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MAPPING THE INTERSECTION OF SUSTAINABILITY AND AFFORDABILITY IN HOUSING: A BIBLIOMETRIC REVIEW

Nur Hafizah Mohd Ezani[1], Mohd Baharudin Ridzuan[2*], Muhammad Fikri Hasmori[3]

[1] Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn, Malaysia
Email: hafizah.ezani@gmail.com
[2] Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn, Malaysia
Email: mdbahar@uthm.edu.my
[3] Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn, Malaysia
Email: mfikri@uthm.edu.my
[*] Corresponding Author

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Abstract:

The intersection of sustainability and affordability in housing has become an increasingly critical area of research, driven by the dual challenges of rising urban housing demand and the global commitment to sustainable development. Despite the increase in studies on either sustainability or affordability, limited bibliometric evidence exists that systematically maps their overlap and research evolution. To address this gap, this study applies a bibliometric approach to examine global publication trends and knowledge structures in the field. Data were collected from the Scopus database using advanced searching with the keywords "sustainable housing," "affordable housing," "green building," "low-cost housing," "housing construction," "housing sustainability," and "housing affordability," resulting in a final dataset of 973 publications. The dataset was refined and harmonized using OpenRefine to ensure consistency and accuracy. Statistical analysis and graphical trends were generated using the Scopus Analyzer, while VOSviewer software was employed to conduct keyword co-occurrence, citation, and co-authorship network visualizations. The analysis revealed a strong growth track in research output, with publications rising significantly after 2019, reflecting heightened global attention to the United Nations Sustainable Development Goals (UN SDGs), particularly SDG 11 on sustainable cities and communities. Country-level analysis identified the United States (US), the United Kingdom (UK), India, China, and Australia as leading contributors, while Malaysia and South Africa emerged as notable contributors from the Global South. The co-occurrence analysis highlighted five major clusters of research themes: energy efficiency and renewable technologies, construction materials and building performance, urban planning and policy frameworks, socio-economic equity and affordability, and decision-making tools for housing sustainability. This

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study concludes that while the field has achieved substantial growth and interdisciplinary breadth, gaps remain in integrating technical innovation with social equity and affordability concerns. The findings provide a comprehensive knowledge map to guide future research, policy, and practice in sustainable, affordable housing.

Keywords:

Sustainable Housing, Affordable Housing, Green Building, Low-Cost Housing, Housing Sustainability, Housing Affordability, Bibliometric Analysis

Introduction

The intersection between sustainability and affordability in housing is a critical area of study, particularly in the context of global urbanization and environmental challenges. Sustainable housing aims to minimize environmental impact through energy efficiency, the use of renewable resources, and eco-friendly construction practices. However, achieving sustainability often comes with higher initial costs, which can make such housing unaffordable for many, especially in lower-income and developing regions. This dichotomy presents a significant challenge: how to balance the need for environmentally sustainable housing with the imperative of making it affordable for all socio-economic groups. This paper explores this intersection, examining the barriers and potential solutions to integrating sustainability and affordability in housing.

The concept of sustainable housing encompasses various dimensions, including environmental, economic, and social sustainability. Sustainable housing is designed to reduce energy consumption, utilize renewable resources, and minimize waste, thereby contributing to environmental sustainability. However, the initial costs associated with sustainable housing can be prohibitive, particularly for lower-income households. Studies have shown that while sustainable housing offers long-term economic benefits through reduced utility costs and improved health outcomes, the upfront investment remains a significant barrier (Khan & Fang, 2020; Mushanga et al., 2024; Thompson & Yang, 2015). This is particularly true in developing countries, where housing shortages and economic constraints are more pronounced (Aliu, 2022; Khan & Fang, 2020).

Affordability in housing is traditionally assessed based on the ratio of housing costs to household income. However, this narrow economic perspective fails to capture the broader implications of housing affordability, which also includes factors such as location, quality, and access to amenities and services (Ezennia & Hoskara, 2021; Mulliner & Maliene, 2011). Recent research advocates for a more holistic approach to housing affordability, integrating sustainability criteria to ensure that affordable housing also meets environmental and social standards (Abuzeinab et al., 2016; Ezennia & Hoskara, 2021; Mulliner & Maliene, 2011). This broader conceptualization of housing affordability aligns with the principles of sustainable development, which emphasize the need to balance economic, social, and environmental goals (Abdul Hamid et al., 2018; Heong & Leng, 2025; Masram et al., 2020).

