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Original scientific paper

Mapping the Discourse: Scientometric Analysis of Affordable Housing Research Trends

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ABSTRACT

Affordable housing is not merely about cost but encompasses quality, safety, and accessibility. The shortage of affordable housing perpetuates cycles of poverty, negatively impacting well-being. Utilizing scientometric techniques —co-authorship analysis, citation network analysis, and keyword co-occurrence analysis— on Scopus data from 1999 to 2024, and employing the VOSviewer tool, the aim of this study is to provide a comprehensive understanding of housing affordability by integrating both monetary and non-monetary factors and identifies 1) the co-authorship, co-occurrence, and countries' collaboration, and 2) the most cited article in the field. The results reveal key contributors in affordable housing research, highlight influential works, and map publishing trends. The outcomes show that nine different groups exist and actively collaborate worldwide. Waddell's work, with 873 citations, is the most cited, followed by Monahan with 421 citations. The analysis highlights significant thematic clusters, such as the integration of technological advancements, health considerations, and policy changes in affordable housing research. The study underscores the critical role of social and environmental sciences in addressing housing equity and community well-being. By mapping the current research landscape and forecasting future trajectories, this study provides critical insights for guiding future research, policy development, and societal progress in affordable housing.

Highlights:	**Contribution to the field statement:**
-Through citation network analysis, the study uncovered the most cited works, illustrating foundational studies and their impact on subsequent research. This provides a clear picture of how knowledge has been built over time. -The study revealed patterns of international collaboration, showcasing the interconnectedness of global research efforts in addressing affordable housing challenges.	The originality of this study lies in its comprehensive and systematic approach to mapping the landscape of affordable housing research using robust scientometric techniques. The study's methodological rigor and multidisciplinary perspective provide a holistic understanding of the research landscape, emphasizing the integration of technological advancements, health considerations, and policy changes.

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1. Introduction

In recent decades, affordable housing has arisen as a crucial global concern, with serious social, economic, and environmental consequences. This study builds on key studies that define housing affordability by the relationship between housing costs and income. Earlier works emphasize the need to consider both monetary and non-monetary factors, such as quality, safety, accessibility, and sustainability of housing. Traditional methods have been critiqued for overlooking broader aspects of household well-being. Recent analyses have mapped global research, identifying key areas and gaps. This study expands on these foundations by exploring the integration of sustainability, the impact of new construction technologies and the effectiveness of financial mechanisms for a comprehensive understanding of housing affordability.

Affordable housing is a multidimensional notion with several characteristics, including housing affordability, accessibility, quality, and security. At its core, affordable housing refers to housing options that are affordable to low- and middle-income households, which are often defined as those whose housing expenditures do not exceed a particular percentage of their income. The most widely accepted definition of housing affordability is the association between housing cost and income (Abd Aziz, Hanif, & Singaravello, 2011; Jewkes & Delgadillo, 2010). Some authors contended that affordability is constantly linked to monetary principles (Mulliner & Maliene, 2015). Stone (2004) claimed affordability extends beyond monetary principle, while also asserting that referring to affordability solely as monetary principle is a superficial definition. According to him, affordability is the link between social and economic situations, without regard for basic human necessities. Sohaimi et al., (2018) also argued that housing affordability solely based on housing costs, as is commonly done in traditional methods like the price-to-income ratio (PIR), may neglect crucial aspects concerning household well-being and sustainability. Therefore, it is imperative to define housing affordability comprehensively, incorporating both monetary and non-monetary factors, including sustainability (Sohaimi et al., 2023).

In this vein, affordable housing is a multidimensional concept that includes affordability, accessibility, quality and security. At its core, affordable housing refers to options that are financially accessible to low- and middle-income households, typically defined as those whose housing costs do not exceed a specific percentage of their income. However, a comprehensive definition must incorporate both monetary and non-monetary factors. Monetarily, affordable housing means that households can cover housing costs—rent or mortgage, utilities, and maintenance—without compromising their ability to meet other essential needs like food, healthcare, education and transportation. Non-monetary factors include the quality and safety of the housing, its accessibility to essential services and its environmental sustainability. Therefore, affordable housing should enable all households to meet their basic needs, maintain a decent standard of living, and thrive in a sustainable and supportive environment (Lazuardi et al., 2022). This holistic approach ensures that housing solutions are inclusive, equitable, and conducive to the overall well-being.

The increase in housing affordability research over the last decade indicates a greater global acknowledgement of the issue's importance. As Linneman and Megbolugbe (1992) remarked, there are numerous dialogues about housing affordability, suggesting its importance in a variety of socioeconomic circumstances. However, in order to fully comprehend the trends, patterns and dynamics within this sector, bibliometric analysis is required as it serves as a valuable tool for depicting the intricate landscape of global housing affordability research. By scrutinising publication outputs from various regions, countries and academic disciplines, researchers can pinpoint geographical hubs of research activity, as well as areas where research is sparse or in its infancy. This comprehensive mapping endeavour facilitates a holistic grasp of housing affordability challenges, encompassing a myriad of socio-economic circumstances and viewpoints. Harnessing bibliometric analysis is not just advantageous but essential for thoroughly exploring the trends within housing affordability studies. By furnishing a systematic, data-driven approach to comprehending the scholarly landscape, bibliometrics empowers researchers, policymakers and practitioners to make well-informed decisions,

foster innovation and effectively tackle housing affordability challenges on a global scale. Through this analytical framework, stakeholders can identify research gaps, discern emerging patterns and devise evidence-based strategies to address housing affordability issues in diverse contexts, ultimately fostering equitable and sustainable housing outcomes worldwide. Despite extensive research on housing affordability, significant gaps remain in understanding the integration of sustainability with affordability, the impact of emerging construction technologies and the effectiveness of various financial mechanisms. Additionally, there is limited empirical evidence on the long-term impacts of social policies, best practices for community involvement and geographical disparities in research. Current definitions of housing affordability often neglect non-monetary factors and there is a need for more holistic approaches. Furthermore, research on the implementation and outcomes of affordable housing policies is scarce. Addressing these gaps is crucial for developing effective, sustainable and inclusive housing solutions globally.

