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Review of Research on Biophilic Building with Bibliometric Analysis Assessment

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Abstract

Biophilic design, an approach emphasizing the integration of nature into human life, is gaining increasing importance. This bibliometric review and content analysis aim to comprehensively analyze and synthesize the scientific literature in the field of biophilic building design. In this context, a comprehensive bibliometric analysis and content analysis were conducted to identify trends and research gaps in biophilic building research conducted between 2006 and 2023. Using Scopus data, the analysis was performed with the Bibliometrix tool. The study results identify the most influential countries, institutions, studies, authors, and keywords focusing on concepts such as biophilic design, biophilic architecture, and biophilic building. According to the findings, the study highlights the importance of incorporating natural systems and processes into the design of the built environment to enhance human health. This research underscores the significance of studies on the impact of biophilic design on mental health, overall well-being, and social relationships.

Keywords: Bibliometric Analysis, Biophilic, Biophilic Design, Biophilic Building Research, R Studio-Biblioshiny.

Biyofilik Bina Konulu Araştırmaların Bibliyometrik Analiz Yönetim ile İncelenmesi

Özet

Doğanın insan yaşamıyla bütünleşmesini vurgulayan bir yaklaşım olan biyofilik tasarım giderek önem kazanmaktadır. Bu bibliyometrik inceleme ve içerik analizi, biyofilik bina tasarımı alanındaki bilimsel literatürü kapsamlı bir şekilde analiz etmeyi ve sentezlemeyi amaçlamaktadır. Bu bağlamda, 2006-2023 yılları arasında yapılan biyofilik bina araştırmalarındaki eğilimleri ve araştırma boşluklarını belirlemek için kapsamlı bir bibliyometrik analiz ve içerik analizi yapılmıştır. Analiz, Scopus verileri kullanılarak Bibliometrix aracı ile gerçekleştirilmiştir. Çalışma sonuçları, biyofilik tasarım, biyofilik mimari ve biyofilik bina gibi kavramlara odaklanan en etkili ülkeleri, kurumları, çalışmaları, yazarları ve anahtar kelimeleri tanımlamaktadır. Bulgulara göre çalışma, insan sağlığını geliştirmek için doğal sistem ve süreçlerin yapılı çevre tasarımına dahil edilmesinin önemini vurgulamaktadır. Bu araştırma, biyofilik tasarımın ruh sağlığı, genel refah ve sosyal ilişkiler üzerindeki etkisine ilişkin çalışmaların öneminin altını çizmektedir.

Anahtar Kelimeler: Bibliyometrik Analiz, Biyofili, Biyofilik Tasarım, Biyofilik Bina Araştırması, R Studio-Biblioshiny.

1. INTRODUCTION

Modern life is increasingly challenging individuals' access to nature. However, the longing for individuals to establish a connection with nature continues to grow [1]. Nevertheless, the rapid increase in urban population and the decrease of natural areas due to construction have led to a weakening connection between humans and nature [2]. Additionally, it is known that individuals spend 90% of their time in enclosed spaces [3]. In this context, efforts to integrate nature into the built environment have gained momentum recently, considering people's living spaces and evolving needs.

Biophilic design, known as one of these efforts, is a design approach that aims to bring humans closer to nature by integrating natural objects, patterns, and components into the built environment [1]. The term "biophilia," used as one of the initial concepts of biophilic design, is defined by [4] as "...the deep-seated need of humans to connect with nature." According to [5], the integration of nature into the built environment is not considered a luxury but, on the contrary, is interpreted as a crucial need based on neurological and physiological evidence for health and productivity. The integration of nature into the built environment through biophilic design has been shown to have positive effects on general health and well-being, such as reducing attentional fatigue and stress [6]. In addition to these benefits, biophilic design possesses features such as enhancing the quality of life, increasing creativity, and strengthening cognitive clarity [7].

New design strategies focusing on the psychological benefits of nature when applied in the built environment are increasingly being implemented in building design [8]. The positive effects of nature, especially plants, on human psychology, health, and well-being have been extensively studied by many researchers [9; 10; 11]. Particularly in response to growing environmental challenges, there is an increasing interest in "nature" and "biophilic design" in architecture. However, unclear questions and ongoing debates about the conceptualization and handling of "nature" persist at both the practical and research levels [12].

When the studies on this subject in the literature are examined, [13] conducted a systematic literature review and visual analysis using CiteSpace and VOSviewer tools to examine the issue of energy efficiency in biophilic architecture. [14], conducted a bibliometric analysis of the relationship between neuroscience and spatial design using publications in the Web of Science database. [15] also conducted a bibliometric analysis aiming to understand the relationship between stress and the built environment by analyzing the literature between 1993 and 2023. [16] examined the issue of biophilic hotel design through a systematic literature review and aimed to analyze the current approaches and trends in this field. Unlike other studies, the aim of this research is to conduct a bibliometric analysis of studies focusing on the biophilic design approach in buildings. For this purpose, a search was conducted in the Scopus database using the keywords “biophilic design” OR “biophilic architecture” AND “building*” and a total of 237 publications were analyzed. These analyses were conducted using the Bibliometrix/Biblioshiny graphical program, a significant package of the R programming language, and the obtained data were visualized with maps. In this framework, the answers to the following questions were investigated.

In the research conducted in the Scopus database, the distribution of the academic studies reached by years, document types and subject areas of the academic studies reached were investigated. However, with the bibliometric analysis performed with bibliometrix / biblioshiny “authors with the highest scientific production, author’s production over time, the productivity of authors as analyzed through Lotka's law, author H-indexes, tree field of author-institution-country collaboration, corresponding author’s country, most cited countries, most relevant affiliations, most relevant sources, sources’Local impact by H Index, the leading sources in the field of biophilic building design, sources’production over time, most global cited documents, most frequent words, trending topics from 2006 to 2024” are revealed.

1.1. Biophilia Hypothesis Theory

The rapidly advancing urbanization process has provided a foundation for the emergence of biophilic design, turning it into an appealing research topic related to human living spaces. Biophilic design, as an approach inspired by nature, promotes ecological diversity and positively contributes to the development of both physical and mental health.

"Biophilia" concept, which forms the basis of the biophilic approach, was first introduced by the social psychologist Erich Fromm in 1964. Subsequently, the term "biophilic" was define the innate need of humans for close contact with nature. Similarly, [13] in his book "Biophilia" described the biophilia hypothesis as an innate tendency of humans to focus on life and lifelike processes. Biophilic design is a design method developed to enhance environmental quality, health, and productivity. This trend, incorporating elements such as nature-inspired

systems, engineering principles, and design cues, has the potential to positively impact the well-being of individuals in living spaces [14]. In this context, biophilic design, which involves integrating natural elements into the built environment, has been gaining increasing interest in the field of architecture [15].

Efforts to maintain human interaction with nature have been observed throughout history [16]. As evidence of this, examples such as medieval Chinese villages, Persian settlements, and the homes of ancient Egyptian nobles are cited [17]. Today, academics such as Edward Wilson, Stephen Kellett, Browning, and Ryan propose design concepts, principles, and strategies that are grounded in nature and aim to establish a balance between humans and the natural world [18; 19]. These proposed principles encourage the use of natural elements and processes in the built environment as a source of inspiration for design [19].

In this context, overcoming the adverse effects of the built environment and redefining the relationship between humans and nature to enhance human well-being has become crucial [20]. Therefore, biophilic design is an innovative approach aimed at addressing the natural conflict between people and the urban environment in the context of rapid urbanization, specifically focusing on designing living, working, healing, and learning spaces. Biophilic design establishes a solid foundation for the development of healthy structures by utilizing artificial environmental design methods that harness the beneficial effects of nature, thus proposing a healthier and more natural living environment [21]. Within this framework, examining studies on biophilic design in buildings through bibliometric analysis has gained importance for understanding the state of the literature, identifying trends and developments, determining connections between relevant topics and disciplines, analyzing interactions through citation analysis, and identifying gaps in the literature.

2. MATERIALS AND METHODS

Literature reviews, processes aimed at developing research fields by effectively utilizing existing knowledge sources, applying and sustaining professional expertise and judgment, increasingly involve the synthesis of findings from past research [22]. In this context, bibliometric analysis is defined as a quantitative technique useful for determining the intellectual structure of a scientific field [23; 24]. Information obtained within the scope of bibliometric analysis is presented as visual knowledge maps. In this framework, visual representation through network mapping is a commonly used technique for researchers to understand, analyze, and visualize complex relationships. This method leverages visual data to represent information in a more understandable and interactive way compared to raw data. In the study, this method reveals trends in the development of a research field, research paths, key points, evaluation processes, and trends in the development of the research area. The visualization method takes the literature (published articles) as an example to visualize the time trend in a specific research field. Consequently, researchers utilize network mapping through visualization to understand and analyze complex relationships [25].