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Several studies have highlighted the potential benefits of integrating sustainability into affordable housing. For instance, sustainable housing can improve health outcomes by providing safer, healthier living environments and reducing exposure to environmental hazards (Li & Fong, 2025; Rana, 2025). Additionally, sustainable housing can enhance social equity by ensuring that all segments of the population have access to quality housing that meets their needs and preferences (Masram et al., 2020; Mushanga et al., 2024). However, achieving these benefits requires overcoming significant challenges, including financing, policy coherence, and the need for cross-sector collaboration (Abraham et al., 2021; Rana, 2025).

Empirical research has identified various strategies to address the challenges of integrating sustainability and affordability in housing. These include the use of lean construction methods, energy-efficient building designs, and government incentives such as subsidies and planning incentives (Abraham et al., 2021; Khan & Fang, 2020; Thompson & Yang, 2015). Additionally, innovative approaches such as the use of smart technologies and modular construction can further enhance the sustainability and affordability of housing (Abraham et al., 2021; Sohaimi et al., 2025). However, the successful implementation of these strategies requires a supportive policy framework and effective stakeholder collaboration (Aliu, 2022; Nhat & Hoang, 2025; Singh & Marwaha, 2025).

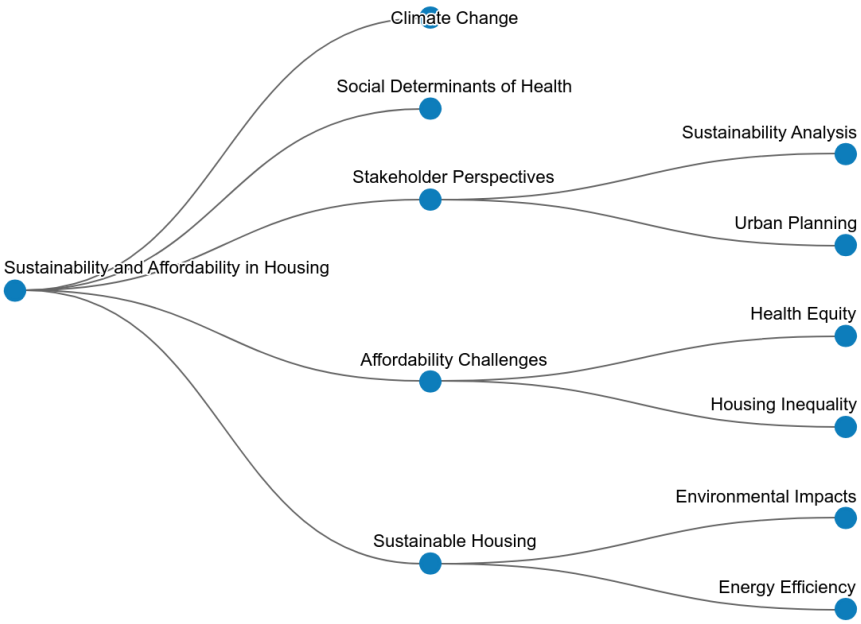

Figure 1: Overview of Literature Map

Figure 1 illustrates how the intersection between sustainability and affordability in housing is shaped by multiple interconnected themes. At its core, the discussion spans environmental, social, and economic dimensions. From the environmental side, sustainable housing links affordability with energy efficiency and the reduction of environmental impacts, highlighting the need to balance cost with ecological responsibility. Social considerations emerge through issues such as health equity, housing inequality, and broader social determinants of health, which emphasize how access to sustainable housing affects community well-being. Stakeholder perspectives—including policymakers, urban planners, and developers—bridge

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these factors, guiding strategies for sustainability analysis and urban planning interventions. At the same time, affordability challenges remain central, as rising costs and financial barriers complicate equitable access to green housing solutions. Climate change further intensifies the urgency of integrating sustainability into housing policy, underscoring the sector's role in both mitigation and adaptation. Collectively, these themes reveal that achieving sustainable and affordable housing requires integrated approaches that account for environmental performance, affordability mechanisms, and social justice considerations, ensuring housing solutions are not only green but also inclusive and equitable.

In conclusion, the intersection between sustainability and affordability in housing is a complex and multifaceted issue that requires a holistic approach. While sustainable housing offers significant long-term benefits, the initial costs and implementation challenges must be addressed to make it accessible to all socio-economic groups. Future research should focus on developing integrated strategies that balance economic, social, and environmental goals, and on identifying best practices for policy and stakeholder collaboration. By doing so, it is possible to create housing solutions that are both sustainable and affordable, contributing to the overall well-being of communities and the planet.

