TPM Vol. 32, No. 3, 2025
ISSN: 1972-6325
https://www.tpmap.org/

MAPPING THE KNOWLEDGE LANDSCAPE OF SUSTAINABLE INTERIOR DESIGN: A CROSS-REGIONAL BIBLIOMETRIC ANALYSIS

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ABSTRACT: With rapid urbanization, many cities face challenges in providing safe, affordable, and adequate housing, often compounded by disparities in housing costs. Sustainable interior design has emerged as a promising approach to reduce expenses while enhancing comfort, health, safety, and community belonging, therefore conforms with the United Nations Sustainable Development Goals. In response, scholarly interest in this domain has grown considerably. This study presents a bibliometric analysis of sustainable interior design research indexed in Scopus between 1980 and 2023. Using quantitative and qualitative methods, the analysis maps publication trends, citation patterns, influential works, leading sources, and the geographic distribution of research output, including a global collaboration network. Furthermore, a qualitative review of the most frequently cited publications highlights dominant themes and methodological approaches, offering deeper insight into the intellectual structure of the field. The findings provide a comprehensive overview of the evolution of sustainable interior design research, identifying key contributions, emerging directions, and opportunities for future study.

Keywords: Interior Design, Sustainability, Knowledge landscape, Bibliometric analysis, Quantitative and qualitative analysis

INTRODUCTION

Housing functions as a shelter for human, providing protection, comfort, security, and the sense of independence, while creating an intimate environment for the residing members. [1]. Beyond being a place to reside, housing should foster conditions that allow occupants to perform daily tasks efficiently and engage in diverse activities within the home [2]. The idea of basic human needs has gradually expanded, moving from the basic necessity of shelter to a broader view of the home as a space that ensures safety, physical and psychological well-being, and opportunities for recreation [3]. As a result, housing design, use, and functionality have continually evolved.

The problem of limited space within homes has long challenged the interior design industry [4], although the underlying causes have shifted over time. In China during the 1980s and 1990s, high birth rates left many households struggling with crowded living spaces due to larger family sizes. Today, however, the issue is more closely tied to residents' pursuit of comfortable and healthy environments [5]. Homes are no longer confined to functions of rest and dining but have expanded into spaces for work, study, socializing, entertainment, and even exercise, as demonstrated during the COVID-19 pandemic. Yet, many modern housing designs focus only on current needs while neglecting future requirements, leading to misalignment between spatial planning and evolving lifestyles [6-7]. This oversight perpetuates the shortage of space. Prolonged residence in restricted environments negatively affects both physical and psychological well-being [8-11], contradicting the principles of sustainable development. Consequently, resolving the problem of relatively confined space in small apartments has become an important research focus for interior designers [12-13].

Bibliometrics provides an effective method to measure the development of a discipline by enabling systematic analysis of relevant literature [14-15]. To strengthen evaluations, bibliometric approaches are often supplemented by indicators such as citation analysis, in terms of frequency and geographical location,

and peer review, which ensure greater reliability. In recent years, the creation of bibliometric reports has been made easier through platforms, such as Web of Science (WoS), SCOPUS and Google Scholar, each offering advanced citation features. However, Google Scholar's broad coverage poses challenges because it includes sources without clear restrictions [16]. Among academic communities, WoS and SCOPUS are the two most commonly referred databases in scientific fields [17]. Therefore, this study seeks to identify the most appropriate research platform by comparing the topics of "interior design" research in WoS and SCOPUS.

METHODOLOGY

In this study, the term "interior design" was used as the subject for data collection. Two of the most widely recognized academic databases, Web of Science (WoS) and Scopus, were selected as the primary sources. To determine the more suitable database for literature screening, title-based searches were carried out on both platforms. The search results showed that Scopus returned a total of 2,395 documents, while WoS returned the query with 2268 documents. This indicates that Scopus provides broader coverage, even though WoS is still regarded as one of the most reliable and comprehensive tools for literature fetching and analysis [18]. On May 30, 2023, a query in Scopus for "interior design" identified 2,395 publications, which collectively received 12,421 citations, averaging 5.18 citations per article. As shown in Figure 1, although the number of studies published on interior design fluctuated from 1930 to 2023, the citation frequency steadily increased each year. This trend highlights not only the field's growing visibility but also the gradual strengthening of research attention to interior design over time.