In this study, bibliometrix software, a package of the R program, was used. It is an effective tool in bibliometric analysis, which allows analyzing the literature, understanding publication trends and research dynamics. It helps to discover information such as the most influential authors, collaborative networks and keyword trends in academic work. Biblioshiny, the web interface of Bibliometrix, enables data upload, analysis and visualization without the need to write code [26].

Based on this, within the scope of this study, the subject of biophilic design in buildings has been determined for bibliometric analysis. Biophilic design, as a design approach emphasizing the integration of nature into human life, is gaining increasing importance. This bibliometric review and content analysis aim to comprehensively analyze and synthesize the scientific literature in the field of biophilic building design. In this context, out of 237 studies conducted between 2006 and 2024, 235 were selected for evaluation. A comprehensive bibliometric and content analysis was conducted to identify trends and research gaps in biophilic building research included in these studies. In the research, analysis was performed using Bibliometrix tool with Scopus data, and visual maps were created (Figure 1).

Figure 1. Research methodology

A search was conducted in the SCOPUS database using the keywords "biophilic design," "biophilic architecture," and "building*" within the title, abstract, and keywords. As a result of this search, 237 publications were identified. After downloading these studies in BibTeX format, they were analyzed using the Bibliometrix program. A restriction was applied to include only publications published in English for the evaluated studies. Thus, focusing on 235 studies related to concepts such as biophilic design, biophilic architecture, and biophilic building, the most influential countries, institutions, studies, authors, and keywords were identified.

3. Results

3.1. Analysis Findings in Scopus Database

On December 23, 2024, a search was conducted in the Scopus database using the query (Tıtle-Abs-Key ("biophilic design" OR "biophilic architecture") AND Tıtle-Abs-Key (building*)). Without a starting year limitation, this search identified a total of 237 studies produced between 2006 and 2024 (Figure 2).

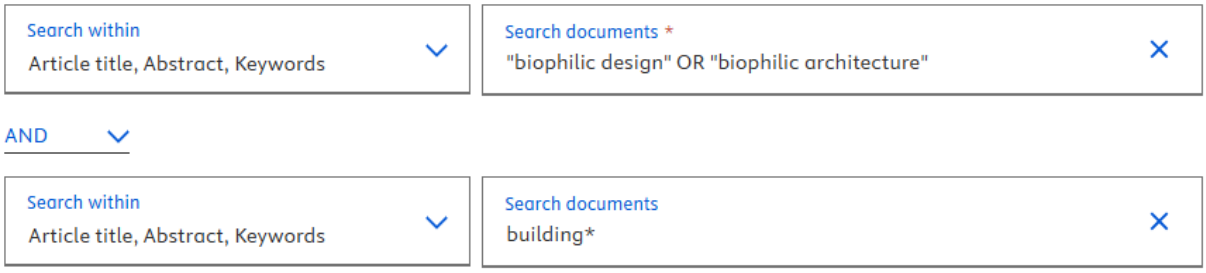

Figure 2. Search conducted with the identified keywords in Scopus.

The evolution of articles published from 2006 to 2024 is presented in Figure 3. The analysis of this graph reveals the change in scientific production over the years. In this context, according to the graph, it is seen that only 1 publication was produced in the field of “biophilic building design” in 2006 and no publication was produced between 2007-2010 (N=0). There is no significant increase in the number of publications from 2006 to 2012. As of 2013 (N=2), a slow upward trend in the number of documents has started. However, a rapid increase in documents has been observed since 2018 (N=11). Especially after 2020 (N=24), a serious acceleration is observed. In this framework, a relationship can be established between the increasing number of publications and the understanding of the importance of the human connection with nature in the context of the COVID-19 pandemic.

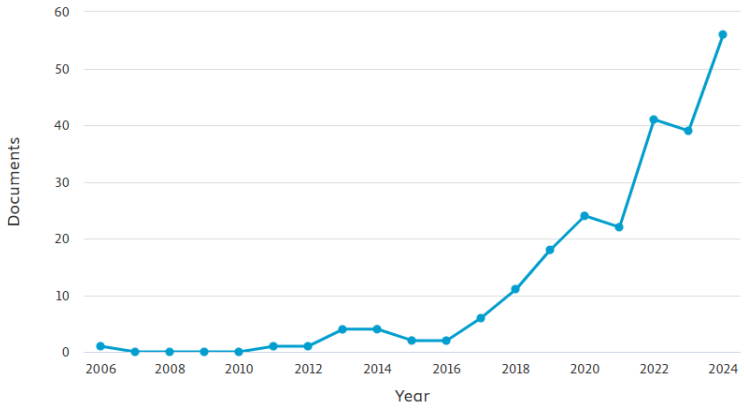

Figure 3. Documents by year

As a result of the analysis, document types were determined as follows: Article (N=132), Conference Paper (N=55), Book Chapter (N=21), Review (N=13), Conference Review (N=8), Book (N=3) (Figure 4).

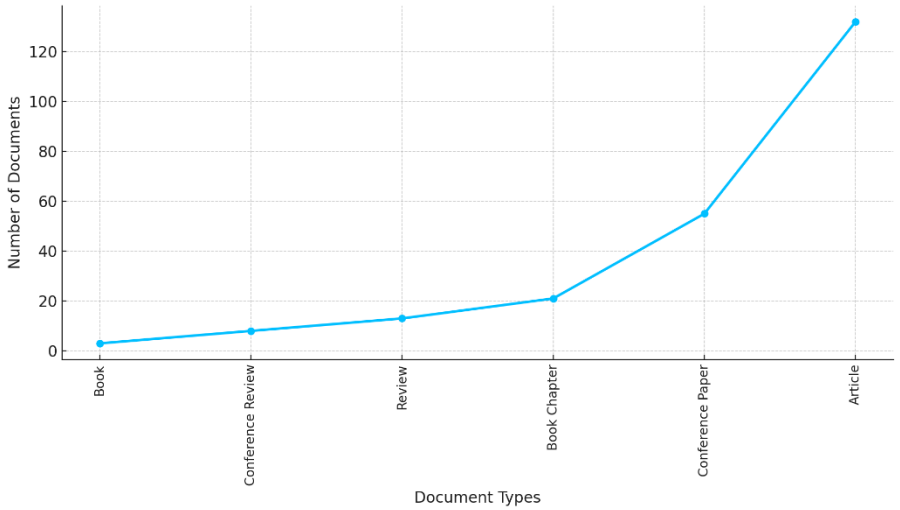

Figure 4. Document types

When the documents are categorized by subject area in the Scopus database, Engineering (N=133), Environmental Science (N=86), Social Sciences (N=71), Energy (N=37) and Earth and Planetary Sciences (N=28) represent the top five fields with the highest number of publications (Figure 5).

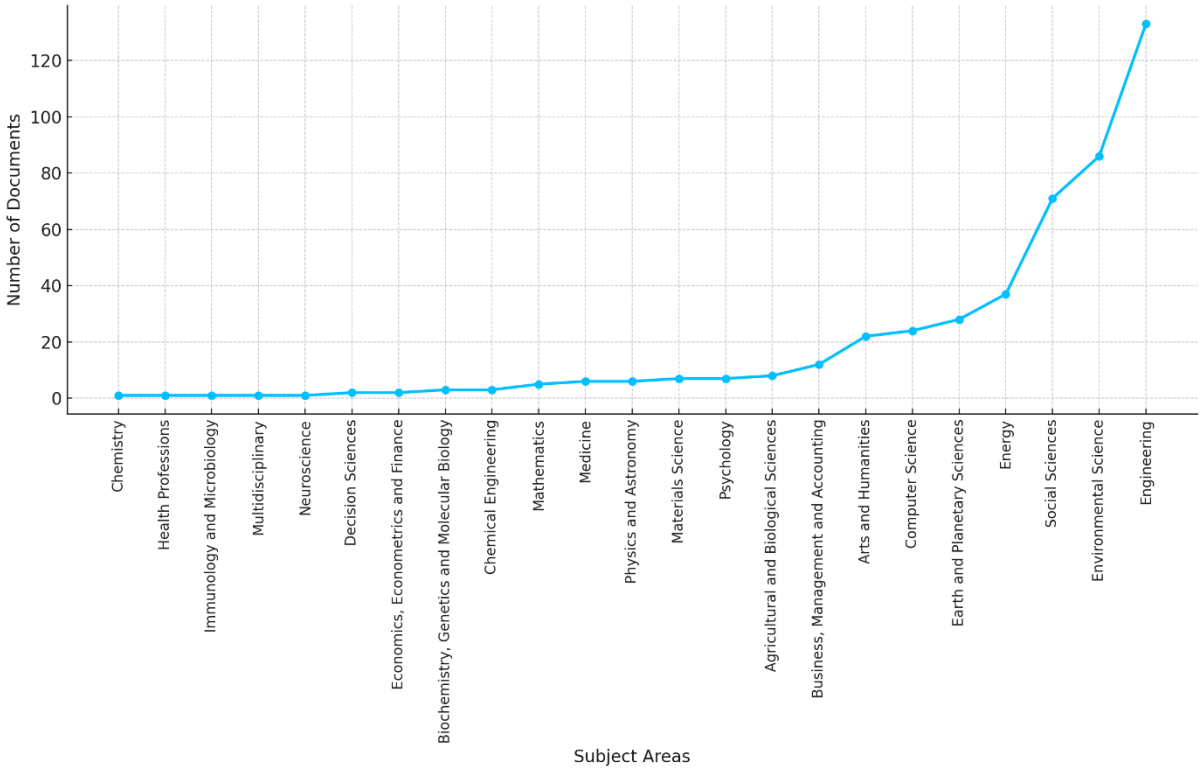

Figure 5. Classification of documents based on subject area.

