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EXPLORING THE CHALLENGE OF DEVELOPING SUSTAINABLE AFFORDABLE HOUSING

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Abstract

The growing urgency of climate change and persistent housing inequality have intensified the need for sustainable affordable housing (SAH). This study aims to examine research trends linking housing and sustainability, identify key barriers to SAH development, and propose effective strategies to address these challenges. Using bibliometric analysis and a systematic literature review (SLR), studies were retrieved through an advanced search of the Scopus and Mendeley databases, yielding 14 articles for detailed analysis. The findings indicate that construction innovation inefficiencies, ineffective policies, and financial constraints remain major impediments to SAH implementation. By synthesising existing evidence, this study provides strategic insights to support policymakers, practitioners, and researchers in advancing sustainable, affordable, and inclusive housing development.

Keywords: Sustainable Affordable Housing, Affordable Housing, Bibliometric, Systematic Literature Review, Sustainability

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INTRODUCTION

SAH refers to housing that is financially accessible to low- and middle-income households while simultaneously promoting environmental sustainability, social inclusion, and long-term community resilience (Sohaimi et al., 2023, 2025). The concept has gained increasing attention amid rapid urbanisation, climate change pressures, and persistent housing affordability challenges worldwide. Despite this growing interest, cities continue to face escalating housing costs, environmental degradation, and social inequality (Sohaimi, 2022), underscoring the complexity of delivering housing that is both affordable and sustainable. Existing research on housing affordability, sustainability, and policy has evolved in parallel rather than as an integrated body of knowledge. Prior studies tend to focus on isolated dimensions, such as technical performance, financial mechanisms, construction materials, or governance frameworks, resulting in a fragmented evidence base (Narayani & Nagalakshmi, 2023). Reviews of affordable housing in developing and emerging economies similarly highlight that the literature often concentrates on specific materials, technologies, or national case studies, limiting cross-contextual learning and holistic understanding of SAH systems (Chan & Wong, 2022).

While numerous studies have identified challenges to SAH implementation, including misaligned incentives, land-market constraints, weak regulatory frameworks, and institutional capacity gaps, these are frequently examined in isolation (Adabre & Chan, 2021; Arham et al., 2025). This fragmented approach provides limited strategic guidance for policymakers and practitioners seeking scalable and integrated solutions that simultaneously address affordability, environmental sustainability, and social equity. Consequently, the interplay between housing affordability, public health, environmental performance, and governance remains insufficiently synthesised in the existing literature (Sharpe et al., 2025). Synthesising evidence on key barriers and effective strategies will provide an evidence-based overview to inform policy, practice, and future research, supporting the development of inclusive, resilient, and sustainable housing across diverse urban contexts.

RESEARCH METHODOLOGY

Material and methods

Three study objectives, each requiring a distinct approach, are summarised in Table 1.

Table 1: Summary of Research Objectives and Methodologies

Research Objectives	Research Method/	Type of analysis
1. To explore the existing housing and sustainability research trend	Quantitative	Bibliometric
2. To identify key obstacles to SAH development	Quantitative	SLR
3. To propose effective strategies for addressing SAH	Quantitative	Thematic

This study employed a combined bibliometric analysis and SLR to ensure a comprehensive and rigorous examination of SAH research. Bibliometric analysis was used to map publication trends, influential sources, keyword networks, and thematic evolution, providing an objective overview of the field's intellectual structure. Complementarily, the SLR systematically synthesises selected high-quality studies to examine key challenges, policy gaps, and strategic responses that cannot be fully captured through quantitative mapping alone. Integrating both approaches enables the study to visualise research patterns while offering a focused qualitative interpretation of critical themes, thereby enhancing analytical depth and the reliability of the findings.

The review follows PRISMA guidelines to ensure transparency and replicability, with the PRISMA flow diagram documenting the search strategy, screening process, inclusion and exclusion criteria, and final study selection. Scopus served as the primary database due to its extensive coverage of peer-reviewed literature in housing, urban studies, and sustainability. Mendeley was used as a complementary screening tool to support duplicate removal, reference organisation, and cross-verification of relevant studies. This integrated approach enhances methodological robustness by combining quantitative trend analysis with qualitative thematic synthesis. This section also outlines the four key subsections, identification, screening, eligibility, and data abstraction.

