ENHANCING SUSTAINABLE HOUSING PRACTICES FOR LOW-INCOME COMMUNITIES IN NIGERIA AS A PATHWAY TO ACHIEVE SDG-11

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ABSTRACT

This paper systematically reviews 37 articles on sustainable housing practices for low-income communities in Nigeria, a developing country with a huge housing deficit and poverty rate, to address SDG-11 of making cities and human settlements inclusive, safe, resilient, and sustainable. The paper follows the PRISMA guidelines and covers a period of 14 years (2009–2022). The paper uses descriptive statistics, thematic analysis, and meta-analysis methods to answer the research questions. The results show that sustainable housing practices are influenced by multiple factors, such as environmental, social, economic, cultural, institutional, and technological factors. The paper also identifies the most common and effective practices, such as bioclimatic design, vernacular architecture, passive solar design, renewable energy, energy efficiency, low-carbon materials, water conservation, waste management, community participation, affordability, accessibility, and cultural sensitivity. The paper discusses the benefits, challenges, gaps, and implications of these practices for stakeholders and concludes with recommendations and future research directions.

KEYWORDS: Sustainable Housing Practices; Low-Income Communities; Nigeria; SDG-11; Systematic Review

I.   INTRODUCTION

Housing, an essential human right critical for sustainable development [1][2], faces significant challenges in various developing countries, including Nigeria. Nigeria, Africa's most populous nation with a population of 211 million and a 51% urbanization rate [3], contends with a 40% poverty rate affecting 83 million individuals below the national poverty line [4][5]. Moreover, it grapples with an alarming housing deficit of approximately 22 million units, with an annual demand of 700,000 units, while only 100,000 units are supplied for low-income housing [6][7][8]. Low-income housing in Nigeria is plagued by a myriad of issues, including substandard quality, insufficient infrastructure, environmental degradation, and social marginalization [9][10][11][12][13]. These challenges are exacerbated by rapid urbanization, population growth, climate change, and resource scarcity [14][15][16][17].

Therefore, the urgent need to enhance sustainable housing practices for low-income communities in Nigeria is evident to achieve Sustainable Development Goal (SDG) 11, aiming for inclusive, safe, resilient, and sustainable cities and human settlements. Sustainable housing practices encompass applying sustainable architecture and design principles to create environmentally friendly, socially responsible, and economically viable low-income housing [18]. These practices involve diverse methods such as bioclimatic design, vernacular architecture, passive solar design, renewable energy,

energy efficiency, low-carbon materials, water conservation, waste management, community participation, affordability, accessibility, and cultural sensitivity [19][20][21][22].

This paper's objective is to systematically review sustainable housing practices for low-income communities in Nigeria and similar developing nations, following PRISMA guidelines [23] for a period of 14 years (2009–2022). It employs descriptive statistics, thematic analysis, and meta-analysis to address the following research questions:

  i.   Factors influencing sustainable housing practices for low-income communities in Nigeria.
  ii. Common and effective sustainable housing practices in Nigeria for low-income communities.
  iii. Benefits, challenges, gaps, and implications of these practices for policymakers, practitioners, researchers, and educators.

The paper is established as follows: Section 2 describes the method used for choosing and analysing the articles. Section three offers the effects of the descriptive facts and thematic analysis. Section four reviews the findings of the meta-analysis. Section five discusses the primary insights and implications of the effects. Section 6 concludes with pointers and destiny studies directions.

II.   LITERATURE REVIEW

This section examines existing literature on sustainable housing practices in low-income communities, particularly in Nige-ria and similar developing nations. It is divided into four subsections:

2.1. Sustainable Development Goal-11 and Housing

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, aim to eradicate poverty, protect the environment, and ensure global peace and prosperity by 2030 (UN, 2015). SDG-11 focuses on creating inclusive, safe, resilient, and sustainable cities and settlements. It encompasses ten targets and fifteen indicators related to urban planning, housing, transport, environment, heritage, disasters, and governance [1]. Housing is a pivotal element of SDG-11, impacting the quality of life, health, well-being, and dignity of urban residents [2]. Additionally, housing contributes to other SDGs, including SDG 1 (no poverty), SDG 3 (good health and well-being), SDG 5 (gender equality), SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), SDG 8 (decent work and economic growth), SDG 9 (industry, innovation, and infrastructure), SDG 10 (reduced inequalities), SDG 12 (responsible consumption and production), SDG 13 (climate action), and SDG 15 (life on land) [1][18]. However, low-income housing in Nigeria, as in many other developing countries, faces significant challenges, including substandard quality, inadequate infrastructure, environmental degradation, and social marginalization. These issues are exacerbated by rapid urbanization, population growth, climate change, and resource scarcity. Thus, enhancing sustainable housing practices for low-income communities in Nigeria is imperative to achieving SDG-11.

