteristic of Ijo riverine architecture across all documented settlements is its temporal nature. Structures are not designed or built to last indefinitely. (Brisibe & Kellett, 2025) further situate this temporality within the broader mobile lifeways of the Ijo, noting that their traditionally migratory fishing practices necessitate a built environment that is flexible, transient, and responsive. The main structural/ building components of a typical dwelling have functional lifespans of 3-4 years, and complete or partial reconstruction of structures within a single generation is common. Roof assemblies are the most frequently replaced element, followed by the materials used for walls, which may vary from mud, thatch, to more recently zinc/aluminium sheets; and secondary floor boarding for the stilted-type dwellings directly above water. Primary stilt members, identified in fishing camps, typically cut from decay-resistant hardwood or what locals call ironwood (ayone tein), have the longest functional lifespan within the system but are equally replaceable without structural consequence to adjacent elements.

Reconstruction is seen as a routine, community-organised activity that draws on shared labour, locally available materials, and accumulated knowledge of site-specific environmental conditions. Field observations across the selected settlements reveal a consistent pattern of incremental modification alongside periodic wholesale rebuilding, with structures simultaneously in different stages of construction, occupation, and decay within the same settlement cluster at any given time.



Figure 4: Stilted Boat refuelling stations at Nembe- Ogbolomabiri Jetty, with remains of a pre-existing structure (centre).

Source: Author

Figure 5: Photograph showing a hut in Kinkiamabugo, made with thatch roofs and corrugated zinc wall cladding (left) with a partially constructed structure (right).

Source: Author



Figure 6: Fully assembled hut at Ekperiyaigbene base camp, Bayelsa State.

Source: (Brisibe & Kellett, 2025)

Figure 7: Photograph showing an abandoned hut which eventually collapsed.

Source: (Brisibe & Kellett, 2025)

What It Means

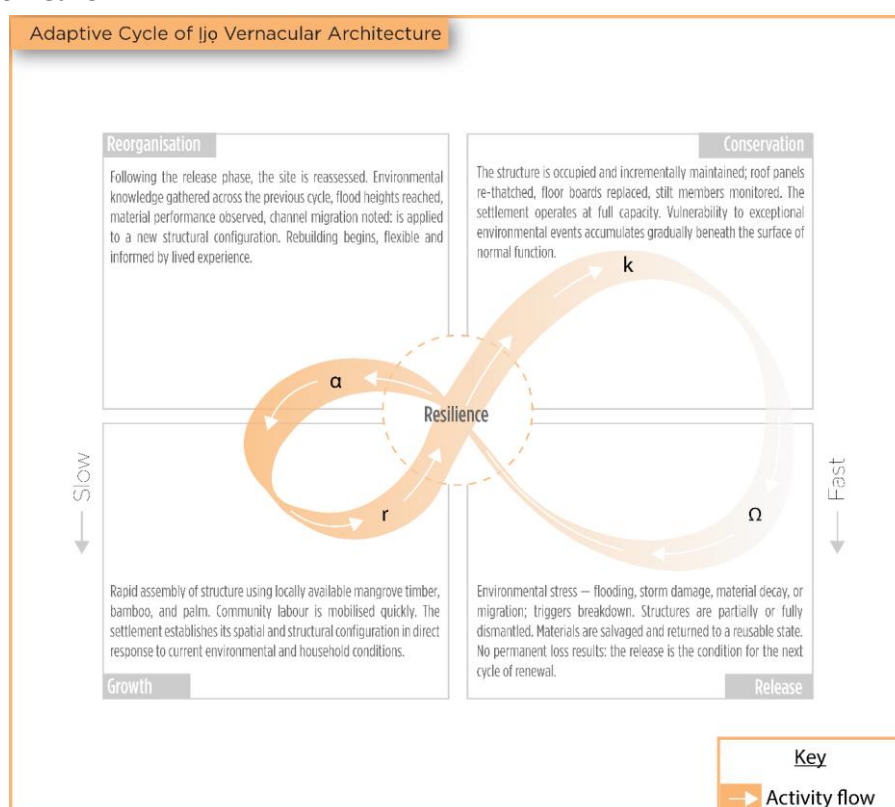


Figure 8: Representation of the adaptive cycle with respect to Ijọ vernacular architecture, reflecting the role of impermanence/ ephemerality to resilience.

Source: Authors Adaptation of Gunderson & Holling (2002) adaptive cycle.

