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Sustainable Construction and Language Mediation in Advancing Environmental Sustainability in Developing Nations

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ABSTRACT **Review Article**

Sustainable construction has emerged as a critical pathway for addressing environmental degradation in developing nations experiencing rapid urbanisation, housing deficits, and resource constraints. This paper presents a narrative integrative review and conceptual synthesis of sustainable construction practices and language mediation as complementary drivers of environmental sustainability. Drawing exclusively on a literature-based review of 45 peer-reviewed journal articles published between 2013 and 2025, the study synthesises scholarship from architecture, construction studies, linguistics, and environmental communication. The review examines low-carbon construction materials, climate-responsive design strategies, and language-based processes, such as framing, discourse, and multimodal communication, that shape public perception, policy legitimacy, and social acceptance. The synthesis reveals that while eco-friendly materials such as stabilised earth blocks, bamboo, and agro-waste composites offer substantial environmental and economic benefits, their adoption is strongly mediated by linguistic framing and communicative practices. The paper contributes conceptually by demonstrating that sustainable construction operates as a socio-technical process in which technical performance and language mediation are mutually reinforcing. By positioning architects and linguists as collaborative agents, the study advances an interdisciplinary framework for promoting environmentally sustainable and socially accepted development in developing nations.

Keywords: Sustainable construction, Language mediation, Environmental sustainability, Green architecture, Developing nations.

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Introduction

Environmental sustainability has emerged as one of the most pressing global challenges of the twenty-first century, particularly in developing nations experiencing rapid urbanisation, population growth, and increasing pressure on natural resources (UNEP, 2022; Lin & Agyeman, 2020). The construction sector is a major contributor to environmental degradation through high energy consumption, material extraction, and greenhouse gas emissions, making it a critical focus area for climate change mitigation and sustainable development strategies (Andrew, 2019; Huang et al., 2018).

In response, sustainable construction has gained prominence as a pathway for reducing environmental impacts while addressing housing and infrastructure deficits in developing economies. Sustainable construction emphasises the use of low-carbon materials, climate-responsive design strategies, and resource-efficient technologies aimed at improving environmental performance across the building life cycle (Adegun & Adedeji, 2017; Akande et al., 2021). Materials such as stabilised earth blocks, bamboo, and agro-waste composites have been widely discussed in the literature for their potential to reduce embodied energy, enhance thermal performance, and support local economies (Sharma et al., 2015; Yadav et al., 2018; Nduka et al., 2020).

However, evidence suggests that the adoption of sustainable construction practices is influenced not only by technical

feasibility but also by social acceptance, institutional legitimacy, and public understanding (Amuda-Yusuf et al., 2020). In this regard, language and communication play a critical role in shaping how sustainability concepts are framed, interpreted, and acted upon by diverse stakeholders. Linguistic framing, discourse practices, and multimodal communication influence perceptions of affordability, relevance, and trust, thereby mediating the translation of technical knowledge into socially accepted practice (Fairclough, 2013; Lakoff, 2014; Kuchler, 2017). This underscores the growing relevance of language mediation in sustainability transitions, particularly within culturally and linguistically diverse developing contexts.

Despite the expanding body of scholarship on sustainable construction and environmental sustainability, existing studies predominantly examine technical solutions, such as materials, design strategies, and performance metrics, largely in isolation from communication and language processes (Adegun & Adedeji, 2017; Andrew, 2019). Conversely, research within linguistics and environmental communication has focused on discourse, framing, and public engagement with sustainability issues, often without direct engagement with construction technologies or material practices (Fairclough, 2013; Lakoff, 2014).

As a result, there remains a limited integrative understanding of how sustainable construction practices and language mediation interact to shape environmental sustainability outcomes in developing nations. The absence of an interdisciplinary synthesis that bridges technical performance and communicative processes constrains both policy effectiveness and practical implementation. Addressing this gap is essential for advancing sustainability as a socio-technical process rather than a purely technical intervention.

This study aims to synthesise existing literature on sustainable construction and language mediation in order to develop an integrative conceptual understanding of their combined role in promoting environmental sustainability in developing nations.