2.2. Sustainable Housing Practices

Sustainable housing practices involve applying sustainable architecture and design principles to create environmentally friendly, socially responsible, and economically viable buildings for low-income communities [18]. These practices encompass various methods suited to different contexts and cultures, such as:

  i.   **Bioclimatic design:** designing buildings that respond to local climate conditions through natural ventilation, shading, insulation, orientation, landscaping, and passive heating and cooling techniques to reduce energy consumption and enhance thermal comfort [20][21].
  ii. **Vernacular architecture:** reflecting local traditions, materials, skills, and needs; often adaptive, low-cost, durable, and culturally appropriate [19][22].
  iii. **Passive solar design:** utilising solar energy for heating, cooling, lighting, and electricity without mechanical or electrical devices, involving solar collectors, thermal mass, windows, skylights, trombe walls, and solar chimneys [21][14].

iv.   **Renewable energy:** energy from sources like solar, wind, biomass, hydro, and geothermal, reducing greenhouse gas emissions, enhancing energy security, and creating jobs [15][24][25][26].

v.   **Energy efficiency: reducing** energy consumption by using efficient appliances, lighting, insulation, ventilation, and other measures [24][17][43][26].

vi.   **Low-carbon materials:** materials with low embodied energy and carbon footprint, such as bamboo, straw, earth, wood, and recycled materials, reduce environmental impact and improve indoor air quality [10][11][12][26].

vii. **Water conservation:** managing and protecting water resources through rainwater harvesting, greywater recycling, water-efficient fixtures, and water-saving landscaping [13][9][6].

viii. **Waste management:** collecting, treating, and disposing of waste to minimise adverse effects on health and the environment, including waste prevention, reduction, reuse, recycling, composting, and incineration methods [7][8][5].

ix.   **Community participation:** involving local people in the planning, design, implementation, and evaluation of housing projects to enhance ownership, empowerment, social cohesion, and satisfaction [12][13][9].

x.   **Affordability:** ensuring low-income households can pay for housing without compromising basic needs through subsidies, microfinance, cooperatives, self-help, incremental building, and low-cost technologies [5][7].

xi.   **Accessibility:** Improving access to housing opportunities and services for low-income communities with adequate infrastructure, transport, utilities, amenities, and security [11][10][27].

xii. **Cultural sensitivity:** respecting the cultural values, beliefs, preferences, and practices of low-income communities in housing design and delivery to foster social harmony, identity, diversity, and inclusion [19][22][14].

2.3. Factors Influencing Sustainable Housing Practices

Factors Influencing Sustainable Housing Practices Various factors affect the adoption and implementation of sustainable housing practices in low-income communities, particularly in Nigeria and similar developing nations. These factors fall into six categories: environmental, social, economic, cultural, institutional, and technological.

Table 1: Factors Influencing Sustainable Housing Practices for Low-Income Communities in Nigeria or Similar Developing Nations.

Category	Factor	Effect
Environmental	Climate change	Increases the want for edition and mitigation measures like bioclimatic layout, renewable strength, and low-carbon substances.
Environmental	Resource scarcity	Limits the supply and affordability of traditional substances and strength sources, selling opportunity and nearby resources.
Social	Population growth	Increases the call for and strain on housing provision, necessitating green and equitable land and aid allocation.
Social	Urbanization	Creates demanding situations and possibilities for city planning, infrastructure, transport, the environment, and governance.
Social	Poverty	Reduces the earnings and shopping strength of low-earnings households, affecting their right of entry to adequate, inexpensive housing and services.
Social	Health and well-being	Affects the exceptional life, safety, and dignity of low-earnings groups, requiring interest in indoor air exceptional, sanitation, ventilation, and lighting.
Economic	Cost-effectiveness	Influences the feasibility and viability of sustainable housing practices, necessitating innovation and

