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A Critical Review of the Materials Criteria in Green Building Certification Systems in South-West Nigeria: Opportunities for Improvement

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Abstract: The building sector is a major contributor to global carbon emissions, with operational and embodied emissions posing substantial challenges. In Nigeria, particularly in the South West region, awareness of green construction is growing, but the adoption of international green building certification systems remains limited. This study critically examines the material criteria within these systems as applied in South West Nigeria, aiming to identify barriers to certification uptake and propose adaptations. Using qualitative content analysis and comparative case studies of certified and culturally significant buildings in Lagos, the research highlights the misalignment between international standards and local realities, including the lack of local LCA databases, high certification costs, and cultural preferences. Findings reveal that while projects like Heritage Place achieve international certification, they face data and supply challenges. In contrast, the John Randle Centre demonstrates the potential of integrating indigenous materials and vernacular design strategies to achieve sustainable outcomes without formal certification. The study concludes that a hybrid approach blending international standards with local knowledge is essential for advancing green building practices in the region. Recommendations include developing local LCA databases, simplifying documentation protocols, implementing tiered fee structures, integrating vernacular performance metrics, and promoting capacity building and policy incentives.

Keywords: *Green building, Certification, Sustainability, Material Criteria, South West Nigeria.*

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I. INTRODUCTION

Globally, the building sector has emerged as a focal point in the fight against climate change as it accounts for roughly 39 percent of energy related carbon emissions, with operational energy use responsible for about 28 percent and embodied emissions from materials and construction processes contributing the remaining 11 percent (World Green Building Council, 2021; Global Alliance for Buildings and Construction, 2022). The 2022 Global Status Report for Buildings and Construction stresses the urgency of this challenge, reporting that operational CO_2 emissions from buildings reached an all time high of 10 Gt in 2022—a 5 percent increase over 2020—despite growing commitments to decarbonization. This has catalyzed the adoption of green building practices worldwide, which aim to curb both operational and embodied impacts through energy efficiency, resource conservation, and, particularly through the selection of sustainable materials (Almusaed et al., 2024).

The choice of materials lies at the heart of green building strategies, as it determines a structure's embodied energy and lifecycle carbon footprint (Abera, 2024). Recent advances in mass timber technology such as the proposed 55 story timber tower in Milwaukee which would push the boundaries of height for wood construction, showcases the potential of mass timber's strength and carbon sequestering benefits (Think Wood, 2023). On a larger urban scale, Stockholm's Wood City project plans to deliver over 250,000 m² of mixed use development almost entirely from engineered timber, demonstrating the feasibility of wood as a primary urban building material (Savage, 2025).

However, in Nigeria, awareness of green construction is growing in major urban centers—particularly in the South West region, where Lagos and Ibadan lead the way—but formal certification under systems such as LEED (Leadership in Energy and Environmental Design) or EDGE (Excellence in Design for Greater Efficiencies) remains limited (Oke et al., 2025). Since its founding in 2009, the Nigerian Green

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Building Council (GBCN) has worked to promote sustainable practices through education, advocacy, and the development of local standards (Green Building Council Nigeria, n.d.). Nonetheless, only a handful of Nigerian projects have achieved international certification, reflecting barriers that include stakeholder unfamiliarity, cost constraints, and the misalignment of foreign criteria with local realities.

A central obstacle lies in the materials criteria themselves, as international rating systems often prioritize recycled content, global supply chain certifications, and detailed lifecycle assessments that rely on data unavailable for many indigenous materials (Chukwu, 2018). A recent evaluation of certified buildings in South Western Nigeria found that these frameworks overlook the environmental and economic advantages of local materials—such as laterite blocks, bamboo composites, and palm kernel shell aggregates—because comprehensive performance data are lacking (Adewolu, 2024). This gap not only hampers the recognition of sustainable local solutions but also perpetuates reliance on imported products that carry high embodied carbon and costs. This paper therefore undertakes a critical review of materials criteria in green building certification systems as applied in South West Nigeria. The specific objectives are to:

- Investigate how prevailing building certification systems conceptualize and operationalize material selection in Southwest Nigeria.
- Understand the extent to which material selection criteria align with Southwest Nigeria supply chain realities.
- Identify the limitations and challenges that impede certification uptake and it propose adaptations for Nigeria.

II. LITERATURE REVIEW

- *Green Building Certification Systems Overview*

From design and material sourcing to construction and operation, green building certification systems act as roadmaps for incorporating sustainability throughout every stage of a building's life (Olanrewaju et al., 2022). These systems provide transparency, allow uniform performance evaluation, and reward projects pushing beyond the lowest acceptable standards or requirements by converting abstract sustainability goals into concrete credits and benchmarks (Olanrewaju et al., 2022). Though several rating systems exist worldwide, four stand out for their impact and relevance to developing countries like Nigeria – LEED, BREEAM, EDGE, and the national system being developed by the Green Building Council Nigeria (GBCN).

The Leadership in Energy and Environmental Design (LEED) framework, pioneered by the U.S. Green Building Council in 1998, remains the most widely adopted global standard (Saleh et al., 2024). In its latest Building Design & Construction rating (v4.1), LEED is organized into eight credit categories, with Materials & Resources (M&R) alone accounting for up to 16 points out of 110 (ELDib, 2024). Within M&R, projects earn credits by conducting a life cycle assessment (LCA) to reduce embodied carbon, optimizing building product disclosures, responsibly sourcing raw materials (e.g., via the Forest Stewardship Council or equivalent), maximizing recycled content, specifying regionally produced materials, and ensuring transparency of chemical ingredients (ELDib, 2024). With the embedding of rigorous LCA and sourcing requirements, LEED v4.1 shifts the industry toward low carbon supply chains and full system accountability (Di Gaetano, Cascone & Caponetto, 2023).

BREEAM (Building Research Establishment Environmental Assessment Method), first launched in the UK in 1990, takes a similarly holistic approach but allocates roughly 12.5 percent of its total score to the Materials section—equating to up to 15 credits in the New Construction v6.0 standard (Council, 2023). BREEAM's materials criteria hinge on Environmental Profiles (BREEAM's version of LCA data), compliance with the BES 6001 responsible sourcing framework, requirements for recycled content, and assessments of durability and adaptability (Saleh et al., 2024). This combination rewards not only low impact materials but also long lasting, flexible design that minimizes future demolition and waste. BREEAM's emphasizes on certified supply chain management (via BES 6001) emphasise its goal of driving systemic improvements in material extraction and processing (Ball et al., 2023).