2. Literature Review

The current affordable housing crisis is an urgent issue in many countries throughout the world. Numerous regions are experiencing a shortage of affordable housing units, particularly for low- and middle-income individuals (Calabrese et al., 2021). High construction costs, limited land availability and tight zoning rules are some of the causes leading to the supply limitation (Enwin & Ikiriko, 2023). This supply scarcity is caused by high building prices, restricted land availability and tight zoning rules. In many markets, home prices and rents have grown faster than wages, making housing less affordable to a growing population. This trend has put affordable housing out of reach for many families, especially in urban areas that have robust job markets. Securing adequate finance for affordable housing production and preservation is an ongoing challenge (Wang & Jacoby, 2023). Government schemes and private sources frequently provide insufficient financing to meet the growing need. The affordable housing crisis is a complex issue that requires extra funding, legislative reforms and collaboration between the public, private and non-profit sectors. Continued research and experimentation are required to find successful solutions that will increase the supply of low-cost housing while simultaneously enhancing access to adequate housing for all. Expanding the supply of affordable housing necessitates a diverse strategy to address the underlying causes of the crisis, and one possible answer is through the use of novel construction technologies and procedures. Modular construction, for example, can cut building costs and time, making it an attractive alternative for low-income housing projects. Additionally, increasing the density of housing complexes through zoning change can help with land scarcity difficulties. Cities can make more effective use of available space by allowing higher buildings and more units per plot of land (Calabrese et al., 2021; Olayiwola, & Ajala, 2022).

Financial mechanisms play an important role in addressing the affordable housing scarcity. Public-private partnerships (PPPs) can increase private sector investment while utilising public resources and incentives to build affordable housing units. Governments can offer tax breaks, subsidies and low-interest loans to developers who agree to produce affordable housing. Furthermore, the creation of housing trust funds at the local and national levels can provide long-term support for affordable housing programmes (Enwin & Ikiriko, 2023). Social policies and tenant safeguards are both critical in ensuring affordable housing is available to those in need. Rent control and housing vouchers greatly assist low-income families in finding affordable accommodation in high-cost locations. Efforts to ensure afford housing units remain inexpensive in the long run through deed restrictions and affordability covenants could help reduce displacement and guarantee the supply of affordable housing for future generations (Wang & Jacoby, 2023). Community involvement and support are essential for the success of affordable housing projects. Engaging local communities in the planning and development process can result in more sustainable and acceptable housing options. Community land trusts, for example, can manage land to benefit the community while keeping housing affordable. Furthermore, nonprofit organisations can play an important role in building, managing and lobbying

for affordable housing (Calabrese et al., 2021). Finally, addressing the affordable housing challenge necessitates a dedication to research and innovation. Continuous review of current programmes and policies can help discover best practices and areas for improvement. Pilot projects and case studies can provide vital insights into what works and what does not, allowing policymakers to make sound decisions. Collaboration between academia, government organisations and the corporate sector can spark new ideas and accelerate affordable housing creation (Enwin & Ikiriko, 2023).

Overall, the affordable housing crisis is a complicated and diverse problem that necessitates a thorough and coordinated strategy. It is possible to establish and maintain affordable housing for everyone by addressing construction costs, land availability, zoning rules, funding sources, social protections and community involvement. Continued research and innovation are critical for establishing successful solutions and ensuring that everyone has access to adequate, affordable housing.

3. Materials and Methods

Bibliographic data in scientific publications is organised, coordinated and examined using bibliometrics (Alves et al., 2021; Assyakur et al., 2022). It includes specific descriptive data such as publishing journals, publication year, and principal author categorisation, in addition to more advanced techniques such as document co-citation analysis (Wu & Wu, 2017). A thorough literature review demands an iterative process that includes finding relevant keywords, doing a literature search and carefully assessing the results to provide a comprehensive bibliography and credible conclusions (Fahimnia et al., 2015). Consequently, this study concentrated on scholarly articles because these papers offer important insights into the theoretical ideas that have guided the field's evolution. To verify data reliability, the data was obtained using the Scopus database (Al-Khoury et al., 2022), and to ensure that only high-quality publications were included, books and lecture notes were omitted from the study, and only papers published in rigorously peer-reviewed academic journals were included. Notably, Elsevier's highly rated Scopus database made it easier to assemble papers from 1999 to December 2024 for further study.