Identification

The first stage was to identify keywords and search for associated related terms using a thesaurus, dictionary entries, encyclopedias, and previous research. After selecting the required terms, the search phrases for both the Scopus and Mendeley databases were established (see Table 2). During the initial step of the SLR technique, the current study successfully obtained 457 papers from both databases.

Table 2: The search strings.

Database	Search strings
Scopus	(challenge* OR issue* OR problem*) AND ("Sustainable Affordable Home*" OR "Sustainable Affordable House*" OR "Sustainable Affordable Home" OR "Sustainable Affordable Housing") AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (OA , "all"))
Mendeley	Challenges OR Issues AND Sustainable Affordable House*

Screening

The screening process entails reviewing a collection of potentially relevant research materials for content related to the selected research questions. One example of a content-related criterion used during the screening process is the decision to choose a group of subject matter items based on the issue or challenges of SAH. By this point, any duplicate papers would have been deleted from the original list of documents to be searched. Following the rejection of 332 articles, 125 articles were assessed in the study's second round of screening using a variety of inclusion and exclusion criteria (see Figure 1). The first criterion used was the literature (research articles), which was the primary source of helpful information. Reviews, meta-synthesis, meta-analyses, books, book chapters, and conference papers that were not covered in the most recent studies were also included. Furthermore, the review only covered papers in English.

Eligibility

The eligibility level, also known as the third level, produced 125 articles. Accordingly, all article titles and essential content were thoroughly reviewed to verify that they fulfilled the inclusion criteria and the current study's aims. Consequently, 111 papers were removed because they were unrelated to the study's topic, their names, study areas, and abstracts were mismatched, and they prohibited full-text access based on empirical evidence. As of the publishing of this article, 14 articles were available for evaluation.

Data Abstraction and Analysis

i. Bibliometric data abstraction

From 2010 until 2024, the Scopus database provided the information for this bibliometric analysis. Data analysis was conducted using the mapping and clustering approaches with VOSviewer software version 1.6.19. The Multidimensional Scaling (MDS) method proposed by (Van Eck et al., 2010) is an alternative to this software. A comparison of these two methods' shared objective is to precisely represent relatedness and similarity by placing the objects in a low-dimensional space, as measured by separation distance (Appio et al.,

2014). To normalise co-occurrence frequencies and enhance the accuracy of the representation of relationships between items, it computes the association strength (ASij), as shown below.

$$AS_{ij} = \frac{C_{ij}}{\omega_i \omega_j}$$

By comparing observed and expected co-occurrences and assuming statistical independence between items i and j, Van Eck and Waltman (2010) established the association strength metric, which quantified the degree of relationship between items i and j. Using a weighted sum of squared distance reduction, the VOSviewer arranges items on a map. In compliance with the guidelines provided by Appio et al. (2014), the LinLog/modularity normalisation technique was also used. By applying the VOSviewer's visualisation tools to the dataset, patterns resulting from mathematical relationships were shown. VOSviewer arranges the components to create a map by first lowering the weighted total of the squared distances between each pair of objects. LinLog/modularity normalisation was recommended by Appio et al. (2014). Keyword co-occurrence analysis is useful for identifying subjects that are frequently addressed across several disciplines and can be used to monitor the development of a study area over time (Li et al., 2016). Consequently, by lowering the weighted total of the squared distances between each pair of objects, the VOSviewer uses this index to arrange the objects into a map. Appio et al. (2014) promoted the use of LinLog/modularity normalisation.