However, recognizing the technical hurdles many emerging market projects face, the Excellence in Design for Greater Efficiencies (EDGE) standard—developed by the International Finance Corporation—adopts a streamlined, metric driven approach. Although, to qualify for EDGE certification, the project must demonstrate at least a 20 percent reduction in three key areas—energy use, water use, and embodied energy (recently reframed as embodied carbon)—relative to a defined local baseline (Agyekum et al., 2023). The focus on these three clear targets, allows EDGE to lower the expertise and data requirements that stymie full LCA approaches, making green certification more accessible and affordable for developers in resource constrained contexts (Agyekum et al., 2023).

While international schemes dominate, Green Building Council Nigeria (GBCN) has been laying the groundwork for a truly local rating system since its founding in 2009 (Green Building Council Nigeria, n.d.). GBCN's forthcoming standard is designed around Nigeria's climatic, economic, and cultural realities, with special attention to indigenous materials (e.g. laterite, bamboo composites, palm kernel shell aggregates) and vernacular design strategies (such as passive cooling techniques) (Emmanuel, 2024). Through pilot certifications, training programs, and advocacy, GBCN iteratively refines criteria that align environmental performance with local supply chains and socio-economic development goals—addressing gaps left by foreign frameworks that often rely on data and materials unavailable in West Africa (Green Building Council Nigeria, n.d.).

Despite their different origins and structures, LEED, BREEAM, EDGE, and GBCN converge on a set of core material criteria—recyclability, life cycle (or embodied carbon) assessment, responsible sourcing, and transparency

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(Saleh et al., 2024). These shared pillars reflect a growing consensus that minimizing a building's environmental footprint demands not only operational efficiency but also rigorous stewardship of material resources from cradle to grave.

➢ *Regional Variations in Materials & Resources Criteria*

The foundation of materials stewardship is shared by green-building systems across geographic contexts. This foundation is centered on life-cycle assessment (LCA), third-party product declarations, recycled content thresholds, responsible sourcing, and encouragement of locally produced materials (Roth, Lewis & Hancock, 2021). However, the manner in which these pillars are framed and enforced varies significantly from one geographic context to another. In the United States, for example, the Leadership in Energy and Environmental Design (LEED) program codifies Materials and Resources (M&R) credits (Eissa & El-Adaway, 2024). These credits require full life cycle assessments (LCAs) from the beginning to the end of the product's life cycle, the collection of Environmental Product Declarations (EPDs), minimum recycled content percentages, and responsible-sourcing verification through approved programs (Eissa & El-Adaway, 2024).

A similar mandate is imposed by BREEAM in the United Kingdom, which requires the utilization of Environmental Profiles, which are the equivalent of life cycle assessments (LCAs), compliance with the BES 6001 responsible sourcing framework, and credits for recycled content, durability, and adaptability (Ball, 2023). In Germany, Passive House is primarily a performance standard that focuses on energy rather than a credit-based scheme; however, it is increasingly integrating embodied-carbon considerations under EN 15978, providing guidance on comparing wall assemblies, and advocating for materials that have a low amount of energy that is embodied in them (Mills et., 2021). While in Canada, Green Globes uses a pragmatic, points-based approach: it includes an M&R section that rewards material selection with low environmental impacts, recycled content, responsible sourcing, and whole-building life cycle assessment studies, regardless of whether or not full system-wide cradle-to-gate assessments are required (Roth, Lewis & Hancock, 2021).

Transitioning to the Global South, rating systems adapt these core pillars to local market conditions and data availability. Australia's Green Star incorporates a Responsible Products Framework that recognizes third-party certifications and thresholds for recycled content, responsible sourcing, and regionally manufactured products (Shooshtarian et al., 2024). Whereas India's IGBC Green Homes prescribes "optimum material utilization" and awards credits for the use of locally available, low-impact materials alongside broader resource-efficiency measures (IGBC, n.d.). The Green Building Index of Malaysia also incorporates materials criteria into its National Resource Evaluation Board (NREB) tool, awarding points for products that are sourced in a responsible manner, components that are recycled, and lifecycle thinking (Lau et al., 2023). Closely matching with India and Malaysia, recycled content, certified wood, local materials use, carbon-footprint reporting, and cradle-to-grave thinking are all topics that are covered in the Material Resources & Cycle category of the Greenship rating tool in Indonesia (Agustiningtyas, 2024).

Furthermore, Green Rivers standard in Iraq, although it is still in its infancy, makes reference to ASTM-based material specifications and promotes the use of local sources of supply within its performance-based code (Mawlood et al., 2024). While the UAE's Pearl Rating System sets "Point of Origin" rules for regional materials and requires a percentage of credits be earned through indigenous product use (Stonehaven, 2025; Estidama, 2012; Government of Abu Dhabi, 2010). A dedicated Materials category with weighted criteria for low-impact materials, recycled content, and supply-chain transparency is included in Qatar's Global Sustainability Assessment System (GSAS), which was developed using an integrated life-cycle approach (Stonehaven, 2025).

Similar to others Egypt's Green Pyramid Rating System (GPRS) offers specific M&R credits for materials that are made from renewable energy, materials that are reused, and materials that are manufactured using renewable energy (Daoud et al., 2023). Also aligning, the Green Star SA in South Africa is a reflection of global best practices, as it mandates life cycle assessment (LCA), verification of responsible sourcing, recognized recycled content, and recognition of regional materials (Crafford, Wessels & Blumentritt, 2021). Finally, in Nigeria the Green Building Council of Nigeria (GBCN) has drawn on these international and regional models to draft a local protocol that foregrounds indigenous materials—like laterite, bamboo composites, and palm-kernel shell aggregates—while proposing simplified LCA templates and batch-testing for common assemblies (Jimoh, 2022; GBCN, n.d.). In aligning the core pillars with domestic supply-chain realities and socio-economic goals, GBCN seeks to bridge the gap between rigorous global benchmarks and on-the-ground feasibility (GBCN, n.d).