3.1 Data Search Strategy

This study utilised a screening technique to determine suitable search phrases for article retrieval. It required querying the Scopus database, which yielded 2153 articles. The process for selecting articles in this study was meticulous to ensure the inclusion of high-quality and relevant sources. Only journal articles were used, as they typically undergo rigorous peer review and provide reliable, up-to-date research findings. Other sources such as books, book chapters and lecture notes were excluded from the analysis. This exclusion was deliberate to maintain a consistent level of scholarly rigor and to focus on research that has been critically evaluated by experts in the field. By prioritising peer-reviewed journal articles, the study aimed to derive the most accurate and comprehensive insights into housing affordability, ensuring that the conclusions drawn are based on the most credible and validated evidence available. To ensure reproducibility, the data handling, cleaning and pre-processing steps included gathering journal articles from Scopus (1999-2024) and importing them into VOSviewer. Duplicate entries and incomplete records were removed, and keywords, author names, and affiliations were standardised. Furthermore, due to several limitations, the researchers were unable to access the Web of Science database. As a result, the Scopus database was utilized comprehensively for this study. This decision was made to ensure data reliability and to provide a broad and detailed analysis, despite the constraints in accessing multiple databases. The use of Scopus allowed the researchers to gather extensive bibliographic data and perform robust analyses to address the research objectives effectively. Next, the search phrases were adjusted to highlight "affordable house" or "affordable home" or "housing affordability" or "home affordability" as the study's focus. This modification yielded 1639 results, which were then scrutinised by the researcher to specifically include research papers written in English while omitting article reviews. Figure 1 depicts a search strategy flow diagram.
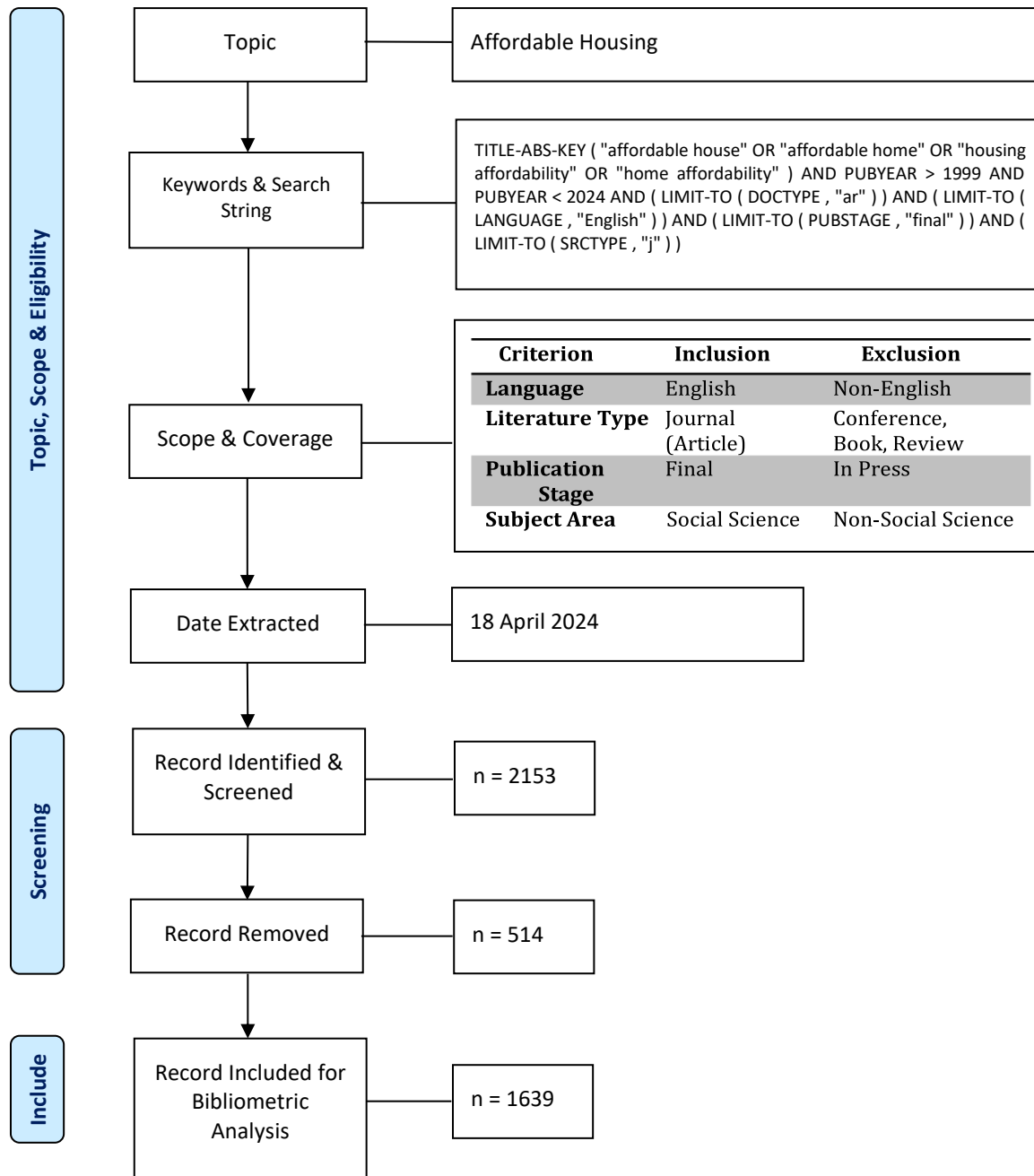
Figure 1. Flow Diagram of the Search Strategy (Adapted from Zakaria et al., 2021; Moher et al., 2009).

3.2 Data Analysis

In the realm of scientometric analysis, several advanced tools offer unique capabilities for visualizing and analysing bibliometric data. (Semi) open-source tools (e.g. CiteSpace, Gephi, VOSviewer) excels emerging trends and pivotal points in scientific literature through citation analysis and co-citation networks, making it a powerful tool for historical and evolutionary research mapping (Zıvalı Turhan & Ayataç, 2021). The data for this scientometric study was gathered from the Scopus database between 2010 and 2023. It contained information in PlainText format on publication year, author, title, journal, keywords and citations. The VOSviewer software version 1.6.19 was employed to analyse the data

using the mapping and clustering techniques. VOSviewer was chosen for this study due to its powerful visualization and analysis capabilities for bibliometric networks. It effectively handles large datasets and provides clear, interactive maps, making it easier to identify research trends, clusters and relationships. VOSviewer was preferred over other tools because of its user-friendly interface, superior visualisation options and compatibility with major bibliometric databases like Scopus. This ensures a comprehensive and detailed presentation of the data, facilitating a deeper understanding of global research trends in housing affordability. VOSviewer is used to create and analyse visual maps of bibliometric data, such as co-authorship networks, keyword co-occurrence and citation relationships, helping to identify research trends, clusters and connections within the data.

This software is an alternative to the Multidimensional Scaling (MDS) approach, which was put forth by Van Eck & Waltman (2010). These two approaches share the similar goal, which is to accurately reflect relatedness and similarity by distancing apart and arranging items in a low-dimensional space (Appio et al., 2014). VOSviewer is a useful tool for normalising co-occurrence frequencies by producing similarity metrics like cosine and Jaccard indexes (Van Eck & Waltman, 2010). It computes the association strength (AS_{ij}) to normalise co-occurrence frequencies and improve the accuracy of the representation of associations between items as illustrated below:

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

The association strength metric, developed by Van Eck & Waltman (2010), measures the degree of association between items i and j, by comparing observed and expected co-occurrences while assuming statistical independence between i and j. By reducing the weighted sum of squared distances between item pairs, VOSviewer arranges objects on a map. Furthermore, the LinLog/modularity normalisation technique was applied in accordance with Appio et al. (2014) recommendations. Patterns formed by mathematical correlations were uncovered using VOSviewer's visualisation techniques on the dataset. This makes it easier to perform various studies, such as keyword co-occurrence, citation analysis and co-citation analysis. After lowering the weighted sum of the squared distances between each pair of objects, VOSviewer arranges the elements to form a map. Appio et al. (2014) advocated using LinLog/modularity normalisation. Many analyses were performed on the dataset utilising VOSviewer's visualisation tools, such as co-citation analysis, co-occurrence analysis, keyword co-occurrence analysis and mathematical correlation patterns. Keyword co-occurrence analysis can be used to track the progress of a study area over time as it is good at discovering frequently discussed topics across multiple disciplines (Li et al., 2016).

