



Sustainable Urban Development in West Africa: A Rapid Review of Challenges and Opportunities

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: The rapid urbanization witnessed across West Africa presents an urgent need to address sustainable urban development.

Objective: This rapid review synthesizes the existing literature on the challenges and opportunities related to sustainable urban development in West Africa. It seeks to clarify the key factors influencing regional urban sustainability and identify practical pathways for policy and planning interventions.

Methods: We reviewed peer-reviewed journal articles published between 2015 and 2025 identified through Web of Science, Environment Complete, Energy & Power Source, Engineering Source, Academic Search Ultimate, and CINAHL Ultimate. Of the 23 studies, 6 articles were selected for the

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review. A thematic analysis was then used to code and categorize the data, resulting in emergent themes showing the challenges and prospects for sustainable urban development.

Results and Conclusion: The findings show that West African cities face formidable challenges, including under-resourced infrastructure, weak policy coordination, entrenched social inequalities, and mounting environmental pressures. Nevertheless, there are also promising opportunities, such as leveraging technological innovations to improve service delivery, implementing policy initiatives aimed at decentralization, enhancing stakeholder engagement, and integrating nature-based solutions into urban planning. Future research should broaden its geographic coverage and employ longitudinal or comparative methods to evaluate the long-term impact of policy and planning interventions.

Keywords: Challenges; opportunities; sustainable development; urbanization; West Africa.

1. INTRODUCTION

Over the last few decades, the rapid urbanization witnessed across West Africa presents an urgent need to address sustainable urban development. By 2050, Africa is expected to host a significant portion of the world's urban population, with many of its cities experiencing growth rates among the fastest globally (UN-Habitat, 2020). This unprecedented urban expansion is a demographic phenomenon and a driver of economic potential, catalyzing innovation and regional integration. However, this growth has also intensified systemic challenges, including severe infrastructure deficits, environmental degradation, and socioeconomic inequalities (Güneralp et al., 2017). For instance, cities such as Lagos and Dakar grapple with unplanned urban sprawl that outpaces their governance and planning capacities (Ofoefie et al., 2022). Climate change further compounds these issues by increasing vulnerabilities to flooding, heat waves, and other extreme weather events (Toit et al., 2018).

Despite growing recognition of these challenges, sustainable urban development remains inadequately explored in the regional context. Sustainable urban development emphasizes the integration of economic, social, and environmental dimensions to ensure cities' long-term viability and livability (Güneralp et al., 2017). While this framework has been extensively studied in cities across Europe and North America, it remains underrepresented in African research, particularly in West Africa. Regional studies are often constrained by limited data availability and a lack of localized perspectives (Dossa & Miassi, 2024). Moreover, contextual factors such as the prevalence of informal settlements, inadequate basic services, and unique climatic challenges demand tailored solutions. The lack of actionable policy recommendations further highlights a critical gap in the literature (Ofoefie et al., 2022).

1.1 Urbanization Trends and Sustainability Challenges

West African cities, such as Lagos, Accra, and Dakar, are emblematic of the complexities of urban growth, serving as economic hubs while simultaneously contending with widespread informality and infrastructural inadequacies (Titz & Chiotha, 2019). Informal settlements, which house a significant portion of the population, often suffer from inadequate sanitation, overcrowding, and limited access to essential services like potable water and electricity, exacerbating vulnerabilities to climate-related disasters (Georgiadou & Loggia, 2016). Furthermore, environmental degradation, such as deforestation and improper waste management, exacerbates the region's urban sustainability challenges (Cobbinah & Finn, 2022). Coastal cities are particularly vulnerable, facing risks such as sea-level rise, coastal erosion, and frequent flooding, which pose significant threats to millions of residents (Orkpeh & Adedire, 2024). These challenges are compounded by the limited integration of green infrastructure and nature-based solutions, which have shown potential to mitigate urban heat and enhance biodiversity but remain underutilized (Maranga, 2021).