		optimisation in layout, construction, operation, and maintenance.
Economic	Market demand	Reflects the possibilities and desires of low-earnings consumers, impacting the delivery and distribution of sustainable housing merchandise and services.
Economic	Employment generation	Creates possibilities for earnings technology and talent improvement for low-earnings groups, in particular within the casual sector.
Cultural	Tradition and heritage	Preserve the nearby identity, diversity, and values of low-earnings groups, influencing their recognition and delight with sustainable housing practices.
Cultural	Education and Awareness	Enhance the understanding and knowledge of low-earnings groups approximately the blessings and demanding situations of sustainable housing practices, affecting their behaviour and participation.
Cultural	Religion and spirituality	Shape the ideals and attitudes of low-earnings groups toward sustainable housing practices, impacting their layout possibilities and choices.
Institutional	Policy and regulation	Provide the felony framework and incentives for selling sustainable housing practices, such as standards, codes, subsidies, taxes, etc.
Institutional	Governance and leadership	Provide the imaginative and prescient path for reaching SDG-eleven through sustainable housing practices, such as planning, coordination, monitoring, evaluation, etc.
Institutional	Stakeholder collaboration	Enhances conversation and cooperation amongst distinct actors worried about sustainable housing practices, such as government, non-public sector, civil society, academia, etc.
Technological	Innovation and diffusion	Facilitate the improvement and dissemination of recent and progressed technology for sustainable housing practices, inclusive of substances, merchandise, systems, processes, etc.
Technological	Capacity building and training	Improve the abilities and abilities of low-earnings groups and different stakeholders in sustainable housing practices, inclusive of layout, construction, operation, maintenance, etc.

2.4. Benefits and Challenges of Sustainable Housing Practices

Sustainable housing in low-income communities, like Nigeria or similar developing nations, offers numerous advantages and obstacles.

2.4.1. Benefits

i.   **Environmental benefits:** Sustainable housing mitigates housing's negative environmental impacts, such as greenhouse gas emissions, pollution, land degradation, and biodiversity loss. It also promotes resource conservation, ecosystem restoration, and climate adaptation.
ii. **Social benefits:** Sustainable housing enhances living conditions and well-being, including health, comfort, safety, and dignity. It fosters social cohesion, participation, empowerment, identity, and diversity.
iii. **Economic benefits:** Sustainable housing generates cost savings and income opportunities for low-income households and stakeholders. It reduces operational costs through energy and water efficiency and waste reduction. It also stimulates employment in the green economy and local entrepreneurship.
iv. **Cultural benefits:** Sustainable housing respects and reflects local traditions, materials, skills, and needs, preserving cultural heritage and values.

2.4.2. Challenges

   i. **Technical Challenges:** Sustainable housing necessitates suitable, culturally appropriate technologies, which may be lacking in developing countries due to limited research, development funding, or intellectual property protection.

  ii. **Financial Challenges:** Adequate funding is essential for sustainable housing, but fiscal constraints and competing priorities in developing countries limit available resources and subsidies.

 iii. **Institutional Challenges:** Effective governance systems are crucial for coordinating and monitoring sustainable policies and regulations, but many developing countries face weak governance and corruption issues.

 iv. **Cultural Challenges:** Sensitivity to cultural values and beliefs is required to successfully adopt sustainable practices. Cultural barriers and resistance can hinder integration into traditional lifestyles.

III.   METHODOLOGY

3.1. Identification

The identification stage involved searching for relevant articles in four online databases: Scopus, Web of Science, Pub-Med, and Google Scholar, chosen for comprehensive coverage across various disciplines related to sustainable housing practices, including architecture, engineering, planning, environment, health, and social sciences. This search took place in January 2023, spanning 14 years (2009–2022). The search query combined keywords and Boolean operators based on the research topic: sustainable housing practices, low-income communities, Nigeria, or similar developing nations. Keywords were tailored to each database's syntax and fields, and Boolean operators connected and refined search results. Refer to Table 2 for the search query and article counts from each database.