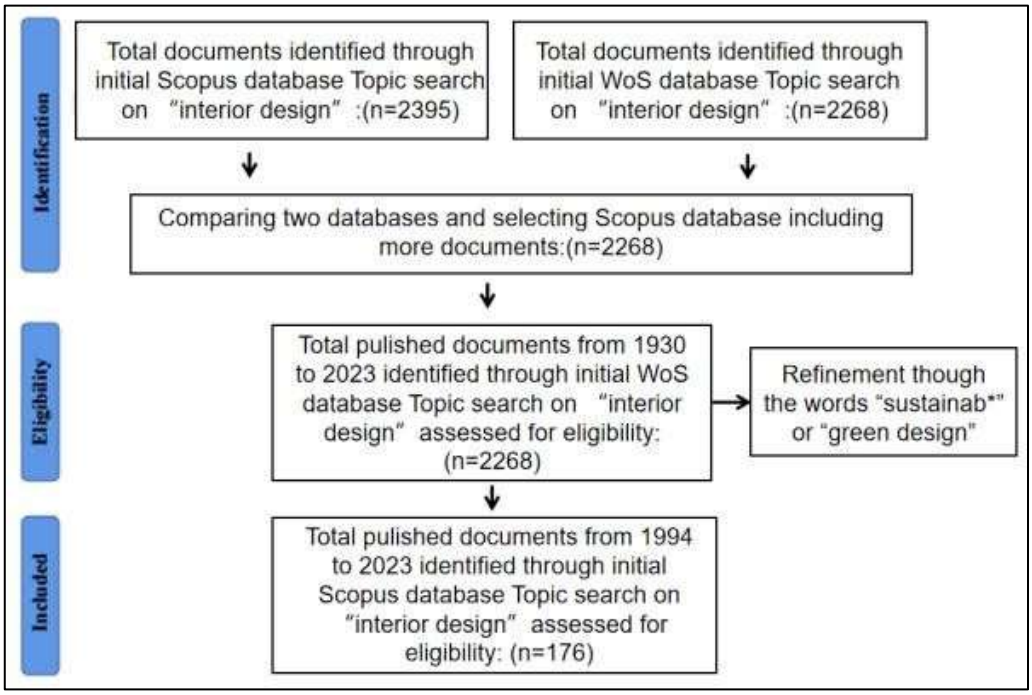

FIGURE 1 The interior design bibliometric analysis's PRISMA flow diagram

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1994:2023
Sources (Journals, Books, etc)	101
Documents	176
Average years from publication	5.99
Average citations per documents	4.324
Average citations per year per doc	0.6098
References	4421
DOCUMENT TYPES	
article	101
book	1
book chapter	7
conference paper	59
conference review	1
editorial	1
note	1
review	3
short survey	2

TABLE 1 Summary of the key output obtained from the bibliometric data

A search in the Scopus database using the keywords “green design” or “sustainab” * identified a total of 176 publications. Among these, studies related to “interior design” received slightly more attention in terms of citations, averaging 4.324 citations per paper. The data collection process is illustrated in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart, shown in Figure 2. For detailed scientific mapping, the final analysis of these 176 publications was carried out with the R-Tool, employing the BiBliometrix package (http://www.bibliometrix.org/).
Key bibliometric information is summarized in Table 1, which lists 7 book chapters, 101 research articles, 3 review articles and 59 conference papers. To explore emerging sub-themes in the field of interior design, especially in regards of green design and sustainability, a qualitative analysis was performed on the 10 most frequently cited articles drawn from the 101 journal papers. The subsequent sections present an integrated discussion of both quantitative and qualitative findings.

Quantitative Analysis

Examination of the Publication Year

Figure 2 traces the growth of research on sustainable and green interior design from 1994 to May 2023. Across this thirty–year span, 176 papers were published, demonstrating how the field has shifted from a niche concern to an established research area. The trajectory divides into two phases. The first, from 1994 to 2011, shows minimal global engagement, indicating that sustainability in interior design had not yet entered mainstream academic discourse. The second, beginning in 2012, marks a turning point, with research activity accelerating rapidly. The sharp increases in 2017 and again in 2022 are especially noteworthy, as they suggest moments of renewed scholarly and societal interest, possibly linked to broader debates on climate change and sustainable development. While minor fluctuations occurred, the consistent growth after 2017 reflects a consolidation of the field as a recognized area of inquiry.
Citation patterns reinforce this trend. In 2009, five articles generated an average of 1.1 citations each, signaling early but limited impact. By 2020, however, the field reached both its highest annual output and its strongest citation performance, with an average of 1.5 citations per article. This indicates not only more research being published but also greater resonance and influence within the academic community. Figure 4 further highlights this impact by identifying the ten most cited works, all central to shaping subsequent scholarship. The three leading papers, published in 2009, remain highly influential with 15, 11, and 9 citations, underscoring their role as foundational contributions that continue to inform contemporary debates.

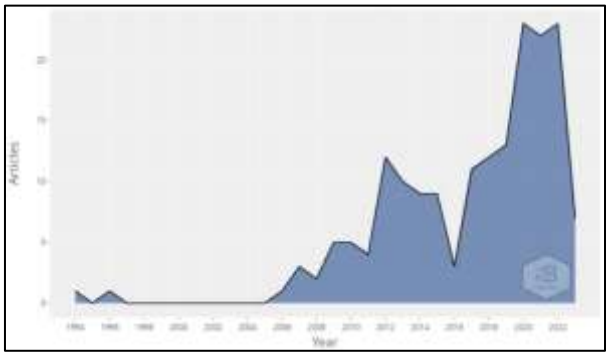

FIGURE 2 Annual scientific output for interior design sustainable and green design research, 1994-2023

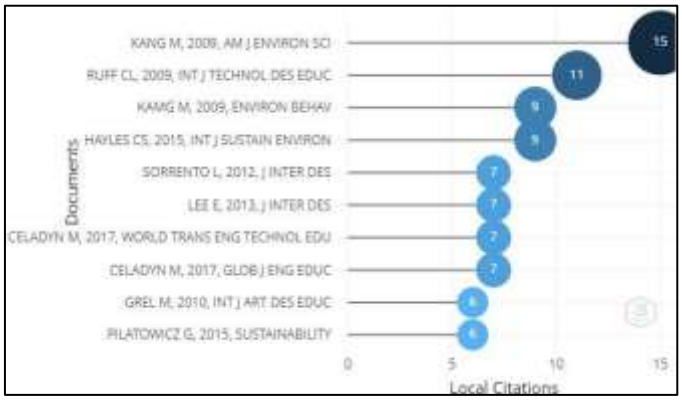

FIGURE 3 The average annual citation count for papers in the subject of sustainable and green interior design research, from 1994 to 2003

Analysis of the Authors

Figure 4 illustrates the contributions of the twenty most prominent authors in sustainable and green interior design research from 1994 to 2023, with each author's active period shown as a red line. For example, Huang J published two papers between 2006 and 2023, making this the longest continuous contribution period. The size of each bubble represents the number of publications in a particular year, as seen in the case of Rashdan W, who produced three papers in 2015. The color intensity of the bubbles reflects the total number of citations received in the corresponding year. For instance, the works of Celadyn M display a higher citation impact compared to those of other authors. Overall, this visualization highlights the expansion of both publication output and citation frequency in sustainable and green interior design, with a pronounced increase in 2022, suggesting growing scholarly interest and a widening research agenda.

