

SUSTAINABLE INTERIOR DESIGN/ARCHITECTURE RESEARCHES AFTER SUSTAINABLE DEVELOPMENT GOALS: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

The Global Goals for Sustainable Development, signed by 170 nations, including Turkey, under UN leadership to address climate change and poverty, have 17 goals to be met by 2030. This study aims to evaluate the studies in the field of sustainable interior architecture/design produced until the end of 2023, taking as reference the date (2015) when these goals came into force. Bibliometric analysis used within the scope of the research. It provides quantitative evaluation of publications through descriptive, conceptual and citation analysis. Research and review articles from the scientifically approved Web of Science were used in the study. After entering keywords, 8,354 publications were limited to 2,026 articles with PRISMA protocol inclusion and exclusion criteria were analyzed. There are sixteen periodicals that are considered primary sources on environmentally friendly interior design/architecture. The field's core subjects are model development and life cycle evaluation, while mechanical properties and durability are emerging. The original value of the study is related to the subject it deals with and its scope. Bibliometric studies related to sustainable interior/architecture are rare in the literature. There is no study examining the effects of the Global Goals for Sustainable Development, which is the subject of the study.

Keywords: Sustainable design, Interior design, Interior architecture, Bibliometric analysis, The Global Goals.

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SÜRDÜRÜLEBİLİR KALKINMA İÇİN KÜRESEL AMAÇLAR SONRASI SÜRDÜRÜLEBİLİR İÇ MİMARİ VE TASARIM ARAŞTIRMALARI: BİBLİYOMETRİK ANALİZ

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ÖZET

İklim değişikliği ve yoksulluk gibi temel sorunlarla savaşmak amacıyla Birleşmiş Milletler öncülüğünde Türkiye dahil 170 ülkenin imzaladığı Sürdürülebilir Kalkınma için Küresel Amaçlar 2030 yılına kadar başarılması gereken 17 temel amaçtan oluşmaktadır. Bu çalışma, söz konusu amaçların yürürlüğe girdiği tarihi (2015) referans alıp 2023 yılı sonuna kadar üretilmiş sürdürülebilir iç mimari tasarım alanındaki çalışmalarını değerlendirerek mevcut bilgi birikimine katkıda bulunmayı amaçlamaktadır. Araştırma kapsamında kullanılan bibliyometrik analiz; yayınların betimsel, kavramsal ve atıf analizi üzerinden nicel olarak değerlendirilmesini sağlamaktadır. Çalışmada kullanılan yayınlar bilim dünyasında kabul gören Web of Science veritabanından elde edilen araştırma ve derleme makalelerinden oluşmaktadır. Anahtar kelimeler girilerek elde edilen toplamda 8.354 yayın PRISMA protokolü kapsamında dahil edilme ve çıkarılma kriterleri ile 2.026 makaleye indirgenmiş ve analizler yapılmıştır. Çevreye duyarlı iç mekan tasarımı ve mimarisi konusunda birincil kaynak sayılan on altı süreli yayın bulunmaktadır. Alanda çalışılan temel konuların model geliştirme ve yaşam döngüsü değerlendirmesine yönelik çalışmalar olduğu, yükselişte olan konuların ise mekanik özellikler ve dayanıklılık temelli olduğu ortaya çıkmıştır. Çalışmanın özgün değeri ele aldığı konu ve kapsamı ile ilgilidir. Sürdürülebilir iç mimarlık ile ilişkili yapılan bibliyometrik analiz çalışmalarına alanyazında az rastlanılmaktadır. Çalışmanın konusu olan Sürdürülebilir Kalkınma için Küresel Amaçların konuya olan etkilerini inceleyen çalışma ise bulunmamaktadır.

Anahtar Kelimeler: Sürdürülebilir tasarım, İç mekan tasarımı, İç mimarlık, Bibliyometrik analiz, Küresel Amaçlar.

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1. INTRODUCTION

The 2030 Agenda for Sustainable Development, which was unanimously endorsed by all Member States of the United Nations in 2015, offers a collective strategy for achieving peace and prosperity for both humanity and the environment, both presently and in the coming years. The core of the initiative consists of the 17 Sustainable Development Goals (SDG), which serve as a pressing demand for collaborative action from all nations, both developed and developing, in a worldwide alliance (UNSTT, 2012). Sustainable interior design is among the attention-grabbing topics of recent years. Nevertheless, the absence of bibliometric analysis in research conducted in the subject is noteworthy. Yaşar (2022) analyzed the research trends of interior design in a famous journal and found that the researches on interiors distributed over a wide geography. While a study conducted about bibliometric analyzes of interior architecture education (Burkut, 2023), another research maintained a broad scope and conducted an analysis without imposing any temporal limitations (Rui & Firzan, 2023). An examination of the subject's link with neuroarchitecture was carried out by Ghamari and his colleagues as part of their research (Ghamari et al., 2021). Park and Lee (2022) investigated bibliometric analyze research pertaining to the application of creative thinking within the design studio. Furthermore, there is a lack of bibliometric research in the subject of interior architecture in the existing literature. The availability of the SDG, which serve as the starting point for this study, is also investigated. Design education (Desha et al., 2021; Lopez et al., 2021; Milovanovic et al., 2021; Sanchez-Carracedo et al., 2020; Suppipat et al., 2021) economic sustainability (Morell et al., 2020; Thakker and Bakshi, 2021) construction and building activity (Ismael and Shealy, 2019), sustainability assessments models (Dushenko et al., 2019), the configuration of buildings, the importance of early stage of design and building information modeling (Dixit et al., 2021; Elshafei et al., 2021; Khahro et al., 2021; Vite and Morbiducci, 2021), review studies on sustainable design (Ashour et al., 2021), the human factor and daily routines (Carta et al., 2021; Thakur and Mangla, 2019), and digitalization (van der Velden, 2018). As a result, it is clear that SDG are important as a starting point. Additionally, there is a dearth of studies focusing on sustainability, particularly those examining the goals established for sustainable development. This study has sought to evaluate the progress of SDGs' post-academic reflections and future directions in sustainable interior architecture/design. Research questions; Q1: What general bibliometric data was gleaned from the research literature on sustainable interior design/architecture? Q2: What are the current and emerging trends and problems in research on sustainable interior design/architecture? Q3: What possible future research routes are recommended based on the most recent breakthroughs in sustainable interior design/architecture?

