Biophilic Retrofit of Historic Industrial Buildings for Community Health Hubs in Nigeria: A Scoping Review

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ABSTRACT

Nigeria's urban landscape is marked by a paradox: a wealth of abandoned industrial buildings alongside a critical shortage of community health infrastructure. This scoping review investigates the viability of bridging this gap by converting these historic structures into biophilic health hubs, offering a solution to urban neglect, health inequity, and the loss of natural connection in cities. Guided by the established scoping review methodology of Arksey and O'Malley, the study synthesizes evidence from 40 key publications, including academic journals and industry reports from the last decade, with a focus on Nigeria and comparable regions. The analysis demonstrates that strategically introducing natural elements like sunlight, fresh air, and greenery into old factories and warehouses can create restorative environments that enhance psychological wellness and strengthen community health. Despite this promise, the path forward in Nigeria is hindered by insufficient policy support, financial constraints, and a need for locally tailored design models. Ultimately, this study positions biophilic adaptive reuse as a pragmatic and sustainable approach to urban regeneration. To move from concept to reality, it calls for specific actions: governments should create financial incentives for reuse projects, design professionals must engage communities directly in the planning process, and the academic community should focus on generating hard data to measure the real-world benefits of these transformative spaces.

Keywords: Adaptive Reuse, Biophilic Design, Community Health, Healing Environments, Heritage Conservation, Industrial Building, Urban Regeneration, Sustainable Architecture.

INTRODUCTION

As global conversations about urban sustainability and public health continue to evolve, the architectural field has increasingly turned toward biophilic design, a framework that integrates natural elements such as light, vegetation, water, and organic forms into built environments. This approach, as argued by Browning and Ryan (2020), is not merely an aesthetic preference but a scientifically grounded response to the human need for connection with nature. Research shows that biophilic spaces can reduce stress, enhance cognitive function, and even improve patient recovery times in healthcare settings. This relevance extends beyond hospitals to encompass broader community-based environments, reinforcing the idea that architecture do not just serve as shelter, but as an active contributor to public health resilience (Freeman, 2024).

Running parallel to this is the growing practice of adaptive reuse, which breathes new life into obsolete structures, particularly historic industrial buildings. This strategy is a key factor of sustainable development, preserving cultural heritage and revitalizing urban cores while reducing the massive carbon footprint of demolition and new construction (Reith and Brajković, 2021). For a fast-growing and budget-conscious regions like sub-Saharan Africa, this is not just an option but a necessity. Rather than erecting costly new buildings, cities can capitalize on the unique spatial volumes, durability, and central locations of industrial relics to accommodate new functions, especially community-oriented ones like wellness centers and public health hubs.

In the Nigerian context, this combination of biophilic designs and adaptive reuse offers great untapped potential. The nation's urban landscapes are filled with abandoned industrial buildings from its colonial and post-independence era. While often seen as blight, these structures hold historic narratives and a sturdy framework worthy preservating (Ekhaese and Mohammed, 2024).

They represent a golden opportunity to address critical gaps in community health infrastructure. As Amadi and Ichendu (2024) suggest, retrofitting these sites with biophilic principles can harmonize sustainable design with social equity, bringing the restorative power of nature to underserved neighborhoods. This is more than preservation, as it is a form of urban acupuncture, thereby injecting life, health, and purpose into forgotten spaces, which is an endeavor that aligns with both sustainability and the urgent public health needs of Nigeria's growing urban populations.

In Nigeria, where the growing urban population faces a serious infrastructure gaps and deepening public health disparities, reimagining such industrial buildings as biophilic community health hubs offers significant intervention. These durable, strategically located buildings, with their high ceilings and open layouts, are naturally suited for conversion into clinics, therapy zones, or recreational centers (Agboola and Arapoglu, 2024; Ikiriko and Enwin, 2024). Beyond their physical utility, such projects can simultaneously restore a sense of historical identity, develop neglected neighborhoods, boost local economies, and advance national goals for sustainable cities.

However, a significant chasm exists between global theory and local practice. While biophilic retrofitting is a proven strategy in many parts of the world, Nigeria lacks a robust body of research or documented case studies. Despite growing awareness of the psychological benefits of nature-connected design (Barau et al., 2023; Umeora et al., 2025), this knowledge has not crystallized into practical frameworks or policy directives for the Nigerian context. This study aims to address the gap by systematically investigating how biophilic design strategies can guide the adaptive reuse of Nigeria's industrial heritage, paving the way for more equitable and health-focused urban futures.