1.2 Opportunities for Sustainable Urban Development

The rapid pace of urbanization offers a rare opportunity to incorporate sustainability principles at the planning stage, especially in emerging secondary cities with nascent growth. Innovations in renewable energy, sustainable transportation, and green infrastructure hold promise for addressing these challenges (Ofoefie et al., 2022). For example, adopting solar energy in cities with abundant sunlight, such as Bamako and Niamey, can enhance energy security and reduce greenhouse gas emissions (Güneralp et al., 2017). Moreover,

integrating green infrastructure, such as urban forests and wetlands, can mitigate urban heat island effects and enhance biodiversity (Dossa & Miassi, 2024). Smart city initiatives, though nascent in the region, have shown potential in improving governance and resource optimization. However, these opportunities necessitate robust governance frameworks and financing mechanisms, areas where current research is notably sparse (Toit et al., 2018).

Significant gaps persist in literature. Research often focuses on broader continental trends, providing limited insights into West African urban dynamics. Additionally, there is insufficient empirical data on localized urban planning policies and their effectiveness in addressing informal settlements and climate resilience (Toit et al., 2018). The potential of green infrastructure remains underexplored, with studies rarely integrating cultural and socio-economic factors into sustainability frameworks (Maranga, 2021). Lastly, the role of digital transformation in enhancing urban resilience, particularly through smart city frameworks, has received scant attention in the context of West Africa (Güneralp et al., 2017). These gaps underline the need for comprehensive, localized research that informs policy and practice.

Given these challenges and opportunities, our review seeks to address the research question:

1. *What are the major challenges and opportunities in achieving sustainable urban development in West Africa?*

This study aims to contribute actionable insights and inform future research and policy initiatives by synthesizing existing knowledge and identifying gaps.

2. METHODOLOGY

2.1 Rapid Review Approach

A rapid review methodology was adopted to synthesize evidence on sustainable urban development in West Africa. According to Tricco et al. (2017), a rapid review is "a type of knowledge synthesis in which components of the systematic review process are simplified or omitted to produce information in a short period of time" (p. 2). This approach was selected because it allows for a timely synthesis of evidence to address urgent research questions, particularly in a field as dynamic as urban development. By simplifying certain steps of the systematic review process, the rapid review

enabled the identification of key challenges and opportunities in sustainable urban development in West Africa while maintaining methodological rigor. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and consistency.

2.2 Search Strategies

The search process was conducted on January 11, 2025, across six electronic databases, resulting in 23 articles: Web of Science (8), Environment Complete (6), Energy & Power Source (4), Engineering Source (2), Academic Search Ultimate (2), and CINAHL Ultimate (1). These databases were chosen for their comprehensive coverage of sustainability, urban planning, and environmental studies. Search terms were developed to identify relevant studies focusing on sustainable urban development, challenges, opportunities, and the regional focus on West Africa. Boolean operators such as "AND" and "OR" were applied to refine the search strategy and ensure the retrieval of relevant studies. The final search string included the following components: "sustainable urban development" OR "urban sustainability," "West Africa" OR "Nigeria" OR "Ghana" OR "Senegal" OR "Côte d'Ivoire" OR "Mali" OR "Togo," "challenges" OR "barriers" OR "constraints," and "opportunities" OR "solutions" OR "strategies." The search also targeted thematic areas such as urban planning, infrastructure, policy, and technology. Only articles published between 2015 and 2025 were included in the search, ensuring contemporary relevance. Additionally, the search was restricted to English-language studies. Duplicate articles were identified and removed using Covidence software.