In addition, mathematical relationship patterns and VOSviewer's visualisation features were used to perform analyses on the dataset, including co-citation, co-occurrence, and keyword co-occurrence analyses. According to Li et al. (2016), keyword co-occurrence analysis is useful for identifying themes that are frequently discussed in various academic fields and for examining the evolution of a research subject over time. This makes it possible for researchers to evaluate the historical significance of the main field of study within a discipline. Correspondingly, important research topics, patterns, and techniques can be found with the use of citation analysis, which makes it simpler to determine the most important research questions, approaches, and techniques as well as to assess the historical significance of a discipline's central field of study.

ii. SLR data abstraction

Meanwhile, one of the evaluation processes employed in the SLR was an integrative analysis, which examined and synthesised several research methodologies (quantitative, qualitative, and mixed). The expert evaluation aimed to identify relevant concerns and subtopics. The data collection technique provided the foundation for the theme's development. The authors carefully

examined a collection of 14 articles, as shown in Figure 1, looking for remarks or material related to the current study's topics. After identifying and constructing key groupings in the second stage, the authors investigated the concerns and obstacles preventing the implementation of SAH. The result of the investigation yielded three key topics: Construction Innovation Inefficiencies, Ineffective Policies, and Financial Constraints.

From this point on, the authors continued with themes, concepts, or ideas for each established subject. As part of this research, the author collaborated with other co-authors to establish evidence-informed themes. Throughout the data analysis, a log was kept for capturing analyses, opinions, puzzles, or extrapolations that were relevant to the data interpretation. The authors examined the findings to determine any variations in the theme development process. It is critical to note that the authors discussed possible conceptual differences that may exist. After some time, the created designs were modified to maintain uniformity. Experts in housing and sustainability conducted a study to determine the validity of the difficulties. The expert analysis process guarantees that each sub-theme is clear, important, and appropriate by demonstrating domain validity.

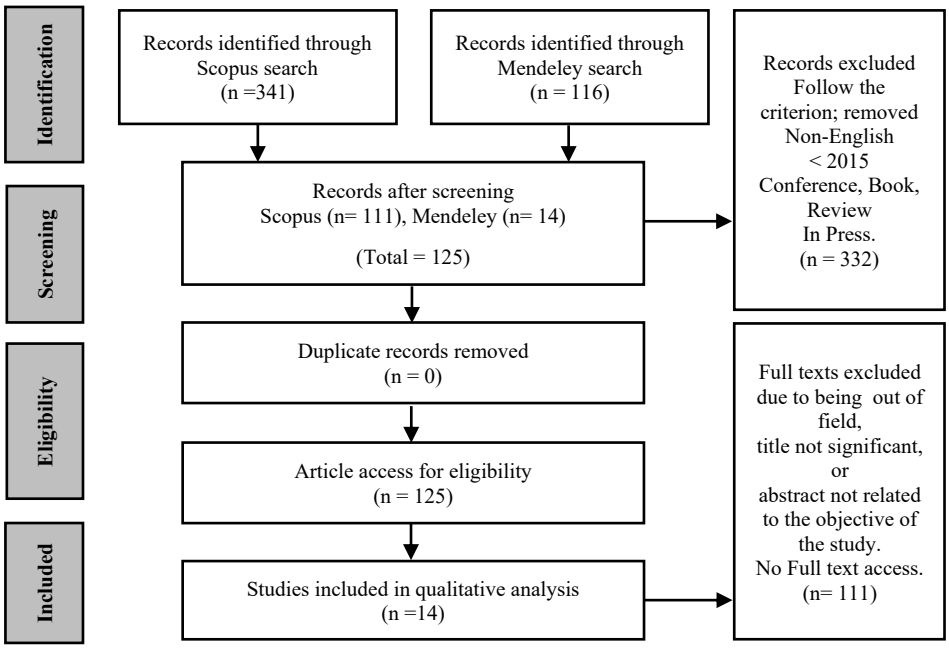

Figure 1: Flow diagram of the proposed search study for systematic literature review.
Source: Moher et. al., (2009)