The specific objectives of the study are to:

i. Examine sustainable construction practices, with particular emphasis on eco-friendly materials and climate-responsive design strategies in developing countries.

ii. Analyse the role of language mediation, including framing, discourse, and communication, in shaping perceptions, acceptance, and policy legitimacy of sustainable construction.

iii. Develop an integrative conceptual framework that explains how sustainable construction practices and language mediation interact to influence environmental sustainability outcomes.

Methodology

This study adopts a structured qualitative review approach to examine the intersection of sustainable construction practices and language mediation in promoting environmental sustainability in developing nations. The methodological choices were guided by the interdisciplinary nature of the study and its focus on conceptual integration rather than empirical measurement.

Research Design

A narrative review design was adopted for this study rather than a systematic review. This choice was informed by the interdisciplinary scope of the research, which draws on literature from architecture, construction studies, linguistics, and environmental communication. Unlike systematic reviews that prioritise narrowly defined questions and homogeneous datasets, a narrative review allows for conceptual flexibility and interpretive synthesis across diverse disciplinary traditions (Green et al., 2006; Baumeister & Leary, 1997).

The primary objective of this study is conceptual synthesis rather than empirical aggregation. The reviewed literature spans qualitative, theoretical, and applied studies that vary in methodology, context, and analytical focus. A narrative approach, therefore, provides an appropriate framework for integrating heterogeneous sources, identifying thematic linkages, and developing an interdisciplinary conceptual framework that captures the socio-technical dimensions of environmental sustainability.

Sources of Literature and Selection Criteria

The literature reviewed in this study was sourced from established academic databases, including Scopus, Web of Science, Google Scholar, ScienceDirect, and JSTOR. These databases were selected to ensure broad disciplinary coverage across the built environment, environmental studies, and language-based research.

Key search terms included combinations of *sustainable construction*, *eco-friendly materials*, *green architecture*, *low-carbon materials*, *environmental sustainability*, *language mediation*, *environmental communication*, *discourse*, and *framing*. Boolean operators were used to refine search results and ensure relevance.

The initial search yielded a wide pool of publications. These were screened based on relevance to the study's focus, publication in peer-reviewed journals, and alignment with the thematic scope of sustainable construction and communication processes in developing contexts. Following this screening process, a total of 45 peer-reviewed journal articles published between 2013 and 2025 were selected for detailed review and synthesis.

Data Analysis and Synthesis

The selected studies were analysed thematically using an interpretive synthesis approach. Themes related to sustainable construction practices, including low-carbon materials and climate-responsive design, were examined alongside themes related to language mediation, such as framing, discourse, and multimodal communication. This process enabled the identification of converging and diverging insights across disciplines and informed the development of the conceptual framework presented in Figure 1.

Analytical Framework

The analysis was guided by a socio-technical perspective that recognises environmental sustainability as an outcome of both technical innovation and social mediation. Sustainable construction practices were examined as technical interventions, while language mediation was analysed as a social process shaping perception, acceptance, and institutional legitimacy. This framework facilitated an integrated interpretation of findings across architectural and linguistic domains.

Contextual Focus

The review places particular emphasis on Sub-Saharan Africa and parts of Asia, regions characterised by rapid urbanisation, housing deficits, and heightened vulnerability to climate change. These contexts are also marked by linguistic diversity, institutional constraints, and socio-economic inequalities that influence sustainability transitions.

While the analysis is grounded in these regions, the findings are not presented as universally generalisable. Rather, they are context-specific, offering analytically transferable insights that may inform sustainability discourse and practice in other developing contexts with similar socio-economic and environmental conditions.

Methodological Limitations

This study is entirely literature-based and does not involve the collection of primary empirical data. As such, the findings reflect interpretations and syntheses of existing scholarship rather than direct empirical validation. This limitation may constrain the ability to draw context-specific causal inferences.

However, the study's strength lies in its integrative perspective, which brings together fragmented bodies of literature to generate conceptual insights. Future research could build on this foundation through empirical investigations, including case studies, surveys, or mixed-methods approaches, to validate and extend the proposed conceptual framework.