2.3 Inclusion and Exclusion Criteria

Predefined inclusion and exclusion criteria were applied to ensure the relevance and quality of selected studies. Articles were included if they were peer-reviewed journal articles published between 2015 and 2025, focused on sustainable urban development in West Africa, and addressed challenges, barriers, opportunities, or strategies. Studies employing quantitative, qualitative, or mixed-methods designs and written in English were also included. Articles were excluded if they did not focus on West Africa, did not address sustainable urban development, or were not peer-reviewed journal articles. Non-peer-reviewed sources such as conference proceedings, editorials, or review

Table 1. Inclusion and Exclusion Criteria for studies

Criterion	Inclusion	Exclusion
Geographic Focus	Studies focused on West Africa (e.g., Nigeria, Ghana, Senegal, Côte d'Ivoire, Mali, Togo).	Studies not related to West Africa or those focused on other geographic regions.
Topic Relevance	Articles explicitly addressing sustainable urban development, including challenges, barriers, opportunities, or strategies.	Studies unrelated to sustainable urban development, such as those focusing on rural development.
Publication Type	Peer-reviewed journal articles.	Non-peer-reviewed sources, including conference proceedings, editorials, or review articles.
Study Design	Quantitative, qualitative, or mixed-methods studies providing empirical data and insights.	Studies lacking empirical data or employing purely descriptive approaches without analysis.
Time Period	Articles published between 2015 and 2025.	Articles published before 2015 or after 2025.
Topic Relevance	Articles written in English or including an English translation.	Articles not written in English or lacking an English translation.