ANALYSIS AND DISCUSSION

Exploring the existing housing and sustainability research trends

The diagram in Figure 2 illustrates the co-occurrence of keywords in a body of literature that is related to sustainable housing. Figure 2 shows multiple phrase clusters that regularly appear together. For example, there is a cluster that includes terms such as "sustainable housing", "developing countries", "energy efficiency", "building", and "construction industry". This cluster suggests a body of research that focuses on how to construct sustainable housing. Another cluster includes terms such as "housing affordability", "stakeholder", "decision making", and "barriers". This cluster likely refers to research on the challenges of making SAH for low-income households in developing countries. Research on cutting-edge building materials, eco-friendly building techniques, and the incorporation of renewable energy sources to improve the sustainability of housing in both developed and developing nations may fall under this cluster. Researchers in this field probably observed how the building sector contributes to sustainable development and strives to solve issues that are unique to developing countries, such as scarce resources and infrastructural limitations. Researchers may also have examined frameworks and strategies for making decisions that are intended to overcome these obstacles and support the fair distribution of SAH options.

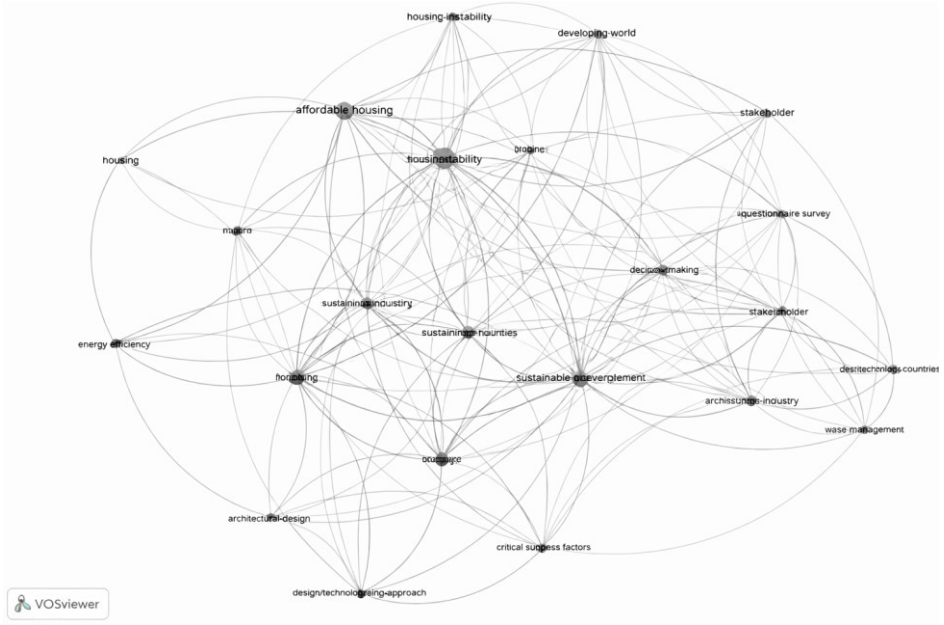

Figure 2: Visualisation of co-occurrence of keywords.

Figure 3 presents a three-field plot illustrating the relationships among author keywords, countries, and authors in housing sustainability studies. The plot depicts ten key author keywords, countries, and authors. Among the keywords, "sustainability", "sustainable housing", and "affordable housing" emerge as the most dominant themes, reflecting a strong scholarly focus on integrating sustainability principles with housing accessibility and affordability. In terms of geographic contribution, Hong Kong, Nigeria, and Malaysia appear as the most prominent countries, indicating significant global engagement in addressing sustainable housing challenges. Sustainability related studies are particularly influential in these countries, while research on affordable housing is especially prominent in Hong Kong and Malaysia. Sustainable housing also represents a major research focus in Hong Kong, followed by the United Kingdom and Nigeria, highlighting the global relevance and wide geographic distribution of research efforts in this field. The consistent contributions from Nigeria, Malaysia, and Hong Kong demonstrate a shared commitment to addressing housing-related challenges through sustainable approaches. Additionally, authors such as Oyetunji and Chan emerge as key contributors, reflecting their substantial influence on advancing knowledge in housing and sustainability research.