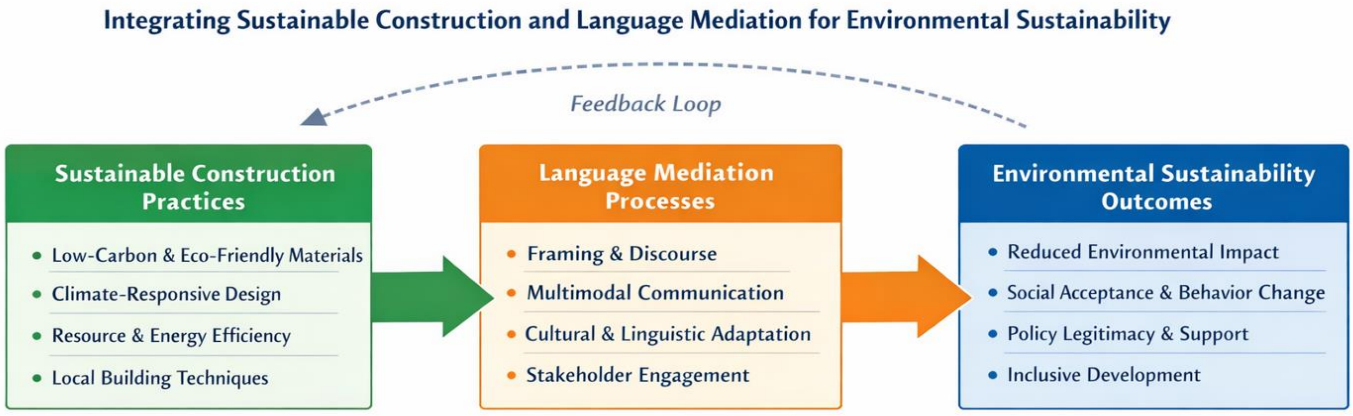

Figure 1. Integrating Sustainable Construction and Language Mediation for Environmental Sustainability

Sustainable Construction Practices

Sustainable construction practices constitute the technical performance layer of the conceptual framework presented in Figure 1. In developing nations, the construction sector significantly contributes to environmental degradation through high material consumption, energy use, and carbon emissions (Andrew, 2019; UNEP, 2022). Improving technical performance in construction is therefore central to achieving environmental sustainability, particularly in contexts characterised by rapid urbanisation and infrastructure deficits.

This section synthesises literature on sustainable construction practices with emphasis on material performance, design efficiency, and resource optimisation. The discussion is deliberately confined to technical dimensions in order to avoid overlap with the communicative and integrative analyses developed in Sections 4 and 5.

Low-Carbon and Eco-Friendly Construction Materials

A major focus of sustainable construction research is the transition from carbon-intensive materials to low-carbon and eco-friendly alternatives. Conventional materials such as cement and steel are widely documented as major sources of embodied energy and greenhouse gas emissions, especially in developing economies with energy-inefficient production systems (Andrew, 2019; Ahmed et al., 2020). Reducing dependence on these materials is therefore a key technical strategy for environmental sustainability.

Studies highlight stabilised earth blocks, bamboo, and agro-waste-based composites as viable alternatives that combine environmental benefits with affordability and local availability (Adegun & Adedeji, 2017; Sharma et al., 2015; Yadav et al., 2018). Stabilised earth construction reduces cement usage while enhancing thermal performance, making it suitable for hot climatic conditions common in developing regions (Nduka et al., 2020). Bamboo offers high tensile strength and rapid renewability, while agro-waste composites support waste reduction and circular material flows (Akande et al., 2021). Within Figure 1, these materials directly contribute to improved technical performance through lower embodied carbon and enhanced environmental efficiency.

Climate-Responsive and Energy-Efficient Design

Beyond material selection, sustainable construction performance is strongly influenced by climate-responsive design strategies. Passive design approaches, such as natural ventilation, optimal building orientation, shading, and thermal mass utilisation, reduce reliance on mechanical systems and improve indoor environmental quality (Adegun & Adedeji, 2017; Maina et al., 2020). These strategies are particularly relevant in developing nations where energy supply is often unreliable and operational costs are high.