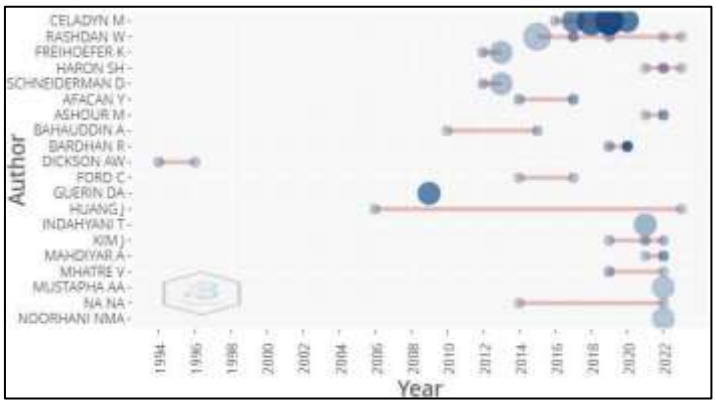

FIGURE 4 Top 20 most influential authors' works in interior design, sustainability, and green design research fields between 1994 and 2023 (authors' timelines shown by the red line, publications by bubble size, and total citations per year by color-intensity of the bubbles)

Source **Analysis**

Figure 5 identifies the ten most relevant publication sources in sustainable and green interior design research, each contributing at least three articles. Among them, Sustainability (Switzerland) leads with eleven publications between 1994 and 2023, followed by the IOP Conference Series: Earth and Environmental Science with ten. Applied Mechanics and Materials and the Journal of Interior Design each contributed eight papers. Together, these journals form the core venues for disseminating research in this area, shaping both scholarly debate and publication strategies for future work. Their prominence underscores where knowledge production is concentrated and where researchers are most likely to find influential studies.

Figure 6 illustrates publication trends among the top five journals from 1994 to 2023. All demonstrate upward trajectories, reflecting the field's increasing maturity and recognition. The Journal of Interior Design was the earliest to publish on sustainability and has maintained steady growth, signaling its enduring role in bridging interior design practice and research. By contrast, Sustainability (Switzerland), which entered the field only in 2015, has grown at a much faster pace and, by 2023, is projected to surpass both the Journal of Interior Design and the IOP Conference Series: Earth and Environmental Science. This rapid rise highlights not only the journal's expanding influence but also the broader acceleration of sustainability-oriented research across disciplines. The trend signals a dynamic and evolving scholarly landscape, where sustainable interior design is gaining visibility and establishing itself as a central research domain.

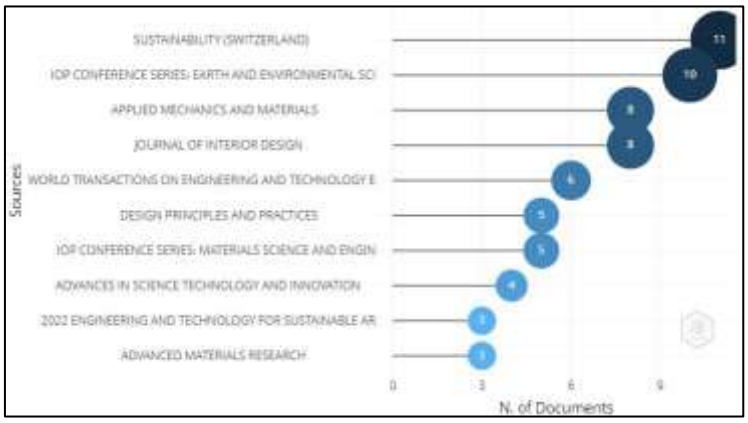

FIGURE 5 Ranking of the 10 most pertinent sites based in terms of paper quantities

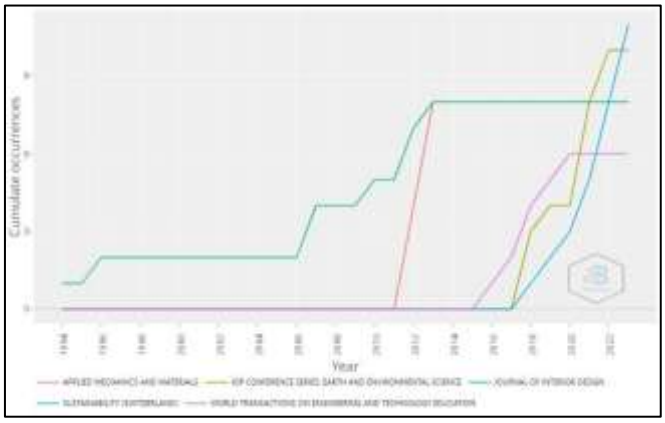

FIGURE 6 Annual incidence of the top 5 sources from 1994 to 2023

Analysis of the State

Across 32 countries, a total of 167 publications were produced in the area of interior design, focusing on sustainable or green practices. Figure 7 highlights the top 20 nations by scientific output. In the figure, the red line represents the publication output of corresponding authors in their home countries, which may include collaborations with international partners. The blue line indicates the total number of articles produced within each country. Publications are classified as Single Country Publications (SCP) when all authors are from the same nation, and Multi-Country Publications (MCP) when international co-authorship is involved. According to the data, the leading countries in this field are China with 22 papers, the United States with 19 papers, and Malaysia with 7 papers. Among these, the United States and Cyprus show the highest levels of international collaboration, reflecting the current global state of research in the field of sustainable and green interior design.

Figure 8 presents a detailed view of the total number of authors affiliated with each country, while Figure 11 illustrates the volume of collaborative publications in sustainable and green interior design across the top contributing nations. The intensity of the blue color represents the number of authors from each country, ranging from deep blue for the United States, which has 49 authors, to light blue for Austria, which has only one. From the visual patterns, it is clear that the United States and China are the most influential contributors, with Malaysia ranking as a secondary hub of research activity. These representations emphasize the widespread collaborative efforts that drive research in this field.

The connections between countries are further depicted in Figure 9, where the thickness of the red lines corresponds to the number of collaborative publications. A thicker line indicates a higher number of shared papers. For instance, the thick red line connecting the United States to Korea represents two collaborative works, whereas the thinner line from the United States to China represents a single collaboration. Overall, the data highlight the United Kingdom's extensive partnerships with multiple countries, showcasing the interconnected nature of global research in sustainable and green interior design.