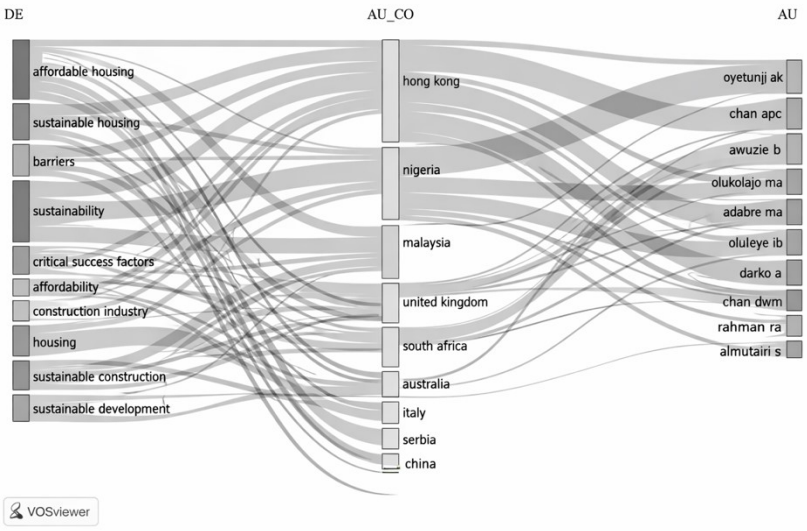

Figure 3: Visualisation of bibliographic coupling by authors.

The key obstacles to SAH development

In this study, the identification of key obstacles to SAH development was conducted solely through a SLR. Relevant articles were selected from the Scopus database based on predefined inclusion criteria to ensure the quality, relevance, and academic rigor of the sources. Each selected paper was then read and

critically reviewed to extract and synthesise evidence related to barriers and challenges affecting SAH development. The SLR process involved a careful examination of empirical and conceptual studies to identify recurring patterns and dominant issues reported across the literature. This approach ensures that the findings are grounded entirely in a comprehensive and transparent review of existing scholarly evidence, thereby enhancing the credibility, reliability, and replicability of the study's results. Through this qualitative synthesis, three major obstacle categories were identified as follows:

a. Construction Innovation Inefficiencies

Inefficiencies in construction innovation pose significant challenges to the development of SAH. According to Reid (2023), innovative measures are crucial for addressing these inefficiencies, highlighting the need for sustainable and inclusive building practices, user involvement, eco-friendly homes, and improved training. Atta et al. (2021) emphasise the importance of developing decision support tools that are tailored for contexts with limited information, which can help decision-makers identify appropriate technological solutions. Without these tools, decision-making can be hindered, leading to delays and increased costs. Moghayedi et al. (2022) point out that the adoption of sustainability-oriented innovations is influenced by various factors. Inefficiencies in managing these factors can slow down the adoption of innovative construction technologies, thereby impeding the development of SAH.

Table 3: Summary of the Construction Innovation Inefficiencies Challenge

Authors	Methods	Result/Advantages
Reid (2023).	Exploratory data mining analysis	Innovative measures are desperately needed to solve the inefficiencies. Fixing affordable housing needs sustainable and inclusive building, user involvement, eco-friendly homes, and better training.
Atta et al. (2021).	Literature review	Suggesting the development of a decision support tool tailored for situations where information is limited. This tool would assist decision-makers in identifying appropriate technological solutions.
Moghayedi et al. (2022).	Structural equation modeling (PLS-SEM)	The need to prioritise and address external barriers to maximise the benefits of adopting sustainable innovations in construction.

b. Ineffective Policies

Ineffective policies pose significant challenges to developing SAH by contributing to several key issues identified in the referenced studies (see Table 4). These policies can lead to poor allocation of resources and corruption, as highlighted in the structural equation modelling approach by Adabre and Chan, (2021), which shows that political and procurement risks significantly impact the achievement of Sustainable Development Goals (SDGs) and influence all other

risk categories, namely, design and construction risks. Inefficiencies in policy implementation can result in regulatory barriers and delays, as noted by Adewunmi et al. (2023), who emphasise the importance of community visioning and public service improvement. Furthermore, Adabre et al. (2023) identify that potentially ineffective and counterproductive policies can hinder the success of sustainable housing projects. Additionally, Lea et al. (2021) stress the need for policies to account for climate change in Indigenous housing, suggesting that failure to integrate such considerations can lead to suboptimal housing solutions. Overall, ineffective policies can undermine efforts to create SAH by fostering an environment of mismanagement, inconsistency, and a lack of comprehensive planning.