Research Question

- What are the publication trends and growth patterns for the research on the intersection between sustainability and affordability from 2015 to 2025?
- Which authors constitute the most influential works based on citation impact in this research domain?
- Which countries have made significant contributions to the research output on sustainable and affordable housing?
- What are the most frequently occurring keywords related to the study?
- Which countries demonstrate co-authorship collaboration in the field of sustainable and affordable housing research?

Methodology

Bibliometrics is a systematic approach that entails the collection, organization, and analysis of bibliographic data from scientific literature (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). While it encompasses basic descriptive statistics such as identifying core publishing journals, temporal publication trends, and prolific authors (Wu & Wu, 2017), the field has evolved to include advanced techniques like document co-citation analysis, which uncovers intellectual linkages and thematic structures within a discipline. A rigorous literature review therefore demands an iterative process: carefully selecting keywords, conducting comprehensive searches, and performing in-depth analyses to ensure the reliability and completeness of the evidence base (Fahimnia et al., 2015). In line with this principle, the present study concentrated on high-impact publications, given their ability to reveal influential theoretical frameworks that shape scholarly discourse. To ensure accuracy and breadth of coverage, Scopus was employed as the primary data source (Al-Khoury et al., 2022; Di Stefano et al., 2010; Khiste & Paithankar, 2017). Moreover, to maintain academic quality, only peer-reviewed journal articles were included, while books and lecture notes were explicitly excluded (Gu et al., 2019). Using Elsevier's Scopus database, recognized for its extensive indexing of international scholarship, publications spanning 2015 to October 2025 were retrieved for further bibliometric analysis.

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Data Searching

The search strategy was conducted using Scopus' advanced search function, applying a carefully structured query to capture studies at the intersection of housing, sustainability, and affordability. The query combined housing with sustainability-related terms such as "sustainable," "green building," "energy-efficient," "eco-friendly," and "resilient," alongside affordability-related terms such as "affordable," "low-cost," and "cost-effective." To ensure relevance and quality, the search was restricted to publications from 2015 to 2025, in the English language, limited to journal articles at the final publication stage, and belonging to four subject categories: Social Sciences, Engineering, Environmental Science, and Energy. Non-English studies, conference papers, books, review articles, and works outside the specified subject areas were excluded. Note that this systematic filtering process allowed for a focused dataset aligned with the research objectives. The assessment date of 3 October 2025 (refer to Table 1) confirmed that the final dataset comprised 973 eligible articles, representing a robust and comprehensive evidence base for analyzing trends and research patterns in sustainable and affordable housing. By narrowing the scope through explicit inclusion and exclusion criteria, the search strategy ensured that the resulting body of literature was both comprehensive and methodologically sound, capturing high-quality peer-reviewed research most relevant to the intersection of sustainability and affordability in housing.

Table 1: The Search String

Database	Search String
Scopus	TITLE-ABS-KEY ((housing AND (sustainable OR "green building" OR "energy-efficient" OR "eco-friendly" OR "resilient") AND (affordable OR "low-cost" OR "cost-effective") Date Assessed: 3 October 2025

Table 2: The Selection Criterion in Searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2015 – 2025	< 2015
Literature type	Journal (Article)	Conference, Book, Review
Publication Stage	Final	In Press
Subject Area	Social Sciences, Engineering, Environmental Science, Energy	Other than in Social Sciences, Engineering, Environmental Science, Energy

Data Analysis

VOSviewer is a widely recognized bibliometric software developed by Nees Jan van Eck and Ludo Waltman at Leiden University, the Netherlands (van Eck & Waltman, 2010, 2017). Designed to support the visualization and analysis of scientific literature, the software

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specializes in producing intuitive network maps, clustering related items, and constructing density visualizations. Its versatility enables researchers to explore co-authorship, co-citation, and keyword co-occurrence networks, offering comprehensive insights into research landscapes. The interactive and continuously updated interface ensures that both novice and experienced users can efficiently navigate large datasets. Additionally, the ability to compute bibliometric indicators and customize visual outputs reinforces its value as a methodological tool for mapping and interpreting knowledge domains.

One of VOSviewer's defining strengths lies in its capacity to transform complex bibliometric datasets into visually interpretable structures. By emphasizing network visualization, the software facilitates the detection of thematic clusters, the analysis of keyword co-occurrence patterns, and the identification of intellectual linkages across disciplines. Its adaptability to diverse bibliometric data sources, including citation and co-authorship records, positions VOSviewer as an indispensable instrument for advancing bibliometric scholarship and enhancing the transparency of scientific inquiry.