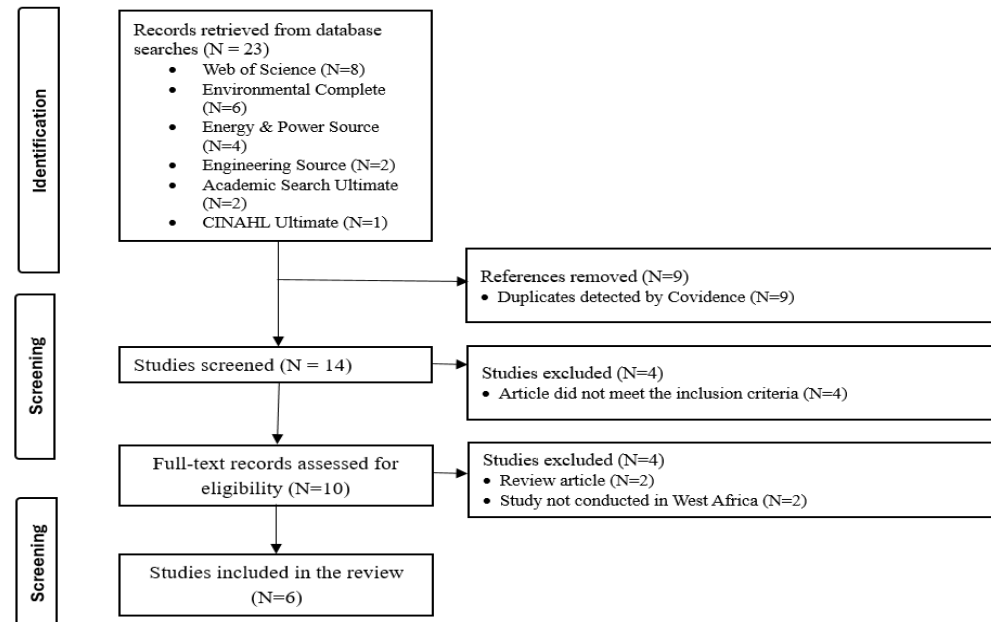


Fig. 1. PRISMA flow diagram of articles

Table 2. General description of the studies

Reference	Country	Sample/Population	Research Design	Journal	Purpose of the Study
Jack et al. (2016)	Nigeria	Stakeholders in urban development in Port Harcourt.	Qualitative study involving interviews and thematic analysis	Sustainable Development and Planning	To develop a sustainability framework addressing challenges in Port Harcourt urban development.
Oladokoun et al. (2024)	Togo	Urban residents and ecological data in Togo cities.	Mixed-methods design combining spatio-temporal analysis, SWOT analysis, social surveys, focus group discussions, and geospatial analysis using QGIS.	Applied Ecology and Environmental Research	The study aims to assess changes in ecological systems due to urbanization, propose strategies for integrating urban ecology into development plans, and develop sustainable urban ecological models tailored for Togo and Africa at large.
Baffoe et al. (2021)	Ghana	Urban and rural residents affected by policy implementation.	Mixed-methods design	Sustainability Science	To analyze urban-rural linkages and identify priority solutions for sustainable development in Ghana.
Fredholm (2015)	Ghana	Planning authorities and stakeholders in Cape Coast	Qualitative design involving discourse analysis and interviews on cultural heritage and planning	Journal of Cultural Heritage Management and Sustainable Development	To examine the role of cultural heritage in urban planning and its sustainability implications.
Agboola & Tunay (2023)	Nigeria	385 ICT stakeholders and urban residents in Nigeria	Quantitative research design	Journal of Cleaner Production	To evaluate the role of ICT in enhancing urban sustainability and stakeholder engagement
Kareem et al. (2022)	Ghana	Stakeholders from local governments, researchers, and community representatives involved in transdisciplinary urban projects.	Qualitative analysis of case studies	Environmental Science and Policy	To investigate power dynamics in transdisciplinary research for sustainable urban transitions.

articles were excluded. Articles outside the specified time frame or written in languages other than English were also excluded.

2.4 Screening and Selection Process

The search identified 23 studies across the six databases. These were imported into Covidence software for further processing. Covidence identified and removed nine duplicates, leaving 14 unique articles for title and abstract screening. During this phase, four studies were excluded for not meeting the inclusion criteria. The remaining 10 full-text articles were assessed for eligibility, resulting in the exclusion of four additional studies: two were review articles, and two studies were not conducted in West Africa. Ultimately, 6 studies were included in the final synthesis. This process adhered to the PRISMA guidelines (Fig. 1), ensuring a comprehensive and transparent review process.

2.5 Ensuring Reliability

Reliability was maintained through the use of Covidence, which provided a structured and transparent screening process. All 23 retrieved articles were initially imported into Covidence, and nine duplicates were identified and removed. The remaining 14 articles underwent a thorough title and abstract screening, leading to the exclusion of four that did not meet the inclusion criteria. The remaining 10 were assessed at the full-text level, each carefully evaluated against the predefined inclusion criteria. Given the 6 studies that ultimately met these criteria, we gave meticulous attention to detail throughout the review process to prevent overlooking any relevant evidence. This systematic approach, guided by clearly defined protocols and consistent application of the selection criteria, helped ensure the reliability and comprehensiveness of the final 6 articles included in the synthesis.

2.6 Content Analysis

A simpler thematic analysis addressed the single research question guiding this review. We read each article thoroughly to ensure familiarity with its content, and segments relevant to the research question were identified and initially coded for key ideas or patterns. These codes were then refined and grouped into broader thematic categories, ensuring the emerging themes accurately reflected the data without

unnecessary overlap. Where direct quotation could further illuminate a particular theme, it was incorporated to provide contextual depth. This systematic approach facilitated a coherent and focused interpretation of the literature, laying the groundwork for the subsequent analysis and discussion

3. RESULTS

3.1 Overview of Included Studies

Six studies met the inclusion criteria, covering publication years from 2015 to 2024. Jack et al. (2016) focused on stakeholder perspectives in Port Harcourt, Nigeria, underscoring infrastructural strains tied to “unprecedented population growth [that] has drastically impacted the capacity of infrastructures” (p. 209). Oladokoun et al. (2024) examined spatio-temporal ecological shifts in Togo, proposing strategies for integrating urban ecology into broader developmental planning. Baffoe et al. (2021) turned attention to Ghana, highlighting how urban–rural linkages can both facilitate and hinder sustainable development, particularly when existing policies unintentionally widen socio-economic divides. Building on governance themes, Fredholm (2015) investigated cultural heritage and planning authorities in Cape Coast, Ghana, revealing how local governance structures directly shape urban sustainability outcomes. Agboola and Tunay (2023) then shifted the focus to technological innovations in Nigeria, demonstrating how ICT-driven tools can improve infrastructure management and bolster stakeholder engagement. Finally, Kareem et al. (2022) explored transdisciplinary research dynamics in Ghana, showing how power imbalances limit community participation and, in turn, the effectiveness of urban initiatives. Together, these studies capture a multi-faceted view of sustainable urban development in West Africa, spanning ecological conservation, policy implementation, cultural preservation, technological adoption, and inclusive governance.