2. METHODOLOGY

Scientific studies have greatly increased in recent years. Handling such big data, filtering the most important works, and assessing their influence became increasingly difficult. Thus, bibliometric analysis was introduced by Garfield and Sher (1963) as a quantitative method (Abafe et al., 2022). Database selection is of importance whether it is convenient for the study. The selection of the database is related to the accuracy and representativeness of a dataset. The Web of Science (WoS) is noted that embodies the most influential publications (Pouris and Pouris, 2010; Zhao et al., 2019). Therefore, the WoS was selected in this study in order to gather bibliometric data. PRISMA flow chart and process of the study is shown in Figure 1.

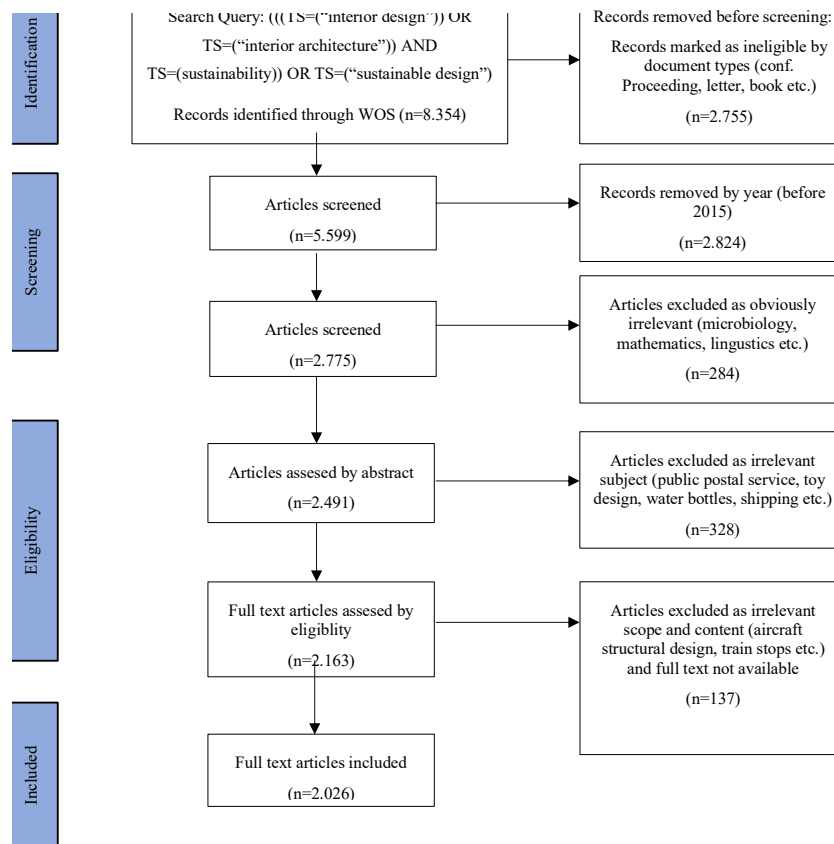


Figure 1. PRISMA flow chart for the current study (prepared by the author)

Software preference is another important issue in bibliometric analysis. Biblioshiny which is written in the R programming language provides a set of tools for bibliometric

analysis (Aria and Cuccurullo, 2017). Being open-source software Biblioshiny is used for the present study to analyze temporal evaluation, journal productivity, and author productivity. On the other hand, in the present study, the analyses for intellectual structure, for example, co-occurrence, and co-citation were carried out by VOSviewer. VOSviewer which is used for bibliometric analysis freely is developed by Nees van Eck and Ludo Waltman (Eck and Waltman, 2009). Bibliometric analysis includes various techniques such as performance analyses and science mapping. While performance analysis is related to the source and/or citation metrics, science mapping is related to co-citation, co-word, and bibliographic coupling.