The primary aim of this scoping review is, therefore, to map the potential and pinpoint actionable strategies for transforming Nigeria's historic industrial buildings into biophilic community health hubs. This study is significant as it confronts two intertwined challenges: many underutilized industrial buildings and growing health disparities in rapidly urbanizing environments. By analyzing both international best practices and local innovations, this study will demonstrate how intentional design can foster physical well-being, mental health, and environmental regeneration.

The review focuses on identifying and classifying industrial heritage buildings in Nigeria that are viable for adaptive reuse, assessing their architectural potential and historical significance. We will also examine a diverse range of biophilic retrofit case studies to determine their applicability within the Nigerian socio-economic and climatic context. A key objective is to evaluate the documented health and social benefits of such interventions, with a focus on marginalized communities. The ultimate goal is to synthesize these findings into a conceptual framework that can guide architects, policymakers, and community leaders in transforming industrial relics into inclusive, sustainable, and health-promoting public assets.

Summary of Research Methodology and Variable

To achieve this, the study adopts a scoping review methodology, following the structured framework of Arksey and O'Malley (2005) to comprehensively map the relevant scholarly landscape. The analysis centers on the dynamic interplay between three core variables: Biophilic Design as the independent variable (e.g., use of natural light and vegetation); Adaptive Reuse of Industrial Buildings as the mediating process; Community Health Outcomes as the dependent variable (encompassing psychosocial and physical well-being). By synthesizing these elements,

this review will identify key themes, establish evidence-based connections, and highlight critical knowledge gaps, ultimately informing a practical and context-sensitive framework for Nigeria.

LITERATURE REVIEW

1. Biophilic Design: Concepts and Benefits in the Built Environment

The concept of biophilic design, brought to prominence by Kellert (2008), is founded on a simple but powerful idea: our well-being is intrinsically tied to our connection with the natural world. This design philosophy moves beyond simply adding plants to a room; it involves a deliberate integration of natural light, organic shapes, and multi-sensory experiences to create spaces that actively support our physical and mental health. Research consistently shows that such environments can lower stress, improve our ability to think clearly, and build emotional resilience, offering a vital antidote to the often sterile nature of modern cities (Ryan and Browning, 2020; Tabb, 2020). The true power of this approach, as noted by Barnaby et al. (2024), is its ability to counteract the alienation of urban life by re-weaving nature into our daily experiences.

The tangible benefits of this connection are especially clear in high-stakes environments like hospitals and schools. Here, elements such as ample daylight, views of greenery, and the sound of water have been linked to faster patient recovery, improved mood, and stronger social ties (Opoku et al., 2024; Yusuf et al., 2024). The conversation is now expanding from individual buildings to entire cities, with biophilic principles being seen as essential for public health, particularly in underserved areas. In nations like Nigeria, this is increasingly viewed as a dual imperative—a strategy for both sustainability and community wellness (Ekhaese et al., 2024). However, as scholars like Amadi and Ichendu (2024) rightly argue, for these principles to take root, they cannot be imported wholesale. They must be adapted through the lens of local culture, indigenous knowledge, and regional aesthetics, highlighting a clear need for more context-specific research.