Table 4: Summary of Ineffective Policies

Authors	Methods	Result/Advantages
Adewunmi et al. (2023)	Structural equation modeling (PLS-SEM)	A policy that requires community vision with an emphasis on public service improvement.
Adabre et al. (2023)	Qualitative & Quantitative	The success characteristics of mixed-use developments also have a big influence on sustainable housing. The results alert decision-makers to potential ineffective and counterproductive policies.
Lea et al. (2021)	Policy review & Interview	It is imperative that housing and health policies for Indigenous people take climate change into account.
Adabre et al. (2021)	Literature review Structural equation modeling (PLS-SEM)	Political and procurement risks significantly impact the achievement of Sustainable Development Goals (SDGs). This risk category significantly influences all other risk categories, with the greatest impact on design and construction risks.

c. Financial constraints

Financial constraints represent a critical obstacle to the development of SAH, as consistently reported in the literature (see Table 5). High construction and material costs directly increase housing prices, thereby reducing affordability for low- and middle-income households. (Oluleye et al., 2021) identify technology and cost-related barriers as major constraints, highlighting that financial limitations are closely linked to technological challenges and other structural factors. Similarly, Okoro et al., 2024) emphasise on the role of market dynamics, land supply and acquisition restrictions, and rising construction material costs as key financial pressures that undermine the provision of affordable housing.

Limited access to financing and credit further restricts developers' capacity to invest in sustainable design features, energy-efficient technologies, and durable materials, which often require higher upfront capital despite offering long-term cost savings. Spaan and Abraham, (2023) note that the lack of funding, compounded by complex regulatory and administrative procedures, significantly impedes affordable housing development. Moreover, weak financial incentives

and subsidy mechanisms discourage private sector participation, prompting developers to prioritise conventional, cost-minimising construction approaches over environmentally sustainable alternatives.

Financial constraints also limit the retrofitting of existing housing stock, thereby constraining improvements in energy efficiency and environmental performance. Adabre et al. (2021) demonstrate that retrofit-related challenges are strongly influenced by incentive-related barriers that are, in turn, shaped by cost considerations, indicating a direct relationship between financial capacity and the implementation of sustainable housing solutions. Wang et al. (2020) identify government credit risks, legal and regulatory imperfections, and insufficient market income as significant financial risks in infrastructure and housing-related public–private partnership projects, which can delay or hinder sustainable housing development. These findings show that financial constraints undermine housing affordability by increasing development and purchase costs while simultaneously weakening sustainability outcomes by limiting the adoption of green technologies, retrofitting initiatives, and long-term resilience measures. Addressing these challenges therefore requires innovative financing mechanisms, targeted incentives, and supportive policy frameworks to facilitate the effective delivery of SAH.

Table 5: Summary of the Financial Constraints Challenge

Authors	Methods	Result/Advantages
Oluleye et al. (2021)	• Literature review • Factor analysis • Ranking and normalisation analysis	The 18 barriers to developing sustainable affordable housing can be simplified into six categories: **technology and costs**, knowledge and awareness, policy implementation, client/human factors, economic barriers, and environmental barriers.
Spaan & Abraham (2023)	• Semi-structured interviews	Recognised challenges, including a lack of funds, complicated regulations, and administrative obstacles.
Okoro et al. (2021)	• Systematic literature review • International expert Interview	The region's ability to provide affordable housing is at risk due to a number of reasons, including market dynamics, land supply and acquisition restrictions, construction material costs, unsupportive legislation, and technical and financial issues.
Adabre et al. (2021)	• Structural equation modeling (PLS-SEM)	Retrofit-related hurdles are significantly influenced by incentive-related barriers. Barriers connected to incentives were significantly impacted by barriers related to costs.
Wang et al. (2020)	• Literature review and in-depth case studies • Structured interviews	Government credit, legal and regulatory system imperfections, market income insufficiency, government approval delays, and fee changes are important risk considerations.