3.2 Challenges in Sustainable Urban Development

3.2.1 Infrastructure and resource constraints

Unregulated urban expansion and population surges continue to overwhelm basic infrastructure and resources in many West African cities. In Nigeria, for example, rapid

migration to urban centers has led to decaying roads, overburdened public utilities, and housing shortages. Port Harcourt has been notably affected, experiencing “unprecedented population growth... [that] has drastically impacted the capacity of infrastructures” (Jack et al., 2016, p. 209). Togo likewise faces ecological degradation due to unplanned urban sprawl, with shrinking savannahs and forests contributing to reduced biodiversity and heightened environmental vulnerability.

3.2.2 Policy and institutional gaps

Weak or fragmented policy frameworks also hinder sustainable urban development. Some urban-focused policies in Ghana have inadvertently deepened the rural–urban divide by allocating disproportionate resources to major cities, leading to uneven economic and social development (Baffoe et al., 2021). Furthermore, poor inter-agency coordination across West Africa impedes the creation of unified, region-wide strategies to guide urban planning, particularly in rapidly growing metropolitan areas (Fredholm, 2015).

3.2.3 Social and economic barriers

Socioeconomic inequities, including widespread urban poverty and limited employment opportunities, obstruct inclusive development in many of the region’s cities. Insufficient community engagement in planning processes compounds these challenges, leaving marginalized groups with little voice in shaping housing policies, infrastructure improvements, and public services. Additionally, hierarchical power dynamics in multidisciplinary research can exclude local perspectives, weakening the efficacy and appropriateness of proposed urban initiatives (Kareem et al., 2022).

3.2.4 Environmental challenges

Environmental stressors, including inadequate waste management and climate-related threats, further complicate sustainable urban development. In Nigeria and Togo, poor waste disposal practices degrade local ecosystems and pose serious public health risks. Meanwhile, coastal hubs such as Lagos and Accra contend with rising sea levels, frequent flooding, and storm surges—all of which demand significant investment in protective infrastructure and environmental safeguards (Baffoe et al., 2021).

3.3 Opportunities in Sustainable Urban Development

3.3.1 Technological advancements

Despite ongoing challenges, technological innovations offer promising pathways for urban resilience. The expanded use of Information and Communication Technology (ICT) can facilitate more efficient resource allocation, real-time monitoring of services, and data-driven policy interventions (Agboola & Tunay, 2023). In Nigeria, for instance, local governments are increasingly adopting ICT solutions to enhance transportation systems and bolster emergency management, while planned developments like Eko Atlantic City in Lagos demonstrate how integrating technology with forward-thinking design can promote long-term sustainability.

3.3.2 Policy innovations

Emerging policy frameworks also provide momentum for reforms. Ghana’s one-district-one-factory initiative aims to curb urban overcrowding by stimulating local industries in smaller municipalities, thereby reducing rural–urban migration pressures (Baffoe et al., 2021). Collaborative arrangements between local, national, and international stakeholders can further optimize resource sharing and establish stronger governance structures to guide regional urban development (Fredholm, 2015).

3.3.3 Community and stakeholder engagement

More inclusive approaches to urban planning can address social disparities and strengthen local ownership of development initiatives. Participatory governance models that involve community members, civil society organizations, and private-sector partners encourage diverse inputs and help align policies with on-the-ground realities (Kareem et al., 2022). This inclusive strategy fosters social cohesion, ensuring that development efforts are context-specific and responsive to local needs.