3.2. Analysis of Articles with Bibliometrix

In this section of the study, initially, based on the Scopus database, it was determined which publications on "biophilic building design" would be evaluated using the Bibliometrix software and which ones would be excluded (Table 1). The assessment of the studies included in the bibliometric analysis is elaborated in detail with graphs and maps.

Table 1. Criteria for inclusion and exclusion in bibliometric analysis.

Inclusion Criteria	Exclusion Criteria
Research conducted between 2006 and 2024	Publications of the year 2025
Studies related to the development of "Biophilic building design"	Studies unrelated to "Biophilic building design"
Documents related to "Biophilic building design"	Duplicate documents in the database
Article, Conference Paper, Book Chapter, Review, Conference Review, Book	Studies where "Biophilic building design" is not the main focus of the research
Studies in the English language	Studies produced in the Korean language

In this context, with the limitations imposed using R Studio-Biblioshiny software, a total of 235 articles were included from 122 sources. According to the information in Figure 6, in the studies conducted between 2006 and 2024, the number of single-authored documents is 31, while the number of collaborative works is 204. The bibliometric analysis method of the study was conducted using a total of 683 keywords between 2006 and 2024, and it is noted that each document received an average of 11.21 citations.

Figure 6. Basic information about the studies included in the bibliometric analysis using Biblioshiny software.

Determining the number of authors in bibliometric analysis studies is crucial for understanding whether research is conducted collaboratively or individually. Examining the number of authors in academic studies serves as a guide to understanding whether the research in the field requires individual or collaborative efforts [27]. Additionally, identifying the most productive authors and collaborations is important for funding institutions and organizations [28]. Therefore, revealing authorship trends helps provide valuable information for stakeholders in research and academic fields.

On the other hand, Figure 7 presents an analysis of the most relevant authors in the field of "biophilic building design." Conducting a bibliometric analysis of the most relevant authors is crucial for understanding the dynamics of research in a specific field.

In Figure 7, the ranking of the top 20 authors who have published the most in "biophilic building design" research is shown. Wijesooriya N ranks first with a total of 10 scientific articles. Brambilla A (N=9), Demers CMH (N=9), Potvin A (N=9) follow. It is important to note that this graph encompasses all types of authorship, including corresponding authors, co-authors, and similar categories.

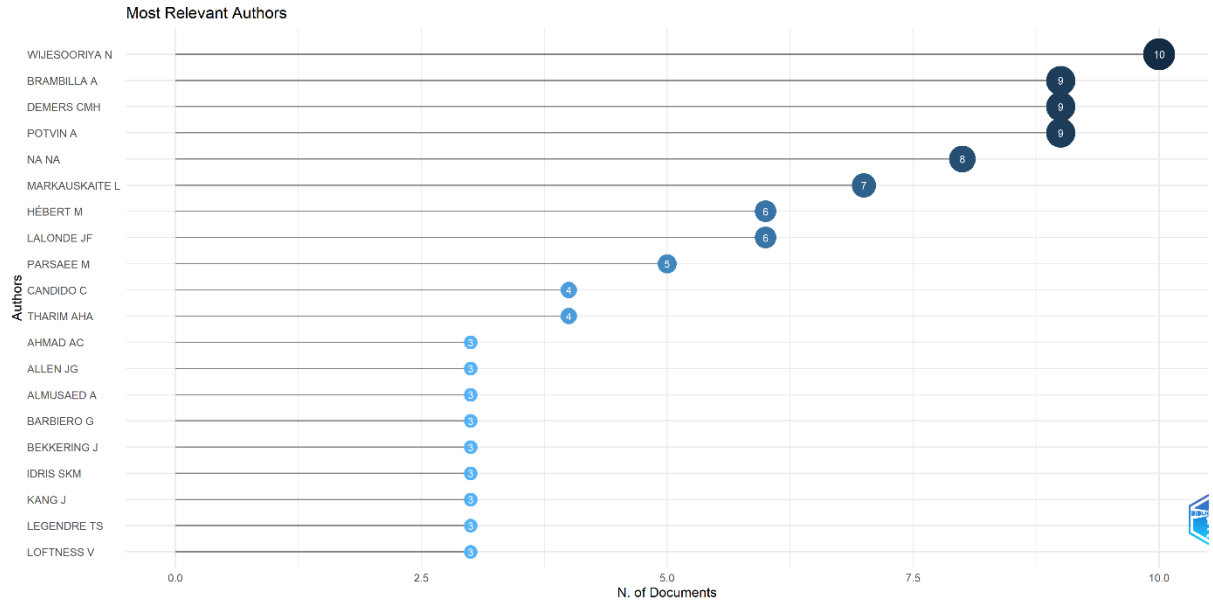

Figure 7. Authors with the highest scientific production

The top authors over time are depicted in Figure 8. This analysis is crucial for illustrating the development of each author over the years. In the graph presented in Figure 8, the darkening of the blue circles indicates more total citations per year, while the growing circles represent more published articles. Wijesooriya N emerges as the most productive author from 2006 to 2024, with a total of 10 articles.

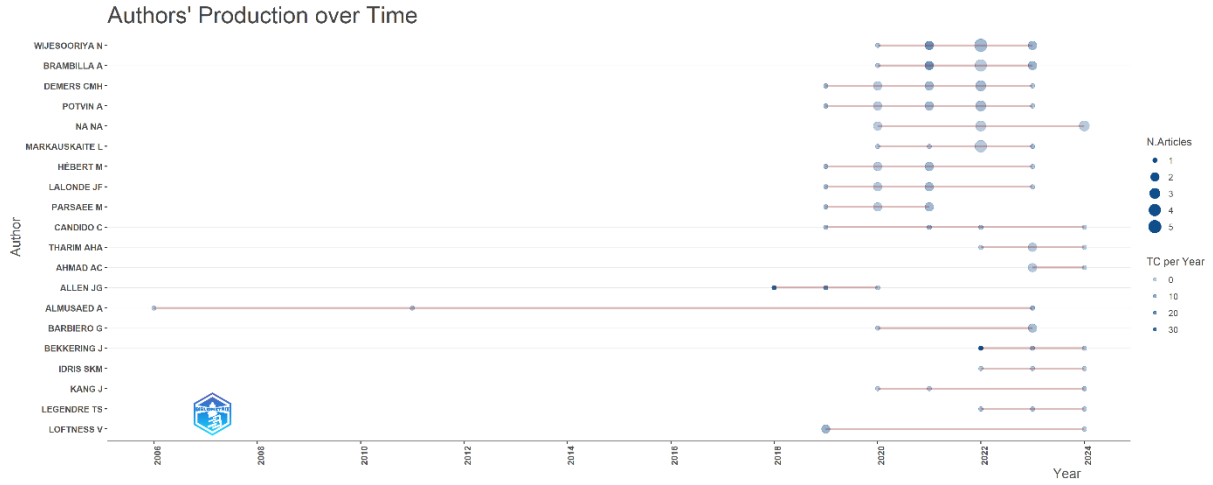

Figure 8. Author's production over time

The assessment of research quality, analysis of emerging trends, examination of impacts within the academic community, and identification of potential collaborations contribute significantly not only to individual researchers but also to institutions and funding organizations.

In the study, Lotka's Law was employed to examine the productivity and impact levels of researchers in a specific knowledge domain. The data presented in Figure 9 illustrates how Lotka's Law is applied based on numerical values representing each author's contribution to articles. While 88.4 % of authors contributed with at least one work, 7.4 % contributed with at least two articles, and less than 1 % contributed with at least six articles. Lotka's Law is commonly used as a tool in bibliometric studies to understand the distribution of productivity among researchers in a particular discipline, identify pioneers, and assess the impact of research.