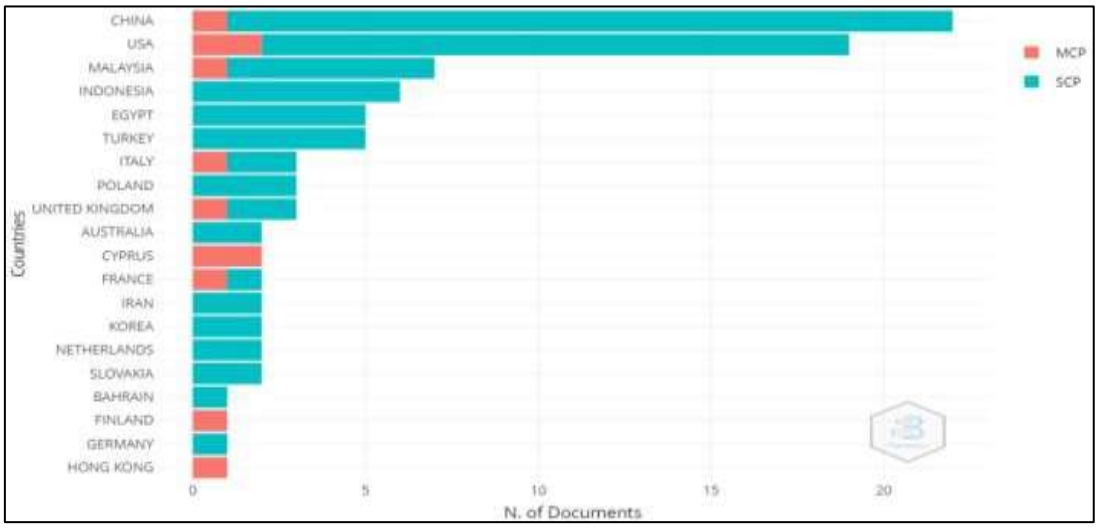

FIGURE 7 Top 20 countries of corresponding authors (blue line indicates SCP; red line denotes MCP)

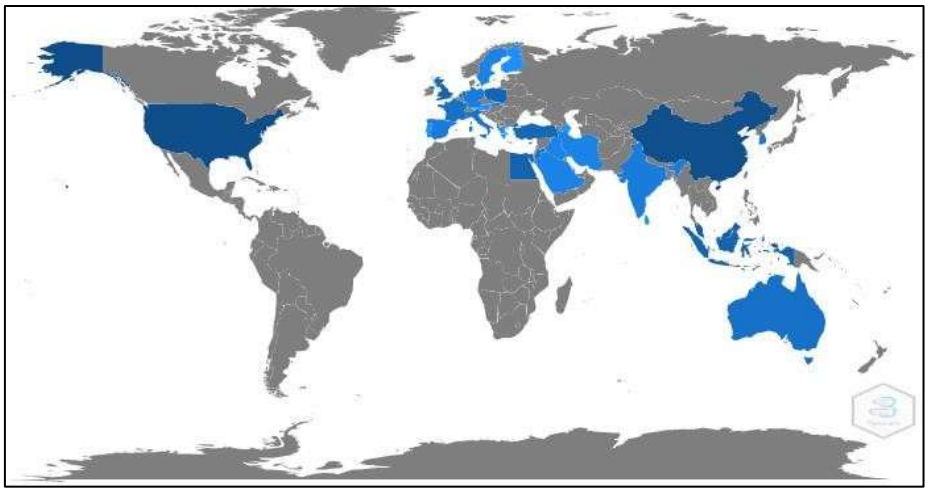

FIGURE 8 Nation's output of researchers on sustainable or green interior design study around the globe. (Intensity of blue color indicates the number of writers associated in the nation; gray color indicates unrelated countries)

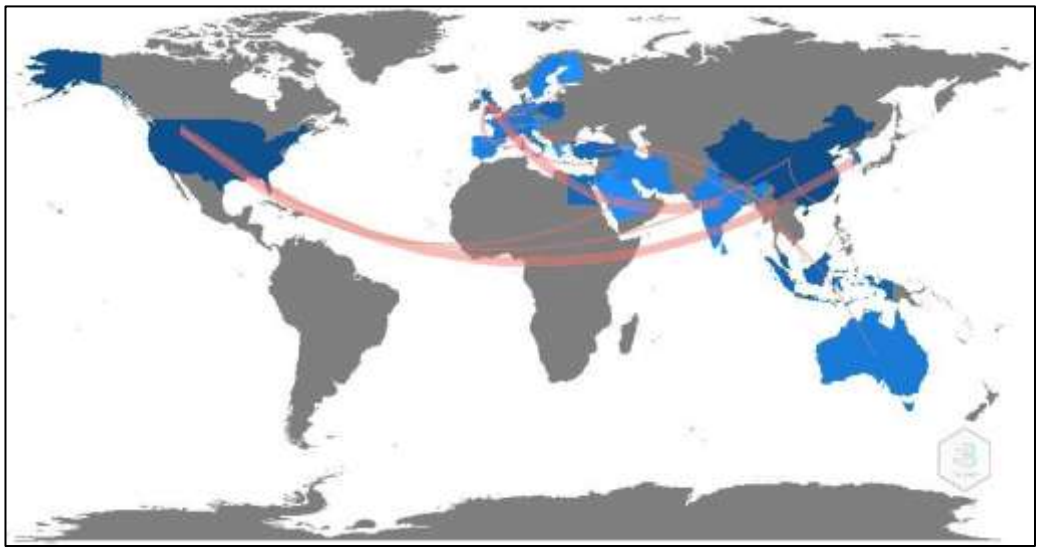

FIGURE 9Global collaboration map for interior design, sustainability, or green design research (Red line thickness indicates the number of joint publications)

Subject Analysis

The study utilized a keyword co-occurrence network to investigate the main topics covered in publications on sustainable or eco-friendly interior design. By analyzing the network through clustering, distinct topics emerged, with each keyword linked to a single theme. Figure 10 presents the resulting topic map, highlighting key themes in sustainable or green interior design. Each bubble in the map represents a cluster of keywords, with the cluster name reflecting the most frequently occurring words. Prominent topics are sustainable solutions, bamboo, eco-design, construction industry, sustainable interior design, architecture and architectural design. Among these, sustainability and housing were identified as the two most influential themes. This visualization offers a clear overview of how different topics interconnect within the field.