Understood through the adaptive cycle of Gunderson & Holling (2002), the temporal logic of Ijò construction operates as a built-in mechanism for productive renewal. The quick fabrication of a structure from readily available materials correlates with the adaptive cycle's growth phase. The duration of occupation and progressive upkeep corresponds to the conservation phase. The deterioration and partial or complete disassembly of structures correspond to the release phase, which is not a failure but a productive disintegration that may result from migration to new ground, as previously discussed, or from a reaction to environmental changes. The rebuilding phase corresponds to the reorganisation phase, in which knowledge about site characteristics, material performance, and spatial requirements is combined to create a new structural arrangement. This cyclic process confers adaptive advantages that are inherently limited to permanent construction. First, each cycle of rebuilding provides an opportunity to incorporate environmental learning: a structure rebuilt after an exceptional flood can be elevated to a greater height; one rebuilt after storm damage can be reconfigured to reduce wind load; one rebuilt following a shift in the creek channel can be repositioned to maintain optimal tidal access. Permanent structures, by contrast, cannot be repositioned without prohibitive cost, and the logic of their original design constrains their modification. Second, cyclic construction ensures that the settlement's built fabric is regularly renewed in relation to the current state of available materials, maintaining alignment with ecological cycles of growth, harvest, and regeneration. Third, the absence of permanent foundations means the settlement imposes no irreversible modification on the substrate, preserving the capacity to relocate in response to environmental change at a scale exceeding the adaptive capacity of any individual structure.

For generations, the temporal logic of Ijò building materialised this principle. Ijò builders have long practised what modern coastal design discourse is beginning to theorise. Through the theoretical framework, we see that impermanence is a type of structural intelligence rather than a vulnerability.

The Material Logic: Lightweight Systems as Enablers of Flexibility

What Is Observed

The material palette of Ijò riverine architecture across the documented settlements draws almost entirely on species and resources available within or immediately adjacent to the settlements themselves. Mangrove timber, particularly hardwood species of the genera *Rhizophora* and *Avicennia*, is widely used for stilt and primary framing members, valued for its density and natural resistance to decay in waterlogged conditions. Bamboo (Opain) is used for secondary framing and woven panel systems where available. Palm species, both *Raphia* and oil palm, contribute frond material for thatching (okain) and woven enclosure panels for mostly roofs and walls in some cases. The processing of these materials requires

no industrial equipment: splitting, lashing, weaving, and driving into the substrate are the primary operations, all achievable using hand tools and communal labour. Men do most of the building work, while women are assigned to weave the raffia palm leaves for the thatch, thereby establishing a domestic labour force. (Brisibe & Kellett, 2025)

The primary structural system observed at the refuelling stations in Nembe- Ogomabiri waterside is a raised platform supported on timber stilts driven or weighted into the creek bed or soft deltaic substrate. Stilt diameters, spacing intervals, and platform heights vary according to size of the spaces above, substrate conditions, and available materials. However, the fundamental typological logic remains consistent: a lightweight superstructure elevated above the tidal zone on a field of point supports that distribute load widely across the substrate.



Figure 9: Photograph showing an abandoned hut which eventually collapsed.

Source: (Brisibe & Kellett, 2025)

The structural system as seen in Kinkiamabugo fishing port is a raised mud-bed platform, situated at the banks of the Brass River. The dwellings here are elevated slightly on four structural timber columns with the inside filled with mud mixed with dry leaves. Some form of shoring is done with wooden logs and mud to protect structures closer to the river.

Wall systems are constructed from split bamboo, palm-leaf weavings, more in recent times corrugated zinc sheets, or thin-section timber planks assembled into panel configurations that are structurally independent of the primary frame. This separation of structural frame and enclosure panel is a key adaptive feature: panels can be removed, replaced, or repositioned without structural consequence, enabling reconfiguration in response to

changing environmental conditions, household needs, or material availability. Roof structures are similarly lightweight, steeply pitched palm thatch over thin timber rafters; assembled using connections that prioritise ease of replacement over permanent fixing like twine/ ropes formed from dried plant barks or in more recent times fixed with nails.



Figure 10: Photograph showing a mud dump used as infill for elevated mud foundations.

Source: (Brisibe & Kellett, 2025)

Figure 11: Photograph showing hand woven palm fronds for thatch roof construction.