As consequently, VOSviewer uses this index to organise the items into a map by reducing the weighted sum of the squared distances between each pair of objects. Appio et al. (2014) advocated for the adoption of LinLog/modularity normalisation. Furthermore, analyses such as co-citation analysis, co-occurrence analysis and keyword co-occurrence analysis were carried out on the dataset using VOSviewer's visualisation capabilities, as well as mathematical relationship patterns. Keyword co-occurrence analysis is beneficial for discovering themes that are commonly discussed in diverse academic domains, as well as for investigating how a research area has evolved over time (Li et al., 2016). This enables researchers to analyse the historical significance of a discipline's major area of study. Meanwhile, citation analysis can aid in identifying key research issues, trends and methodologies. This makes it easier to examine a discipline's core area of study for historical relevance and identify key research issues, strategies and methodologies.

4. Results
4.1 Co-Authorship Analysis by Countries
Figure 2 shows the network visualisation of co-authorship by countries. There are nine clusters within this network that show nine different groups that actively collaborate among them. Countries with

similar colours share the same cluster while circles symbolise countries. In terms of the size of nodes, it represents the number of documents per country. For example, the United States has the largest circle, hence it has the most published articles. The thickness of the line shows the strength of collaboration. As an illustration, the thick line connecting the United States and Canada demonstrates a close collaboration between scholars in those two countries. This type of a bibliometric map can be used to analyse patterns in international collaboration among scholars. For example, the map reveals that the United States has significant collaborative links with a number of other countries, including Canada, the United Kingdom, Germany and France. This indicates that scholars in the United States are actively involved in international research projects.

However, the illustration in Figure 2 only shows co-authorship, which is just one indicator of collaboration. Other types of collaboration, such as data sharing or cooperative research projects are not included. Besides, the visualisation only shows data from the countries that are depicted. This implies that it may not provide an accurate depiction of global collaboration trends. In general, this bibliometric map provides a useful overview of international research collaboration. It can be used to discover trends, analyse changes over time, and compare collaboration patterns between different fields of research.
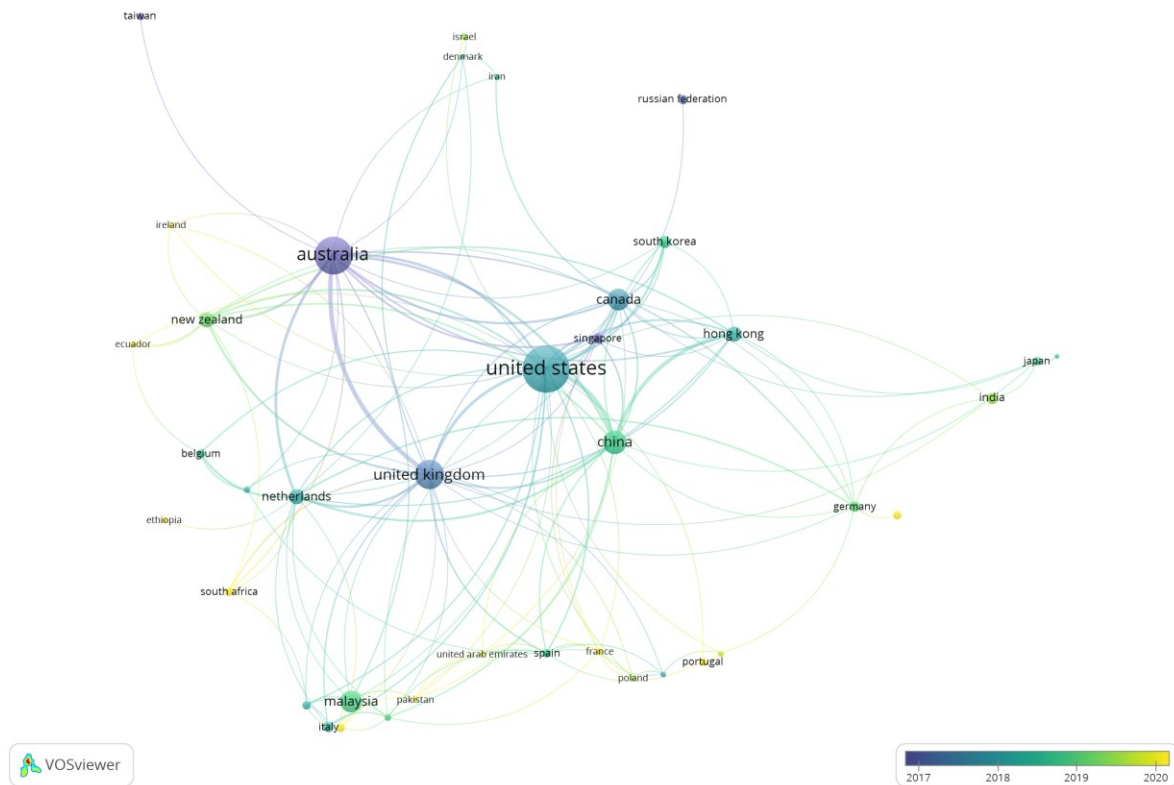

Figure 2. Network Visualisation of Co-authorship Analysis by Countries.

4.2 Co-occurrence and Keywords

The illustration presents a comprehensive co-occurrence network analysis of keywords related to housing affordability (Figure 3). This network visually represents how frequently keywords appear together throughout the dataset. The size of each circle indicates the frequency of the keyword, with larger circles like "housing affordability" showing the most common terms. Lines between the circles reflect co-occurrence relationships, with thicker lines indicating stronger connections between keywords. Different colours are used to distinguish groups of keywords, likely representing distinct research themes within the field of housing affordability. For example, a blue cluster containing

keywords such as "residential mobility," "residential satisfaction" and "location affordability" seem to focus on the social and geographic dimensions of affordability. This thematic clustering helps to identify various areas of research and their interconnections.