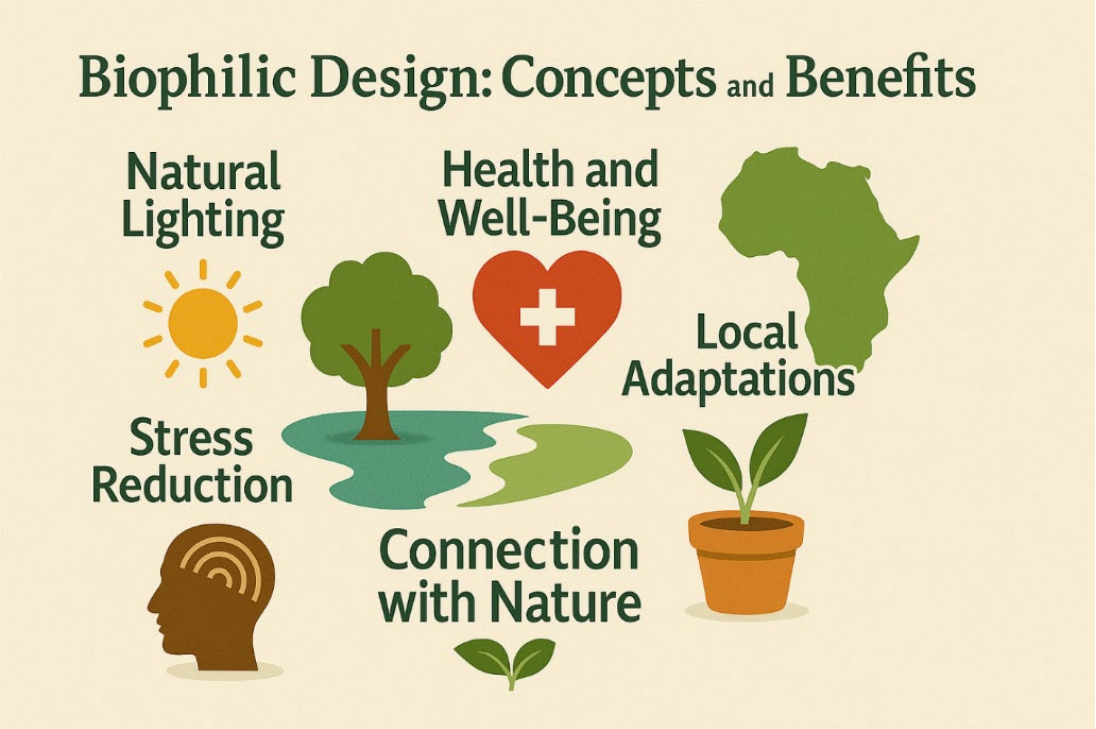

Figure 1: Biophilic Design: Concepts and Benefits

Source: Authors' Research work 2025

2. Adaptive Reuse: Giving Old Buildings a New Purpose

Around the world, the practice of adaptively reusing old buildings has emerged as a powerful tool for sustainable urban development. Instead of demolishing historic factories and warehouses, cities from Amsterdam to Pittsburgh are transforming them into housing, offices, and cultural centers. This approach not only preserves a city's architectural character but also represents a profound act of environmental conservation, drastically reducing the carbon emissions associated with new construction (Tabb, 2020). Interestingly, these projects often naturally lend themselves to biophilic strategies, using features like green roofs and natural ventilation to literally regrow nature within the skeletons of old industrial zones.

In Nigeria, however, this potential remains largely untapped. The path to adaptive reuse is blocked by a familiar set of challenges: unclear regulations, a lack of financial incentives, and limited public awareness about the value of building conservation (Ajayi et al., 2024; Obiadi et al., 2023). Despite these hurdles, the opportunity is immense. The very structure of Nigeria's colonial and post-colonial industrial buildings—their robust frames, spacious floors, and central locations—makes them ideal candidates for a new life. With the right mix of supportive policies and genuine community involvement, scholars suggest these forgotten structures could be reborn as vital community health infrastructure, serving neighborhoods that need it most (Enwin and Ikiriko, 2024).

3. The Nexus between Community Health and the Built Environment

It is now widely accepted that our physical surroundings are a key determinant of our health. The World Health Organization emphasizes that access to green, communal space is not a luxury but

a necessity for urban populations, especially where pollution is high and healthcare is scarce. The design of our buildings and neighborhoods directly shapes our stress levels, emotional health, and sense of community (Onwuzuligbo et al., 2025a). Conversely, spaces that are noisy, overcrowded, and poorly ventilated can actively harm mental well-being (Barnaby et al., 2024).

This is where green infrastructure and biophilic design prove their worth. Parks, greenways, and nature-integrated buildings have been shown to encourage physical activity, reduce stress, and strengthen social bonds (Gana, 2023). In Nigeria, a small but growing body of evidence confirms that design which incorporates nature can deliver significant mental health benefits to communities (Adedeji, 2023; Oguntona and Aigbavboa, 2024). Yet, a major disconnect persists. The insights from this research rarely make their way into official urban planning guidelines or standard architectural practice. As a result, the vision of biophilic health hubs remains a theoretical concept rather than a practical solution on the ground.

4. Sustainable Architecture and Heritage Conservation in Nigeria

Nigeria's architectural legacy is under threat from relentless urban expansion and inadequate legal protection. Yet, within this challenge lies an extraordinary opportunity. Historic buildings from the nation's recent past are not just relics; they are undervalued assets ripe for sustainable reinvention (Ekhaese et al., 2024). Preserving this heritage does more than save walls; it can revitalize entire districts, boost tourism, and create jobs, contributing directly to sustainable development goals (Okafor et al., 2024a). When biophilic design is woven into these conservation projects, it enhances their livability and ensures they align with global aims for resilient and inclusive cities, as outlined in SDG 11 (Ajayi et al., 2024).

As Okafor et al. (2024b) point out, these buildings are also pillars of community identity and pride. However, efforts to retrofit them consistently run aground due to funding shortfalls, bureaucratic red tape, and a skills gap in specialized conservation techniques (Okeke et al., 2024). Success requires architects, public health officials, and policymakers to work together, but the current system in Nigeria does little to encourage such collaboration (Barau et al., 2023). This impasse forces a rethinking of heritage itself—from a static artifact to be preserved to a dynamic, "living infrastructure" that can actively promote community wellness and urban regeneration.