For this study, datasets containing publication year, title, author, journal, citation count, and keywords were extracted in PlainText format from the Scopus database, covering the period from 2005 to October 2025. The data were analyzed using VOSviewer version 1.6.20, applying clustering and mapping techniques to generate knowledge maps. Unlike the traditional Multidimensional Scaling (MDS) approach, which primarily relies on similarity measures such as cosine or Jaccard indices (Appio et al., 2014), VOSviewer adopts the "Visualization of Similarities" (VOS) technique to position items in a low-dimensional space, where the distance between items reflects their relatedness (van Eck & Waltman, 2010b).

$$AS_{ij} = \frac{C_{ij}}{w_i w_j}.$$

Central to this approach is the Association Strength (AS_{ij}) normalization, defined as proportional to the ratio between the observed and expected number of co-occurrences of two items under statistical independence assumptions (van Eck & Waltman, 2007). This refined normalization ensures more accurate mapping of bibliometric relationships, thereby strengthening the interpretive power of bibliometric analyses.

Result

Bibliometric analysis offers a structured method for systematically examining research data. This approach enhances research efficiency, facilitates data visualization, and presents findings in a clear and understandable format. By applying bibliometric methods, researchers and readers can better comprehend research patterns and contribute to the advancement of knowledge across various disciplines.

Publication Trends and Growth Patterns

The publication trend between 2015 and 2025 (Figure 2) demonstrates a clear and consistent growth in research at the intersection of sustainability and affordability in housing. From 2015 to 2019, the numbers rose gradually from 38 to 60 documents, indicating an early but steady interest in this field. A more significant jump is observed from 2020 onwards, with publications increasing from 82 in 2020 to 170 in 2024, the highest recorded year. This sharp growth reflects how global awareness of climate change, urbanization pressures, and the affordability crisis

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has intensified research attention, particularly after the COVID-19 pandemic, which reshaped housing priorities and amplified the demand for resilient and sustainable solutions. The high count in 2023 and 2024 also suggests a peak period where both policymakers and academics converged on affordability and sustainability as dual priorities in housing discourse.