Core themes in the research are established by large and central keywords like "housing" and "affordability." These terms form the foundation of the network and highlight well-established areas of study. Additionally, connections between keywords like "housing prices" and "interest rates" indicate traditional research topics. In contrast, the presence of keywords like "short-term rentals" and "sharing economy" suggests emerging trends and new areas of interest within the field. The network analysis not only identifies dominant themes and emerging trends, but also reveals potential research gaps. The prominence of certain keywords and their connections can guide researchers to areas that may require further investigation or interdisciplinary collaboration. Furthermore, the analysis may highlight regional research priorities or areas facing unique challenges, providing valuable insights for geographically targeted studies. Overall, this co-occurrence network analysis serves as a tool for researchers to navigate the current landscape of housing affordability research. It enables them to strategically position their contributions, identify collaboration opportunities and address gaps in the existing literature, ultimately advancing the field in meaningful ways.
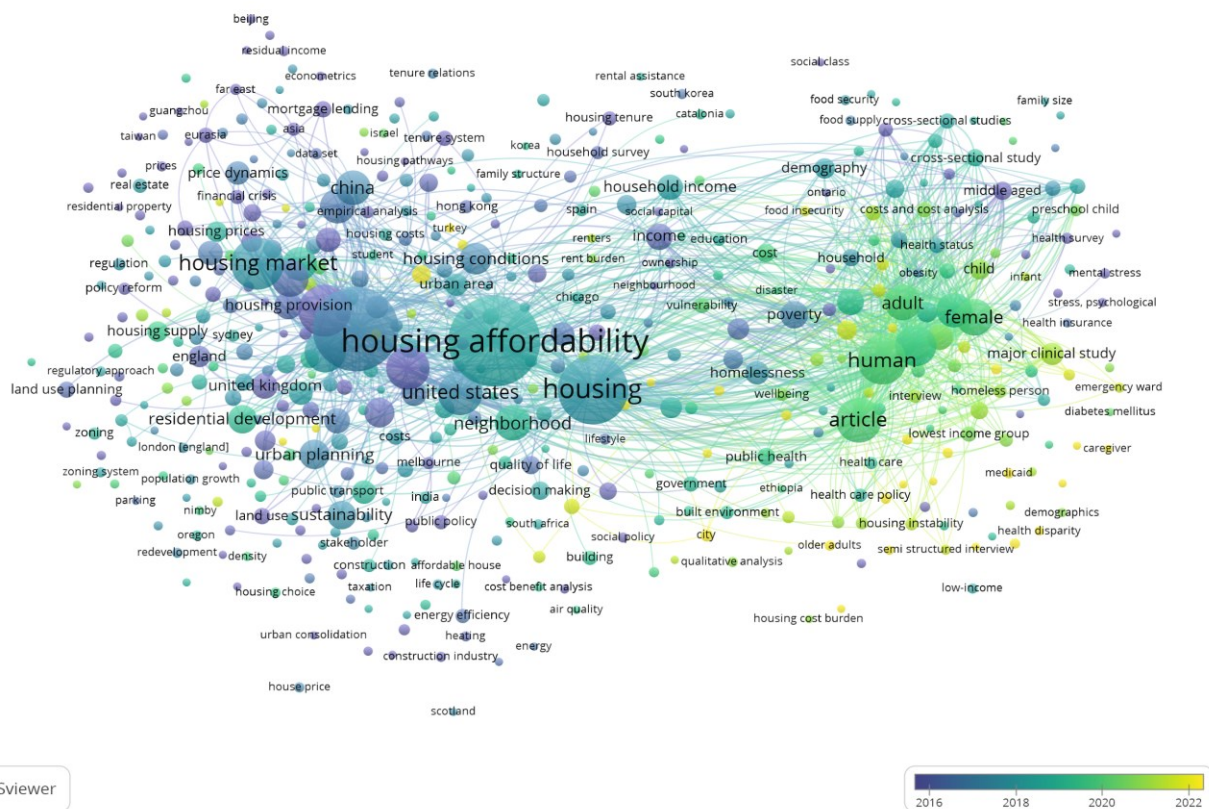

Figure 3. Network Visualisation of Co-authorship Analysis by Keywords.

4.3 Citation and Documents

Figure 4 demonstrates the relationship between scholarly documents based on citations. The VOSviewer software also displays a chronology at the bottom of each image. This demonstrates that research covered by the network was published between 2001 and 2020. This analysis is a version of bibliometrics and is frequently used to estimate the scholarly impact of publications. As mentioned above, circles symbolise documents and the size of the circle represents the number of times the document has been cited in other scholarly works. In the centre, for example, is a huge circle labelled