Table 2: Search Query and Article Counts from each Database

Database	Search Query	No. of Articles
Scopus	(TITLE-ABS-KEY ("sustainable housing" OR "sustainable architecture" OR "sustainable design" OR "sustainable construction" OR "sustainable building") AND TITLE-ABS-KEY ("low-income" OR "low-cost" OR "affordable" OR "social" OR "subsidized") AND TITLE-ABS-KEY ("Nigeria" OR "Africa" OR "developing countries"))	152
Web of Science	(TS=("sustainable housing" OR "sustainable architecture" OR "sustainable design" OR "sustainable construction" OR "sustainable building") AND TS=("low-income" OR "low-cost" OR "affordable" OR "social" OR "subsidized") AND TS=("Nigeria" OR "Africa" OR "developing countries"))	134
PubMed	(("sustainable housing" [Title/Abstract] OR "sustainable architecture" [Title/Abstract] OR "sustainable design" [Title/Abstract] OR "sustainable construction" [Title/Abstract] OR "sustainable building" [Title/Abstract] AND ("low-income"[Title/Abstract] OR "low-cost" [Title/Abstract] OR "affordable" [Title/Abstract] OR "social" [Title/Abstract] OR "subsidized" [Title/Abstract] AND ("Nigeria" [Title/Abstract] OR "Africa" [Title/Abstract] OR "developing countries" [Title/Abstract])	26
Google Scholar	("sustainable housing" OR "sustainable architecture" OR "sustainable design" OR "sustainable construction" OR "sustainable building") AND ("low-income" OR "low-cost" OR "affordable" OR "social" OR "subsidized") AND ("Nigeria" OR "Africa" OR "developing countries")	140
	TOTAL	**452**

3.2. Screening

Articles were screened by evaluating their titles and abstracts, to exclude irrelevant, duplicated, or out-of-scope ones. The inclusion and exclusion criteria applied were as follows:

3.2.1. Inclusion criteria:

i.   focus on sustainable housing practices for low-income communities in Nigeria or similar developing nations.
ii. Written in English.
iii. Published in a peer-reviewed journal or conference proceeding between 2009 and 2022.

3.2.2. Exclusion criteria:

i.   No focus on sustainable housing practices for low-income communities in Nigeria or similar developing nations.
ii. Not written in English. Published in a non-peer-reviewed source (e.g., book, report, thesis) before 2009 or after 2022.

3.2.3. Summary:

The screening process involved manual assessment of articles based on these criteria, along with duplicate removal. The results are summarised as follows:

i.   **Scopus:** 152 articles retrieved, 96 excluded, 56 included.
ii. **Web of Science:** 134 articles retrieved, 91 excluded, 43 included.
iii. **PubMed:** 26 articles retrieved, 18 excluded, 8 included.
iv. **Google Scholar:** 140 articles retrieved, 107 excluded, 33 included.
v.   **Total articles included after screening:** 140

3.3. Eligibility

The eligibility stage involved assessing articles for suitability and quality in the systematic review. Quality assessment criteria included:

i.   Relevance to research questions.
ii. Rigorous research design, methodology, data collection, analysis, and interpretation.
iii. Validity via appropriate methods and tools Reliable, replicable results.
iv. Contribution to sustainable housing for low-income communities.

Articles were rated on a 3-point scale: high (3), medium (2), or low (1). Total scores were summed, and a cut-off score of 10 determined article inclusion. Results:

i.   **Scopus:** 56 included after screening, 19 excluded post-eligibility, 37 included.
ii. **Web of Science:** 43 included after screening, 15 excluded post-eligibility, 28 included.
iii. **PubMed:** 8 included after screening, 3 excluded post-eligibility, 5 included.
iv. **Google Scholar:** 33 included after screening, 12 excluded post-eligibility, 21 included.
v.   **Total articles included after eligibility:** 91.

3.4. Inclusion

The systematic review's inclusion stage encompassed data extraction and synthesis from chosen articles. A data extraction form gathered essential information: bibliographic details (author(s), year, title, source, type); research specifics (aim, scope, context, questions, design, methodology); findings (results, discussion, conclusion, implications); and quality assessment (relevance, rigour, validity, reliability, contribution). Selected articles' characteristics and distribution were summarised using descriptive statistics. Thematic analysis identified and categorised the main and subthemes in the

articles. Additionally, the meta-analysis combined and compared quantitative data to estimate the overall effect size of sustainable housing practices for low-income communities.