Table 1 Comparative Matrix of M&R Criteria Across Certification Systems

Criteria	LEED (GN)	BREEAM (GN)	Passive House (GN)	Green Globes (GN)	Green Star Aus (GS)	IGBC GH (GS)	GBI MY (GS)	Greenship (GS)	Green Rivers (GS)	Pearl (GS)	GSAS (GS)	GPRS (GS)	Green Star SA (GS)	GBCN (NI)
Whole-building LCA	✓	✓	✗	◐	◐	◐	◐	◐	◐	✗	✓	✓	✓	◐

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EPD/Product Disclosure	✓	✓	✗	◐	✓	◐	◐	✗	✗	✗	✓	✗	✓	◐
Recycled Content	✓	✓	✗	✓	✓	✓	◐	✓	◐	✗	✓	✗	✓	◐
Indigenous-Materials Credit	◐	◐	✗	◐	✓	◐	✗	✓	◐	✗	✓	✓	✓	✓
Responsible Sourcing	✓	✓	✗	✓	✓	◐	◐	✓	✗	◐	✓	◐	✓	◐
Regional Materials	✓	✓	✗	◐	✓	✗	✓	✓	◐	✓	✓	◐	✓	✓
Supply-Chain Transparency	✓	✓	✗	◐	✓	◐	◐	✓	✗	◐	✓	✗	✓	◐

✓ = fully addressed; ◐ = partially addressed; ✗ = not addressed

This matrix reveals clear patterns: nearly all developed-world systems mandate full cradle-to-gate LCAs, EPD collection, and third-party responsible sourcing verification (USGBC, 2024; GBCN, n.d), whereas many developing-world schemes accept simplified baselines, proxy databases, or regional templates to accommodate limited local data (Crafford, Wessels, & Blumentritt, 2021). Nigeria's emerging standard diverges further: while it aspires to integrate vernacular materials and passive-cooling techniques within its M&R credits, it currently lacks formal LCA protocols, comprehensive EPD repositories, and verified supply-chain benchmarks (GBCN, n.d.).

➢ *Sustainability and Building Materials*

According to Yahia and Shahjalal (2024) and Korra (2021), the selection of materials has been identified as one of the most important levers for minimizing the overall environmental footprint of a residential or commercial construction. Embodied carbon, which includes emissions from material extraction, processing, transportation, and end of life, accounts for up to thirty percent of a building's lifecycle footprint (Myint & Shafique, 2024). Due to this, the construction industry has adopted a collection of materials that are low in carbon emissions and the circular economy materials in order to address this challenge. Mass timber, for example, not only provides high strength-to-weight ratios and rapid prefabrication benefits, but it also actively sequesters carbon. According to Chamber of Progress (2025), each cubic meter of engineered wood stores approximately one metric ton of carbon dioxide while simultaneously reducing waste on-site and accelerating construction schedules.

Beyond timber, though, innovations in low-carbon concrete—including geopolymer binders and blends with supplementary cementitious materials such as fly ash or slag—have demonstrated reductions in embodied emissions of 30–50 percent compared to conventional Portland cement mixes (Nukahm 2024). Bio-based composites too, from hemp-lime ("hempcrete") panels to mycelium-grown blocks, further enhance circularity by utilizing renewable feedstocks and enabling end-of-life compostability (Liland, 2024). These material advances not only lower lifecycle impacts but also align with the triple bottom line of sustainability, including environmental stewardship, economic viability, and social well-being (Elkington, 1994). These renewable, low-embodied-energy materials deliver long-term cost savings through improved thermal performance—reducing heating and cooling loads—and lower maintenance requirements, while healthier, toxin-free assemblies contribute to superior indoor air quality and occupant health (Enel, 2023; Emmanuel, 2024); and by integrating these material innovations, building designers move beyond incremental efficiency gains to a systems-level transformation—one in which the very substances that compose the built environment become active partners in carbon mitigation, resource regeneration, and human well-being.

➢ *Material Use and Sustainable Practices in South West Nigeria*

In South-West Nigeria, the prevailing construction paradigm still centers on cement, steel, and imported finishes, driven by associations of modernity, durability, and aesthetic prestige (Fadayiro, 2022; Abraham & Ololade, 2024). Yet cement production alone emits roughly 0.8 kg CO_2 per kilogram of product, and steel manufacture contributes even higher embodied carbon—leaving projects vulnerable to both environmental and economic volatility tied to global commodity markets (Hart, D'Amico & Pomponi, 2021). In contrast, laterite blocks, made from locally abundant iron-rich soils, exhibit a thermal conductivity of just 0.435 W/m·K—nearly one-third that of typical concrete blocks—providing superior passive insulation that can slash cooling energy needs in Nigeria's tropical climate (Alausa et al., 2013).

Complementing laterite, bamboo composites offer rapid renewability (harvest cycles of 3–5 years) and tensile strengths comparable to mild steel, making them suitable for non-load-bearing partitions, scaffolding, and even hybrid structural systems (Auwalu & Dickson, 2019). Likewise, palm-kernel shell aggregates, when substituted for up to 35 percent of conventional coarse aggregate, have produced

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concrete with compressive strengths around 18 MPa—sufficient for many low-rise residential applications—while reducing aggregate-related emissions (Seng et al., 2024). Locally sourced timbers, from plantation eucalyptus to indigenous hardwoods, also demonstrate favorable embodied carbon profiles and durability when harvested under sustainable regimes, as recent assessments in Benin City confirm performance on par with imported species (Usuemerai & Oyewole, 2024).

However, despite their promise, these indigenous materials remain underutilized. As construction professionals cite limited performance data, the absence of building codes that recognize non-traditional materials, professional unfamiliarity, and client biases favoring "modern" imports as key barriers (Mogaji, Mewomo & Bondinuba, 2024).