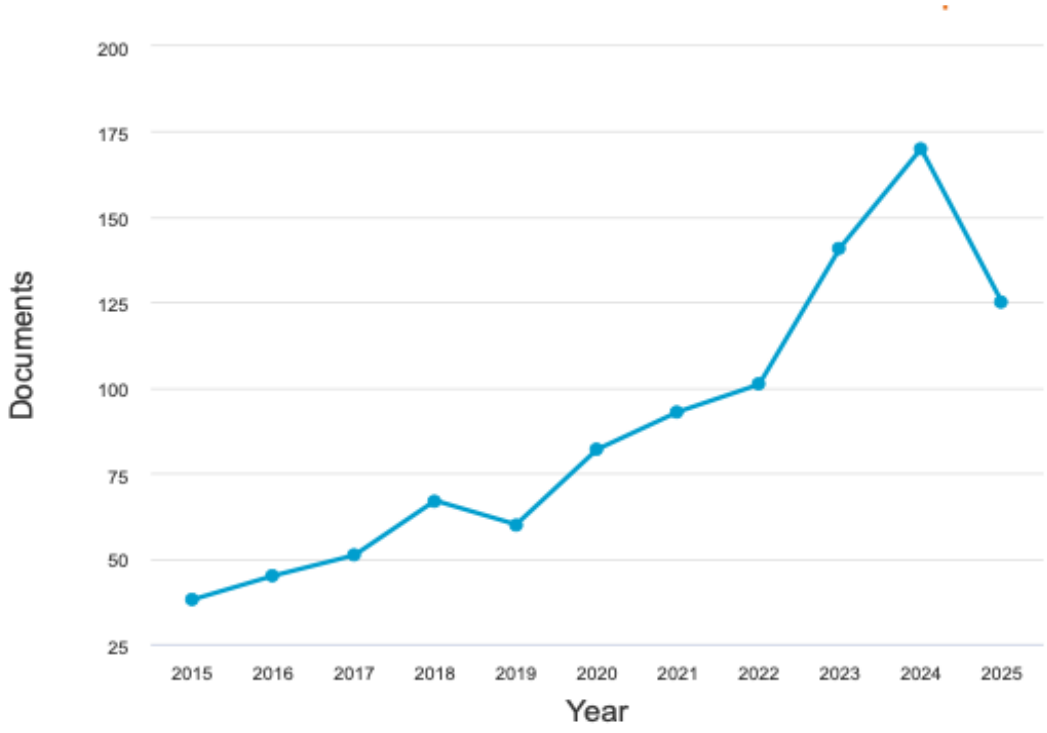

Figure 2: Publication Trends Between 2015 and 2025

The slight decline from 170 in 2024 to 125 in 2025 (noting that 2025 data may be incomplete if assessed mid-year) does not necessarily indicate reduced interest. Instead, it may reflect indexing lag or the natural tapering of ongoing large research projects. The overall trajectory shows that the field has matured significantly over the decade, moving from niche interest to mainstream academic and policy focus. The increase is driven by global policy frameworks such as the United Nations Sustainable Development Goals (UN SDG 11: Sustainable Cities and Communities), national housing policies promoting green and affordable housing, and the proliferation of bibliometric and systematic review studies consolidating the field. This confirms that housing research has transitioned toward integrated approaches, where sustainability and affordability are no longer studied in isolation but as interdependent priorities shaping future urban housing agendas.

Most Cited Article

The citation trend among the top ten most-cited articles reveals two dominant directions in the literature: theoretical and critical perspectives on the social and institutional aspects of sustainable housing, and empirical studies that provide technical and practical solutions for green affordable housing. Highly cited works such as Immergluck & Balan (2018) on environmental gentrification (235 citations) and Tummers (2016) on self-managed co-housing

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(157 citations) highlight the critical discourse on who benefits from "sustainable" housing and the equity implications of green urban development. In contrast, Adabre & Chan (2019) and Chan & Adabre (2019) (170 and 139 citations respectively) set a benchmark for the field by establishing critical success factors and bridging criteria between sustainability and affordability, making their frameworks widely cited references. Their prominence reflects how scholars seek conceptual clarity to guide both research and practice.

On the technical side, Dabaieh et al. (2015) (160 citations) and Lee & McCuskey Shepley (2020) (138 citations) gained traction by demonstrating practical energy-saving interventions such as passive cooling roofs and solar PV for low-income housing, appealing to researchers focused on applied engineering solutions. Similarly, Arora et al. (2020) and Aiello et al. (2018) broadened the debate by linking sustainable housing to the circular economy and resource recovery, emphasizing the interdisciplinary relevance of the field. The high citation counts of these studies can be attributed to their relevance to urgent global challenges, including energy poverty, climate change, affordability crises, and the UN SDGs 7, 11, and 12. Collectively, these works became widely referenced because they offered either critical frameworks or actionable solutions that policymakers, practitioners, and researchers could adopt, ensuring their long-lasting influence.

Table 3: Most Cited Article

No	Authors	Title	Year	Journal title	Cited by
1	Immergluck & Balan	Sustainable for whom? Green urban development, environmental gentrification, and the Atlanta Beltline	2018	Urban Geography	235
2	Adabre & Chan	Critical success factors (CSFs) for sustainable affordable housing	2019	Building and Environment	170
3	Dabaieh et al.	Reducing cooling demands in a hot dry climate: A simulation study for non-insulated passive cool roof thermal performance in residential buildings	2015	Energy and Buildings	160
4	Tummers	The re-emergence of self-managed co-housing in Europe: A critical review of co-housing research	2016	Urban Studies	157
5	Chan & Adabre	Bridging the gap between sustainable housing and affordable housing: The required critical success criteria (CSC)	2019	Building and Environment	139
6	Lee & McCuskey Shepley	Benefits of solar photovoltaic systems for low-income families in social housing of Korea: Renewable energy applications as solutions to energy poverty	2020	Journal of Building Engineering	138

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7	Adabre et al.	Critical barriers to sustainability attainment in affordable housing: International construction professionals' perspective	2020	Journal of Cleaner Production	125
8	Arora et al.	Buildings and the circular economy: Estimating urban mining, recovery and reuse potential of building components	2020	Resources, Conservation and Recycling	117
9	Gan et al.	How affordable housing becomes more sustainable? A stakeholder study	2017	Journal of Cleaner Production	115
10	Aiello et al.	A decision support system based on multisensory data fusion for sustainable greenhouse management	2018	Journal of Cleaner Production	114

Country Contributions to Research Output

The distribution of publications by country shows that research on the intersection of sustainability and affordability in housing is dominated by developed nations such as the United States (US) (151), the United Kingdom (UK) (134), and Australia (77). These countries have long-standing research infrastructures, strong academic funding, and established policy frameworks supporting green and affordable housing, which explains their high output. The US and UK, in particular, have advanced debates around energy efficiency, social housing, and sustainable urban planning, often driven by both environmental commitments and housing affordability crises. Australia's presence reflects its acute challenges with urban sprawl, energy-intensive housing, and affordability in major cities such as Sydney and Melbourne, which have become strong motivators for research and policy innovation.