Source: (Brisibe & Kellett, 2025)

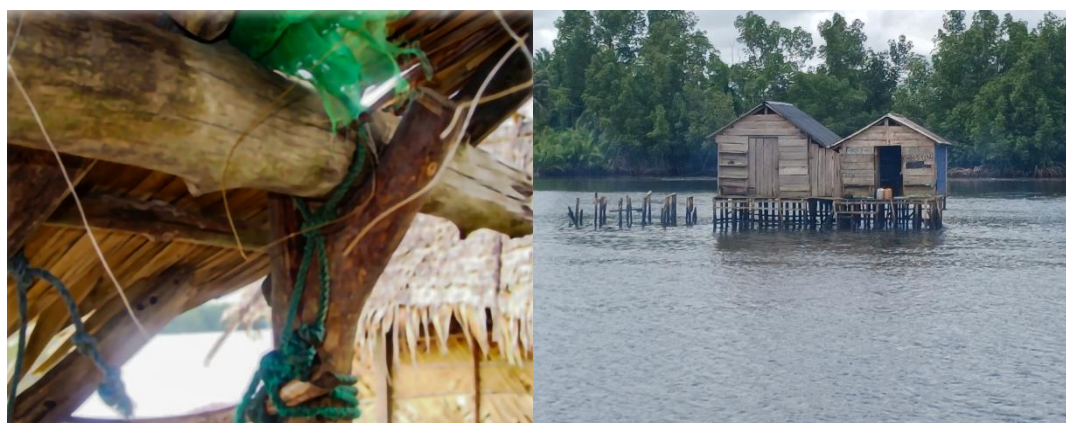


Figure 12: Y-shaped timber post fastened to the roof beam with ropes at Ekperiyaigbene base camp, Bayelsa State.

Source: (Brisibe & Kellett, 2025)

Figure 13: Image showing a refuelling station on timber stilts with Timber board cladding for walls and aluminium roofing sheet for roofs.

Source: Author

What It Means

Two interrelated imperatives govern the structural logic of lightweight construction in this context. The first is substrate management: the soft alluvial soils of the Niger Delta have low bearing capacity and are prone to differential settlement under concentrated loads. Lightweight superstructures distributed across a field of point supports are structurally better suited to these conditions than the consolidated heavy foundations required by masonry or concrete construction.

The second imperative is material economy and community self-sufficiency especially in fishing camps/ ports. Lightweight materials can be transported, handled, and assembled without mechanised equipment, enabling construction and repair to be carried out by household and community labour using locally procured resources. This independence from external material supply chains is a resilience property in the technical sense identified by (Walker et al., 2004): the settlement's capacity to build and repair is not dependent on systems that may be disrupted precisely when resilience is most needed, as in the aftermath of a flood or storm event.

Modularity is the structural property through which lightweight materiality translates into adaptive capacity. Individual wall panels, roofing sections, floor boards, and secondary framing members are assembled using lashing, pegging, and slotting connections rather than adhesive or embedded fixing. These connections maintain structural integrity under normal loading conditions but can be released without damaging the connected components during disassembly. Any component can therefore be replaced, upgraded, or repositioned without requiring modification of any other component.

The material logic further reflects empirical knowledge of material performance in waterlogged and humid tropical conditions. The selection of mangrove timber for submerged and splash-zone structural elements; components most severely exposed to moisture and biological degradation, reflects practical understanding of species-specific decay resistance broadly consistent with contemporary materials science knowledge of mangrove timber's preservative properties. The use of lighter, less durable species for above-platform elements, where biological degradation is less severe and replacement is easier, reflects a calibrated material hierarchy that optimises performance across the environmental gradient from water to air.

The Ecological Logic: Environmental Integration as Structural Principle

What Is Observed

The spatial relationship between the documented settlements and the surrounding mangrove and estuarine ecosystem is visibly aligned structurally. Settlements are consistently positioned at the interface between open-water channels and the mangrove

fringe, with built fabric extending into, and in some cases through, the mangrove root zone. The mangrove fringe provides material resources, fishery habitat, and a degree of natural wave attenuation, while the open-water channel provides access, mobility, and aquatic resources. Ijo settlements occupy the interface between these two ecological zones, exploiting the productivity of both.

Within the settlements, the waterway functions simultaneously as infrastructure, resource system, and social space. Structures are oriented toward the water, with primary access points; doorways, platforms, and jetties, facing the channel.

Field observation reveals that the spatial configuration of the stilt fields supporting these settlements functions in ways that are morphologically and hydro dynamically analogous to the root systems of the mangrove formations within which they are embedded. Mangrove prop roots form dense, branching networks that increase hydraulic resistance, reduce current velocity, and trap sediment particles, building up the substrate over time (Friess et al., 2022). Ijo stilt fields, while not biologically productive, impose comparable hydraulic effects in their immediate vicinity: the dense array of vertical elements increases resistance to wave propagation, reduces local current velocity, and creates conditions favourable to sediment deposition beneath and around the settlement footprint.



Figure 14: Photograph of Mangrove trees elevated above the tide on stilted root system.