The position of each bubble in the thematic map is determined by the cluster's centrality and density, while the bubble size indicates the frequency of the keywords within the cluster. In the context of interior design research, centrality measures the significance of a theme, whereas density indicates how developed it is. Therefore, the map can be interpreted as follows:

- The lower left corner shows themes that are either emerging or declining.
- The lower right corner represents key themes with lateral connections.
- The upper left corner depicts highly developed but isolated themes.
- The upper right corner indicates core or motor themes with both high significance and development.

For instance, keywords such as ecodesign, sustainable interior design, and sustainable solutions appear in the upper left corner, representing well-developed but isolated themes. These motifs have advanced considerably but hold moderate relevance within the broader research landscape.

Conversely, terms including construction industry, architecture, architectural design, sustainability, bamboo and housing appear across five clusters categorized as basic or transversal topics. Among these, housing, sustainability, and architectural design are the most frequently occurring themes, with architectural design showing the highest centrality, highlighting its prominence in sustainable interior design research. Overall, this thematic analysis provides a comprehensive view of the key topics, illustrating both the frequency and significance of terms that shape the field.

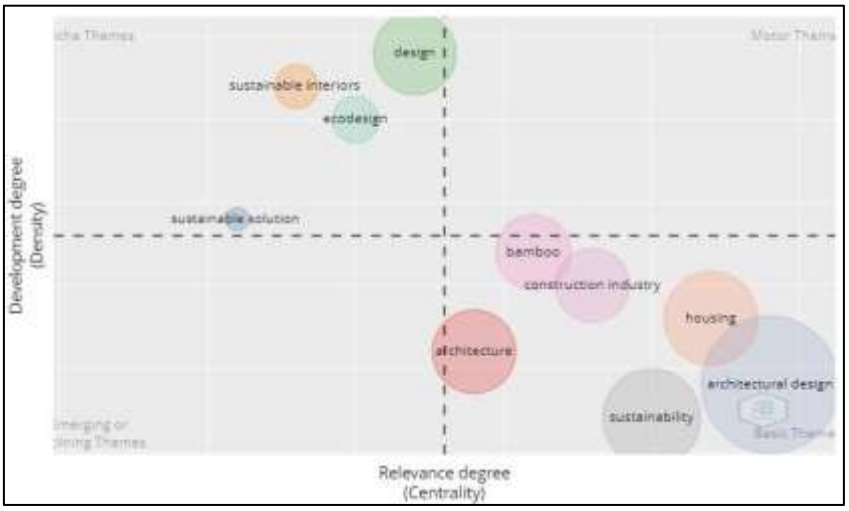

FIGURE 10 A theme map on keyword network clusters. (Bubble size: the clusters word frequency)

Keyword Analysis

Figures 11 and 12 provide an integrated view of the keywords, authors, and journals that shape sustainable interior design research. Figure 11 highlights three major metadata domains: authors on the right, sources on the left, and keywords at the center. This visualization makes clear the connections between recurring terms, leading contributors, and influential journals. Authors such as Rashdan W, Bardhan R, Ashour M, Haron SH, Celadyn M, Schneiderman D, Dickson AW, Freihoefer K, Bahauddin A, and Afacan Y are consistently associated with central themes. Frequently used terms include interior design, sustainability, sustainable design, and sustainable interior design. These keywords are strongly represented in journals such as the International Journal of Sustainability in Higher Education, Sustainability (Switzerland), Design Principles and Practices, and the International Journal of Design Education. Among these, the International Journal of Sustainability in Higher Education stands out as a pivotal outlet, bringing together key authors, recurring concepts, and foundational works.

Figure 12 expands this perspective by incorporating Keywords Plus—terms automatically extracted from cited works—linking them with journals and authors. This structure reveals how research themes evolve over time. For instance, computer aided design is tied to publications in E3S Web of Conferences alongside terms such as design methods, interior planning, sustainable development, and architectural design. Sustainability (Switzerland) again emerges as a central platform, particularly connected to concepts like energy conservation and architecture. Notably, architectural design appears across multiple journals, reflecting its status as a cross-cutting concern. The analysis further shows that around eighty percent of authors prioritize sustainable development, publishing in outlets such as E3S Web of Conferences, Journal of Physics Conference Series, Applied Mechanics and Materials, and the IOP Conference Series. Contributions by Ashour M, Haron SH, Rashdan W, and Celadyn M in the 2022 collection Engineering and Technology for Sustainable Architectural and Interior Design Environments further underscore the field's thematic breadth. Collectively, these insights guide researchers in identifying journals best suited for advancing work on sustainable or green interior design.

Figures 13 and 14 provide a conceptual view of the thematic structure of the field. Figure 13 maps associations among keywords, with sustainable or green interior design at the core, surrounded by clusters that reveal emerging research directions. The co-word network shows how terms interconnect, offering a foundation for correspondence analysis and other techniques that can uncover subfields and trace the discipline's intellectual evolution.

Figure 14 refines this mapping by clustering terms into two groups. The smaller blue cluster includes four relatively isolated concepts—indoor air quality, indoor air pollution, and indoor environmental quality. The larger red cluster, containing fifty-four terms, represents the dominant focus of the literature, encompassing topics such as interior architecture, sustainable interiors, sustainable development, carbon, and even technical areas like fluid dynamics and shore protection. This contrast highlights the breadth of the field while also revealing the relative marginalization of health-related indoor quality studies.

Finally, the thematic tree diagram in Figure 15 offers another perspective, arranging keywords according to their frequency of co-occurrence. Terms positioned closely are more likely to appear together, while greater distances indicate weaker associations. This visual structure provides a nuanced map of how research themes

interrelate, clarifying the conceptual foundations of sustainable interior design and highlighting opportunities for future exploration.