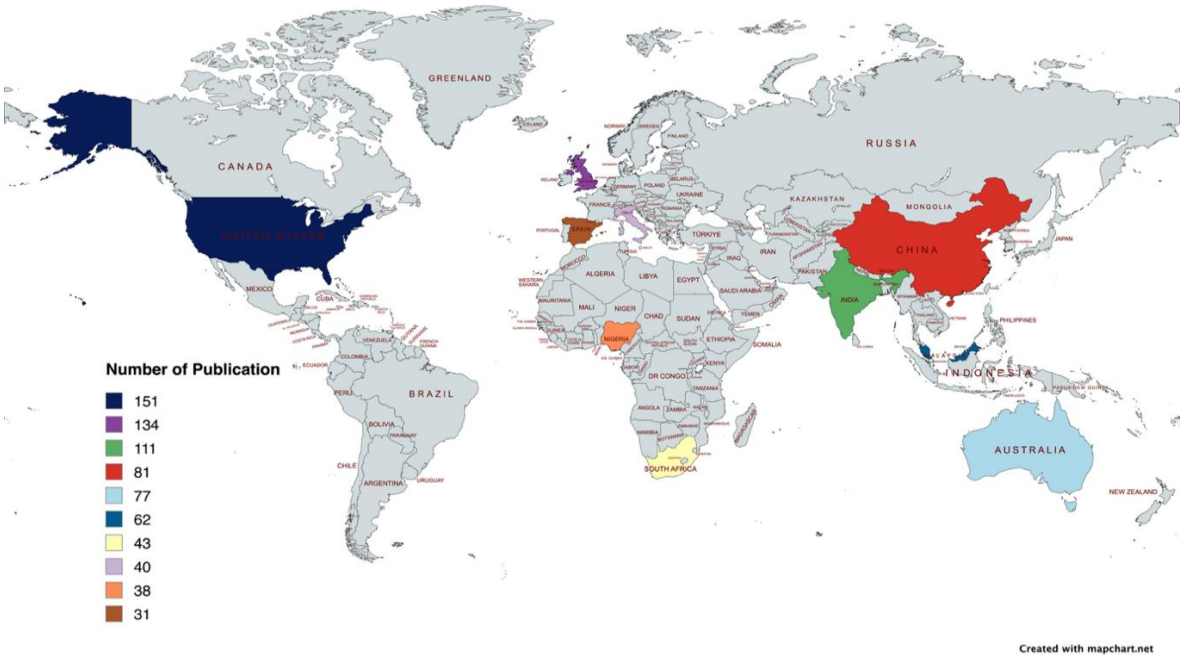

Figure 3: Publish Research by Country

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At the same time, emerging economies such as India (111), China (81), and Malaysia (62) also contributed substantially, reflecting rapid urbanization, rising middle-class demand, and government-led sustainable housing initiatives. India's high number demonstrates its urgent need to balance affordable housing demand with environmental concerns, as seen in large-scale housing schemes and Smart City programs. Malaysia's relatively strong position among developing nations highlights the country's proactive adoption of green rating tools (e.g., GBI, GreenRE, MyCREST) and its national policies to integrate sustainability into affordable housing programs. Meanwhile, countries like South Africa (43) and Nigeria (38) demonstrated growing interest, primarily due to socio-economic pressures to provide low-cost housing within constrained urban environments. The relatively lower outputs from European nations such as Italy (40) and Spain (31) suggested that while sustainability is a priority, the affordability debate in Southern Europe may be less pronounced compared to Asia and Africa, where housing demand and affordability gaps are more pressing.

Keyword Co-Occurrence and Thematic Structure

The co-occurrence analysis of author keywords using VOSviewer illustrates the thematic landscape of research linking sustainability and affordability in housing. The network map, based on a full counting method with a minimum threshold of five occurrences, identified 499 significant keywords out of 3,843, which were grouped into five clusters. The central dominance of "sustainable development" indicates its role as the overarching concept uniting technical, social, and policy-driven dimensions of housing research. Surrounding this core, clusters reflect distinct thematic directions: the green cluster emphasizes energy efficiency, renewable energies, and residential building technologies. The blue cluster highlights construction materials and performance, the red cluster focuses on urban planning, housing policy, and stakeholder engagement, while the yellow cluster covers socio-economic issues such as equity, poverty, and well-being. These clusters show how the field has evolved into an interdisciplinary domain where technical innovation is integrated with urban planning and social justice concerns.