with a slew of author names, most likely reflecting a widely cited paper on housing affordability. In the centre, there is a large circle with several author names, likely representing a seminal work by Waddell (2002). This work appears to be the most cited within the dataset, suggesting it as a foundational text in the field.
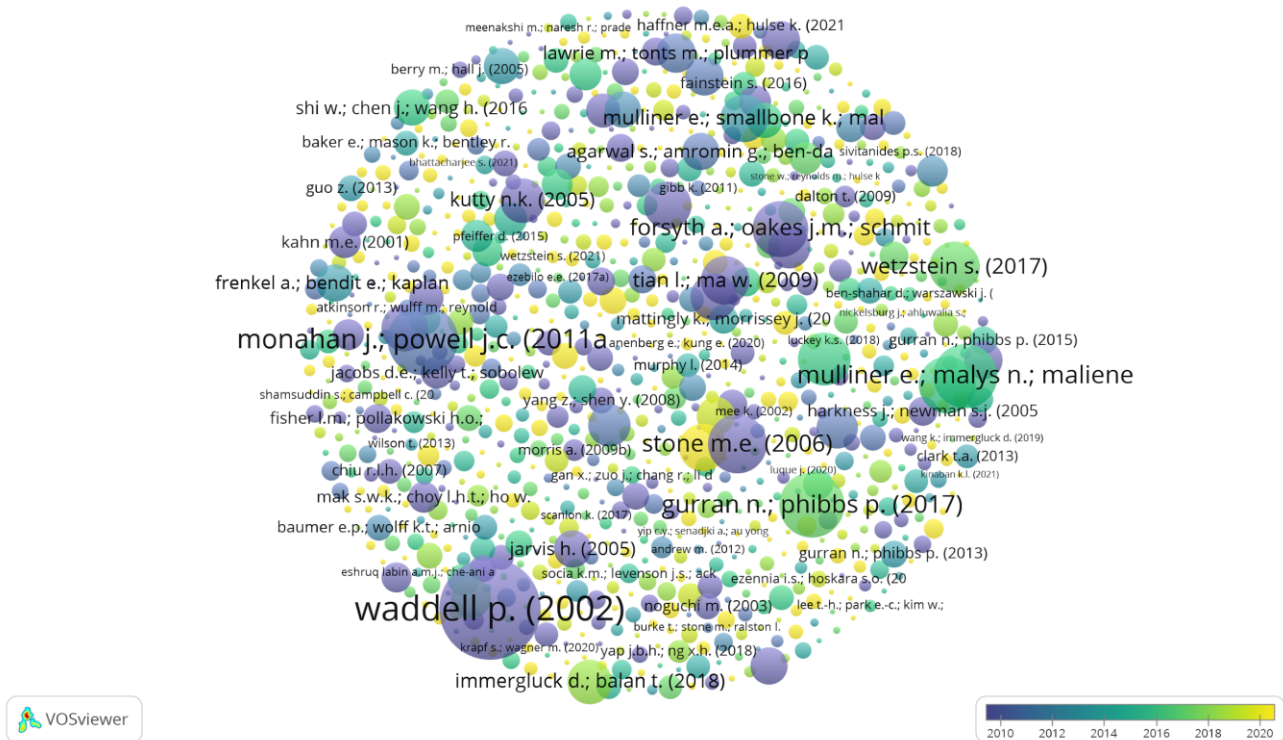

Figure 4. Network Visualisation of Citation and Documents.

The data presented in Table 1 highlights numerous prominent academic works on housing affordability, displaying distinct thematic focuses and their impact on the scholarly community. The data is similar to that in Figure 4, except it contains more detailed information. One of the most cited works is Waddell's (2002) article, which models urban development for land use, transportation and environmental planning, demonstrating the critical role of simulation and modelling in urban planning with 873 citations. Another significant contribution is Monahan & Powell's (2011) study, cited 421 times, which delves into the embodied carbon and energy analysis of modern construction methods, emphasising the importance of sustainability in housing construction. Gurran & Phibbs' (2017) written work on Airbnb, which has been mentioned 360 times, specifically addresses tourism's impact on property markets. This study investigates the issues that urban planners confront as a result of the increase in short-term rentals. Similarly, home affordability is examined from several perspectives, including Mulliner et al.'s (2016) comparative analysis of Multi-Criteria Decision-Making (MCDM) methodologies (348 citations) and Stone's (2006) support for the residual income approach (301 citations). The data also underscore the significance of geographic and policy contexts in housing affordability. Zhang (2016), with 235 citations, discusses global urbanisation trends, while Wetzstein (2017), cited 221 times, addresses the global urban housing affordability crisis. Tian & Ma (2009) provide insights into China's government intervention in land supply, showing the importance of policy-driven urban development, with 203 citations. Forsyth et al. (2007) investigated whether home density affects physical activity and received 272 citations. This demonstrates the interdisciplinary nature of urban planning research, which combines public health with urban design. Finally, Fields & Uffer (2016) critically explore the financialisation of housing in their comparative examination of New

York City and Berlin, and the study has received 279 citations. This study sheds insight on how financial markets affect rental housing, highlighting the larger economic factors at work in metropolitan housing markets. These studies highlight the complexities of housing affordability and urban growth, emphasising the need for interdisciplinary research, novel techniques and successful policy interventions. These publications' high citation counts reflect their major impact on the academic discourse and ability to inform practical solutions to these important global concerns.

Table 1: Publication by the authors.

Authors	Title	Year	Source Title	Cited By
Waddell P.	Urbansim: Modelling urban development for land use, transportation, and environmental planning	002	Journal of the American Planning Association	873
Monahan J.; Powell J.C.	An embodied carbon and energy analysis of modern methods of construction in housing: A case study using a life cycle assessment framework	011	Energy and Buildings	421
Gurran N.; Phibbs P.	When Tourists Move In: How Should Urban Planners Respond to Airbnb?	017	Journal of the American Planning Association	360
Mulliner E.; Malys N.; Maliene V.	Comparative analysis of MCDM methods for the assessment of sustainable housing affordability	016	Omega (United Kingdom)	348
Stone M.E.	What is housing affordability? The case for the residual income approach	006	Housing Policy Debate	301
Fields D.; Uffer S.	The financialization of rental housing: A comparative analysis of New York City and Berlin	016	Urban Studies	279
Forsyth A.; Oakes J.M.; Schmitz K.H.; Hearst M.	Does residential density increase walking and other physical activity?	007	Urban Studies	272
Zhang X.Q.	The trends, promises and challenges of urbanisation in the world	016	Habitat International	235
Wetzstein S.	The global urban housing affordability crisis	017	Urban Studies	221
Tian L.; Ma W.	Government intervention in city development of China: A tool of land supply	009	Land Use Policy	203

5. Discussion

The comprehensive bibliometric analysis conducted in this study provides valuable insights that both confirm existing knowledge and contribute new perspectives to the discourse on affordable housing. By mapping the breadth and diversity of research in this field, the study highlights several key themes and trends that align with and extend current understandings. Existing literature emphasizes that housing affordability encompasses more than just financial cost, incorporating aspects such as accessibility, quality and security (Abd Aziz, Hanif, & Singaravello, 2011; Jewkes & Delgadillo, 2010). This study confirms these findings by identifying affordability as a multi-dimensional concept,

reinforcing the need for a holistic approach to addressing housing issues. Additionally, previous studies have highlighted the significant role of government policies and regulations in shaping housing affordability (Wang & Jacoby, 2023). The current analysis supports this view, demonstrating the critical impact of policy-driven initiatives and the influence of local and global policy frameworks on affordable housing outcomes. The literature extensively discusses the importance of financial mechanisms such as public-private partnerships (PPPs), tax incentives and housing trust funds in addressing housing scarcity (Enwin & Ikiriko, 2023). This study corroborates these findings, underscoring the necessity of robust financial strategies to enhance the supply of affordable housing. Moreover, the study introduces novel perspectives on the potential of innovative construction technologies, such as modular construction, to reduce building costs and time. These findings suggest new avenues for research and practical implementation, offering potential solutions to the affordable housing crisis that have not been extensively explored in previous literature.