3. RESULTS AND DISCUSSION

In 642 sources there are 2.026 documents had been analyzed for the present study. Overall 5.034 authors contributed to the research field. In terms of the document type, while 1.882 of them are basically research articles, the rest (144) are review articles. So, it can be deduced that review articles are less popular in sustainable interior design/architecture research after the SDG.

3.1. Descriptive analysis

Studies related to sustainable interior design/architecture had been evaluated after coming into force the SDG. The distribution of 2026 publications through eight (2015-2023) years is indicated in the Figure 2. Despite a consistent upward trend, the decline in 2021 is particularly significant. The annual growth rate of 7.02% is evidence of increasing interest.

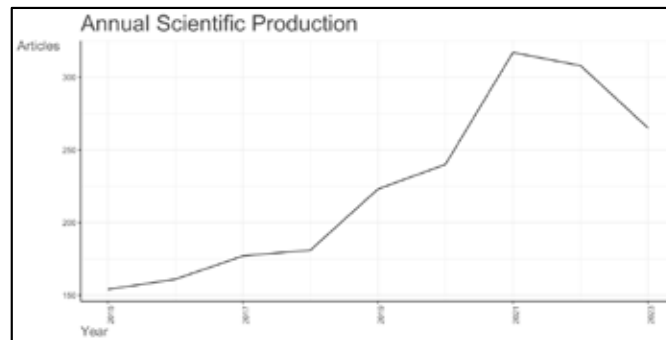


Figure 2. Annual Scientific Production (prepared by the author with the Biblioshiny program).

Bibliometrics allows for the investigation of journal production, namely the examination of publications by year. There are 642 publishers in total, but only data for the five

most prolific publishers are shown in Figure 3. The “Sustainability” and the “Journal of Cleaner Production”, which include multi-disciplinary publications, attract attention both with more publications on an annual basis than other journals and with an increasingly cumulative number of publications.

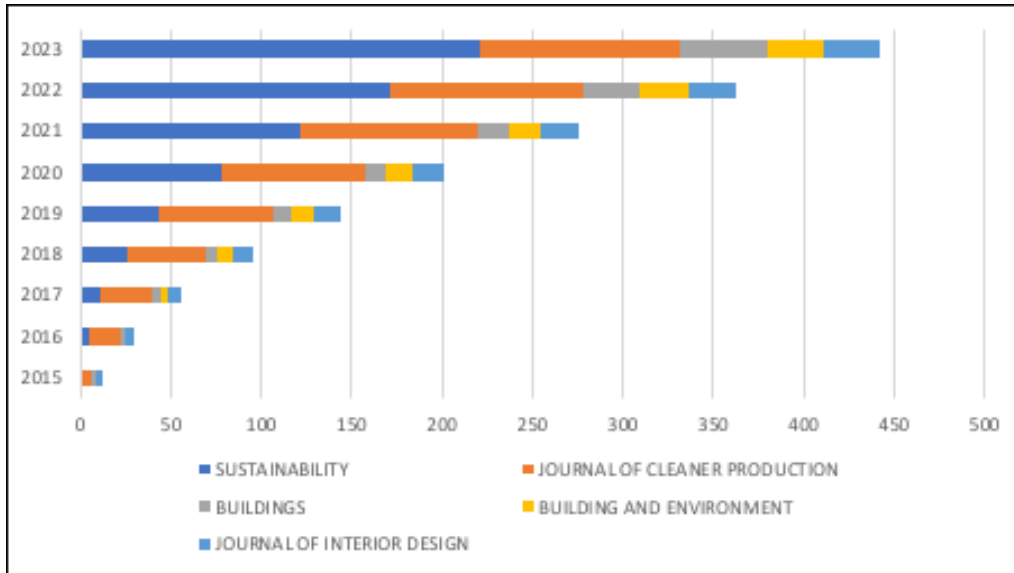


Figure 3. The most productive top five sources and the distribution over the years (The graph is created by Excel with the data obtained from Biblioshiny).

Author-level h-index gauges publication output and citation impact. Hirsch (2005) claims that a high h-index suggests individuals who continuously create an adequate flow of work rather than those who produce a few highly referenced extraordinary publications or a large number of uninteresting works. Fengqi You has an h-index of 23 and is the most prolific author with 31 publications(Figure 4).

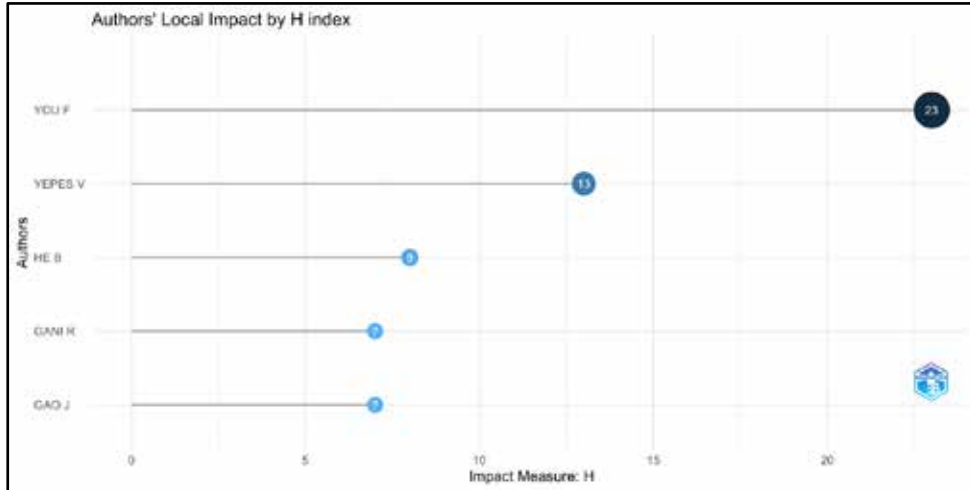


Figure 4. The authors with the highest h-index (prepared by the author with the Biblioshiny program).