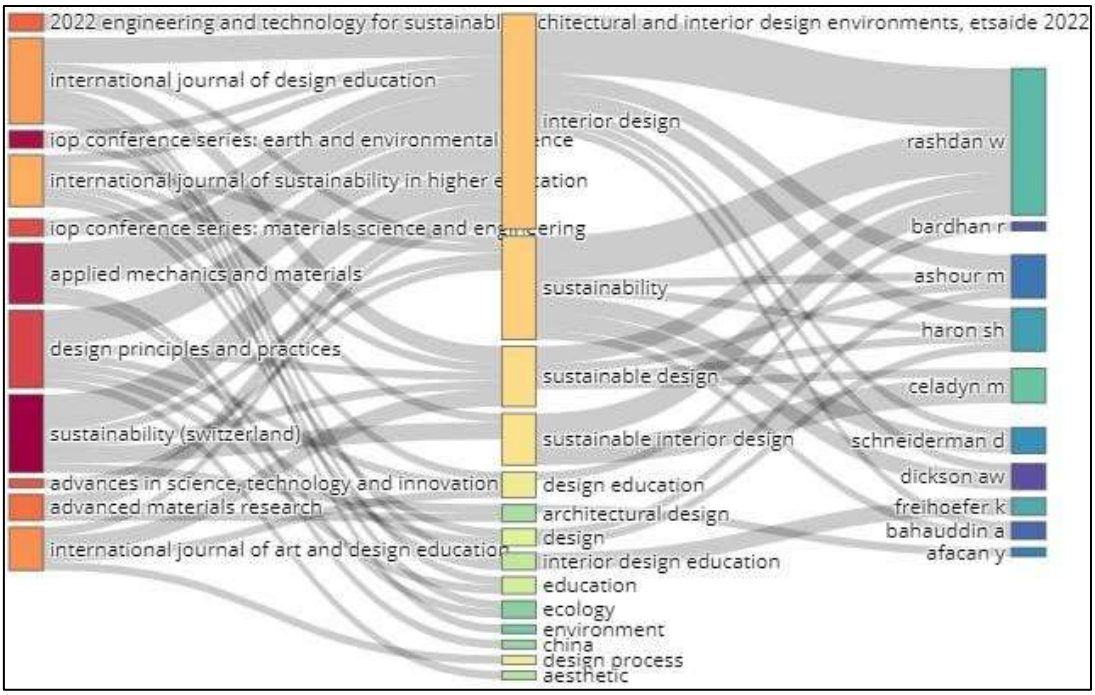

FIGURE 11 The association in sustainable or green interior design, between the top sources (left), keywords (middle) and authors (right)

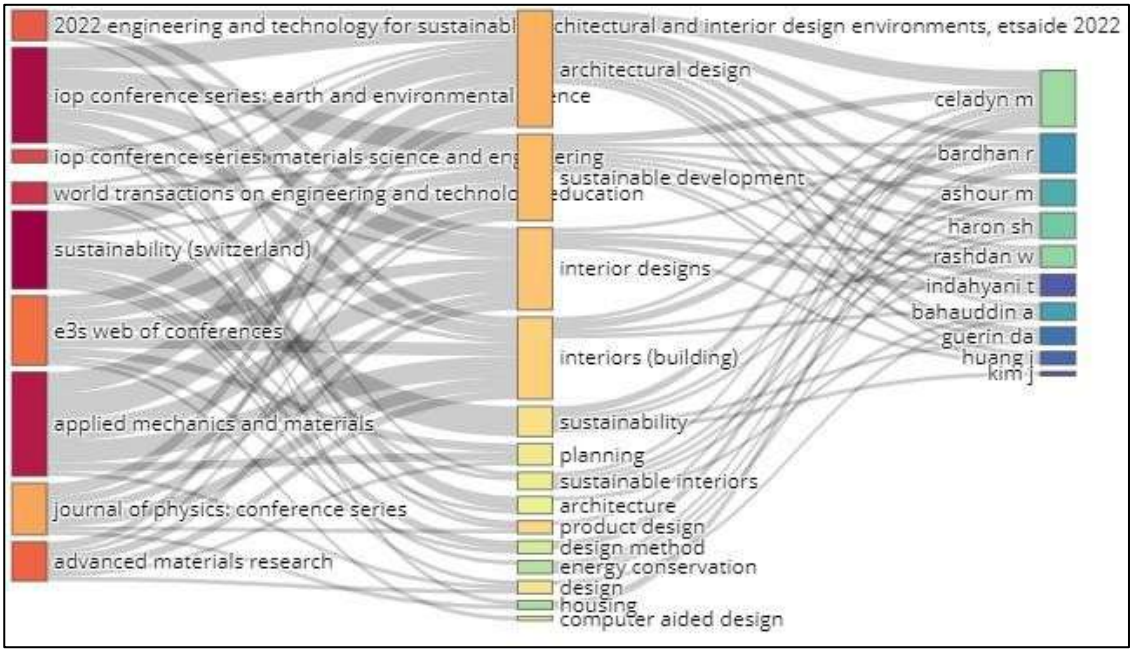

FIGURE 12 Figure 12 A relationship of interior design sustainable or green design publication's between top sources (left), top keywords (middle) and top authors (right)