5. Identified Research Gap

While the individual concepts of biophilic design, adaptive reuse, and community health are well-established in the literature, there is a critical lack of synthesized research that explores their intersection in the Nigerian context. Scholars have explored the theory of biophilia, others have assessed the reuse potential of old buildings, and a few have examined the health impacts of the built environment. However, a critical synthesis is missing. There is a conspicuous absence of research that brings these three strands together to provide a clear, practical framework for converting Nigeria's industrial heritage into biophilic health hubs.

This gap creates a significant problem for practitioners. Without an integrated model, architects, urban planners, and policymakers lack the guidance needed to translate this powerful concept into built reality. Therefore, this study seeks to bridge this divide by developing a contextually sensitive framework that specifically addresses how Nigeria's historic industrial buildings can be adaptively

reused as biophilic infrastructure for community health, tackling a pressing challenge at the intersection of urban development and public well-being.

METHODOLOGY

To navigate the multidisciplinary nature of the study, scoping review methodology was adopted. We were guided by the five-stage framework developed by Arksey and O'Malley (2005), which provides a rigorous yet adaptable roadmap for mapping emerging fields of research. This approach was particularly suited to our goal of systematically surveying the landscape of evidence surrounding biophilic retrofits, industrial heritage, and community health, helping to clarify key ideas and identify gaps (Munn et al., 2018). Its flexibility was crucial for synthesizing insights from the interconnected worlds of architecture, public health, and sustainability policy.

Research Design and Analytical Approach

The review followed the five iterative stages of the Arksey and O'Malley (2005) framework:

I. **Identifying the Research Question:** The primary question guiding this review was: "What does existing research reveal about transforming historic industrial buildings into biophilic community health hubs, and its implications in the Nigerian context?"
II. **Identifying Relevant Studies:** A comprehensive search strategy was developed using key terms such as "biophilic design," "adaptive reuse," "industrial heritage," "community health," and "Nigeria."
III. **Study Selection:** Pre-defined eligibility criteria were applied to filter studies, as detailed in Table 1.
IV. **Organizing the Data:** A standardized data extraction form was used to collate information from included studies.
V. **Collating, Summarizing, and Reporting the Findings:** The extracted data was analyzed thematically to identify patterns, gaps, and lessons.

The analysis involved both quantitative summary (e.g., publication year, geographic focus) and qualitative thematic content analysis. Thematic clusters were developed inductively by identifying recurring concepts across the literature.

Population, Sample Design, and Data Collection Instrument

The population for this review included all accessible peer-reviewed articles and grey literature that touched upon the intersection of our three core themes: biophilic design, the adaptive reuse of industrial buildings, and community health outcomes.

Sample Design and Justification for Literature Period

We focused our search on literature published between 2015 and 2025. This decade-long window was strategically chosen to capture the most current innovations and trends in sustainable urbanism and biophilic design, while also ensuring a sufficient base of established knowledge. This period is especially relevant as it aligns with the global push behind the UN Sustainable Development Goals (SDGs) (Barnaby et al., 2024).

Sample Size

The final sample size consisted of 40 studies that met all inclusion criteria. This number was not predetermined but was naturally reached when we observed thematic saturation, the point at which new studies no longer introduced novel concepts to our research question.

Data Collection Instrument

The primary data collection instrument was a structured data-charting form designed in Microsoft Word. Its structure was designed to extract the following data from each study: Bibliographic details (Author, Year, Title); Geographic Region and Context (e.g., Nigeria, Global, etc.); Building Typology; Specific Biophilic strategies used; Documented Health and Well-being Outcomes; Identified Barriers and Enablers; Key Findings and Relevance to Nigeria.

Data Sources and Search Strategy

To ensure a comprehensive search, we queried five major academic databases between March and May 2025: Scopus, Web of Science, PubMed, JSTOR, and African Journals Online (AJOL). Recognizing that valuable insights often exist outside traditional journals, we also incorporated grey literature, such as reports from architecture firms, policy briefs from environmental NGOs, and urban planning documents.

Eligibility Criteria and Study Selection

The inclusion and exclusion criteria were formulated to ensure the review's focus and relevance. These criteria are presented in Table 1, which provides a clear breakdown of the logical framework used to filter the literature.