Author productivity evaluation is seen in Figure 6 as a sign of intellectual maturity associated with the research base of a domain (Snaith, 2013). The most productive authors are important in developing a scientific area. Compared to the influential authors' graph in the field, it is clear that the most productive authors are also the most effective (Figure 5).

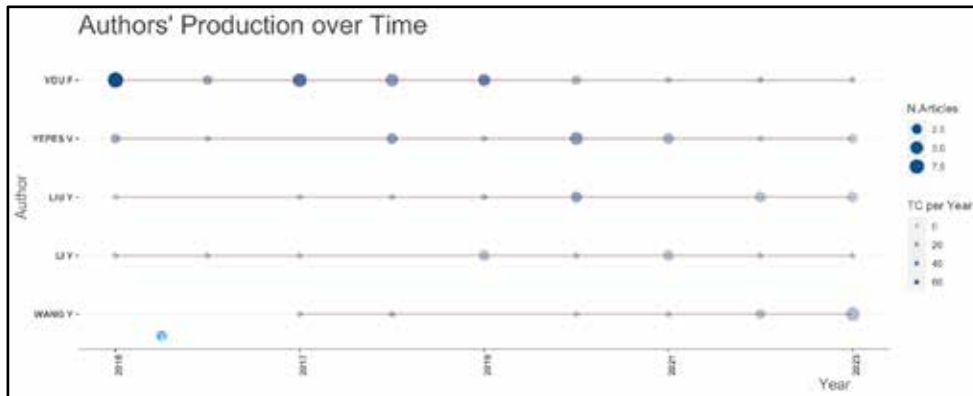


Figure 5. Top-authors' production over time (prepared by the author with the Biblioshiny program).

Bradford's Law measures scientific literature distribution. The number of articles published in a topic inversely impacts the number of journals that publish them (Bradford, 1934). Thus, more journals publish fewer papers in a subject while fewer publish most of

them (Andres, 2009). The graph illustrates this domain's key sources for the next eight years. Figure 6 shows sixteen journals.

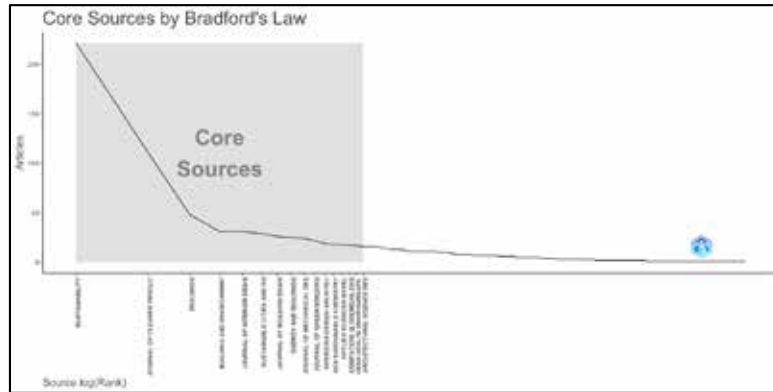


Figure 6. Core sources by Bradford's Law (prepared by the author with the Biblioshiny program).

While basic descriptive analyses of the most prolific authors can be performed to identify the most productive authors in a specific field of research, the data can also be approached in a different manner. In fact, author productivity is frequently assessed using a widely accepted bibliometric law: Lotka's law (Andres, 2009). Lotka's law defines the frequency with which authors publish in a particular field (Rowlands, 2005). N number of contributors is approximately $1/n^2$ of a contributor, and the proportion of all contributors making a single contribution is around 60% (Lotka, 1926). When authors are listed by a number of publications, the law describes pretty regular patterns which appear in subject bibliographies (Figure 7).

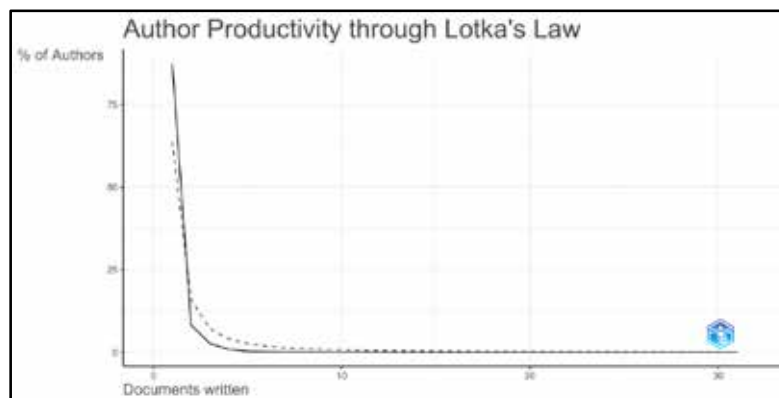


Figure 7. Author Productivity through Lotka's Law (prepared by the author with the Biblioshiny program).