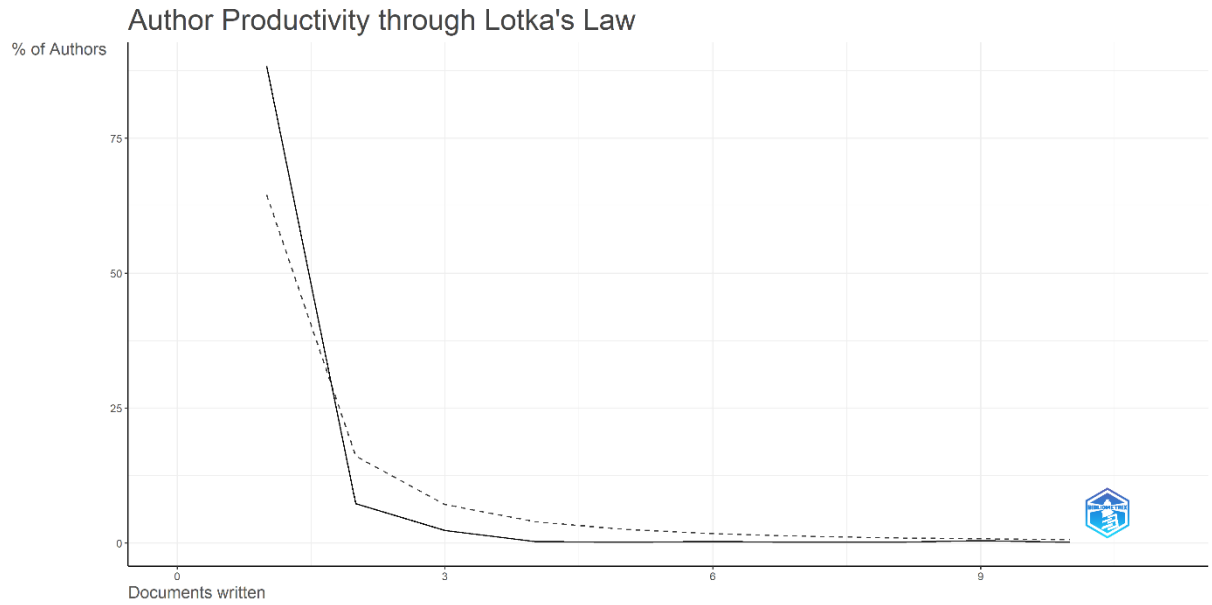

Figure 9. The productivity of authors as analyzed through Lotka's law.

Evaluating the impact of authors is commonly done through indices such as the H-index, which measures the productivity of publications and the impact of citations, considering both the quantity (number) of highly cited articles and the citation count received in other research. Therefore, this index is crucial for bibliometric analyses. In Figure 10, different groups of authors are observed. The H-index for authors in the first group is 5, while authors in the second group have an H-index of 4.

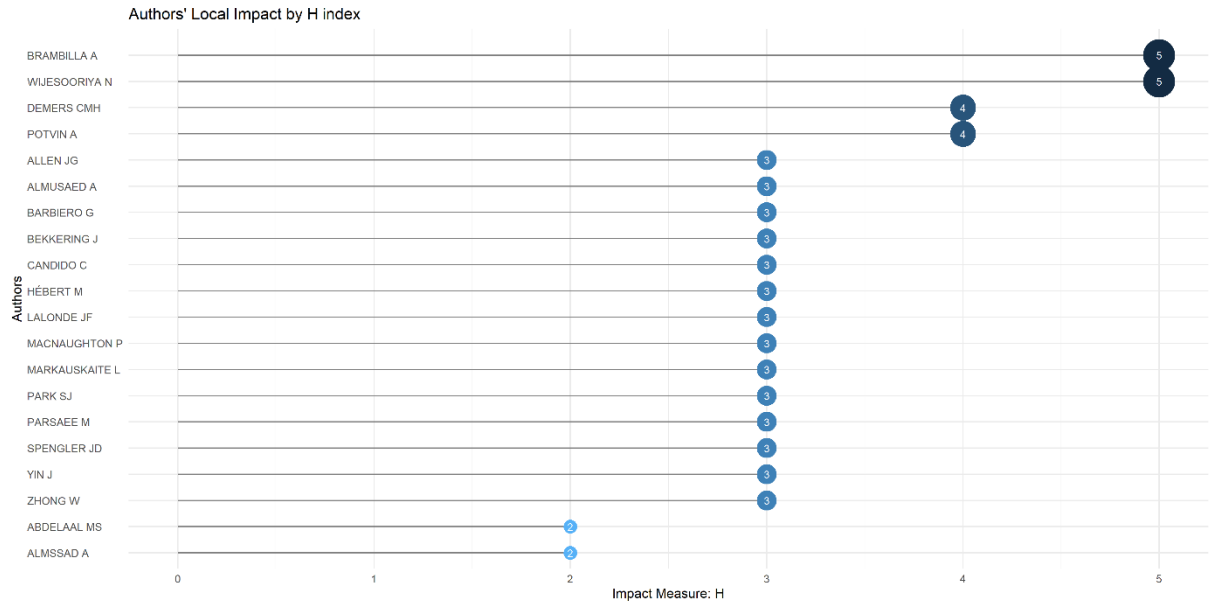

Figure 10. Author H-indexes

In Figure 11, authors collaborating with different institutions and countries are observed. The height of the bars shown in different colors indicates the level of effectiveness.

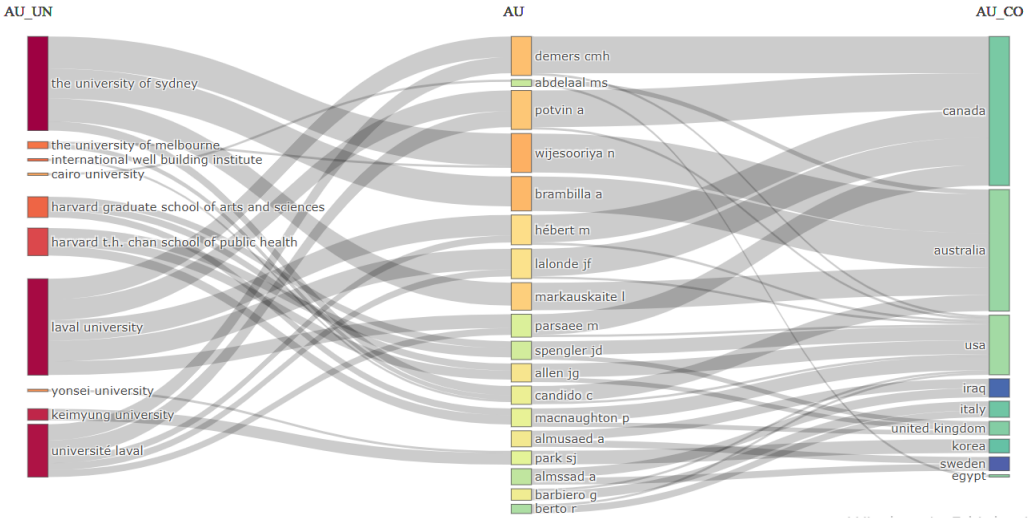

Figure 11. Tree field of Author-institution-country collaboration

The distribution based on the number of publications produced individually or in collaboration with other countries by the top 20 countries is shown in Figure 12. Australia ranks first with 2 multiple and 23 single publications. The USA is in second place with 2 individual publications and 18 multiple publications. Egypt, on the other hand, has no collaboration outside its country and is in third place with 11 individual publications. These countries are followed by Canada and the United Kingdom.

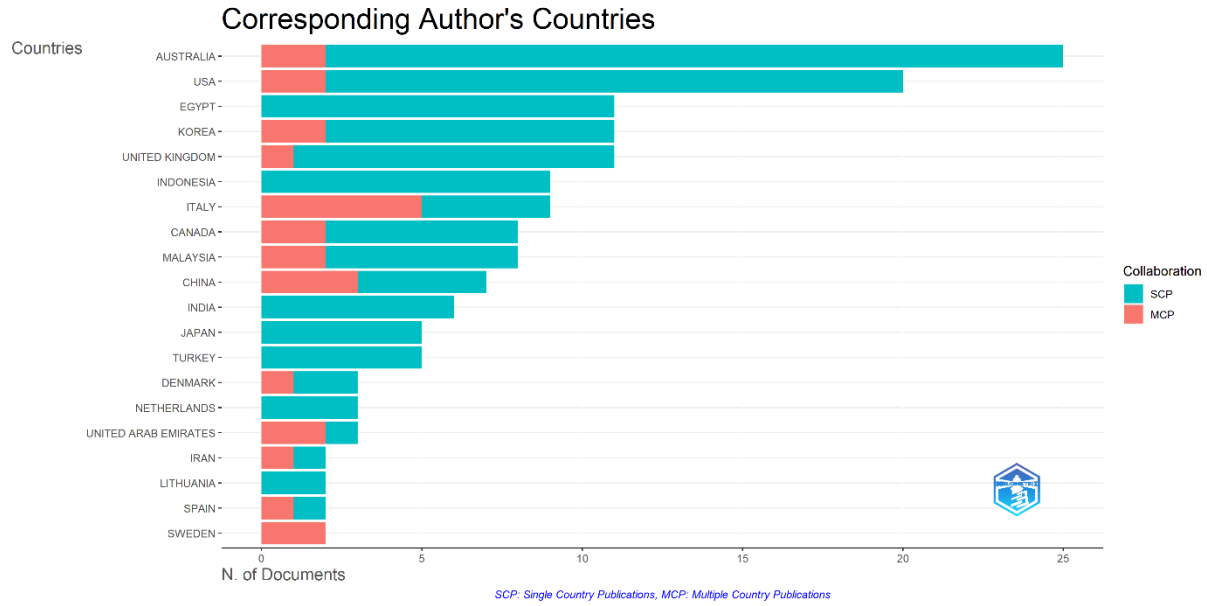

Figure 12. Corresponding author's country

Figure 13 displays the total citation counts for each country in the field of "biophilic building design". The USA is ranked first with 764 citations, followed by Australia with 271 citations, Netherlands with 139, United Kingdom with 125, Canada with 115 citations and, Italy and Italy with 115 citations.