Table 1: Inclusion and Exclusion Criteria

Source: Authors' Research work 2025

CRITERIA CATEGORY	INCLUSION CRITERIA	EXCLUSION CRITERIA
Publication Date	Studies published between 2015 and 2025	Pre-2015
Language	English	Non-English
Geographic Focus	Nigeria, Sub-Saharan Africa, LMICs, or globally with transferable lessons	High-income, non-comparable regions
Building Typology	Industrial heritage (warehouses, factories, mills)	New construction, non-industrial buildings
Study Type	Peer-reviewed articles, reviews, case studies, credible grey literature	Opinion pieces, editorials without data
Design Focus	Biophilic design, adaptive reuse, sustainable retrofitting	Solely structural/materials engineering
Health Dimension	Studies linking built environment to public, mental, or community health	No health or well-being discussion
Full-Text Availability	Full-text accessible online or through academic databases	Abstract-only entries or pay walled/unavailable full texts

The review prioritized studies that explored biophilic design, adaptive reuse, industrial heritage, or community-based health architecture, particularly those situated within the Nigerian context or transferable to similar low- and middle-income countries. Furthermore, to maintain linguistic consistency and accessibility for analysis, only articles published in English were included. Conversely, studies were excluded if they were non-English publications, focused solely on technical or engineering aspects without discussing design, health, or reuse implications, or involved entirely new constructions rather than retrofitting existing structures.

Table 2: Comparative Matrix of Selected Studies on Biophilic Retrofit and Community Health

Source: Authors' Research work 2025

Study	Region	Building Type	Biophilic Elements Applied	Purpose of Retrofit	Health Outcomes/Findings
Khalilikhoo (2024)	Europe (Italy)	Nursery/Industrial Complex	Daylight, indoor plants, wood, thermal comfort	Educational and therapeutic retrofit	Improved learning environment and reduced stress
Al Khatib et al. (2024)	Global (Meta-Review)	Healthcare facilities	Nature views, ventilation, materials, water features	General hospital healing environments	Faster recovery rates, reduced anxiety in patients
Tabb (2020)	North America	Mixed-use Urban Fabrics	Urban vegetation, rooftop gardens, bio-skin facades	Regenerative, resilient city strategy	Enhanced well-being and microclimatic performance
Grimaldi (2020)	Europe	Industrial Museums	Day lighting, stone textures, interior gardens	Adaptive reuse for culture/education	Emotional and sensory engagement with space
James (2020)	North America	Factories to Community Centers	Natural light, green courtyards, water elements	Community wellness hub	Improved air quality and physical activity levels

Amadi and Ichendu (2024)	Nigeria	Rehabilitation Centers	Courtyards, shaded walkways, plants, cross-ventilation	Healing and recovery support	Reduced patient stress; increased patient-staff interaction
Ikiriko and Enwin (2024)	Nigeria	Urban Residential Blocks	Bioclimatic features, green integration	Regenerative housing design	Increased user satisfaction and perceived comfort
Ekhaese and Mohammed (2024)	Nigeria	Orthopaedic Hospital Retrofit	Louvres, shading devices, plant interfaces	Climate-sensitive design	Lower energy use, improved ventilation
Agboola et al. (2024)	Nigeria	Heritage Market Conversion	Passive airflow, native vegetation, public gathering spaces	Community co-benefit and health access	Elevated social cohesion and informal health interactions
Barau et al. (2023)	Nigeria	Civic and Open Urban Spaces	Indigenous trees, shade, biodiversity corridors	Reclaiming ecological memory	Higher psychological comfort and identity reinforcement

In addition, literature without accessible full-text versions, such as conference abstracts, paywalled reports, or incomplete preprints, was omitted from the final synthesis. This approach ensured a focused, high-quality body of evidence directly aligned with the study's aim to explore how biophilic design can support adaptive reuse for community health in Nigeria's urban landscape.

Table 3: Summary of Global Practices in Biophilic Retrofit for Health

Source: Authors' Research work 2025

Study/Author	Country/Region	Building Typology	Biophilic Interventions	Health Outcomes	Implementation Enabler
Grimaldi (2020)	Italy	Industrial museum	Daylight, natural stone, courtyard gardens	Sensory comfort, social engagement	Strong heritage policy

Khalilikhoo (2024)	Italy	Educational reuse	Vegetation, daylight, organic interior flow	Reduced stress, better cognition	Government–university partnership
Tabb (2020)	USA	Urban multi-use	Rooftop greenery, water, shaded trails	Improved walkability, reduced anxiety	Urban biophilic zoning
Din et al. (2023)	Global (Review)	Hospital gardens	Views of nature, healing gardens	Lowered BP, shorter recovery time	Hospital management initiative

Table 4: Summary of African Practices and Lessons for Nigeria

Source: Authors' Research work 2025

Study/Author	Country	Building Typology	Biophilic Interventions	Constraints Faced	Policy/Practice Implication
Amadi and Ichendu (2024)	Nigeria	Rehab center	Shaded walkways, courtyards, local greenery	Budget limits, lack of awareness	Biophilic elements can be low-cost
Ekhaese and Mohammed (2024)	Nigeria	Hospital retrofit	Cross ventilation, vertical greenery	Climatic misfit of imported designs	Need for contextual passive strategies
Barau et al. (2023)	Nigeria	Urban civic space	Native trees, biodiversity lanes	Encroachment, weak landscape policies	Green corridors for mental health
Makunda (2020)	Kenya	Hospital redesign	Biomorphic forms, spatial sequencing	Lack of biophilic education in schools	Curriculum reform for sustainability