- *Critiques of Green Certification Systems in African Contexts*

International green building certification systems have undeniably driven significant advances in sustainable design worldwide, yet their Western-centric benchmarks frequently misalign with the technical, economic, and cultural realities of African contexts (Adewolu, Ademilua & Imomoh, 2024). On the technical front, one of the most pervasive challenges is the absence of robust, locally relevant LCA (life-cycle assessment) databases (Fnais et al., 2022). While global repositories such as Ecoinvent and Sphera host thousands of datasets, they offer scant information on indigenous African materials or region-specific production processes. A recent review of LCA studies in Africa revealed that fewer than 10 percent incorporate local material data, forcing practitioners either to omit embodied-carbon calculations or to substitute ill-fitting proxies (Karkour et al., 2023). Compounding this data gap is the scarcity of certified sustainable material suppliers—for example, FSC-certified timber or recycled-content steel producers—meaning that credits for responsible sourcing are often unattainable in practice.

Beyond data constraints, the complexity of international systems presents another barrier. LEED and BREEAM, for instance, require extensive documentation and third-party verification for each material credit—an undertaking that demands specialized expertise and time, resources that many local firms lack (Fnais et al., 2022). Consequently, smaller architectural practices and contractors may simply forgo certification, viewing it as an insurmountable administrative burden.

The economic obstacles are equally notable. For one, certification fees alone can run into tens of thousands of dollars: LEED registration and certification costs for a modest 20,000 ft² project typically exceed $7,000, with additional expenses for energy modeling, commissioning, and consulting (U.S. Green Building Council, 2024; BuildingGreen, 2023). For small- and medium-scale developments—by far the most common project types in Nigeria—such outlays represent a substantial share of construction budgets, deterring many stakeholders from pursuing formal recognition.

Culturally, the prescribed aesthetics and product standards embedded in these rating systems often clash with vernacular preferences and indigenous building traditions (Garg & Singh, 2024). The sleek glass façades and high-tech materials lauded in many LEED Platinum case studies can seem out of place—and even impractical—in hot, humid climates where passive ventilation, thick masonry walls, and shaded courtyards have long provided thermal comfort (Garg & Singh, 2024). Research on Ghana's nascent green building market underscores this tension, noting that local practitioners view many international credits as irrelevant or unattainable without significant adaptation (Addy et al., 2024).

- *Theoretical Framework*

This study is anchored in two interlocking theoretical lenses that together facilitate a holistic critique and contextual refinement of materials criteria in green building certifications for South-West Nigeria. First, the Sustainability Triangle—often referred to as the triple bottom line—posits that enduring sustainability emerges at the nexus of environmental integrity, economic viability, and social equity. Coined by John Elkington in 1997, this framework challenged traditional business metrics by insisting that true success must be measured not only in profits but also in people and the planet (Elkington, 1994). More recent corporate applications, such as Enel's 2023 Sustainability Report, demonstrate how environmental targets (e.g., carbon neutrality), financial performance, and community impact can be integrated into coherent strategy and reporting structures (Enel, 2023). In building materials, the Sustainability Triangle requires that selection criteria deliver ecological benefits (e.g., low embodied carbon), economic returns (e.g., lifecycle cost savings, local job creation), and social value (e.g., health, cultural relevance) (Oladazimi et al., 2021).

Second, Life-Cycle Thinking and Contextual Sustainability extends conventional cradle-to-gate analyses to full cradle-to-grave (and even cradle-to-cradle) perspectives, embedding circular-economy principles and local knowledge systems (Lei, 2024). The UNEP's 2024 guidance on circularity in the built environment underscores the importance of maintaining material value throughout use, reuse, and end-of-life phases and highlights the need for context-sensitive data collection methods that reflect regional production practices (UNEP, 2024). In Nigeria, where formal recycling infrastructures may be limited, integrating vernacular strategies—such as the reuse of laterite blocks or the compostability of bio-based composites—can yield net-positive outcomes that global LCA tools alone might overlook (Karkour et al., 2021).

- *Empirical Review and Gaps*

Several empirical studies have advanced our understanding of green building assessment and material selection in Nigeria. For one, Atanda & Olukoya (2019) conducted a qualitative content analysis comparing LEED's rating categories—material/waste control, water efficiency, indoor environmental quality, energy efficiency, sustainable site, and innovation in design—with the provisions of

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Nigeria's National Building Code. They found that while LEED offers a robust framework for sustainable development, Nigeria lacks a dedicated GBAT, and while their proposed synthesis framework could strengthen the Code's sustainability criteria, it remains untested in practice. Furthering this, Eze et al. (2021), through an internet-mediated survey and exploratory factor analysis of construction stakeholders in Southeast Nigeria, identified recycled plastic, natural clay, stone, bricks, cellulose, straw bales, grasses, limestone, and timber as commonly used sustainable materials. Although awareness of these materials was high, actual adoption was moderate; the authors distilled five determinant clusters—emissions minimization, low running and lifecycle costs, thermal and energy efficiency, health and safety, and waste minimization—and recommended integrating these factors into project specifications. Lastly, Ebekozien et al. (2022) used expert interviews in Benin City, Abuja, and Lagos to uncover twelve barrier sub-themes (e.g., absence of policy framework, low awareness, high costs) and eight concept sub-themes (e.g., policy incentives, capacity building) affecting green certification uptake. Their proposed model outlines strategic levers to promote GCB in Nigeria but stops short of detailing how material-selection criteria should be operationalized or adapted to local supply chains.

Despite these valuable insights, three critical gaps persist. Therefore, this study would investigate how prevailing building certification systems conceptualize and operationalize material selection in Southwest Nigeria, understand the extent to which material selection criteria align with Southwest Nigeria supply chain realities, and identify the limitations and challenges that impede certification uptake and propose adaptations for Nigeria in order to fill the gaps noted.

III. METHODOLOGY

The study employs a qualitative research method to critically investigate the material criteria in green building certification systems as used in South-West Nigeria. The approach offers a thorough knowledge of the topic by qualitative content analysis, comparative case studies, and thematic analysis.

➢ *Research Design*

The foundation of this study is a qualitative content analysis, which enables a thorough examination of textual data from different green building certification standards. This approach makes it easier to spot biases, themes, and patterns in these systems' material criteria. In addition, a comparative case study methodology is used, concentrating on particular structures in Lagos. This dual approach makes it possible to thoroughly examine how local building methods and materials in South-West Nigeria align to or clash with international certification criteria.