3.3.4 Environmental restoration

Efforts to rehabilitate ecosystems and incorporate nature-based solutions into urban designs can enhance resilience against climate variability. In Togo, for instance, reforestation programs and green space initiatives seek to offset ongoing ecological losses. At the same time, coastal regions in Ghana and Nigeria

explore flood defenses and ecosystem preservation to protect vulnerable populations (Baffoe et al., 2021). Integrating environmental considerations into planning processes is thus pivotal for achieving sustainable urban growth in West Africa.

4. DISCUSSION

The findings from our rapid review highlight the pressing challenges and the emerging opportunities for sustainable urban development in West Africa. Infrastructure and resource constraints are among the challenges, which often stem from rapid urbanization that outpaces local capacity (Jack et al., 2016). This aligns with analyses from other regions: for instance, Adelekan (2010), examining coastal communities in Lagos, similarly concludes that escalating urban populations, coupled with inadequate infrastructure planning, leave many cities vulnerable to environmental and health hazards. Such deficiencies underscore the need for forward-looking urban management strategies capable of anticipating future population growth.

Policy and institutional gaps are equally problematic, including weak inter-agency coordination and uneven policy implementation (Baffoe et al., 2021; Fredholm, 2015). These gaps mirror broader governance issues observed across the continent. A study by Pieterse (2019) points out that siloed administrative structures in many African countries hamper the creation of unified urban strategies. Policymakers may design programs without coordinating with multiple sectors—energy, public health, and transport—leading to fragmentation and inefficiency. In line with the suggestions of Fredholm (2015), strengthening cross-sectoral collaboration could significantly improve synergy among urban planning, conservation, and social services.

Moreover, social and economic barriers hinder inclusive development, including pervasive urban poverty and limited community participation in decision-making. For example, Jack et al. (2016) note that marginalized communities in Nigeria struggle to have their voices heard in urban planning processes. Similarly, Obeng-Odoom (2013) found that inadequate participatory planning in Ghana's growing cities often perpetuates inequitable development outcomes, particularly in housing and public services. When local knowledge holders are sidelined, important aspects such as cultural norms, livelihood strategies, and social networks may be

overlooked, undermining the relevance and success of proposed urban interventions.

Compounding these social and policy constraints are environmental challenges, ranging from inadequate waste management to climate-related threats in coastal zones (Oladokoun et al., 2024; Baffoe et al., 2021). Recent assessments by UN-Habitat (2020) echo this concern, noting that the vulnerability of coastal West African cities to rising sea levels and extreme weather is exacerbated by insufficient drainage systems and rampant waste disposal problems. Coastal flooding, in particular, can inflict both economic and public health consequences, further burdening already-stretched municipal budgets and infrastructure.

Despite these obstacles, multiple opportunities for sustainable urban development emerge in the findings. Technological advancements, such as ICT-based solutions for service delivery, align with other scholarship that emphasizes the transformative potential of digital tools in cities (Agboola & Tunay, 2023). A case in point is Bah et al. (2018), who detail how mobile apps and data analytics platforms have enabled better traffic management and reduced congestion in certain African metropolises. Meanwhile, policy innovations like Ghana's one-district-one-factory initiative (Baffoe et al., 2021) resonate with calls for more decentralized approaches to urban governance—approaches that also appear in broader African contexts (Pieterse, 2019). Such models help balance growth across regions and reduce the stress on primary cities.

Finally, our review underscored the importance of community and stakeholder engagement and environmental restoration efforts. Jack et al. (2016) emphasized the importance of stakeholder participation in addressing the infrastructural challenges posed by rapid urbanization in Port Harcourt, Nigeria. Similarly, Kareem et al. (2022) explored how power imbalances in transdisciplinary research can limit community participation and reduce the effectiveness of urban initiatives in Ghana. These findings align with external studies that highlight the significance of participatory governance in achieving sustainable urban development. For instance, participatory processes in the regeneration of Kumasi Central Market in Ghana demonstrate how engaging all relevant stakeholders enhances resilience and project sustainability (Danso et al., 2023). Additionally, environmental restoration initiatives, such as those examined by Oladokoun et al. (2024) in

Togo, highlight the importance of integrating urban ecology into development planning to align conservation goals with urban expansion. This is further supported by external reviews, which emphasize the role of urban greening and reforestation in mitigating climate challenges and enhancing biodiversity (Ofoezie et al., 2022).