Identification of Relevant Studies

The study selection process, illustrated in the PRISMA flow diagram (Figure 2), began with 183 identified records. After duplicate removal (n=162) and a two-stage screening process (title/abstract followed by full-text), 40 studies were included for final synthesis. This rigorous process ensured the final sample was both comprehensive and highly relevant. The process of selection is illustrated in the PRISMA diagram below:

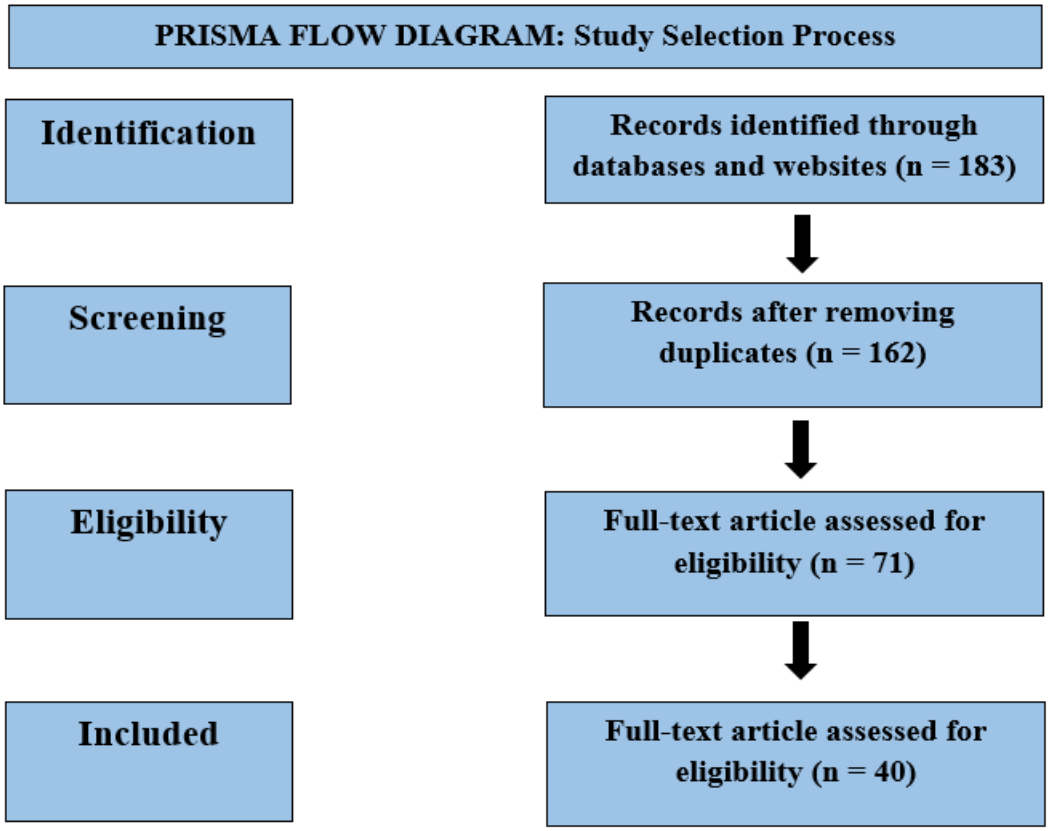

Figure 2: PRISMA Flow Diagram

Source: Authors' Research work 2025

FINDINGS AND THEMATIC MAPPING

Our analysis of the 40 included studies reveals several interconnected themes that illuminate both the promise and the practical challenges of adapting Nigeria's industrial past for community health. The following synthesis moves beyond listing best practices to uncover the specific insights and hurdles relevant to the Nigerian context.

Typologies of Industrial Buildings in Nigeria with Reuse Potential

The literature reveals a largely untapped resource scattered across Nigerian cities like Lagos, Kaduna, and Port Harcourt: a diverse collection of abandoned textile mills, colonial warehouses, and former processing plants (Ekhaese & Mohammed, 2024; Obiadi et al., 2023). These structures are not merely ruins; their robust concrete and steel frames, central locations, and spacious, flexible interiors make them architecturally ideal for conversion into community centers. Their inherent durability and proximity to populous areas position them as prime candidates for becoming high-impact health hubs. However, a critical gap identified is the absence of a systematic national inventory or typological classification of these assets, which hinders large-scale planning and policy intervention.