➢ *Data Sources*

The study employs secondary data sources to guarantee a thorough analysis, such as a desk review of green certification standards, which entails a thorough examination (Guerin et al., 2018) of documentation from LEED, BREEAM, EDGE, and GBCN. This allows for the extraction and comparison of material criteria, paying special attention to elements like emissions, sourcing, life cycle assessment, and recyclability. Two building case studies have also been chosen for further examination. The John Randle Centre for Yoruba Culture & History in Lagos State, Nigeria, and the Heritage Place in Lagos State, Nigeria, are two examples of case studies. Being the country's first LEED-certified structure, the heritage place provides important insights into how LEED criteria are really applied in Nigeria, given that it incorporates sustainable characteristics, including eco-friendly materials and energy-efficient systems. On the other hand, the John Randle Centre for Yoruba Culture & History in Lagos emphasizes the use of regional building materials and methods while fusing traditional Yoruba architectural features with contemporary ecological design. It is a relevant case for this study because of its emphasis on environmental concerns as well as cultural sustainability. These case studies were chosen to offer a range of viewpoints on how green construction requirements are being applied in the area.

➢ *Data Collection and Analysis*

Data collection involves a thorough review of certification documents, architectural plans, and sustainability reports related to the selected buildings. While thematic analysis (Clarke & Braun, 2017) is employed to analyze the collected data, involving:

- *Coding:*

Systematic coding of textual data to identify recurring themes and patterns related to material criteria and their applicability in Nigeria.

- *Theme Development:*

Grouping codes into themes that reflect the challenges and opportunities associated with aligning international certification standards with local practices.

- *Interpretation:*

Contextualizing the themes within the broader discourse on sustainable building practices in Nigeria and drawing comparisons between the case studies and certification standards.

This analytical approach facilitates a comprehensive understanding of the material criteria's effectiveness and relevance in South-West Nigeria.

IV. FINDINGS AND DISCUSSION

➢ *Current Material Criteria in Certification Systems Applied in South West Nigeria*

Green building certification systems applied in South-West Nigeria—principally LEED, EDGE, and emerging GBCN protocols—share a common emphasis on four core material criteria: recyclability, life-cycle (embodied-carbon) assessment, responsible sourcing, and supply-chain transparency (Ebekozien et al., 2022; Saleh et al., 2024; Emmanuel, 2024). In practice, LEED's Materials & Resources (M&R) category requires projects to pursue credits

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for Building-Product Disclosure and Optimization, Environmental Product Declarations (EPDs), and optimized LCA to minimize embodied carbon (U.S. Green Building Council, 2023). However, EDGE simplifies this by mandating at least a 20 percent reduction in embodied carbon compared to local baselines, thereby lowering the technical barrier to entry for developers (Green Business Certification Inc., 2025). Meanwhile, GBCN standard aspires to localize these benchmarks by incorporating indigenous materials—such as laterite, bamboo composites, and palm-kernel shell aggregates—into its material credits, while aligning sourcing requirements with domestic supply-chain realities (Green Building Council Nigeria, n.d.).

Despite these shared pillars, the interpretation and application of material criteria vary. For instance, while LEED projects in Nigeria often rely on international EPDs and proxy datasets for LCA, given the absence of local inventory data, EDGE-certified developments demonstrate embodied-carbon reductions using the IFC's global materials database, which similarly lacks region-specific entries (Unegbua, 2024). GBCN's framework, still under development, proposes a hybrid approach: projects use simplified LCA templates for indigenous materials, supplemented by performance testing, to claim credits for low-impact local resources (Adegbile, 2012). Comparative studies suggest that while LEED and EDGE criteria provide robust global benchmarks, GBCN's localized adjustments are critical for relevance and uptake in the Nigerian context (Olawumi & Chan, 2023).

- *Application Challenges of Certification Systems in South West Nigeria*

Implementing these material criteria faces technical, economic, and cultural hurdles. Technically, the scarcity of local LCA databases forces practitioners to adopt proxy data or omit embodied carbon calculations altogether, undermining the rigor of material credits (Mushi, Nguluma & Kihila, 2022). The complexity of documentation—particularly for LEED's product disclosure and responsible sourcing credits—demands specialized expertise, which many local firms lack. Similarly, EDGE's requirement for baseline comparisons presupposes reliable regional data that is often unavailable.

Economically, certification fees and associated compliance costs are prohibitive for the small to medium scale projects that dominate the region. LEED registration and certification for a typical mid rise office building can exceed USD 7,000, excluding consulting and modeling fees, representing a significant portion of project budgets (U.S. Green Building Council, 2024). EDGE fees are lower but still represent an additional expense that many developers view as non essential. While GBCN aims to introduce tiered fee structures, current projects seeking international certification must absorb full costs.

Culturally, the Western aesthetic bias embedded in many rating systems—favoring high performance glazing, sleek metal façades, and advanced HVAC systems—can conflict with vernacular traditions that emphasize passive cooling, thick masonry, and locally crafted finishes. Practitioners report that clients often perceive green certification as a "foreign" concept misaligned with local identity (Adewolu, 2024). Without adaptation—such as crediting courtyard shading effectiveness or local craftsmanship—uptake will remain limited (Karamoozian & Zhang, 2025).

- *Insights from Case Studies*

- *Heritage Place, Lagos*

Plate 1: Heritage Place, Lagos (Omidire, 2015)

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- *Overview & Certification*

First LEED certified building in Nigeria, achieving LEED BD+C: Core & Shell v3 (2009) in February 2018, for a 14 story, ~15,736 m² office development on Alfred Rewane (Kingsway) Road, Ikoyi (Omidire, 2015).

Developed and completed by Actis in Q1 2016, designed by Capita Symonds/ECAD, with 350 parking bays and 91 percent occupancy as of 2020 (Omidire, 2015).

- *Sustainable Materials & M&R Credits*

✓ Energy and Water:

30–40 percent reduction in energy use versus a baseline; rainwater harvesting system collects rooftop runoff for irrigation and WCs; passive solar shading on façades (Actis, n.d.).

✓ Materials:

Life cycle assessment (LCA): Conducted an LCA to optimize embodied carbon and informed selection of lower impact concrete mixes.

Building product disclosure & optimization: Disclosure of material ingredients and supply chain transparency. Responsible sourcing: FSC certified wood for millwork and regionally sourced aggregates.

Recycled content & regional materials: Use of recycled steel and concrete with supplementary cementitious materials, and local stone finishes.