It is seen that 87.4% of the researchers working on sustainable interior design/architecture made only one publication, the rate of the authors who made two publications were 8.2%, and the remaining 2% of the researchers published between 3 and 5 studies on the field. In this context, when sustainable interior design/architecture studies are evaluated for the last eight years according to the Lotka law, it is concluded that the relevant literature is insufficient and needs to be developed.

3.2. Conceptual Structure

Analysis of high-frequency words and their bursts was evaluated to map the trending topic. The Figure 8 shows the 24 groups of terms with the highest frequency. Default parameters in Biblioshiny are used for this evaluation. The word minimum frequency is 5 and the number of words per year is 3. It has been revealed that “performance”, “design”, and “model” topics are numerous in number, but they are in demand for a certain period of time. This shows that efficiency measurements and model development studies were popular in this field during a certain period. The analysis results also show that optimization-oriented studies were more popular when the SDG first came into force, but later this trend shifted to planned behavior and adoption studies.

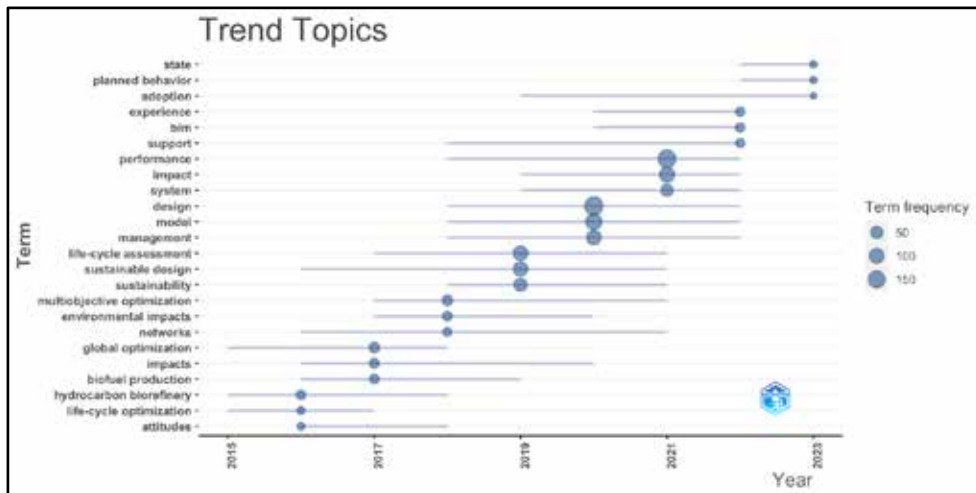


Figure 8. Trend topics (prepared by the author with the Biblioshiny program).

Co-occurrence analysis, that is shown Figure 9, objectively and algorithmically defines and assembles significant phrases to indicate major research areas and future research (Ali and Gölgeci, 2019). Keywords determine article content and study area clusters/networks (Ding et al., 2001). Minimum number of occurrences of a keyword is 10. Of the 8.819 keywords, 203 meet the threshold. There are 6 clusters and these clusters