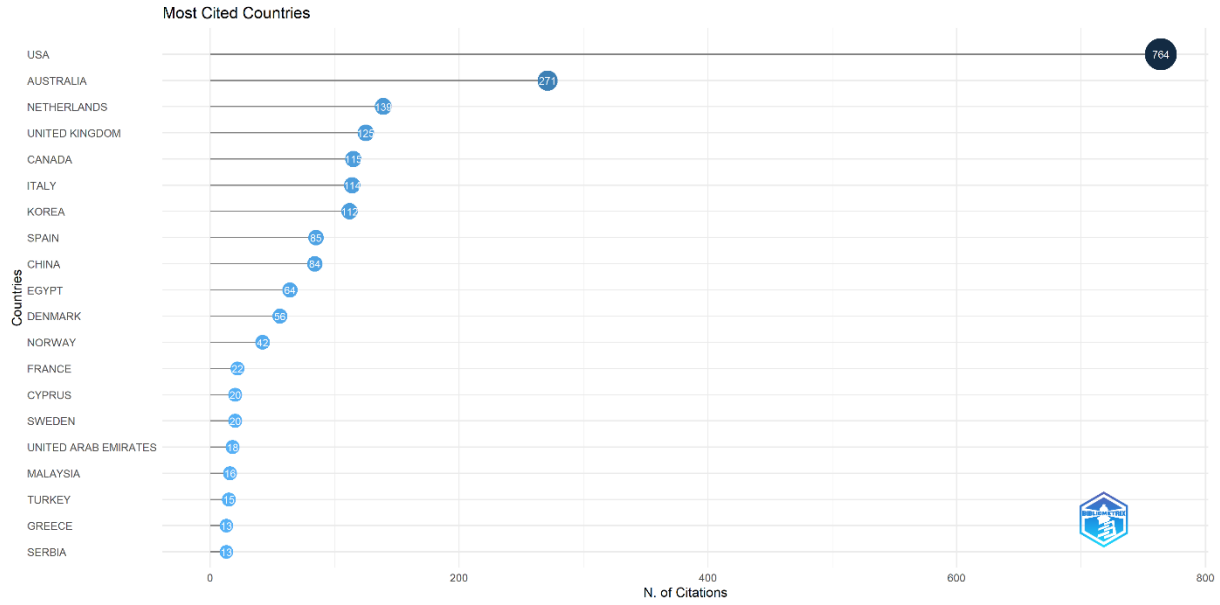

Figure 13. Most cited Countries

The top 20 institutions with the highest number of publications are shown in Figure 14. At the front of the list is The University of Sydney with a total of 31 studies. Additionally, Harvard T.H. Chan School of Publıc Health (N=16, Laval University (N=15), University Technology Mara (N=14), and Malaysia Kelantan University (N=13) are among the top five universities.

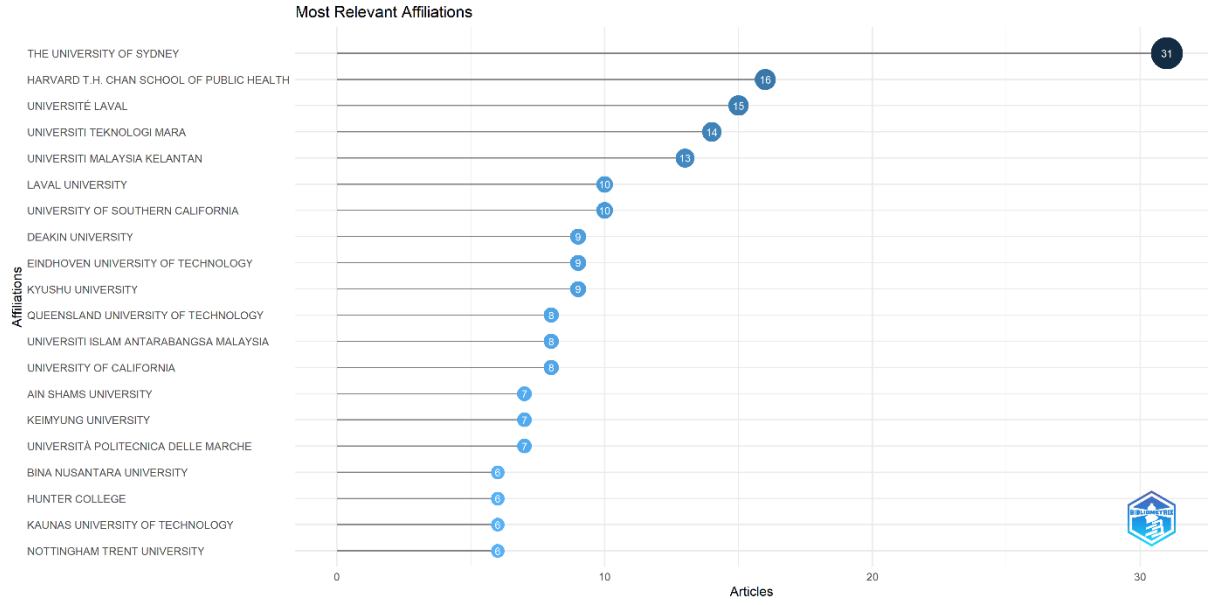

Figure 14. Most relevant affiliations

Figure 15 displays the most relevant sources. The top five positions are occupied by IOP Conference Series (N=17), Buildings (N=16), Sustainability (N=9), Building and Environment (N=8), and Journal of Building Engineering (N=8) sources, respectively.

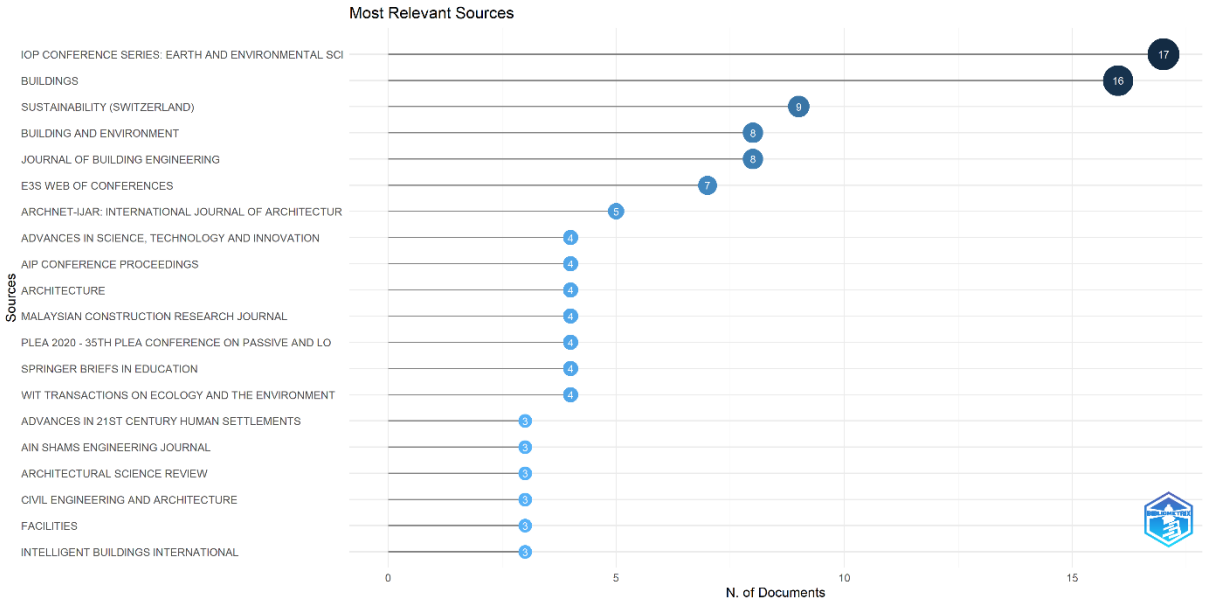

Figure 15. Most relevant sources

In addition to all of these, Figure 16 illustrates the local impact of sources based on the H index. Building and Environment take the top position with a 7 H index, followed by Buildings and Sustainability and Sustainability with a 6 H index.