CONCLUSION

The findings highlight the need for governments to accelerate sustainable construction through policies that incentivise modern building methods and strengthen capacity-building initiatives. Supportive frameworks that encourage

collaboration between industry, academia, and public agencies are essential to promote the adoption of digital construction tools, such as Building Information Modeling (BIM), modular construction, and other resource-efficient technologies. Streamlining approval processes and supporting pilot or demonstration projects can further illustrate that environmentally sustainable construction practices can be implemented without compromising housing affordability.

The results also emphasise the importance of coherent and integrated governance structures in housing policy. Reducing regulatory fragmentation and improving inter-agency coordination are critical to ensuring that affordability and sustainability objectives reinforce one another rather than operate in isolation. Aligning national housing strategies with global development agendas, particularly the Sustainable Development Goals (notably SDG 11), provides clear policy direction, accountability, and consistency across scales. In addition, robust housing data systems and cross-sectoral planning linking housing with transport, environmental management, and social infrastructure can enhance the effectiveness and equity of urban development policies.

Furthermore, addressing financial constraints requires the mobilisation of innovative and inclusive financing mechanisms. Governments and local authorities can play a catalytic role by expanding public private partnerships, introducing targeted subsidies, and utilising tax-based incentives to reduce upfront costs and financial risks for developers. Integrated financial policies that incorporate risk-sharing arrangements and long-term incentives can attract private sector investment into sustainable housing initiatives. Innovative instruments such as green bonds, revolving funds, and concessional financing schemes offer further opportunities to simultaneously improve housing affordability, environmental performance, and long-term resilience.

Despite the growing body of literature on SAH, several critical research gaps remain, necessitating further investigation to advance empirical understanding, policy effectiveness, and practical implementation. Future research should further investigate the role of emerging technologies in enhancing the affordability and sustainability of housing, as existing studies remain largely conceptual or limited to small-scale applications. Digital construction methods such as BIM, three-dimensional printing, and prefabrication have demonstrated potential to improve efficiency, reduce material waste, and lower construction costs. However, empirical evidence on their long-term cost-effectiveness and scalability in affordable housing contexts remains limited (Ouda & Haggag, 2025). Similarly, the integration of renewable energy systems and smart-home technologies has shown promising results in improving energy efficiency and reducing carbon emissions, yet most findings are based on simulations or pilot-scale studies rather than real-world implementation (Bagdadee et al., 2025). Future research should therefore prioritise empirical

investigations, including cost–benefit analyses of demonstration projects and living laboratories, to generate robust evidence on the economic viability and sustainability performance of these technologies in diverse housing contexts.

Longitudinal and comparative research is needed to address the limited understanding of how housing policies, financial models, and delivery mechanisms evolve over time and across regions, particularly in developing and emerging economies. Much of the existing literature relies on cross-sectional or single-country analyses, limiting insights into policy durability, institutional learning, and long-term outcomes (Muhammed et al., 2025). The use of long-term datasets, policy-tracking approaches, and cross-country comparisons would help identify the conditions under which SAH initiatives can be successfully scaled and adapted across different socio-economic and governance contexts.

This study underscores that advancing SAH requires an integrated approach that simultaneously addresses construction innovation, governance effectiveness, and financial constraints. The findings highlight the critical role of policy frameworks in accelerating the adoption of modern, resource-efficient construction methods, strengthening institutional coordination, and aligning national housing strategies with global sustainability agendas such as SDG 11. Equally important is the mobilisation of innovative and inclusive financing mechanisms, including public–private partnerships and risk-sharing instruments, to enhance affordability while supporting long-term environmental resilience. Despite growing scholarly attention, significant research gaps remain, particularly in the empirical evaluation of emerging technologies, the long-term performance of housing policies, and the scalability of sustainable housing models across diverse contexts. Addressing these gaps through robust empirical, longitudinal, and comparative research will be essential to inform evidence-based policymaking and support the effective delivery of affordable, inclusive, and sustainable housing globally.

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