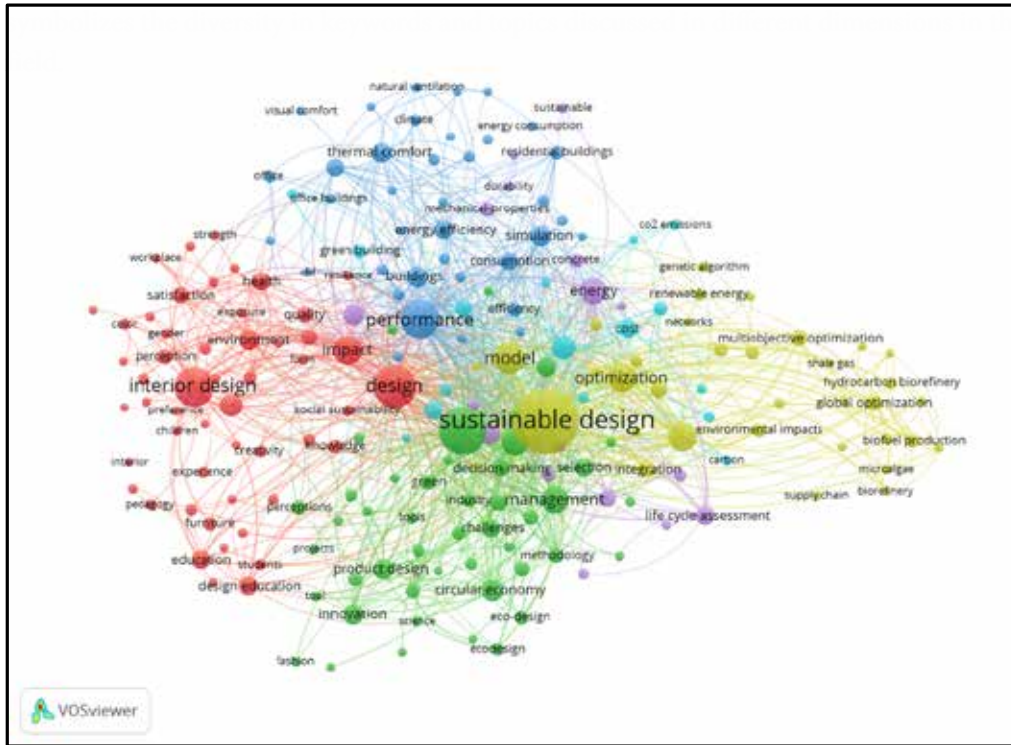


Figure 9. Co-occurrence analysis (prepared by the author with the Vosviewer program).

Thematic map which is a distribution of the themes is shown Figure 10. While centrality is shown on the X-axis, density is shown on the Y-axis. Centrality means the relevance or importance of the classified themes. On the other hand, density means the development phases of themes. Average and central trend measurements such as mean and median are used to reach the centrality and density of a research theme. Thus, themes were classified and scattered four-quarterly. The quarters are entitled; motor themes (upper-right), basic themes (lower-right), niche themes (upper-left), and emerging or declining themes (lower-left). The upper-right quarter of the graph contains motor themes that are both fundamental and well-developed, representing a combination of high density and high centrality. These are “performance”, “impact”, and “behaviour”.

Placing the lower-right quadrant on the graph, basic themes are composed of high centrality-low density. Although the themes that are found in this quarter are not adequately developed, they are prominent themes in the research area. Demonstrating emerging or declining themes, lower-left quarter where themes are poorly developed but rising, therefore they are appropriate for the studies in the future. The themes “mechanical properties” and “durability” are foremost in this quarter. Being high density and low centrality,

niche themes are very specialized themes located in the upper-left quarter. Themes like “global optimization” and “multiobjective optimization” are advanced themes but in relation to sustainable interior design/architecture remain isolated due to a low level of centrality.

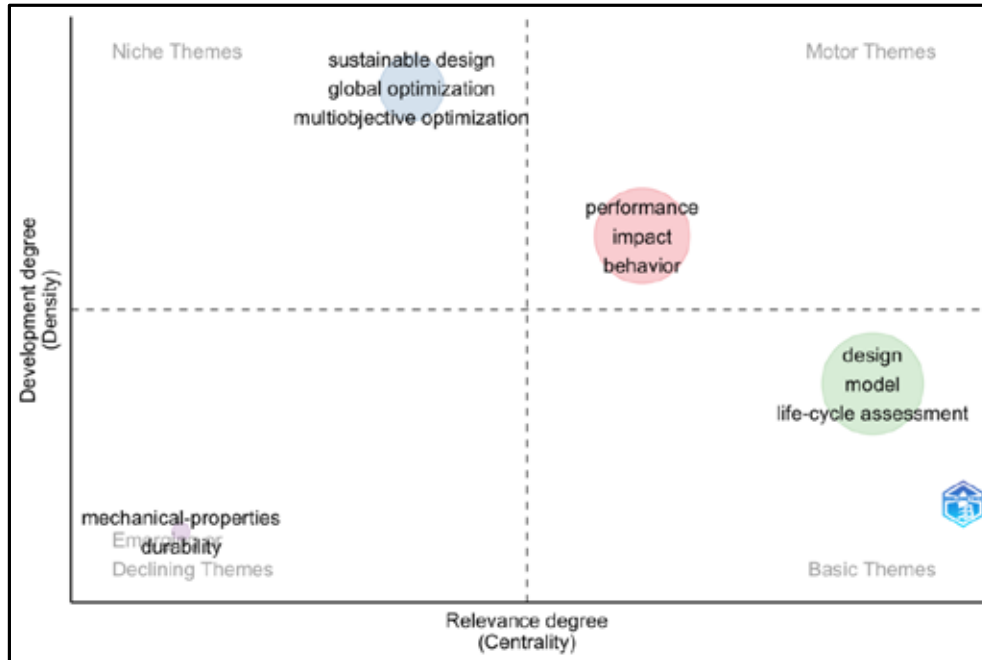


Figure 10. Thematic map (prepared by the author with the Biblioshiny program).

Thematic evolution is based on keywords plus (Figure 11). The parameters are the presets of Biblioshiny. The value of the number of words is 250, the minimum cluster frequency (per thousand documents) is 5, inclusion index is weighted by word occurrences. Over the last five years, the thematic evolution of keywords demonstrates a clear shift in sustainable interior architecture/design research streams. The number of keywords is fluctuating.