The bibliometric analysis identifies geographical hubs of research activity and areas with sparse research, pointing to a need for more geographically diverse studies. Additionally, the emphasis on interdisciplinary research highlights the necessity of integrating public health, urban planning, economic policies and social equality to propose comprehensive solutions to housing affordability challenges. Furthermore, while the importance of community involvement is acknowledged in the literature, this study brings new insights into best practices for engaging communities in affordable housing projects. The findings suggest that successful community engagement can lead to more sustainable and acceptable housing solutions, emphasizing the role of local participation in addressing housing issues. This study's findings contribute significantly to the existing body of knowledge on affordable housing by confirming the multi-dimensional nature of affordability, the critical role of policy and financial mechanisms and the importance of sustainability. Additionally, the study offers new insights into emerging construction technologies, highlights geographical and disciplinary research gaps, and underscores the value of community involvement. By integrating these findings with existing literature, this study enhances our understanding of affordable housing challenges and provides a foundation for developing more effective, sustainable and inclusive housing strategies worldwide. Continued research and interdisciplinary collaboration are essential to address the complex and evolving nature of affordable housing and to ensure that all individuals have access to safe, decent, and affordable homes.

Based on the findings and supported by previous research, the following specific, actionable recommendations are proposed for policymakers and practitioners to address housing affordability. Policymakers should adopt the residual income method in national and local housing affordability assessments to provide a comprehensive understanding of housing costs relative to essential living expenses. Developing region-specific benchmarks for essential living expenses, including food, transportation, healthcare and education, is crucial and should be regularly updated in collaboration with statistical agencies and research institutions. Creating targeted subsidy programs that use the residual income method can help identify and assist households most in need, ensuring subsidies cover the gap between actual housing costs and what households can afford after essential expenses. Revising zoning and land use policies to encourage high-density developments and mixed-use projects can reduce land costs and increase affordable housing availability. Promoting innovative construction techniques, such as modular and prefabricated housing, through government incentives can reduce construction costs and expedite the delivery of affordable housing units. Strengthening public-private partnerships (PPPs) can leverage resources and expertise to finance and build affordable housing projects, combining public funding with private investment. Enhancing financial education and support services can help households manage their budgets and understand the importance of residual income, empowering them to make informed housing and financial decisions. Establishing a robust monitoring and evaluation framework to assess the effectiveness of housing affordability programs based on the residual income method can ensure that programs meet their goals and identify areas for improvement. Involving local communities in the planning and development of affordable housing

projects through public consultations and participatory planning processes can ensure solutions are responsive to community needs and gain local support. Finally, investing in ongoing research and data collection to refine the residual income method and better understand its implications for different household types is essential. Collecting and analysing data on housing affordability can inform policy decisions and track progress over time. By implementing these specific recommendations, policymakers and practitioners can create a more effective and comprehensive approach to addressing housing affordability, ensuring all households have access to safe, decent and affordable housing.

6. Conclusion

This study significantly contributes to the field of housing affordability research by integrating both monetary and non-monetary factors into a comprehensive definition of affordable housing. It highlights the importance of considering sustainability, quality, safety and accessibility alongside traditional financial metrics. Furthermore, the study uses VOSviewer to provide a detailed bibliometric analysis, mapping global research trends and collaboration networks, and identifying key research gaps. Future research should focus on further exploring the integration of sustainability with housing affordability. It is imperative to conduct comprehensive studies that investigate the long-term effects of innovative construction technologies and novel financial mechanisms on both affordability and sustainability. In this manner, studies should examine how these emerging technologies can be leveraged to reduce costs while enhancing environmental performance. Additionally, research should investigate the effectiveness of social policies and best practices for community involvement in housing projects. There is also a need for more geographically diverse studies to understand regional disparities and to develop tailored solutions for different contexts. Finally, interdisciplinary research combining public health, urban planning, economic policies and social equality will be essential to address the complex nature of housing affordability comprehensively.

Conflicts of Interest
The authors declare no conflicts of interest.

Data availability statement
Not related.

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References

Abd Aziz, D. W., Hanif, N. R., & Singaravello, K. (2011). A study on affordable housing within the middle-income households in the major cities and towns in Malaysia. *Journal of Basic and*

Applied Science, 258–267. https://inspen.gov.my/images/INSPEN/PDFDoc/Affordable-housing.pdf

Al-Khoury, A., Hussein, S. A., Abdulwhab, M., Aljuboori, Z. M., Haddad, H., Ali, M. A., Abed, I. A., & Flayyih, H. H. (2022). Intellectual capital history and trends: A bibliometric analysis using Scopus database. *Sustainability (Switzerland)*, *14*(18), 11615. https://doi.org/10.3390/su141811615

Alves, J. L., Borges, I. B., & De Nadae, J. (2021). Sustainability in complex projects of civil construction: Bibliometric and bibliographic review. *Gestao e Producao*, *28*(4). https://doi.org/10.1590/1806-9649-2020v28e5389

Appio, F.P., Cesaroni, F. & Di Minin, A. (2014). Visualizing the structure and bridges of the intellectual property management and strategy literature: a document co-citation analysis. *Scientometrics* 101, 623–661. https://doi.org/10.1007/s11192-014-1329-0

Assyakur, D. S., & Rosa, E. M. (2022). Spiritual leadership in healthcare: A bibliometric analysis. *Jurnal Aisyah: Jurnal Ilmu Kesehatan*, *7*(2) 355-362. https://doi.org/10.30604/jika.v7i2.914

Calabrese, T., Breadles, A., & French, K. (2021). *The impacts of affordable housing: A literature review*. Center for Community Engaged Learning – Community Research Extension.