Transparency: Material ingredient reporting to achieve LEED M&R credits (up to 16 points) ((Actis, n.d.).

As Nigeria's first LEED certified building (LEED BD+C: Core & Shell v3), Heritage Place in Ikoyi demonstrates both the potential and the constraints of applying global material criteria in South West Nigeria. The project achieved multiple M&R credits by conducting an LCA to optimize concrete mixes, specifying FSC certified wood millwork, incorporating recycled content steel, and sourcing regionally quarried stone finishes (Heritage Place Ikoyi, n.d.). These efforts reduced embodied carbon by an estimated 15 percent compared to conventional design, while bolstering nascent local supply chains (Faremi et al., 2021).

However, the team faced significant data and supply challenges as no local EPDs existed for concrete or steel, necessitating reliance on international databases; FSC certified timber had to be imported at premium cost; additionally, high upfront cost of certification (registration, energy modeling, commissioning) and scarcity of local LCA data required proxies and international data sets (Heritage Place Ikoyi, n.d.). Despite these hurdles, Heritage Place showcases how foreign rating systems can be applied in Nigeria when paired with strategic sourcing and clear stakeholder engagement.

➢ *John Randle Centre for Yoruba Culture & History, Lagos*

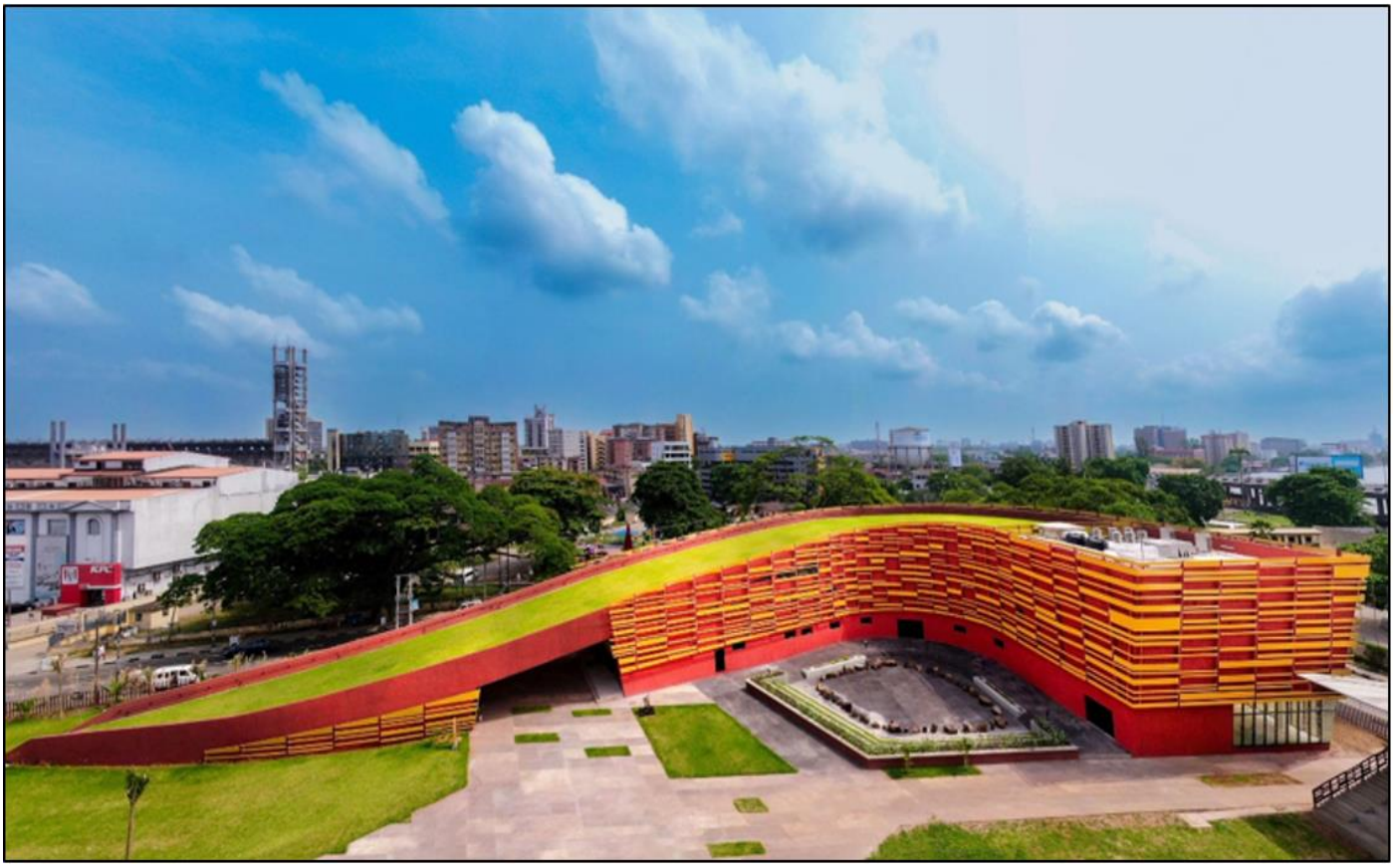

Plate 2 John Randle Centre for Yoruba Culture & History, Lagos (Fazzare, 2023)

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➢ *Overview & Cultural Integration*

- Adaptive reuse & regeneration of the 1928 John Randle public pool and 1950s J.K. Randle Memorial Hall into a 9,000 m² cultural complex, officially unveiled January 2023 and opening to the public in 2024 (Fazzare, 2023).
- Designed by Lagos based firm SI.SA (Seun Oduwole, principal), it forms part of a new "cultural corridor" adjacent to the National Museum and Centre for Black and African Arts and Civilization (The Guardian, 2024).

➢ *Material Strategies & Vernacular References*

- Dyed Tyrolean cement façades echo ancient mudbrick walls, using earth pigmented renders to reduce finish layers and transport emissions.
- Golden metal slats (fractal, powder coated steel screens) reference Yoruba weaving and provide solar shading, reducing cooling loads.
- Concrete tinted to match local laterite hues and ring shaped plan drawn from traditional Yoruba city layouts to foster natural ventilation and communal gathering.
- Green roofed gallery: A sloped, vegetated roof over the exhibition wing, offering thermal insulation, stormwater retention, and public amenity space.