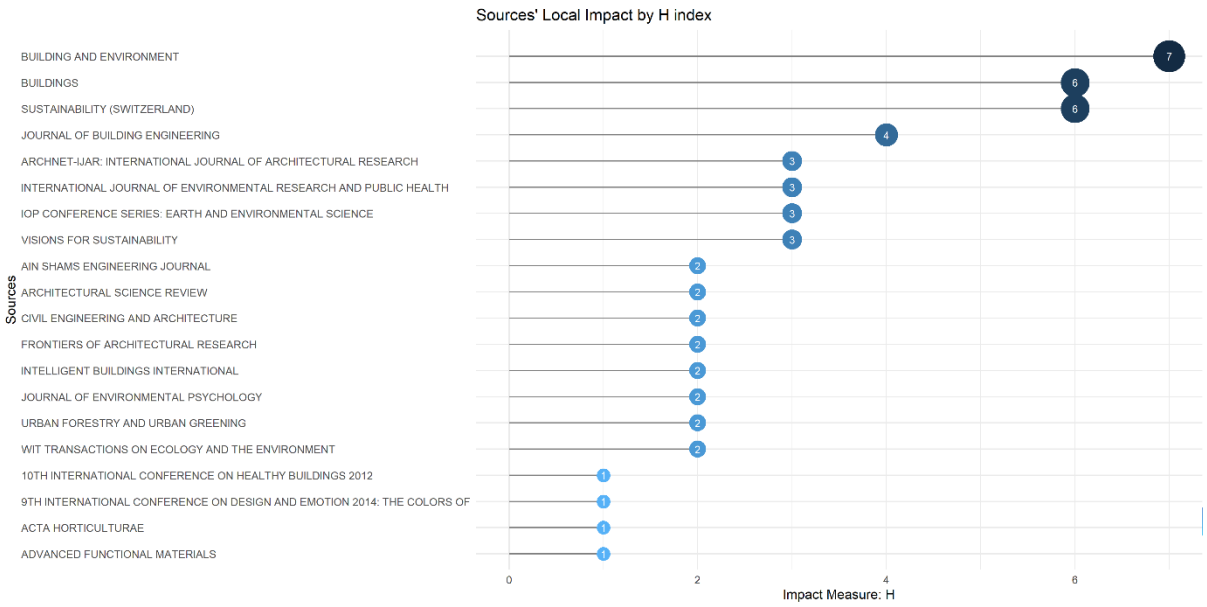

Figure 16. Sources'Local Impact by H Index

Bradford's Law classifies sources based on their productivity to manage the use and access of information. In this context, Figure 17 lists the leading sources in the field of 'biophilic building design'. While the first central zone contains a limited number of sources, each subsequent zone contains an increasing number of sources. The most productive sources can be observed in the graph below.

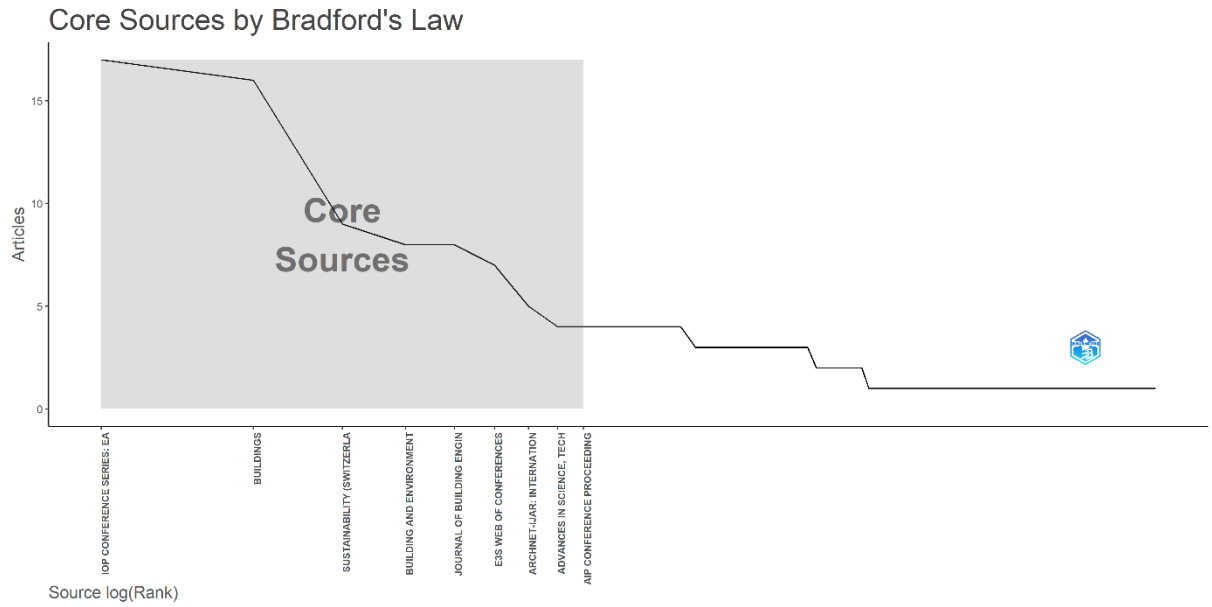

Figure 17. The leading sources in the field of biophilic building design.

Figure 18 illustrates the cumulative source dynamics. This graph reveals the cumulative numbers of documents in sources over the years. It is observed that until the year 2012, only one source produced documents. However, from 2017 to 2024, source diversity becomes apparent.

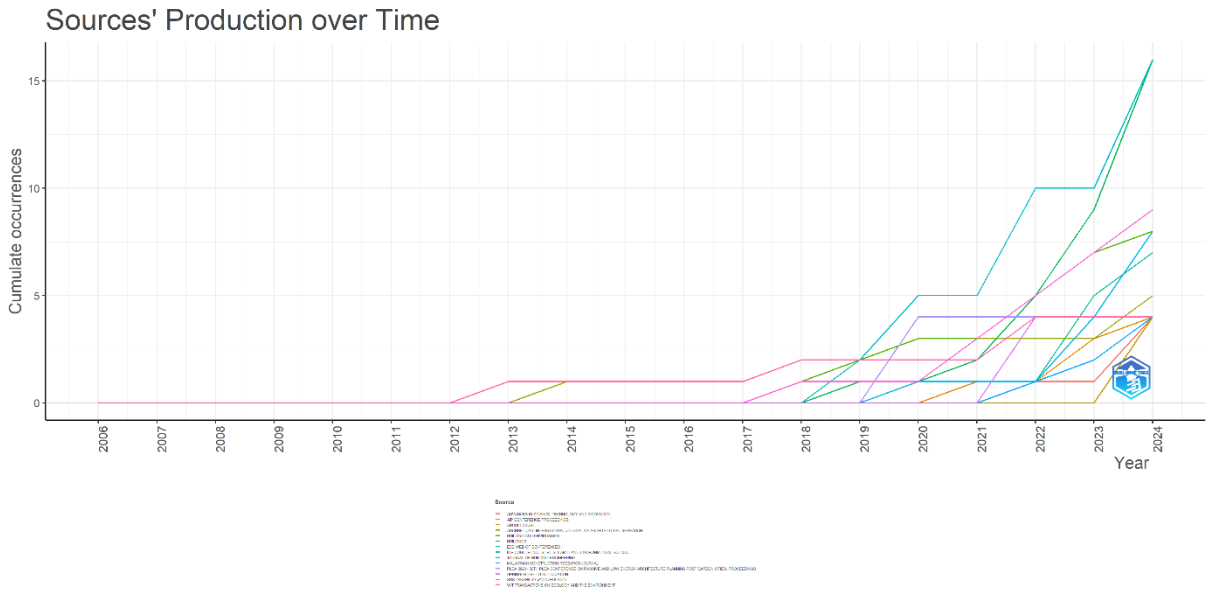

Figure 18. Sources'production over time

Citation signifies the recognition of a writer's contributions to the scientific field. Therefore, determining which publications receive the most citations is crucial not only for an author's reputation but also for evaluating the impact of a journal [29].