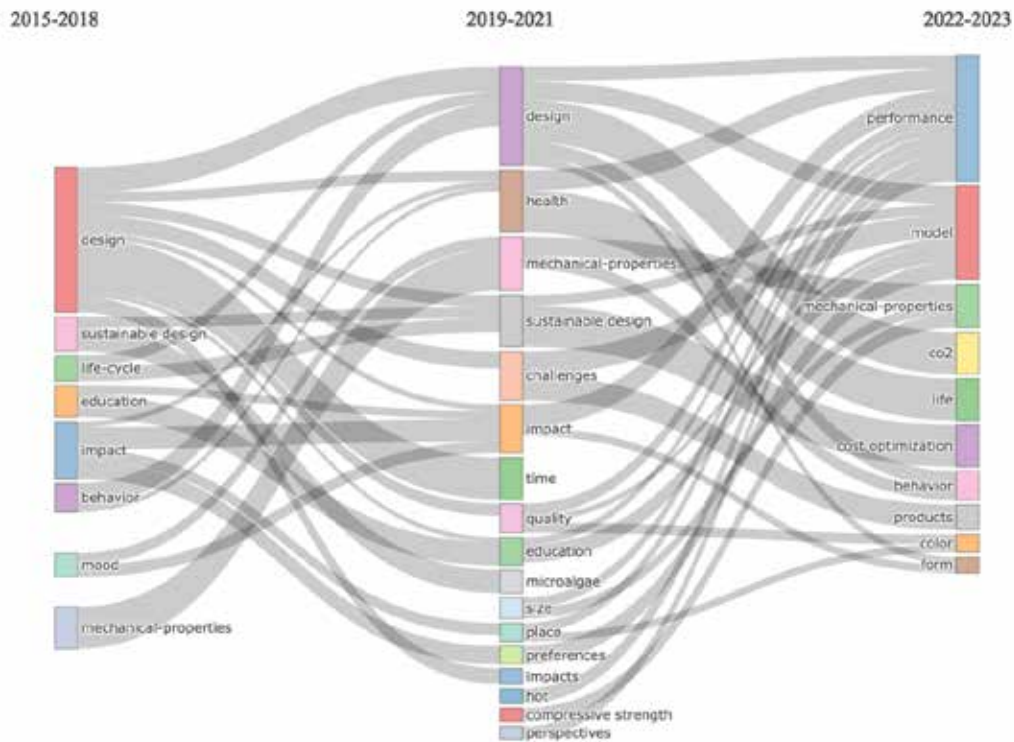


Figure 11. Thematic evaluation (prepared by the author with the Biblioshiny program).

The findings show that at the start, the following topics were prevalent: “design”, “sustainable design”, “life-cycle”, “education”, “impact”, “behaviour”, “mood”, and “mechanical-properties”. Furthermore, “mechanical-properties” is the only keyword that appears year after year. The design keyword, which has a large portion, has spread to various keywords in the following years.

3.3. Citation Analysis

Co-citation analysis can be carried out by both author and source co-citation analysis. If two authors are cited in the same documents, there should be a relationship between these two documents (Hota et al., 2020). Moreover, the more the two sources are cited together frequently, the closer the relationship between the two (Gmür, 2006). In other words, there would be an intellectual distance, if two authors are not preferred to be co-cited frequently (Kreuzman, 2001). Thus, the linking strength between the two documents based on common citations is provided by VOSviewer to reveal the range of studies that form the basis of the scientific literature on the sustainable interior design/

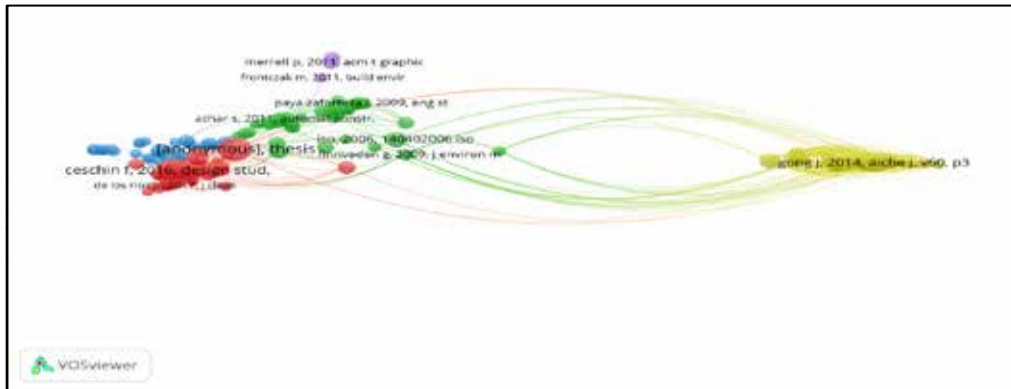


Figure 12. Co-citation analysis (prepared by the author with the Vosviewer program).

The highly cited reference with 227 total link strength, 69 links, and 50 citations is the paper about evolution of sustainable design (Ceschin & Gaziulusoy, 2016). Within the scope of their research, Cheschin and Gaziulusoy (2016) examine the historical development of approaches to sustainability issues within the design profession. The following study with 175 total link strengths, 14 citations, and 42 links is an overview of the sustainable design synthesis of energy systems(Gong and You, 2015). Another point to be emphasized is the most intensive linkage among the five papers. (Ceschin and Gaziulusoy, 2016; Luttropp and Lagerstedt, 2006; Ramani et al., 2010) thus, illustrating the important idea in the field of sustainable interior design/architecture.