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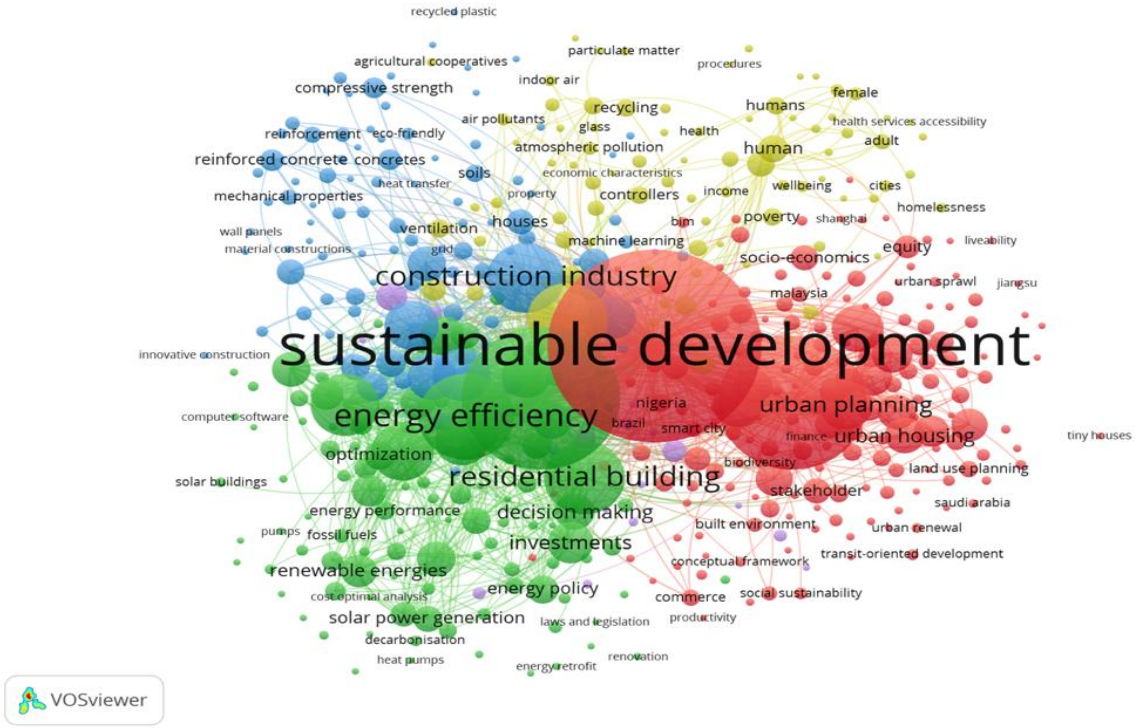

Figure 4: Network Visualization Map of Keywords' Co-Occurrence

The findings contribute to the body of knowledge by demonstrating that the intersection of sustainability and affordability is no longer addressed from a single disciplinary lens but rather through interconnected perspectives. The prominence of energy-related terms suggests strong attention to engineering solutions, while the emergence of socio-economic keywords such as poverty, equity, and liveability indicates a growing recognition of social sustainability and housing inclusivity. This alignment with the UN SDGs (particularly SDG 7, SDG 11, and SDG 12) underscores how the literature reflects global policy agendas. At the same time, the relatively weaker density of links between technical and socio-economic clusters signals a research gap—highlighting the need for more integrative approaches that bridge construction innovations with affordability and equity considerations. This insight provides valuable direction for future scholars aiming to address the holistic challenges of sustainable, affordable housing.

Co-Authorship Collaboration Networks

The co-authorship analysis of countries, as visualized in VOSviewer, maps international research collaborations by linking nations that have co-published studies in the domain of sustainability and affordable housing. In this visualization, the size of each node (country) reflects the number of publications produced, while the connecting lines indicate the strength of collaboration between countries. The analysis was generated using the full counting method with a minimum occurrence threshold of five publications, resulting in 48 out of 95 countries meeting the threshold. By applying a minimum cluster size of five, the map identified nine clusters, each representing groups of countries with closer collaborative ties. The UK, the US, and Australia emerge as central hubs, forming extensive networks with both developed and developing countries, reflecting their leading role in global housing and sustainability research.