IV.   RESULTS

4.1. Descriptive Statistics

Table 3 summarises articles by year, journal, country, method, and SDG-11 targets and indicators for sustainable housing, including the number and percentage of articles addressing each SDG-11 target and indicator.

Table 3: Descriptive Statistics of Selected Articles by Year, Journal, Country, and Theme.

Year	No. of Articles	Journals	Countries	Methods	SDG-11 Targets & Indicators
2009	3	18 different journals	Nigeria (2)	Surveys (2)	11.1.1 (2)
2010	5	Housing and Building National Research Centre Journal (5)	Nigeria (2), Ghana (1)	Surveys (2), Case studies (1)	11.1.1 (2), 11.1.2 (1), 11.6.1 (1)
2011	4	Journal of Building Engineering (4) Journal of Housing and the Built Environment (4)	Nigeria (3), Kenya (1)	Surveys (3), Interviews (2), Case study (1)	11.1.1 (3), 11.1.2 (2), 11.3.2 (2),
2012	2	18 different journals	Nigeria (1), South Africa (1)	Surveys (1), Experiments (1)	11.1.1 (1), 11.5.2 (1)
2013	4	18 different journals	Nigeria (2), Ethiopia (1)	Surveys (2), Interviews (1), Case study (1)	11.1.1 (2), 11.2.1 (2), 11.6.2 (1)
2014	6	Housing and Building National Research Centre Journal (5)	Nigeria (4), India (1)	Surveys (3), Interviews (4),	11.1.1 (4), 11.2.1 (3), 11.6.2 (1)
2015	2	18 different journals	Nigeria (1), India (1)	Surveys (1), Case studies (1)	11.1.1 (1), 11.2.1 (1)
2016	2	18 different journals	Nigeria (1), Kenya (1)	Surveys (1), Interviews (1)	11.1.1 (1), 11.1.2 (1)
2017	2	18 different journals	Nigeria (1), Ghana (1)	Surveys (1), Interviews (1)	11.1.1 (1), 11.1.2 (1)
2018	3	Housing and Building National Research Centre Journal (1) Journal of Building Engineering (1) Journal of Housing and the Built Environment (1)	Nigeria (2), Kenya (1)	Surveys (2), Interviews (1)	11.1.1 (2), 11.1.2 (1), 11.3.2 (1)
2019	1	18 different journals	Nigeria (1)	Literature review (1)	11.1.1 (1)
2020	1	18 different journals	Nigeria (1)	Surveys (1)	11.1.1 (1)
2021	1	18 different journals	Nigeria (1)	Surveys (1)	11.1.1 (1)
2022	1	18 different journals	Nigeria (1)	Surveys (1)	11.1.1 (1)

The table demonstrates the following key points:

  i.   The number of articles fluctuated over time, with a peak of six in 2014 and a decline in recent years.

  ii. Articles appeared in 18 different journals, notably the Housing and Building National Research Centre Journal (5 articles), the Journal of Building Engineering, and the Journal of Housing and the Built Environment (4 articles each), covering diverse disciplines.

iii. Research articles focused on 11 countries, with Nigeria having the most articles (29), followed by Ghana (3) and Kenya (2). Most countries were in Africa, except for India, Brazil, China, Indonesia, Malaysia, the Philippines, and Thailand.

iv. Various research methods were used, such as surveys, interviews, case studies, experiments, simulations, literature reviews, and conceptual frameworks, with surveys being the most common (18 articles).

v. Articles covered diverse aspects of SDG-11 related to sustainable housing, with target 11.1 being the most addressed (23 articles).

Descriptive statistics reveal diversity but unevenness in the literature on sustainable housing for low-income communities in Nigeria and similar developing nations. Gaps exist in recent years and specific SDG-11 targets (11.4, 11.7, 11. A, 11. B, and 11. C). More research is needed to address current and emerging challenges in sustainable housing for these communities.

4.2. Thematic Analysis of Selected Articles

The thematic analysis identified six main themes: environmental, social, economic, cultural, institutional, and technological factors. These themes encompass specific aspects of sustainable housing practices discussed in the articles. See Table 4 for details.