Although not LEED-certified, John Randle Centre embodies many M&R principles—local sourcing, reduced embodied carbon, lifecycle thinking—within a cultural sustainability framework (Obinna, 2023). The Centre exemplifies a cultural-first approach to sustainable materials. The design team prioritized locally available earth-pigmented Tyrolean renders, which echo traditional mudbrick walls while reducing finish layers and transport emissions (Fazzare, 2023). Powder-coated steel screens, inspired by Yoruba weaving patterns, provide passive solar shading and require minimal maintenance. The gallery's green roof delivers thermal insulation and stormwater management, and tinted concrete walls—matched to local laterite hues—minimize embodied-carbon intensity by reducing reliance on imported pigments (Fazzare, 2023).

This project highlights the value of vernacular performance metrics—such as courtyard ventilation effectiveness and material culture resonance—that fall outside standard certification frameworks (Greenroofs, 2025; Fazzare, 2023). By integrating cultural narratives and indigenous materials, the Centre achieved net-positive social and environmental outcomes without incurring high certification costs. Its success suggests that hybrid certification models, which blend formal credits with contextual performance indicators, could better capture the holistic sustainability of such culturally embedded projects (Afrigather, 2024). Other similar projects include:

➢ *Kingsway Tower, VI, Lagos.*

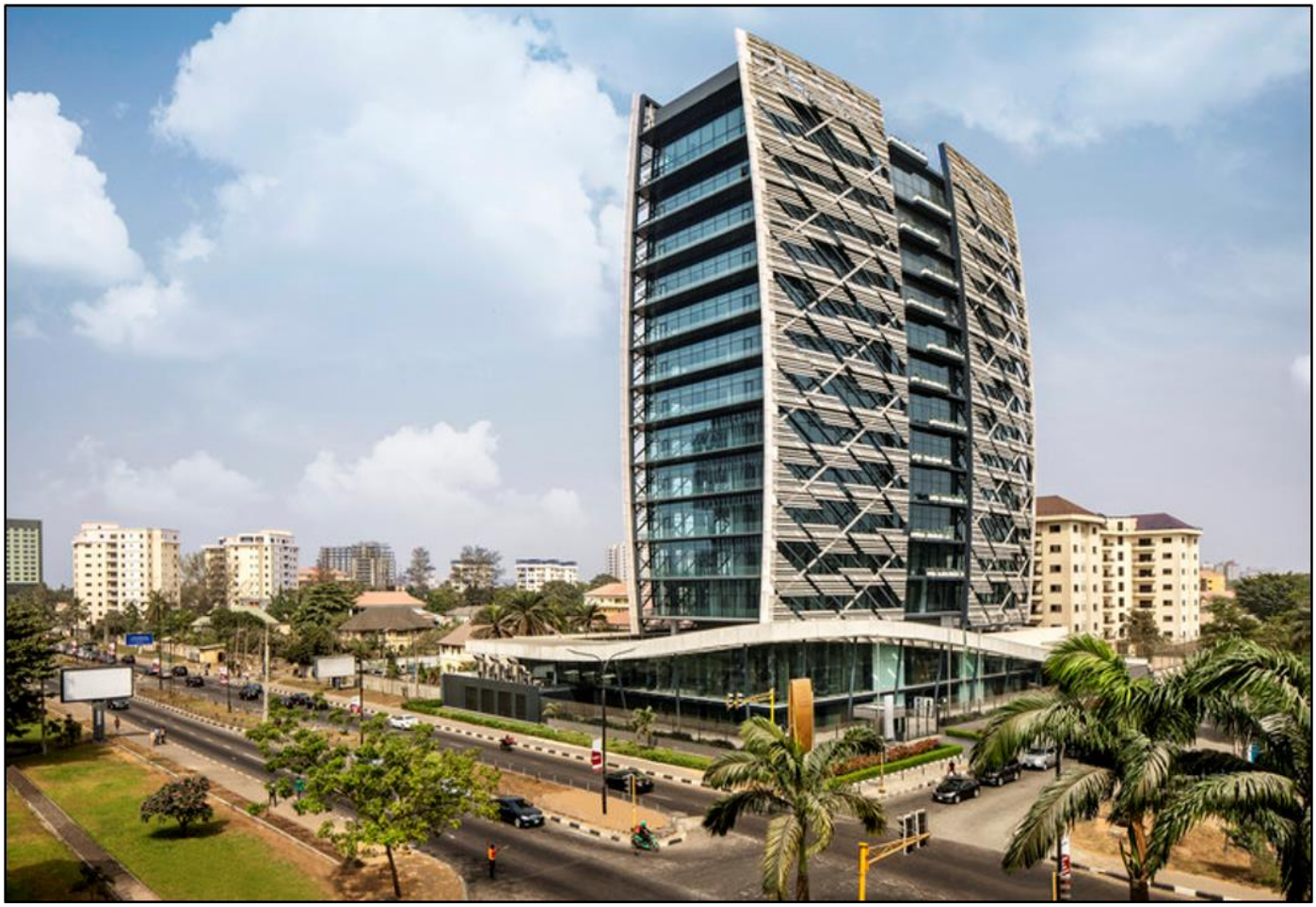

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Plate 3: Kingsway Tower, Victoria Island Lagos

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➢ *The Nestoil Tower*

The Nestoil Tower is one of the developments in Nigeria to attain the Leadership in Energy and Environmental Design (LEED) certifications.

The fifteen-story structure located in the highbrow Akin Adesola Street, Victoria Island, Lagos and consists of 12, 200 m2 commercial space, and a helipad.