Figure 19 shows the top 20 authors with the most cited publications. "Physiological and cognitive performance of exposure to biophilic indoor environment" by [15] ranks first with 234 citations. [4] research article titled "Biophilic Design Patterns, Emerging Nature-Based Parameters for Health and Well-Being in the Built

Environment" was the second most cited study. [6] study titled "The impact of a view from a window on thermal comfort, emotion, and cognitive performance" ranked third with 183 citations.

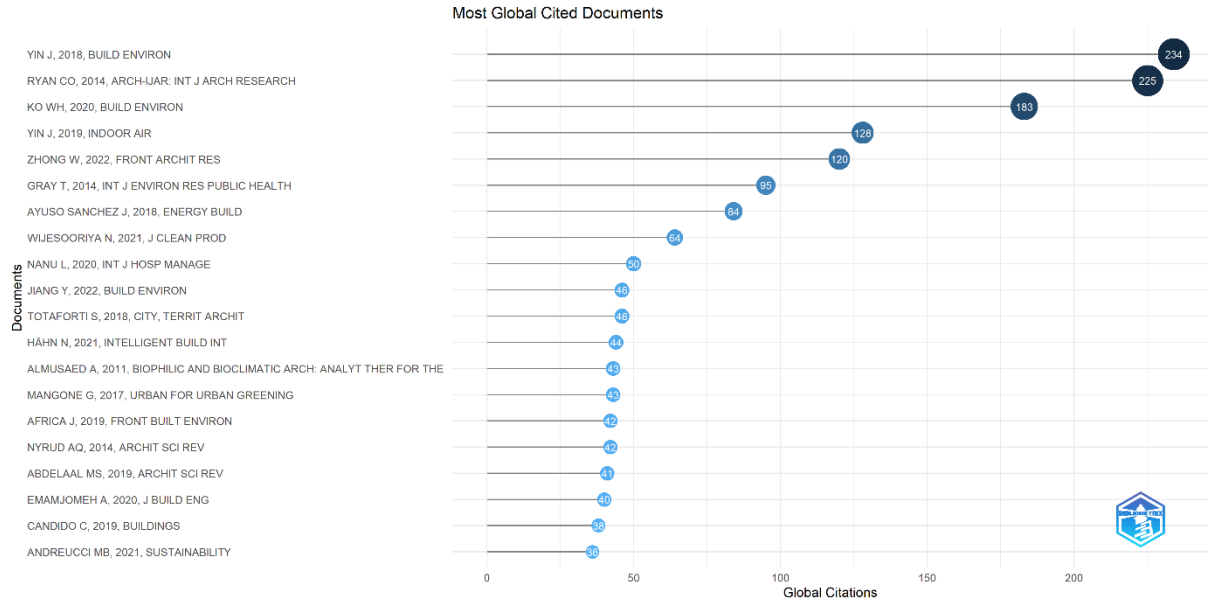

Figure 19. Most Global Cited Documents

The analysis results reveal in Figure 20 that the most frequently used keyword is "biophilic design". Following this term, keywords such as biophilia, sustainability, well-being, nature, biophilic architecture, sustainable architecture, and virtual reality are identified. The presence of workplace biophilic design in these keywords indicates a frequent focus on the impact of biophilic design on workspaces. These keywords reveal that the biophilic design approach is a multidisciplinary field with a broad scope ranging from sustainability to health, from technology to the natural environment.

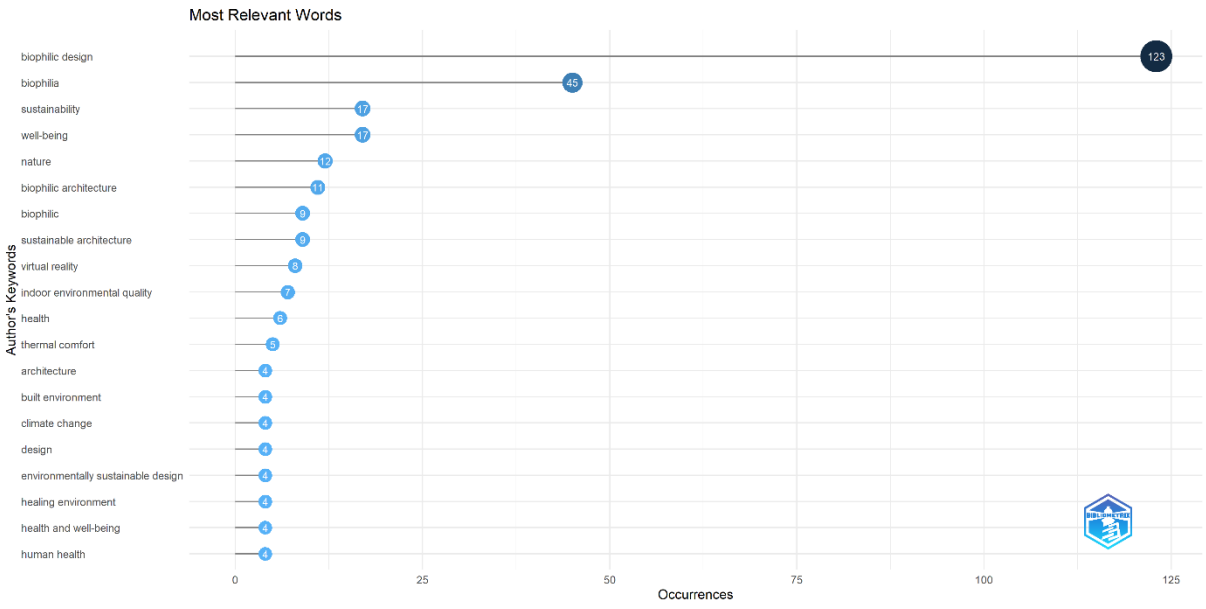

Figure 20. Most frequent words

In addition, an analysis of the trending topic based on the keywords in the dataset of the authors was conducted. Figure 21 illustrates the trending topics within the studies. For this analysis, the time range was set from 2006 to 2023, with a minimum word frequency of 4 and an number of Words per year of 10. Biophilic design (N=123), biophilia,(N=45), well-being (N=17), sustainability (N=17), nature (N=12) as trending topics. This analysis provides insights into the trending keywords in the literature on 'biophilic building design' from 2006 to 2024.

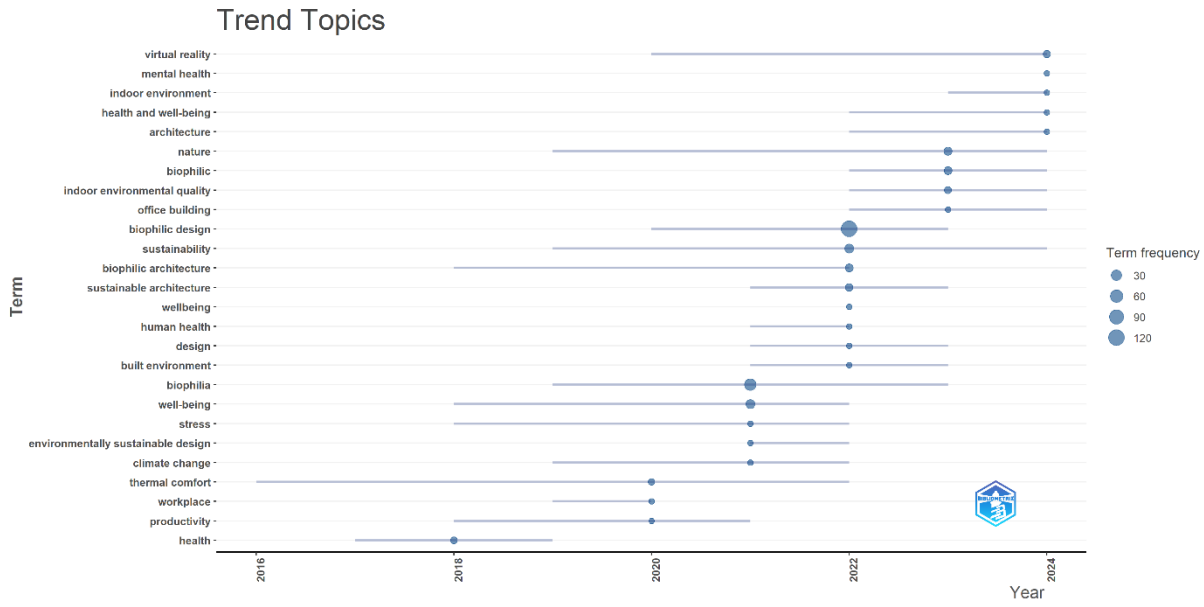

Figure 21. Trending topics from 2006 to 2024

In the thematic mapping analysis, the size of the clusters determines the formation of word clusters. The X-axis shows the importance of the study theme, the centrality of network clusters, or the degree of interaction with other graphic clusters. The Y-axis represents the importance within a cluster network and the density of theme size [30; 31; 32]. In the graphical representation of emerging themes in the study, different patterns have become apparent. (a) Located in the first quadrant (top right), reflecting motor themes characterized by high density and centrality, indicating strong developments and critical roles in structuring the research topic. (b) In the second quadrant (top left), low centrality and high density, indicating niche themes with limited relevance. (c) In the third quadrant (bottom left), low density and centrality, representing developing or declining themes with marginal importance and minimal development. Finally, (d) in the fourth quadrant (bottom right), high centrality and low density, emphasizing the importance of interdisciplinary research topics, representing core themes. The visual representation also includes the temporal dimension; here, the trajectory defines the segmentation of time into sections. In particular, an upward trend over time is indicated towards the top right, while a downward path towards the bottom left signifies a decreasing trend [33].