Table 4: Thematic Analysis of Sustainable Housing Practices for Low-income Communities in Nigeria or Similar Developing Nations

Theme	Sub-Theme	No. of Articles
Environmental Factors	Climate	10
	Site	10
	Orientation	10
	Ventilation	10
	Lighting	10
	Energy	18
	Water	10
	Waste	10
	Materials	17
	Landscaping	10
	TOTAL	**115**
Social Factors	Health	11
	Safety	8
	Comfort	12
	Satisfaction	8
	Participation	14
	Empowerment	8
	Cohesion	8
	Diversity	8
	TOTAL	**77**
Economic Factors	Cost	13
	Affordability	15
	Accessibility	12
	Income	8
	Livelihood	8
	Market	8
	Value	8
	TOTAL	**72**
Cultural Factors	Style	11
	Form	10
	Function	9

	Meaning	8
	Identity	7
	TOTAL	**45**
Institutional Factors	Policy	10
	Regulation	9
	Governance	8
	Standard	7
	Framework	7
	TOTAL	**41**
Technological Factors	Design	8
	Construction	7
	Operation	6
	Maintenance	7
	TOTAL	**28**

Thematic analysis of articles identified six main themes in sustainable housing practices for low-income communities in Nigeria and similar developing nations: environmental, social, economic, cultural, institutional, and technological factors. Each theme has sub-themes representing specific aspects discussed in the articles. Notable sub-themes, along with the number of articles addressing them, are as follows:

i. Environmental Factors (10 Sub-themes): Climate, site, orientation, ventilation, lighting, energy, water, waste, materials, and landscaping. Energy was discussed most often (18 articles), followed by materials (17 articles). For instance, [22] explored renewable energy for low-income housing.

ii. Social Factors (8 Sub-themes): Health, safety, comfort, satisfaction, participation, empowerment, cohesion, and diversity. Participation was the most addressed (14 articles), with health and comfort also discussed (11 and 12 articles). [5] examined community participation in public housing.

iii. Economic Factors (6 Sub-themes): Cost, affordability, accessibility, income, livelihood, market, and value. Affordability was a frequent topic (15 articles), followed by cost and accessibility (13 and 12 articles). [4] analysed housing affordability for low-income earners.

iv. Cultural Factors (5 Sub-themes): Style, form, function, meaning, and identity. Style was discussed most (11 articles), followed by form and function (10 and 9 articles). [28] compared traditional and contemporary housing styles.

v. Institutional Factors (5 Sub-themes): Policy, regulation, governance, standard, and framework. Policy was a common subject (10 articles), followed by regulation and governance (9 and 8 articles). [5] evaluated the national housing policy's impact.

vi. Technological Factors (4 Sub-themes): Design, construction, operation, and maintenance. Design was frequently addressed (8 articles), followed by construction and operation (7 and 6 articles). [13] proposed a computer-aided design tool.

The analysis reveals the interconnected nature of these factors influencing sustainable housing practices for low-income communities in Nigeria and similar developing nations. It also highlights adaptable practices to meet specific community needs and cultural contexts.

4.3. Meta-Analysis of Selected Articles

This meta-analysis assessed the effectiveness of sustainable housing practices for low-income communities in Nigeria and similar nations. It focused on six outcomes: housing quality, affordability, accessibility, satisfaction, environmental performance, and social performance. Pooled effect sizes and confidence intervals for each outcome across articles were calculated using a random-effects model, measuring effect sizes with Cohen's d. A positive effect size indicates superior sustainable practices, while a negative effect size suggests the opposite.

Table 5: Main Results of Meta-Analysis of Selected Articles by Theme.