Source: Author

Figure 15: Photograph of mangrove trees at low tide, showing stabilised silt beds.

Source: Author



Figure 16: Photograph of kinkiamabugo settlement showing its relationship with the surrounding vegetation.

Source: Author

Figure 17: Photograph of stilted huts at Nembe-Ogbolomabiri waterside showing its relationship with the surrounding vegetation.

Source: Author

What It Means

The functional convergence between Ijò stilt field morphology and mangrove root system dynamics is the analytically most significant finding of this study. It is evidence of conscious biomimicry by Ijò builders. Both systems attenuate wave energy through arrays of vertical elements. Both create conditions of reduced hydraulic energy that favour sediment deposition. Both are distributed, permeable, and structurally redundant; properties that (Folke et al., 2010) identify as central to adaptive capacity in social-ecological systems.

This similarity has a further implication that goes beyond the analytical. If Ijò settlements, through their stilt field morphology, produce hydrodynamic effects comparable to those of mangrove systems, then they are not merely co-located with the ecological infrastructure of the delta, they are participating in it. Rather than disrupting the sediment dynamics and wave attenuation functions of the mangrove fringe, they may actively contribute to the accretion processes that build and maintain deltaic landforms. This positions the built settlement itself as a form of ecological infrastructure; a proposition that aligns directly with the most current formulations of NbS in coastal contexts (Cohen-Shacham et al., 2016; Friess et al., 2022)

The NbS literature, through recent scholarship and institutional investment, has concluded that ecological integration yields better coastal resilience outcomes than ecological exclusion. Ijò architecture, as this analysis demonstrates, has embodied this conclusion spatially and materially for generations. The Sankofa framework allows this prior and independent alignment to be named clearly: what contemporary design discourse presents

as a new proposition, indigenous Ijo builders encoded in the spatial organisation of their settlements long before the terminology existed to describe it.

The Three Logics as an Integrated System

The three adaptive logics documented and analysed above operate as an integrated system in which each logic reinforces the others. Ephemerality depends on lightweight materiality: structures can only be rebuilt cyclically and incrementally if their materials are locally available, easily processed, and assembled without permanent connections. Lightweight materiality depends on ecological integration: the availability of appropriate building materials: mangrove timber, bamboo, palm; is a function of the health and proximity of the surrounding ecosystem, which the settlement's spatial configuration preserves. Ecological integration depends on ephemerality: the settlement's functional alignment with mangrove and estuarine dynamics is maintained across time precisely because the absence of permanent foundations and heavy infrastructure means the built fabric does not accumulate irreversible ecological impacts across generations.

Together, the three logics constitute what (Folke et al., 2010) would recognise as a coupled social-ecological system, in which the resilience of the human settlement and the resilience of the surrounding ecosystem are mutually reinforcing rather than in competition. This is the central finding of the study, and the principle from which its implications for contemporary coastal design flow directly.

Discussion

Planning and Policy

Current planning frameworks inside the Niger Delta consistently characterise vernacular riverine settlements as deficient, evaluating them against standards developed for terrestrial, sedentary contexts. However, this study proves otherwise. The characteristics labelled as deficiencies are, in fact, those that provide adaptive capacity in deltaic environments.

(Adjei & Moss, 2026) contends that this pattern reflects epistemological bias rather than technical judgment, showing a systemic preference for imported models over indigenous ones. The expertise necessary to design resilient coastal settlements in the Niger Delta is already present within the communities that have inhabited these areas for generations. Policy ought to prioritise the recognition and development of this local knowledge rather than its replacement.

Significance for Coastal Design

The three logics provide transferable design principles rather than forms that can be directly replicated. Applying these principles in other coastal contexts, such as Southeast Asian

deltas, East African mangrove coasts, or West African flood-exposed urban margins, requires adaptation to local environmental and material conditions rather than formal imitation.

The temporal logic supports designing coastal buildings with explicit provisions for incremental adjustment and renewal, rather than optimizing solely for permanence. In the context of climatic uncertainty, adaptability serves a more defensible objective than durability. The material logic advocates for structural systems that minimise substrate impact, promote community self-sufficiency in construction and repair, and maintain ecological function, qualities that become essential when external supply chains are disrupted by climate events or simply unsustainable costs of transportation. The ecological logic promotes spatial configurations that actively interact with coastal hydrodynamic processes, positioning the built settlement as an ecological infrastructure rather than as an imposition.

In all contexts, effective application of these principles depends on the same condition that enabled their development in the Ijọ case: detailed, community-grounded knowledge of local ecological and hydrodynamic conditions. The primary methodological lesson of this study is that durable adaptive design intelligence emerges from the careful study of existing community knowledge, rather than from the importation of outside solutions.