Enwin, A. D., & Ikiriko, T. D. (2023). Understanding the challenges of affordable housing provision in Nigeria: An analysis of key factors and policy implications. *European Journal of Theoretical and Applied Sciences*, *1*(4), 420-436. https://doi.org/10.59324/ejtas.2023.1(4).38

Fahimnia, B., Sarkis, J., & Davarzani, H. (2015). Green supply chain management: A review and bibliometric analysis. *International Journal of Production Economics*, 162, 101-114. https://doi.org/10.1016/j.ijpe.2015.01.003

Fields, D., & Uffer, S. (2016). The financialization of rental housing: A comparative analysis of New York City and Berlin. *Urban Studies*, *53*(7), 1486-1502. https://doi.org/10.1177/0042098014543704

Forsyth, A., Oakes, J. M., Schmitz, K. H., & Hearst, M. (2007). Does residential density increase walking and other physical activity? *Urban Studies*, *44*(4), 679-697. https://doi.org/10.1080/00420980601184729

Gurran, N., & Phibbs, P. (2017). When tourists move in: how should urban planners respond to Airbnb? *Journal of the American Planning Association*, *83*(1), 80-92. https://doi.org/10.1080/01944363.2016.1249011

Jewkes, M. D., & Delgadillo, L.M. (2010). Weaknesses of housing affordability indices used by Practitioners. *Journal of Financial Counseling and Planning*, 21(1), 43–52. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2222052

Lazuardi, S. N., Sulistyantara, B., & Pratiwi, P. I. (2022). The Role of Home Gardens in Developing Cities for Improving Workers' Psychological Conditions. *Journal of Contemporary Urban Affairs*, *6*(2), 233-248. https://doi.org/10.25034/ijcua.2022.v6n2-9

Li, H., An, H., Wang, Y., Huang, J., & Gao, X. (2016). Evolutionary features of academic articles co-keyword network and keywords co-occurrence network: Based on two-mode affiliation network. *Physica A: Statistical Mechanics and its Applications*, *450*, 657-669. https://doi.org/10.1016/j.physa.2016.01.017

Linneman, P. D., & Megbolugbe, I. F. (1992). Housing affordability: Myth or reality? *Urban Studies*, *29*(3-4), 369–392. https://doi.org/10.1080/004209892200804

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & PRISMA Group (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS medicine*, *6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Monahan, J., & Powell, J. C. (2011). An embodied carbon and energy analysis of modern methods of construction in housing: A case study using a lifecycle assessment framework. *Energy and buildings*, *43*(1), 179-188. https://doi.org/10.1016/j.enbuild.2010.09.005

Mulliner, E., & Maliene, V. (2015). An Analysis of Professional Perceptions of Criteria Contributing to Sustainable Housing Affordability. *Sustainability, 7*(1), 248–270. https://doi.org/10.3390/su7010248

Mulliner, E., Malys, N., & Maliene, V. (2016). Comparative analysis of MCDM methods for the assessment of sustainable housing affordability. *Omega*, *59*, 146-156. https://doi.org/10.1016/j.omega.2015.05.013

Olayiwola, A. M., & Ajala, O. A. (2022). Correlation between socio-economic characteristics and housing quality of residential neighbourhoods in Akure, Southwest Nigeria. *Journal of Contemporary Urban Affairs*, *6*(2), 217-231. https://doi.org/10.25034/ijcua.2022.v6n2-8

Stone, M. E. (2004). Shelter Poverty: The Chronic Crisis of Housing Affordability. *New England Journal of Public Policy*, *20*(1), 107–119. https://doi.org/10.1300/J031v02n03_07

Stone, M. E. (2006). What is housing affordability? The case for the residual income approach. *Housing policy debate*, *17*(1), 151-184. https://doi.org/10.1080/10511482.2006.9521564

Sohaimi, N. S., Abdullah, A., & Shuid, S. (2018). Determining housing affordability for young professionals in Klang Valley, Malaysia: Residual income approach. *Planning Malaysia*, *16*. https://doi.org/10.21837/pm.v16i6.464

Sohaimi, N. S., & Shuid, S. (2023). Do Young Professionals in Malaysian Urban Areas Prioritise Sustainability When Making Housing Decisions? *Journal of Contemporary Urban Affairs*, *7*(2), 171-186. https://doi.org/10.25034/ijcua.2023.v7n2-11

Tian, L., & Ma, W. (2009). Government intervention in city development of China: A tool of land supply. *Land use policy*, *26*(3), 599-609. https://doi.org/10.1016/j.landusepol.2008.08.012

Waddell, P. (2002). UrbanSim: Modeling urban development for land use, transportation, and environmental planning. *Journal of the American planning association*, *68*(3), 297-314. https://doi.org/10.1080/01944360208976274

Wang, L., & Jacoby, S. (2023). Housing experimentation and design guides: Affordable housing in Guangzhou since 2006. *Architecture*, *3*(4), 692-712. https://doi.org/10.3390/architecture3040038

Wu, Y. C. J., & Wu, T. (2017). A decade of entrepreneurship education in the Asia Pacific for future directions in theory and practice. *Management Decision*, *55*(7), 1333-1350. https://doi.org/10.1108/MD-05-2017-0518

Wetzstein, S. (2017). The global urban housing affordability crisis. *Urban studies*, *54*(14), 3159-3177. https://doi.org/10.1177/0042098017711649

Van Eck, N., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *scientometrics*, *84*(2), 523-538. https://doi.org/10.1007/s11192-009-0146-3

Zakaria, R., Ahmi, A., Ahmad, A. H., Othman, Z., Azman, K. F., Ab Aziz, C. B., ... & Shafin, N. (2021). Visualising and mapping a decade of literature on honey research: A bibliometric analysis from 2011 to 2020. Journal of Apicultural Research, 60(3), 359-368. https://doi.org/10.1080/00218839.2021.1898789

Zhang, X. Q. (2016). The trends, promises and challenges of urbanisation in the world. Habitat International, 54, 241-252. https://doi.org/10.1016/j.habitatint.2015.11.018

Zıvalı Turhan, T. & Ayataç, H. (2021). Understanding of the relation between ethnic diversity and public space: A bibliometric analysis. *Urbani Izziv, 32*(2), 73-86. https://doi.org/10.5379/urbani-izziv-en-2021-32-02-01

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