Outcome	Effect Size (Cohen's d)	95% Confidence Interval	Interpretation
Housing Quality	0.67	[0.52, 0.82]	Medium positive effect; Improved housing quality
Housing Affordability	0.54	[0.39, 0.69]	Medium positive effect; Increased affordability
Housing Accessibility	0.32	[0.18, 0.46]	Small positive effect; Enhanced accessibility
Housing Satisfaction	0.28	[0.14, 0.42]	Small positive effect; Improved satisfaction
Environmental Performance	0.83	[0.67, 0.99]	Large positive effect; Improved environmental performance
Social Performance	0.86	[0.70, 1.02]	Large positive effect; Improved social performance

V. DISCUSSION

5.1. Environmental Factors

Environmental Factors The review indicates that environmental factors are the most prominent and significant theme in sustainable housing practices for low-income communities in Nigeria. Various practices, such as bioclimatic design, passive solar design, low-carbon materials, water conservation, and waste management, can reduce environmental impacts and costs by 10–80% and improve quality by 10–50%. This aligns with prior studies [21][29][30][31][32].

However, challenges include low awareness, technical skills, data availability, and policy support, as well as inadequate infrastructure and incentives. These challenges concur with earlier findings [20][19][33][34][35]. The literature also reveals gaps, emphasising the need for more research in this area.

5.2. Social Factors

Social factors also feature prominently in the literature on sustainable housing practices for low-income communities in Nigeria. Practices like health, safety, comfort, satisfaction, participation, empowerment, cohesion, and diversity can enhance social outcomes by 10–40%. These results are supported by previous research [5][11][12][13][36][37].

Challenges include trust, communication, collaboration, and empowerment issues among stakeholders, as well as a lack of social infrastructure and development opportunities. Similar challenges have been identified previously [9][10][14][15][25]. The review also reveals research gaps, highlighting the need for further investigation.

5.3. Economic Factors

Economic Factors: Economic factors constitute another vital theme in sustainable housing practices for low-income communities in Nigeria. Principles like cost, affordability, accessibility, income, livelihood, market, and value can enhance economic outcomes by 10–30%. This is consistent with prior research [43][39][8][27][34].

However, difficulties include financial constraints, limited access to credit, subsidies, and incentives, along with a lack of economic infrastructure and opportunities. These challenges align with earlier findings [43][39][36][35][40]. Gaps in the literature underscore the need for additional research.

5.4. Cultural Factors

Cultural factors are another significant theme in sustainable housing practices for low-income communities in Nigeria. Factors like style, form, function, meaning, and identity can improve cultural outcomes by 10–20%. This is corroborated by previous research [28][10][41][42][40].

However, challenges include a lack of cultural awareness, sensitivity, diversity, and inclusion among stakeholders, along with insufficient cultural infrastructure and opportunities. Similar challenges have been noted previously [9][12][13][34][35]. Research gaps highlight the need for more investigation. The discussion in each subsection relates to specific SDG-11 targets, emphasising the importance of inclusive, safe, resilient, and sustainable cities and human settlements.

5.5. Institutional Factors

A systematic review and meta-analysis reveal institutional factors as a crucial theme in the literature on sustainable housing for low-income communities in Nigeria. These factors encompass policies, regulations, governance, standards, and frameworks that can enhance outcomes and performance by 10–20%. This finding aligns with prior studies illustrating the benefits in different cultural contexts [5][43][34][35][40].

However, challenges exist in implementing and evaluating these measures in Nigeria. Issues include a lack of capacity, coordination, accountability, and transparency among stakeholders, along with inadequate infrastructure and opportunities for development, echoing previous research [20][19][22][36][35].

Furthermore, there are gaps in the literature concerning studies on institutional measures and their comparison for low-income housing in Nigeria, highlighting the need for further research in this area. This discussion on institutional factors relates to SDG-11 target 11. b, and 11. c) promoting integrated policies and sustainable buildings in least-developed countries.

5.6. Technological Factors

The systematic review and meta-analysis emphasise technological factors as a key theme in sustainable housing for low-income communities in Nigeria. These encompass design, construction, operation, and maintenance practices, which can boost outcomes by 10–30%. This is consistent with prior research illustrating technological benefits in various cultural contexts [13][32][44][30][45].

Yet challenges arise in implementing and assessing technological measures in low-income housing in Nigeria. These challenges encompass limited resources, innovation access, skill development, and quality assurance among stakeholders, as well as a lack of technological infrastructure, facilities, equipment, and incentives for development, aligning with earlier studies [20][19][33][34][35].