Empirical studies demonstrate that energy-efficient design contributes to long-term reductions in operational energy demand while improving occupant comfort and building performance (Akande et al., 2021). As represented in Figure 1, such strategies extend sustainability benefits beyond the construction phase, reinforcing technical performance across the building life cycle.

Resource Efficiency and Localised Construction Practices

Sustainable construction practices also emphasise efficient resource use and the incorporation of locally available materials and labour. Local sourcing reduces transportation-related emissions and supports local economies, thereby strengthening the environmental and economic dimensions of sustainability (Lin & Agyeman, 2020). Resource-efficient construction methods further minimise waste generation and material loss during building processes.

However, the literature identifies persistent technical challenges, including limited material standardisation, performance variability, and weak regulatory support for alternative materials (Amuda-Yusuf et al., 2020). Within the conceptual framework (Figure 1), these challenges constrain the full realisation of technical performance and highlight the need for complementary processes, addressed in subsequent sections, to support wider adoption.

Language Mediation and Environmental Sustainability

Building on the analysis of sustainable construction practices in Section 3, Figure 1 illustrates that technical performance alone does not guarantee environmental sustainability outcomes. Rather, the environmental and economic benefits generated by sustainable construction are mediated through language, discourse, and communication processes that shape how these practices are understood, interpreted, and accepted. Language mediation, therefore, constitutes the social–communicative layer of the conceptual framework, translating technical possibilities into socially meaningful and actionable practices.

The literature on environmental sustainability increasingly recognises that transitions in the built environment are socio-technical in nature, involving not only material innovation but also shifts in meaning, perception, and behaviour (Fairclough, 2013; Lakoff, 2014). In developing nations characterised by linguistic diversity, cultural plurality, and institutional constraints, effective communication plays a decisive role in legitimising sustainable construction and fostering long-term adoption.

Framing and the Construction of Meaning

Language frames how environmental sustainability is perceived and evaluated. The way sustainable construction is described influences whether it is viewed as desirable, attainable, or relevant by policymakers, professionals, and communities (Lakoff, 2014; Flusberg & Thibodeau, 2023). In many developing contexts, sustainability discourse relies heavily on technical or bureaucratic language that limits engagement among non-expert stakeholders.

When sustainability is framed as abstract, externally imposed, or technologically complex, public resistance and scepticism tend to increase, particularly in socio-economically vulnerable settings (Lin & Agyeman, 2020). In contrast, framing sustainable construction in relation to everyday concerns—such as affordability, thermal comfort, health, and resilience—enhances relevance and social legitimacy, thereby improving acceptance and participation.

Discourse, Trust, and Institutional Legitimacy

Beyond framing, broader discourse patterns influence trust in sustainability initiatives. Discourses that emphasise compliance, regulation, or expert authority without meaningful engagement can reinforce perceptions of exclusion and mistrust (Fairclough, 2013). Conversely, inclusive and participatory discourse supports transparency and institutional legitimacy.

In the context of sustainable construction, discourse shapes how policies, standards, and material innovations are perceived by practitioners and users. Clear, consistent, and context-sensitive communication strengthens confidence in alternative materials and design approaches, supporting their diffusion within the built environment.

Multimodal and Participatory Communication

Effective language mediation extends beyond verbal communication to include visual, spatial, and experiential modes of engagement. Demonstration projects, diagrams,

prototypes, and on-site interactions allow stakeholders to experience the performance of sustainable construction practices directly, reducing uncertainty and resistance (Kress, 2010).

Participatory communication strategies further enhance understanding by involving communities in dialogue rather than one-way information transfer. In developing nations, where oral traditions and local languages play a significant role in knowledge exchange, multimodal and participatory approaches are particularly effective in translating sustainability concepts into lived experience.

Linking Language Mediation to Sustainability Outcomes

As represented in Figure 1, language mediation functions as the bridge between technical performance and environmental sustainability outcomes. By shaping meaning, trust, and legitimacy, communicative processes influence behavioural change, policy support, and long-term adoption of sustainable construction practices. This mediating role underscores the necessity of integrating linguistic considerations into sustainability strategies for the built environment.