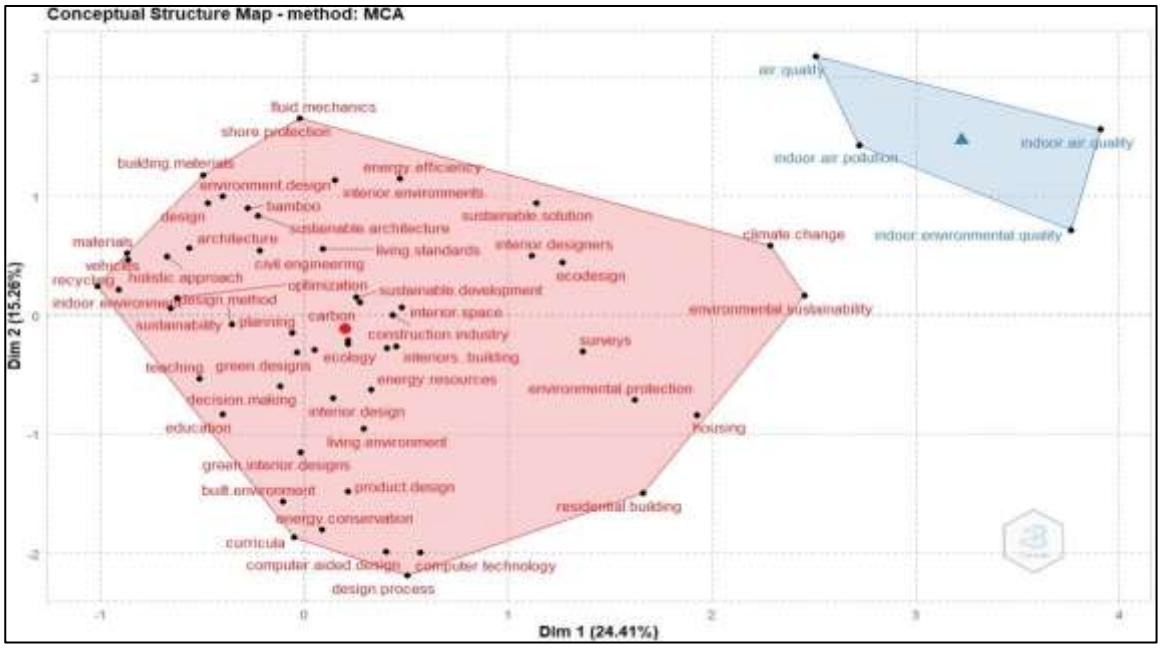

FIGURE 13Keywords applied in publications on sustainable or green interior design, presented as conceptual framework (Dim.1 and Dim.2: average position of articles included in each term)

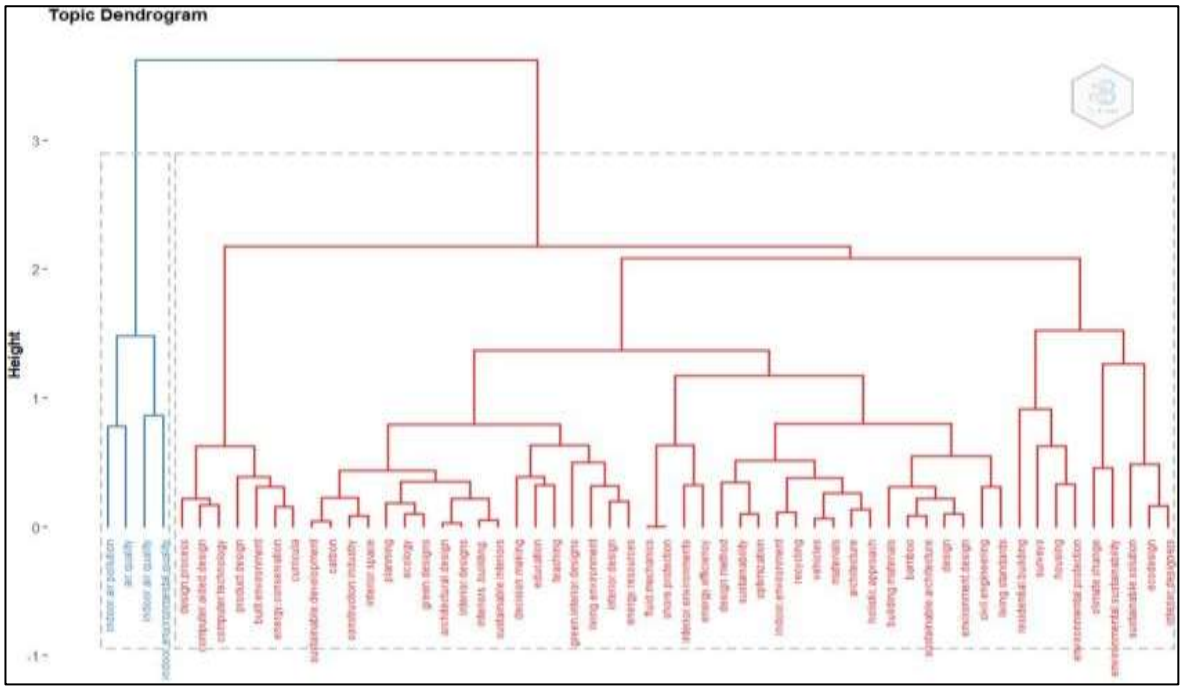

FIGURE 14 Keyword from sustainable or green interior design publications, presented as conceptual framework dendrogram (Height denotes separation between word clusters)

FIGURE 15 Top keywords plus in publications on sustainable or green interior design (Font size: frequency of keywords used)

FIGURE 16 Top author's terms in publications on sustainable or green interior design (Font size: frequency of keywords used)

FIGURE 17 Top title terms in publications on green or sustainable interior design (Font size: frequency of keywords used)

FIGURE 18Top abstract words in interior design sustainable or green design publications (Font size: frequency of keywords used)

Readers often benefit from a concise overview of the terms that define a research field. Figures 15 through 18 provide such a perspective by examining Keywords Plus, Author Keywords, Title Keywords, and Abstract Words. Keywords Plus capture the breadth of an article's content, while Author Keywords reveal how scholars intentionally frame their work. Both sets are central to bibliometric analysis, with Keywords Plus offering broader coverage of the literature [21].

Figure 15 displays the Keywords Plus for sustainable and green interior design between 1994 and May 2023, with font size and color reflecting frequencies that range from 69 mentions to just 3. The most prominent terms are interior design, architecture, sustainable development, and building interiors. Figure 16 highlights

Author Keywords, which range from 62 occurrences to a single instance, with sustainable interior design, sustainable design, and interior design dominating. Figure 17 turns to article titles, where interior design and sustainable design again emerge as central. Figure 18 shows that abstract terms closely align with these patterns. The consistency across all sources underscores the coherence of the field's vocabulary. It also indicates that careful selection of well-recognized terms in titles, abstracts, and keywords can improve clarity, visibility, and discoverability [22].

Figure 19 tracks the annual frequency of leading keywords from 2006 to May 2023. Architectural design has grown especially rapidly since 2008, appearing 69 times by 2023. Other terms, including sustainable development, interior designs, and building interiors, have also gained momentum in recent years. This upward trajectory demonstrates not only the expanding academic interest but also the likelihood that sustainable or green interior design will continue to evolve as a dynamic research domain [23].