➢ *Comparative Metrics*

Table 1 Comparative Metrics of Heritage Place and the John Randle Centre for Yoruba Culture & History

Criterion	**LEED v4.1 M&R (up to 16 pts)**	**BREEAM v6 Materials (up to 15 pts)**	**EDGE (≥ 20 % embodied-energy reduction)**	**GBCN (Local) (indigenous materials, vernacularity)**
Whole-building LCA	HP: ✓ (4 pts)	HP: ✓ (EPD/EP profiles)	HP: ✓ (≥ 20 % via mix optimization)	– (no formal LCA protocol yet)
	JR: ✗	JR: ✗	JR: ✗	
EPDs & Product Disclosure	HP: ✓ (2 pts)	HP: ✓ (EPDs accepted)	–	–
	JR: ✗	JR: ✗		
Responsible Sourcing	HP: ✓ (2 pts, FSC wood)	HP: ✓ (BES 6001 via FSC)	–	HP: ◐ (local aggregates only)
	JR: ◐ (local, uncertified)	JR: ✗		JR: ✓ (use of laterite, bamboo, timber)
Material-ingredient Reporting	HP: ✓ (2 pts)	HP: ✓ (requires supply-chain transparency)	–	–
	JR: ✗	JR: ✗		
Recycled Content	HP: ✓ (2 pts)	HP: ✓ (credit for recycled steel, SCMs)	–	–
	JR: ✗	JR: ✗		
Regional/Indigenous Materials	HP: ✓ (2 pts)	HP: ✓ (regionally sourced stone)	–	HP: ◐ (partial)
	JR: ✓	JR: ✓ (local laterite, bamboo)		JR: ✓ (core of GBCN vision)
Certified Wood	HP: ✓ (1 pt, FSC)	HP: ✓ (wood credit via FSC)	–	–
	JR: ✗	JR: ✗		
Durability & Adaptability	HP: ✓ (general spec)	HP: ✓ (credit for durability)	–	
				JR: ✓

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Criterion	LEED v4.1 M&R (up to 16 pts)	BREEAM v6 Materials (up to 15 pts)	EDGE (≥ 20 % embodied-energy reduction)	GBCN (Local) (indigenous materials, vernacularity)
	JR: ✓ (Tyrolean cement, metal)	JR: ✓ (durable finishes)		(vernacular resilience)
Embodied-carbon reduction	HP: ✓ (via LCA)	HP: ✓ (LCA results)	HP: ✓ (assumed)	–
	JR: ✗	JR: ✗	JR: ✗	

HP = Heritage Place; JR = John Randle Centre

✓ = fully meets; ◐ = partially meets; ✗ = does not meet or undocumented

"–" indicates the criterion is not explicitly addressed in that system

The comparative alignment of Heritage Place and the John Randle Centre for Yoruba Culture & History highlights where each project meets, partially meets, or diverges from the core material criteria.

Heritage Place, as Nigeria's first LEED certified building, aligns strongly with LEED and BREEAM material credits—having executed a full building LCA, disclosed product data, sourced FSC certified wood, specified high recycled content, and used regional aggregates. These actions likely exceed the EDGE threshold for embodied energy reduction. However, Heritage Place only partially fulfills the emerging GBCN emphasis on indigenous materials and vernacular strategies, since its material palette remains largely conventional despite regional sourcing.

By contrast, the John Randle Centre excels in contextual sustainability: it foregrounds locally abundant laterite, bamboo composites, palm kernel shell aggregates, and vernacular design forms to achieve thermal comfort and cultural resonance. Yet it lacks the formal LCA studies, third party EPDs, and documented recycled content or certified wood sourcing that underpin international certification credits. As a result, it diverges from LEED, BREEAM, and EDGE benchmarks despite delivering low embodied carbon in practice, and perfectly embodies the GBCN vision of a truly localized green standard.

➢ *Opportunities for Improvement*

Drawing on these findings, several context sensitive enhancements to material criteria emerge:

- Develop Local LCA Databases: Establishing a national inventory of embodied carbon data for indigenous materials (laterite, bamboo, palm kernel shell) would enable accurate cradle to gate assessments and reduce reliance on proxies (Adegbile, 2012).
- Simplify Documentation Protocols: Introducing streamlined LCA templates and batch certifications for common material assemblies can lower technical barriers. GBCN's proposed simplified protocols—requiring only key parameters such as material density, transport distance, and energy intensity—offer a promising model (Karamoozian & Zhang, 2025).
- Tiered Fee Structures: Scaling certification fees to project size and local economic capacity—alongside subsidized or pro bono certification for pilot projects—would broaden participation. International bodies should consider fee waivers for a region's first certified building, as demonstrated by USGBC's LEED Earth initiative (Ohueri, 2022).
- Integrate Vernacular Performance Metrics: Expanding material credits to include cultural sustainability—such as local craftsmanship, passive cooling strategies, and material culture narratives—would align certification more closely with regional identity and performance realities (Oladoja & Ogunmakinde, 2021).
- Capacity Building and Policy Incentives: Government incentives—tax breaks, fast track approvals, or grants—for projects using certified indigenous materials would stimulate market development (Karamoozian & Zhang, 2025).

By implementing these improvements, green building certification systems can become more rigorous, relevant, and inclusive—advancing both environmental performance and socio economic development in South West Nigeria.

V. CONCLUSION & RECOMMENDATIONS

➢ *Summary of Findings*

The study reveals that while green building certification systems like LEED, BREEAM, EDGE, and the emerging GBCN framework share core material criteria—such as recyclability, life cycle assessment, responsible sourcing, and transparency—their application in South West Nigeria faces several challenges. The absence of local LCA databases, high certification costs, and the misalignment of international standards with local materials and cultural preferences hinder the widespread adoption of these systems. Case studies of Heritage Place and the John Randle Centre highlight the potential for integrating indigenous materials and vernacular design strategies to achieve sustainable outcomes, albeit through different pathways.

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➢ *Conclusion*

As a result of these findings, it is clear that green building certification methods in South West Nigeria require modifications that are tailored to the region. There are data gaps, economic hurdles, and cultural misalignments that hinder the efficacy of international frameworks, despite the fact that some of these frameworks provide very strong benchmarks. The success of projects like the John Randle Centre demonstrates that integrating local materials and cultural sustainability can achieve significant environmental and social benefits without the high costs of formal certification. Therefore, in order to advance green construction practices in the region, it is vital to take a hybrid strategy that combines international standards with local expertise and practices.

➢ *Recommendations*

Based on the findings of the study, the following are recommended:

- Co-develop with certification bodies and local stakeholders a localized materials selection framework incorporating indigenous materials and vernacular performance metrics.
- Establish a regional materials database and simplified LCA protocol for South-West Nigerian materials to align certification criteria with local supply-chain realities.
- Implement tiered certification fee structures and streamlined documentation processes to reduce economic and technical barriers to uptake.

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