Integration of Sustainable Construction and Language Mediation

Sustainable construction and language mediation operate most effectively when understood as interdependent components of a socio-technical system, rather than as parallel or sequential processes. As illustrated in Figure 1, environmental sustainability outcomes emerge from the interaction between technical performance and communicative mediation. This section synthesises insights from Sections 3 and 4 to explain how material innovation and language-based processes jointly shape sustainability transitions in developing nations.

Translating Technical Performance into Social Meaning

Technical innovations in sustainable construction generate environmental and economic potential but do not, on their own, ensure acceptance or long-term adoption. Materials such as stabilised earth blocks, bamboo, and agro-waste composites demonstrate strong performance characteristics, including reduced embodied carbon and improved thermal efficiency (Adegun & Adedeji, 2017; Sharma et al., 2015; Akande et al., 2021). However, their effectiveness depends on how these attributes are interpreted and valued by users, institutions, and policymakers.

Language mediation translates technical performance into social meaning by framing sustainability in terms that resonate with lived experience. When environmental benefits are communicated through narratives of comfort, affordability, and resilience, sustainable construction becomes relatable and legitimate rather than abstract or experimental (Lakoff, 2014; Lin & Agyeman, 2020). This translation process transforms technical potential into socially actionable knowledge.

Co-Production of Acceptance and Legitimacy

Socio-technical integration involves the co-production of acceptance and legitimacy through ongoing interaction between technical systems and social communication. Discourse surrounding sustainable construction influences trust in materials, confidence in regulatory frameworks, and willingness to adopt alternative practices (Fairclough, 2013). At the same time, material performance and visible outcomes reinforce or challenge these discursive constructions.

This reciprocal relationship highlights that neither technical excellence nor effective communication alone is sufficient. Instead, sustainability outcomes depend on iterative feedback between construction practice and language mediation, as reflected in the feedback loop within Figure 1.

Institutional and Policy Integration

At the institutional level, integration shapes how sustainability policies are interpreted and implemented. Regulatory frameworks that recognise alternative materials but rely on technical or exclusionary language often struggle to gain broad compliance (Amuda-Yusuf et al., 2020). Conversely, policies that combine performance-based standards with inclusive and accessible communication foster greater understanding and adoption.

Interdisciplinary collaboration among architects, linguists, planners, and policymakers strengthens this integration by ensuring that technical guidelines are supported by communication strategies that build trust and clarity. Such collaboration aligns institutional objectives with social realities, enhancing the effectiveness of sustainability interventions.

Dynamic Integration and Sustainability Outcomes

Socio-technical integration is not static but dynamic, evolving through practice, feedback, and learning. As sustainable construction practices are implemented and experienced, communicative narratives adapt to reflect observed performance and user experience. These evolving narratives, in turn, influence future design decisions, material choices, and policy development.

As conceptualised in Figure 1, this dynamic integration underpins environmentally sustainable outcomes that are not only technically sound but also socially accepted and culturally grounded. Recognising this interdependence is essential for advancing sustainable development in the built environment of developing nations.

Discussion

This section interprets the findings of the review through a critical and integrative lens, drawing attention to

convergences, tensions, and unresolved issues within the literature on sustainable construction and language mediation. Rather than restating descriptive findings, the discussion evaluates how technical and communicative dimensions interact in practice and where gaps persist.

Sustainable Construction Beyond Technical Determinism

The literature consistently affirms the environmental and economic benefits of sustainable construction practices, particularly low-carbon materials and climate-responsive design strategies (Adegun & Adedeji, 2017; Akande et al., 2021). However, a critical tension emerges between demonstrated technical performance and actual adoption rates in developing nations. While many studies present alternative materials as technically viable, fewer address the institutional, cultural, and communicative barriers that limit their diffusion.

This divergence suggests that technical determinism—assuming that performance advantages alone will drive adoption—remains implicit in parts of the literature. Studies that foreground material efficiency without engaging social context risk overestimating the transformative potential of technical innovation. This limitation reinforces the need to situate sustainable construction within broader socio-technical systems.

Language Mediation as an Enabler and Constraint

Research on language mediation highlights the power of framing, discourse, and narrative in shaping environmental understanding and behaviour (Fairclough, 2013; Lakoff, 2014). Yet, the literature presents mixed evidence regarding its practical impact. While some studies demonstrate that inclusive and culturally grounded communication enhances acceptance, others reveal persistent scepticism even when communication strategies are deployed.