Effective Biophilic Retrofit Strategies for Health Outcomes

The evidence highlights a consistent set of biophilic design strategies for bringing buildings to life. As in Tab. 2, the study demonstrates that incorporating natural ventilation, maximizing daylight through strategic openings, and introducing vegetation via courtyards or green walls are highly effective (Tabb, 2020; Amadi & Ichendu, 2024). In African settings, these approaches are often tailored through an emphasis on shading, seamless indoor-outdoor connections, and the use of native plants to meet climatic and cultural needs (Barau et al., 2023). Crucially, these are not just aesthetic choices; studies directly link elements like nature views and fresh air to measurable health improvements, including lower anxiety and quicker patient recovery (Al Khatib et al., 2024; Din et al., 2023). These strategies were found to enhance not only aesthetics but also thermal comfort, acoustic quality, and social interaction, an essential trifecta for creating restorative environments.

The Implementation Gap: Barriers and Emerging Enablers

A clear theme across the studies is the stark contrast between the conceptual appeal of biophilic retrofits and the reality of their execution in Nigeria. As shown in Tab. 4, significant systemic barriers persist, including a chronic lack of funding for heritage projects, weak regulatory frameworks, and a development culture that often favors demolition over creative reuse (Ajayi et al., 2024; Paul-Agboola, 2024). Overcoming these hurdles requires more than good design; it demands supportive policies and professional training. Encouragingly, the review also identifies potent enablers, such as strong grassroots community support, interest from international NGOs, and a new wave of environmentally conscious architects. The most successful cases, often informal pilot projects, show that collaboration between government and communities is a critical ingredient for success.

Learning from the World, Designing for Nigeria

Tab. 3 and 4 provides a comparative view of global and African practices. International case studies from Italy to South Africa provide a rich repository of ideas, demonstrating how industrial buildings can be transformed into health and educational spaces (Grimaldi, 2020; Khalilikhoo, 2024). However, a key finding is that these models cannot be imported wholesale. Their direct application is limited by Nigeria's unique socio-economic, and climatic context. Successful adaptation hinges on customizing universal principles to local realities. This means prioritizing low-cost, locally sourced materials, genuinely engaging community members in the design process, and creating hybrid spaces that blend healthcare with cultural and social activities (Amadi & Ichendu, 2024; Barau et al., 2023). The core principles of daylight and natural ventilation are universal, but their execution must be made to fit the Nigerian context.

The Human Element: Community and Policy as Foundations

Perhaps the most critical insight is that the long-term success of these hubs depends fundamentally on human systems, not just architectural ones. The literature strongly advocates for deep community involvement and the breaking down of traditional policy silos (Enwin & Ikiriko, 2024; Okeke et al., 2024). A major obstacle is the disconnect between heritage conservation and public health planning in Nigeria. The evidence suggests that a multisectoral approach, one that brings community stakeholders to the table from the beginning and creates policies that incentivize collaboration, is essential for projects to be sustainable and scalable.

DISCUSSION

This review weaves together global and local threads of evidence to reveal a powerful connection between biophilic design, industrial heritage reuse, and community health, a connection with profound significance for Nigeria's urban trajectory. The five themes explored above collectively build a case for this integrated approach as a pragmatic and sustainable pathway for urban and public health advancement.

The divergence between well-funded, policy-backed retrofits in the Global North and the emergent, grassroots efforts in Nigeria is striking (Khalilikhoo, 2024; Grimaldi, 2020 vs. Amadi & Ichendu, 2024). This gap underscores a fundamental need for structured support systems within Nigeria. Yet, the very existence of successful local pilot projects demonstrates the approach's innate feasibility. The lesson is clear: Nigeria's strategy should not be to imitate Western blueprints, but to harness its own considerable assets, community solidarity and local ingenuity, while constructing the necessary institutional frameworks to scale these efforts.

The potential impact on healthcare accessibility is substantial. By converting central, soundly built industrial relics into health hubs, this strategy directly tackles spatial inequality. It offers a practical method for advancing the UN's Sustainable Development Goals for health (SDG 3) and sustainable cities (SDG 11). The documented benefits of such spaces, from lowered stress to stronger community ties, provide a compelling evidence base to reposition this concept from an architectural niche to a core urban health strategy (Barau et al., 2023; Yusuf et al., 2024).

Furthermore, our findings confirm that a perfect design is worthless without community trust. The principle of contextual adaptation reinforces that biophilic design is a collaborative process, not a pre-packaged solution. Engaging local ecological knowledge and fostering a sense of ownership through co-design are not optional extras, but vital components for ensuring cultural relevance and long-term maintenance (Enwin & Ikiriko, 2024). This participatory model helps overcome historical distrust and empowers communities to become stewards of their own well-being.