A Note on Nature-Based Solutions

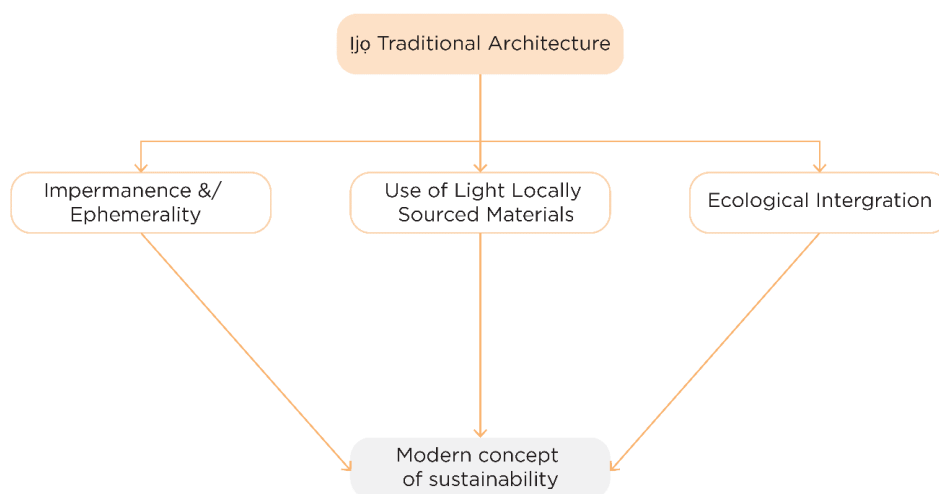


Figure 18: Synthesis on the three logics and relation to modern sustainable policies like the NbS

The Nature-Based Solutions (NbS) literature often presents ecological integration as a recent scientific and policy development (Cohen-Shacham et al., 2016; Friess et al., 2022). However, the findings of this study indicate that Ijo architecture reached the same conclusion that spatial and structural conformity with natural systems results in better resilience outcomes compared to separation; through centuries of direct inhabitation. This prompts a critical question for the NbS field: how many other indigenous coastal building traditions possess equivalent ecological intelligence, and what would it mean to treat these traditions as primary sources rather than as post-hoc confirmations of externally derived insights?

Conclusion

This paper aimed to document and analyse the adaptive features of indigenous Ijo riverine architecture in the Niger Delta, using the Sankofa principle as its steering framework. Through observations in selected riverine communities and engagement with the literature, three key principles: ephemerality, lightweight materiality, and ecological integration, were identified as vital toward understanding its resilience. Each principle was examined for its spatial and material expression and its systemic function as an adaptive strategy through Resilience Theory, and its relationship to modern coastal design and Nature-Based Solutions.

The main conclusion is that Ijo riverine architecture is a coherent adaptive system, formed over centuries of interaction with the dynamic coastal environments it inhabits. Its apparent structural temporality, simplicity and integration with surrounding ecosystems show advanced ecological knowledge and serve as a productive resilience trait.

The study does three things, furthermore. First, this study provides methodical documentation of Ijo riverine architecture, adding to a largely overlooked but growing body of literature. Secondly, it demonstrates that Ijo and African indigenous architectural knowledge can interact meaningfully with contemporary theoretical discussions. Thirdly, the principles present a valuable design vocabulary for coastal architecture in climate-sensitive areas.

Subsequent research could focus on quantitative hydrodynamic and sediment analyses around Ijo stilt settlements to confirm or more exhaustively prove the functional parallels with mangroves and other ecological systems, as well as on long-term documentation of settlements to support temporal logic. Furthermore, future research needs to be participatory with Ijo communities to deepen the contextual understanding of decision-making and knowledge transmission that support these principles.

The Sankofa principle emphasises the importance of reclaiming forgotten knowledge. The Ijo have retained the skill to build in harmony with water, and the architectural field is beginning to recognise its significance.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Author Contributions (CRediT)

Salolomo, Ebiegberi Michael: Conceptualisation, Methodology, Investigation, Formal Analysis, Data Curation, Visualisation, Writing – Original Draft.

Napoleon, Onu Imaah: Supervision, Validation, Writing – Review & Editing.

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Data Availability

The data supporting the findings of this study, including field observations and photographs, were collected by the author during site visits and are available from the corresponding author upon reasonable request. Additional supporting data were drawn from previously published literature, cited throughout the manuscript.

AI Usage Declaration

During the preparation of this work, the author used *Grammarly* to improve the language and readability of some parts of the manuscript. After using this tool, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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