In this context, as seen in Figure 22, the thematic map has been created based on Keywords Plus and mapped into four themes: niche (top left), motor (top right), emerging or declining (bottom left), and core themes (bottom right). In motor themes, well-developed research themes are shown in the top right, and among them, in Cluster 1: architectural design, sustainable development, biophilic design; Cluster 2: Office buildings, building, workplace; Cluster 3: ecology, urban design, climate change are observed.

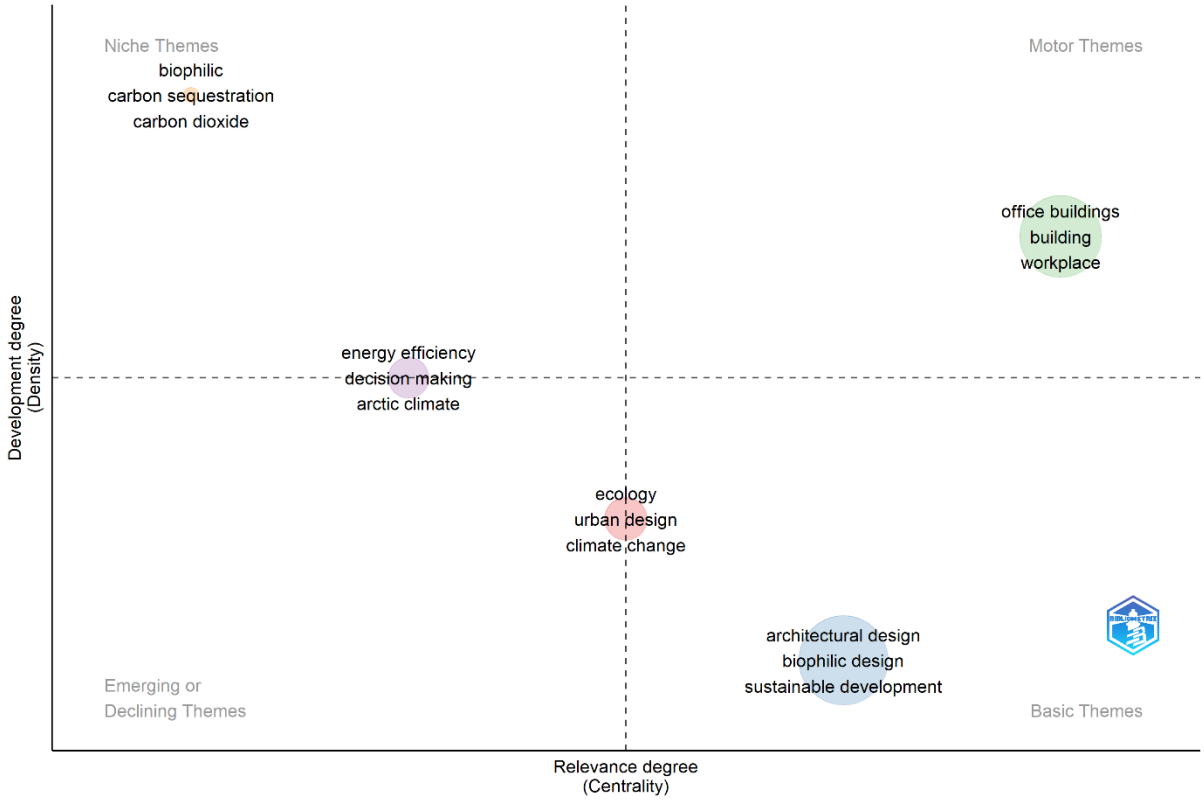

Figure 22. Visualization of thematic mapping.

4. Content Analysis

In this section, content analysis has been conducted for the top 20 most cited articles. Information related to content analysis is presented in Table 2.

Table 2. Content Analysis of the Most Cited Articles

No	Article Content	Reference
1	Measuring the Physiological and Cognitive Benefits of Indoor Biophilic Features	[15]
2	Developing a Conceptual Framework for Biophilic Design	[4]
3	The Effects of Observed Landscape through Windows on Thermal Comfort, Emotional State, and Cognitive Performance	[6]
4	Measuring the Effects of Cognitive Function and Stress Response of Biophilic Approach in a Virtually Designed Office Environment	[34]
5	Evaluation of the Impact of Biophilic Design-Equipped Construction Site Offices on Users	[35]
6	Measuring the Impact of Biophilic Design Approach on Workplace Performance	[36]
7	Critical Examination of the Effects of Biophilic Design Approach in Architecture on Health, Well-being, and Sustainability	[37]
8	Evaluation of the Use of Natural Building Materials in Patient Rooms by Hospital Staff	[8]
9	Benefits of Biophilic Approach and Its Application in Architecture	[38]

10	A Critical Review on the Relationship between Biophilic Design and Sustainable Design	[39]
11	Application of biophilic approach to hospital design	[40]
12	Investigating user preferences and perceptions of indoor and outdoor workspaces integrated with nature	[41]
13	A systematic literature review in the context of investigating the characteristics of the design of biophilic healthcare spaces	[42]
14	Investigation of spatial comfort and user satisfaction in open office buildings designed with biophilic design approach	[43]
15	Investigating the use of biophilic approach in the design of sustainable urban area	[44]
16	Determining the elements used in hotel lobby design and how they affect guests' booking intentions	[45]
17	Investigation of biophilic design approach as a solution for the harsh climatic conditions of northern regions in terms of daylight availability	[20]
18	Investigation of biophilic criteria in historical buildings	[46]
19	A review on the benefits of biophilic design on the built environment and human health	[14]
20	Measuring the performance, health and well-being of employees in the office organised with biophilic design	[47]

This research, which examines different aspects of biophilic design and is based on a review of the 20 most cited papers, emphasises the need for an interdisciplinary approach and the use of a variety of methodologies. Topics such as conceptual framework development, measurement of indoor biophilic properties, evaluation of the cognitive effects of designs in virtual environments show that biophilic design has a wide application potential. Critically examining the effects of biophilic design, especially in areas such as workplace performance, health, well-being and sustainability, is an important step towards evaluating the potential of this design approach on general architectural applications. A systematic literature review on the evaluation of the use of natural building materials in patient rooms by hospital staff and the characteristics of biophilic design in the design of healthcare spaces contributes to our understanding of the effects of design decisions on user experience. At the same time, studies such as examining the relationship of biophilic design with sustainable design and investigating user preferences and perceptions of indoor and outdoor workspaces provide a comprehensive view to understand how design affects not only aesthetics but also important factors such as usability and satisfaction. As a result, by addressing the potential impacts of biophilic design in a variety of contexts, this information can contribute to more informed decisions in future design projects and a wider acceptance of this design approach.

5. CONCLUSIONS

Within the scope of this research, a bibliometric analysis was conducted using the keywords ("biophilic design" OR "biophilic architecture" AND "buildings") between 2006-2024 and 237 studies were identified as a result of this analysis. Among these 235 studies, the most influential studies, keywords, authors, countries and institutions were identified. Then, the 20 most cited publications were analysed by content analysis and the topics, methodologies and objectives addressed in the biophilic approach were identified. The findings in this context emphasise the importance of incorporating natural systems and processes into the design of the built environment to impro”ve human health.

The data obtained within the scope of the study can guide researchers, authors and publishers in determining the direction of future research. As a result, this study can create knowledge maps by contributing to academic development and sustainable development. The analysis carried out within the scope of the study provides an important contribution to the biophilic building design literature, providing an opportunity to better understand the theoretical and conceptual framework of existing studies. The data and maps obtained contribute to the enrichment of academic discussions by forming the basis for future research. As a result, the data obtained within the scope of the study can support more informed decisions in future design projects and a more widespread acceptance of this design approach by considering the multifaceted effects of biophilic design.

In this context, it has been determined that the impact of biophilic design on energy efficiency is not sufficiently detailed and empirical studies are needed. In addition, it has been observed that most of the studies focus on public buildings and office designs, while biophilic applications in commercial and residential buildings are addressed at a limited level. There are gaps in relating biophilic design practices to cultural and climatic contexts in different geographical regions. These gaps offer important opportunities for future research and reveal the need to address biophilic design in a broader context.

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