To dismantle the identified policy barriers, a concerted, cross-sectoral effort is essential. Our analysis points to the urgent need for innovative policy instruments. We join the call for concrete measures such as tax incentives for adaptive reuse, targeted grants for community health projects, and the formal inclusion of biophilic principles in the National Building Code. Simultaneously, integrating these concepts into the education of future architects and planners is a critical long-term investment in building local capacity.

In conclusion, this discussion affirms that the biophilic retrofit of Nigeria's industrial buildings is a realistic and multi-faceted solution to the intertwined crises of urban decay, health inequity, and environmental disconnect. The central question is no longer if it can be done, but whether there is the collective will to prioritize it. The way forward must be charted by the core lessons of this review: champion community-led design, implement smart enabling policies, and foster interdisciplinary collaboration to reimagine heritage structures as foundational infrastructure for a healthier, more resilient Nigeria.

CONCLUSION

This scoping review systematically mapped the relationship between three core research variables: biophilic design principles (the independent variable), adaptive reuse of industrial

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heritage (the mediating variable), and community health outcomes (the dependent variable). The synthesis of 40 studies reveals that these elements are not just loosely connected; they form a powerful, self-reinforcing cycle. We found that biophilic interventions such as; strategically harnessing daylight, fresh air, and native greenery, are fundamental operational features, not optional decorations. They are what allow a decayed factory to become a genuine sanctuary for community well-being. This cause-and-effect relationship is well-supported by evidence showing tangible improvements in mental health, stress reduction, and social bonds in such environments (e.g., Amadi & Ichendu, 2024; Al Khatib et al., 2024).

The main challenge, however, lies in application. The main disconnect is not in the theory, but in the on-the-ground execution within Nigeria. While the relationship between the variables is sound, their successful integration is thwarted by a familiar set of systemic obstacles: fragmented policies, isolated professional sectors, and a scarcity of localized data (Ajayi et al., 2024; Obiadi et al., 2023). In direct response to these identified gaps, this review translates its findings into a set of actionable, context-sensitive guidelines, moving from diagnosis to prescription.

Contribution to Knowledge

This research makes a distinct contribution across three domains:

I. **Theoretical Impact:** It provides a novel, integrated conceptual framework that explicitly links heritage conservation theory with public health metrics in an African urban setting. While these fields have often been discussed in parallel, this study synthesizes them into a single, actionable model for "therapeutic heritage."
II. **Methodological Impact:** By employing a scoping review methodology, this study consolidates a fragmented body of multidisciplinary knowledge, creating a clear evidence base that can inform future primary research, policy design, and architectural practice in Nigeria and similar regions.
III. **Practical Application:** Its most significant output is a set of pragmatic guidelines tailored for Nigeria. These go beyond generic biophilic principles to offer a realistic toolkit that confronts local constraints head-on.

A Framework for Action: Validated Guidelines

Forged from the evidence, the following guidelines provide a roadmap for implementation:

I. **Prioritize Passive, Climate-Responsive Biophilia:** Prioritize passive, low-cost strategies that work with the local climate. This means designing for natural cross-ventilation, creating cool, shaded courtyards, and maximizing free daylight, all while specifying readily available local materials (Ekhaese & Mohammed, 2024).

II. **Implement a Community Co-Design Protocol:** To ensure longevity and cultural resonance, the design process must be collaborative from the very beginning. This involves structured workshops that honor indigenous knowledge and prioritize the health needs defined by the community itself (Enwin & Ikiriko, 2024).

III. **Create Hybrid, Multi-Purpose Hubs:** For long-term economic viability, these spaces must be flexible. They should blend clinical services with wellness programs, social gathering areas, and even local entrepreneurial activity, making them a true heart of the community (Agboola et al., 2024).

RECOMMENDATIONS

To translate this framework from page to practice, we propose the following targeted actions:

For Policymakers: Champion this agenda by creating a "Heritage-Health Catalyst Fund," offering tangible incentives like tax relief for projects that demonstrably merge biophilic design with community health functions. Furthermore, institutionalize this vision by embedding these principles into the National Building Code and the core curricula for urban planning.

For Researchers: Shift the evidence base from conceptual to concrete. There is an urgent need for longitudinal studies that track the real-world performance of biophilic retrofits in Nigeria, measuring their impact on health metrics and local economies to continuously refine these guidelines.

For Architects and Planners: Adopt the proposed guidelines as a mandatory checklist in your projects. More importantly, break down professional barriers by proactively building interdisciplinary teams that include public health experts and dedicated community representatives from the inception of any retrofit initiative.

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