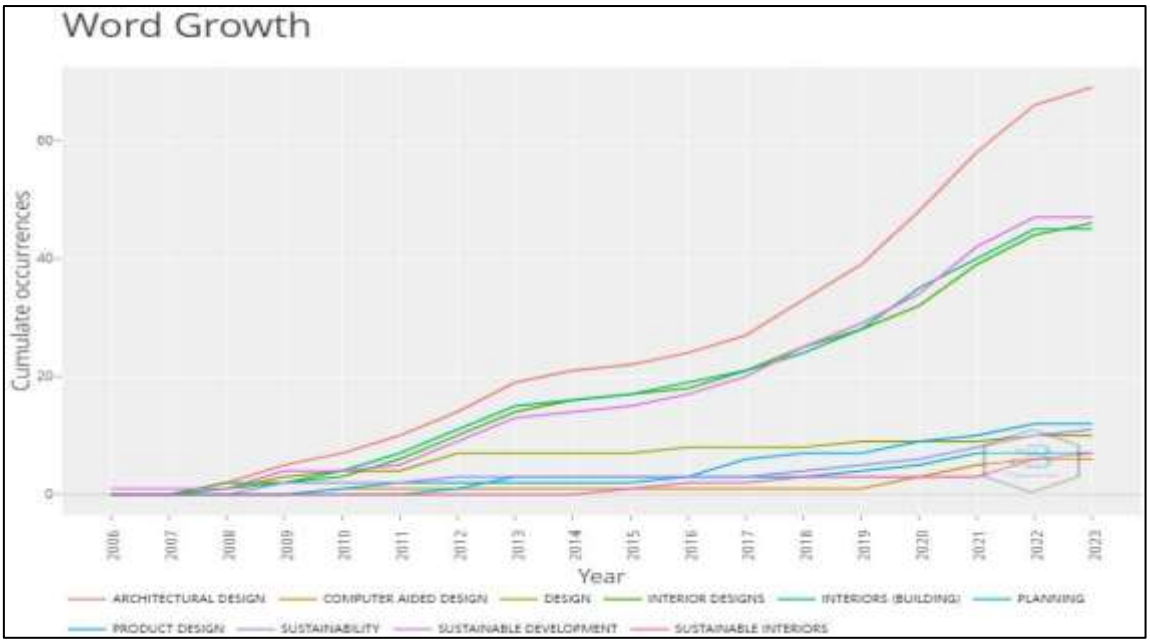

FIGURE 19 Top keywords in interior design research that is related to sustainable or green from 2006 to 2023

Qualitative Analysis

Between 1994 and May 2023, 176 papers related to sustainable interior design were published. Of these articles there are 101, and in this section, the 10 most cited articles are qualitatively analyzed.

Subjects

The most frequently cited themes in sustainable interior design research include ecodesign, health, sustainable materials, indoor environmental quality, environmental attitudes, sustainable design, education, and design preference. Notably, about 80 percent of the studies incorporate environmental and human health in their case analyses [19]. Roughly half of the authors focus on the selection and application of sustainable materials. Although "sustainable material" once ranked among the leading abstract keywords, it now appears in only about half of the most cited works. In contrast, relatively few publications explicitly use terms such as sustainable interior design, education, or attitude as subject-specific keywords [19].

Titles containing phrases like interior design, sustainable materials, or Theory of Planned Behavior (TPB) remain uncommon, suggesting that the intersection of these themes is still underexplored [20]. Across the cited literature, sustainable interior design consistently emerges as the unifying focus, with greatest attention given to environmental sustainability, occupant health, and indoor comfort. Economic dimensions are mentioned far less often [21–23]. Although some studies address the educational implications of sustainable interior design, financial considerations continue to receive limited emphasis [19, 24, 25]. Many contributions portray sustainable interior design as a strategy for enhancing energy performance in building interiors while simultaneously improving occupant wellbeing [21–23]. However, only one study explicitly underscores the value of adopting a user centered perspective in shaping sustainable interior environments [22].

METHODS

Research in sustainable interior design predominantly relies on two methodological approaches: quantitative statistical analysis and qualitative interview-based case studies. Interestingly, experimental methods are only sparingly used in this field [21]. A major portion of the cited studies examines the respondents' attitudes and their willingness to apply sustainable interior design techniques in their environments, typically

through the use of structured questionnaires [19, 20, 22-25]. Commonly applied statistical techniques include descriptive statistics, regression analysis, t-tests and Pearson correlation analysis. The case study approach appears less frequently, featuring in just three publications [26-28]. These studies utilize interviews to investigate how users' preferences for public space design and optimized interior layouts influence sustainability outcomes. A few articles have even incorporated virtual reality technology to simulate interior environments. Overall, the diversity of research methods allows for a well-rounded evaluation of sustainable interior design, qualitatively and quantitatively.

CONCLUSION

This study provides an econometric assessment of sustainable interior design research from 1980 to 2023, based on data from the Scopus database. The analysis reveals steady expansion in the field, with a pronounced acceleration after 2017, when annual publication rates began to rise consistently. This growth signals the increasing scholarly and practical importance of sustainability in interior spaces. China, the United States, and Malaysia emerge as the most active contributors, with China and the United States leading in output. Sustainability (Switzerland) and the IOP Conference Series: Earth and Environmental Science stand out as the primary outlets for disseminating research in this area.

The bibliometric mapping highlights central and intersecting themes, including ecodesign, sustainable interior design, and sustainable solutions. Over time, research attention has shifted toward architectural design, sustainable development, and interior design practice, while interest in computer aided design and sustainable interiors has declined. Qualitative analyses show that ecodesign and health are the most frequently examined topics, whereas quantitative approaches typically rely on questionnaires and related tools.

Overall, these findings trace the intellectual trajectory of sustainable interior design while identifying emerging research directions. They offer scholars and practitioners a clearer understanding of the field's development and provide guidance for advancing both theoretical inquiry and applied practice.

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