Our findings indicate that successful urban sustainability in West Africa requires multi-level governance reforms and community-based partnerships. Drawing upon a wider body of scholarship, this discussion reaffirms that while the region faces daunting challenges, from infrastructure gaps to climate threats, innovative technologies, participatory governance models, and ecologically sensitive approaches can foster more resilient and equitable urban futures.

5. RECOMMENDATIONS, LIMITATIONS, AND FUTURE RESEARCH

The findings of this rapid review emphasize the importance of fostering multi-level governance that aligns national goals with localized priorities, encouraging collaboration among governmental agencies, private sectors, and local communities. Strengthening participatory processes can help integrate marginalized voices in urban planning, while investments in information and communication technologies enable data-driven policymaking that addresses infrastructure gaps and improves service delivery. Adopting nature-based solutions, such as reforestation and wetlands restoration, can also enhance climate resilience in urban areas prone to flooding and environmental degradation. These recommendations, however, must be adapted to local contexts to avoid one-size-fits-all approaches that overlook cultural, social, and ecological nuances.

Despite these insights, the study is limited by the relatively small number of peer-reviewed articles meeting the specified inclusion criteria and focusing solely on West African urban contexts. This narrow scope may restrict the generalizability of the results beyond the countries represented. Future research should, therefore, broaden its geographic coverage and incorporate longitudinal or comparative analyses across diverse West African cities. Gathering more empirical data on local policies, informal settlement interventions, and climate adaptation strategies can further illuminate how best to embed sustainability principles in the region's ongoing urbanization. Researchers might also explore the role of emerging technologies,

gender perspectives, and economic factors in shaping equitable development pathways, thus contributing to more holistic and context-specific insights into sustainable urban development.

6. CONCLUSION

Our analysis of empirical studies underscores that West Africa contends with a complex set of challenges that hinder progress toward sustainable urban development, encompassing infrastructural deficits, policy fragmentation, and environmental threats. While these constraints are substantial, multiple opportunities exist to foster more resilient growth, including community engagement, innovative policy approaches, and integrating technology-based solutions. Emerging evidence suggests that West African cities stand at a critical juncture, necessitating inclusive governance structures, collaborative planning, and nature-centered interventions to prepare for the region's rapidly changing socioeconomic and environmental conditions.

The synthesis indicates that cohesive governance frameworks, strong stakeholder participation, and clear commitments to ecological restoration can drive more equitable urban prosperity. Strengthening policy alignment, cultivating local leadership, and directing strategic investments into technology transfer are all crucial steps that can expedite the adoption of sustainable practices and lessen climate-related vulnerabilities. At the same time, the region's ongoing urban transformation provides a rare opportunity to address systemic inefficiencies, secure meaningful community input, and implement solutions that curb environmental impacts. Embracing cross-disciplinary collaboration, allocating adequate resources, and incorporating cultural considerations into urban design can help transition West Africa toward thriving urban environments that are both socially inclusive and ecologically aware. The insights gathered from this review highlight that coordinated efforts, and transparent decision-making can bridge the gap between aspiration and reality, ultimately guiding urban growth toward a sustainable, inclusive, and adaptable future for all.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that the Consensus app (<https://consensus.app/home/about-us/>) plugin with ChatGPT was used for the literature review. The use of this tool was limited to identifying relevant studies and summarizing their key

findings to inform the development of the manuscript. Full responsibility for the content, interpretation, and conclusions of this manuscript remains with the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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