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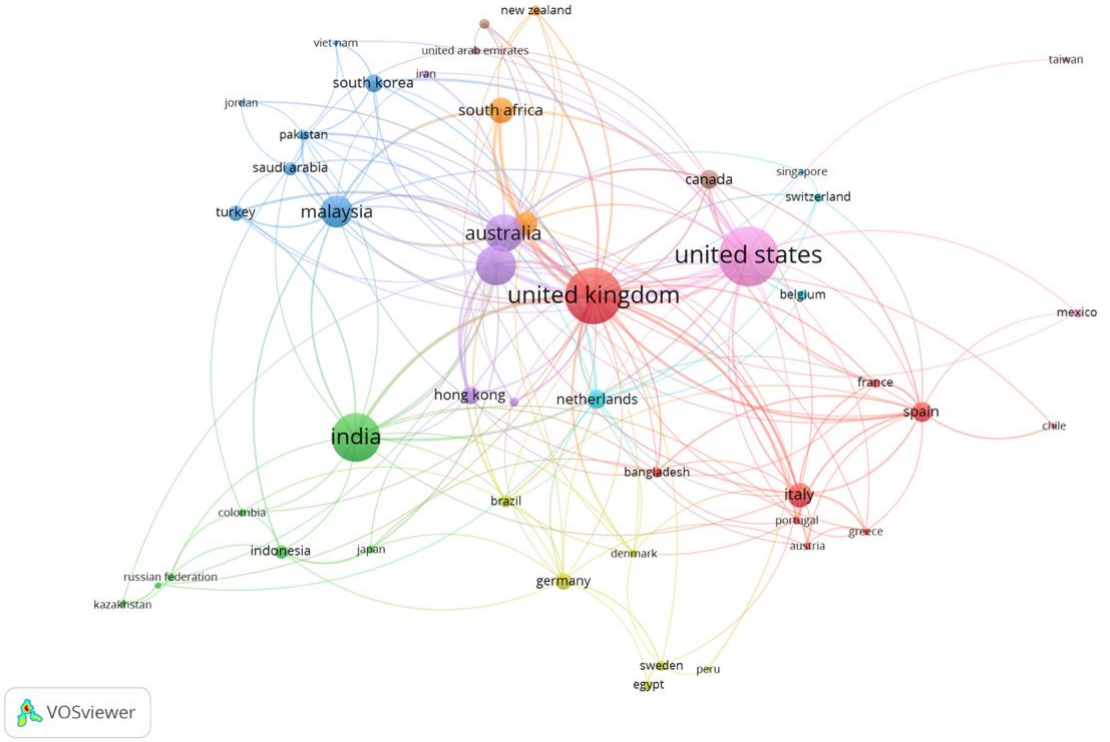

Figure 5: Co-Authorship by Countries' Collaboration

The findings contribute to the body of knowledge by highlighting the global and collaborative nature of housing sustainability research. The presence of strong links between developed countries (e.g., UK–US, Australia–UK) and developing economies (e.g., India, Malaysia, South Africa) shows how expertise and contextual challenges are being integrated through joint studies. This indicates that while advanced economies often drive theoretical and policy frameworks, emerging economies contribute valuable insights from the perspective of rapid urbanization, affordability challenges, and climate vulnerabilities. The clustering also reflects regional research priorities, with Asia (India, Malaysia, China) and Africa (South Africa, Nigeria) strengthening their visibility in international collaborations. This map underscores that cross-country partnerships are essential to addressing sustainability and affordability in housing, as the issues are global in scale but require localized responses that benefit from shared knowledge and comparative experiences.

Conclusion

This study set out to examine global research trends on the intersection of sustainability and affordability in housing through a bibliometric analysis of 973 Scopus-indexed publications. The results show a consistent growth in output, with a marked increase after 2019, reflecting global concerns over climate change, urban housing demand, and alignment with the UN SDGs. The most-cited works reveal two main directions: critical frameworks that connect sustainability with equity and affordability, and technical studies offering practical solutions such as energy-efficient design and renewable energy integration. Country-level findings highlight the dominance of the US, UK, and Australia, alongside emerging contributions from India, China, and Malaysia. Keyword mapping produced five clusters representing themes of

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energy efficiency, construction practices, policy frameworks, socio-economic equity, and decision-making approaches, while co-authorship analysis demonstrated the importance of international collaboration in addressing these challenges. Consequently, the study contributes to knowledge by clarifying how research in this field has matured into an interdisciplinary domain and reveals the need to better integrate technical innovation with social equity concerns. Limitations include reliance on a single database and a restricted timeframe. Future studies should broaden coverage and adopt comparative approaches to address remaining gaps. Overall, the analysis reinforces the significance of bibliometric methods for understanding global trends and guiding policy and practice in sustainable, affordable housing.

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