This contradiction reflects variability in institutional trust, literacy levels, and cultural interpretation across contexts. In some cases, language mediation is treated as a supplementary tool rather than as an integral component of sustainability strategies. As a result, its transformative capacity is unevenly realised, underscoring the importance of integrating communication processes more deeply into sustainability planning.

Socio-Technical Integration: Opportunities and Gaps

Studies that adopt socio-technical perspectives provide stronger explanatory power by recognising the interdependence of material systems and social processes (Lin & Agyeman, 2020). However, such integrative approaches remain relatively limited in the literature. Many studies continue to privilege either technical or communicative dimensions, resulting in fragmented insights.

This gap points to an unresolved challenge: while integration is widely acknowledged in theory, it is less consistently operationalised in research and practice. The conceptual framework proposed in this study responds to this limitation by offering a structured lens through which sustainable construction and language mediation can be analysed as mutually reinforcing rather than parallel domains.

Policy and Institutional Implications

The findings of this review have important implications for policy and institutional practice. Policies promoting sustainable construction often emphasise technical standards and performance metrics but rely on complex or exclusionary language that limits understanding and compliance (Amuda-Yusuf et al., 2020). This disconnect can weaken policy effectiveness, even when regulatory intentions are sound.

Effective sustainability policy should therefore combine performance-based standards with clear, inclusive, and context-sensitive communication. Institutional collaboration among architects, linguists, planners, and policymakers is essential to ensure that sustainability initiatives are both technically robust and socially legitimate. Such alignment can enhance trust, improve implementation, and support long-term sustainability transitions in developing nations.

Contribution to Knowledge and Research Gaps

This study contributes to knowledge by providing an integrative conceptual synthesis of sustainable construction and language mediation, addressing a gap in interdisciplinary sustainability research. It demonstrates that environmental sustainability in the built environment cannot be fully understood through technical analysis alone and highlights the role of communication as a mediating force.

Despite this contribution, gaps remain. Empirical studies that jointly examine material performance and communication processes are limited, particularly in developing contexts. Future research should adopt mixed-methods approaches to test and refine the conceptual relationships proposed in this review.

Synthesis of Discussion (Tightened)

Overall, the discussion reinforces the central argument that environmental sustainability in developing nations emerges from the interaction between sustainable construction practices and effective language mediation. Technical innovation provides the means to reduce environmental impact, while communication shapes how these innovations are understood, legitimised, and sustained. Recognising this interdependence is essential for translating sustainability from concept into socially accepted practice.

Conclusion and Recommendations

This study has presented a narrative integrative review and conceptual synthesis of sustainable construction practices and language mediation as interconnected drivers of

environmental sustainability in developing nations. Drawing exclusively on existing literature, the study has examined how technical innovations in construction interact with communicative processes to influence sustainability outcomes. As a literature-based review, the study does not involve primary empirical data, and its conclusions are therefore interpretive rather than causal.

The key contribution of this study lies in its interdisciplinary conceptual integration. By bridging architectural and linguistic perspectives, the paper advances understanding of sustainable construction as a socio-technical process in which material performance and language mediation are mutually reinforcing. The proposed conceptual framework provides a structured lens for analysing why technically viable sustainable construction solutions often face resistance and how effective communication can enhance acceptance, policy legitimacy, and long-term adoption.

Based on the findings, the study recommends that sustainability initiatives in the built environment explicitly integrate communication strategies alongside technical design and material innovation. Architects, planners, and policymakers should collaborate with linguists and communication specialists to ensure that sustainability narratives are inclusive, context-sensitive, and accessible to diverse stakeholders. Such collaboration can strengthen trust, improve policy implementation, and support environmentally responsible construction practices.

Future research should build on this conceptual foundation through empirical investigation. Mixed-methods studies combining material performance assessment with discourse analysis, community surveys, or case studies would help validate and refine the relationships proposed in this review. Comparative research across regions could further illuminate how socio-cultural and institutional contexts shape the interaction between sustainable construction and language mediation.

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