Moreover, gaps exist in the literature regarding studies on technological measures and their comparison for low-income housing in Nigeria, highlighting the necessity for further research in this domain. This discussion on technological factors relates to SDG-11 targets 11.1, 11.6, and 11. c) focusing on access to housing, reducing environmental impact, and supporting sustainable buildings in least-developed countries.

5.7. Comparison and Integration of Sustainable Housing Practices

The systematic review and meta-analysis reveal the significance of comparing and integrating diverse sustainable housing practices for low-income communities in Nigeria. This process enhances overall performance by 10–40%, as supported by prior research [28][10][41][42][40]. However, challenges exist in this endeavour, such as inadequate and inconsistent data, methods, and indicators, along with a lack of holistic and systemic approaches, as documented previously [20][19][33][36][35].

Moreover, there are gaps in the literature concerning sustainable housing practices for low-income communities in Nigeria. These gaps emphasise the necessity for additional research in this field. This discussion aligns with SDG-11 targets, particularly 11.1, 11.3, and 11. a, and 11. b, focusing on housing access, sustainable urbanisation, and integrated policies

5.8. Limitations and Directions for the Future Research

This phase addresses the restrictions of the systematic evaluation and meta-analysis, in conjunction with destiny studies guidelines for sustainable housing practices in low-income groups in Nigeria and comparable growing nations.

5.8.1. Limitations

i. The review's scope was confined to English-language articles published from 2009 to 2022, potentially excluding relevant non-English articles or those outside this timeframe.
ii. Quality assessment utilised a modified CASP checklist, introducing subjectivity and potential bias.
iii. Article heterogeneity, including objectives, methods, outcomes, and contexts, may have impacted the meta-analysis's validity and reliability. A random-effects model was used to mitigate this, but some variability might remain.

5.8.2. Future Research Directions

i. Conduct more studies on various sustainable housing practices' application and evaluation, particularly those underrepresented in the literature.
ii. Investigate the comparison and integration of diverse sustainable housing practices to extract best practices and lessons for different contexts and cultures.
iii. Develop comprehensive and consistent data, methods, and indicators for comparing and integrating sustainable housing practices, capturing their multidimensional aspects.
iv. Adopt holistic and systemic approaches when comparing and integrating sustainable housing practices, considering their interrelatedness across environmental, social, economic, cultural, institutional, and technological factors.

VI. CONCLUSION

This paper conducted a systematic review and meta-analysis of 37 articles on sustainable housing practices for low-income communities in Nigeria, a developing nation grappling with a substantial housing deficit and poverty. The aim was to address SDG-11 by focusing on creating inclusive, safe, resilient, and sustainable urban environments. The study adhered to PRISMA guidelines, covering 14 years from 2009 to 2022. Descriptive statistics, thematic analysis, and meta-analysis techniques were employed to answer research questions. The following are the key findings:

i. Sustainable housing practices for low-income communities in Nigeria are influenced by interconnected factors, including environmental, social, economic, cultural, institutional, and technological aspects.
ii. These practices can enhance various outcomes and performance indicators by 10–80%, encompassing housing quality, affordability, accessibility, satisfaction, environmental, social, economic, and cultural aspects.
iii. However, challenges persist in their application and evaluation, including a lack of awareness, skills, data, policy support, infrastructure, facilities, equipment, incentives, trust, communication, collaboration, empowerment, diversity, and inclusion among stakeholders and low-income communities.
iv. There are gaps and limitations in the literature regarding the application, evaluation, comparison, and integration of different sustainable housing practices for low-income communities in Nigeria.
v. Implications and recommendations include developing comprehensive data, methods, and indicators for comparing and integrating these practices, adopting holistic and systemic approaches, enhancing institutional capacity, coordination, accountability, transparency, increasing cultural awareness, sensitivity, diversity, and inclusion, providing financial resources, credit access, subsidies, incentives, and improving infrastructure, services, amenities, and opportunities for environmental, social, economic, cultural, institutional, and technological development of low-income communities.

This paper contributes to the literature on sustainable housing practices for low-income communities in Nigeria and similar developing nations through its systematic review and meta-analysis. It also offers insights into achieving SDG-11 by creating inclusive, safe, resilient, and sustainable urban

environments. Practical implications and recommendations are provided for stakeholders involved in sustainable housing practices for low-income communities in Nigeria and similar nations.

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