CONCLUSION

Under the guidance of the United Nations, 170 countries, including Turkey, have signed the SDG to combat climate change and poverty. The goals list 17 objectives that must be accomplished by the year 2030. Using the year 2015 as a point of reference, the purpose of this study is to conduct an analysis of the research that has been conducted in the subject of sustainable interior architecture and design up until the end of the year 2023. Bibliometric analysis is utilized within the confines of the study project, and it offers quantitative evaluation of publications by means of descriptive, conceptual, and citation analysis. In this study, research and review publications from the Web of Science, which has been approved by the scientific community, were utilized. Search query for this study is as follows; (“interior design”) OR TS=(“interior architecture”) AND TS=(sustainability)) OR TS=(“sustainable design”). Following the entry of keywords, the number of publications that were allowed to be evaluated was reduced from 8,354 to 2,026 articles using the PRISMA protocol’s inclusion and exclusion criteria. Within the

scope of Bradford Law, the 16 most influential journals in this field were determined and it was seen that the “Sustainability” had the largest portion. The construction of models and the evaluation of life cycles are the primary focuses of this study, but mechanical qualities and durability are becoming increasingly important. Researchers who are interested in publishing on the topic should therefore pay attention to the issues that have been raised. Additionally, the sensitivity of researchers to the most recent advancements in the area is revealed by the changes that have occurred over time in the trending issues that have been explored in publications in the field. The evaluations that were carried out within the framework of citation analysis revealed that the publications in the field were given co-citations. As a consequence of this, it sheds light on the widespread interest in research projects that provide a conceptual foundation for sustainable design through a historical process.

REFERENCES

- Abafe, E. A., Bahta, Y. T. and Jordaan, H. (2022). Exploring Biblioshiny for Historical Assessment of Global Research on Sustainable Use of Water in Agriculture. *Sustainability*, 14(17), 10651. DOI: 10.3390/su141710651
- Ali, I. and Gölgeci, I. (2019). Where is supply chain resilience research heading? A systematic and co-occurrence analysis. *International Journal of Physical Distribution and Logistics Management*, 49(8), 793–815. DOI: 10.1108/IJPD-LM-02-2019-0038
- Andres, A. (2009). *Measuring Academic Research: How to Undertake a Bibliometric Study*. Oxford: Elsevier.
- Aria, M. and Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959–975. DOI: 10.1016/j.joi.2017.08.007
- Ashour, M., Mahdiyar, A. and Haron, S. (2021), A Comprehensive Review of Deterrents to the Practice of Sustainable Interior Architecture and Design, *Sustainability*, 13(18), 10403, DOI:10.3390/su131810403.
- Bradford, S. C. (1934). Sources of information on specific subjects. *Engineering*, 137, 85–86.
- Burkut, E. B. (2023). Evaluation of Interior Architecture Education Research in the Web of Science Database: Bibliometric and Science Mapping Analysis. *Journal of Architectural Sciences and Applications*, 8(1), 387–407. <https://doi.org/10.30785/mbud.1263207>
- Carta, S., Pintacuda, L., Owen, I. and Turchi, T. (2021). Resilient Communities: A Novel Workflow. *Frontiers in Built Environment*, 7. DOI: 10.3389/fbuil.2021.767779
- Ceschin, F. and Gaziulusoy, I. (2016). Evolution of design for sustainability: From product design to design for system innovations and transitions. *Design Studies*, 47, 118–163. <https://doi.org/10.1016/j.destud.2016.09.002>
- Desha, C., Caldera, S., and Hutchinson, D. (2021). Exploring the development of context appreciation in coursework that targets problem-solving for sustainable development. *International Journal of Sustainability in Higher Education*, 22(5), 1186–1224. DOI: 10.1108/IJSHE-01-2020-0024

- Ding, Y., Chowdhury, G. G., and Foo, S. (2001). Bibliometric cartography of information retrieval research by using co-word analysis. *Information Processing and Management*, 37(6), 817–842. DOI: 10.1016/S0306-4573(00)00051-0
- Dixit, S., Stefanska, A., and Musiuk, A. (2021). Architectural form finding in arboreal supporting structure optimisation. *AIN Shams Engineering Journal*, 12(2), 2321–2329. DOI: 10.1016/j.asej.2020.08.022
- Dushenko, M., BJORBAEK, C., and Steger-Jensen, K. (2019). Application of a Sustainability Model for Assessing the Relocation of a Container Terminal: A Case Study of Kristiansand Port. *Sustainability*, 11(1). DOI: 10.3390/su11010087
- Eck, N. van, and Waltman, L. (2009). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523–538. DOI: 10.1007/s11192-009-0146-3
- Elshafei, G., Vilcekova, S., Zelenakova, M. and Negm, A. (2021). Towards an Adaptation of Efficient Passive Design for Thermal Comfort Buildings. *Sustainability*, 13(17). DOI: 10.3390/su13179570
- Garfield, E. and Sher, I. H. (1963). New factors in the evaluation of scientific literature through citation indexing. *American Documentation*, 14(3), 195–201. DOI: 10.1002/asi.5090140304
- Ghamari, H., Golshany, N., Naghibi Rad, P. and Behzadi, F. (2021). Neuroarchitecture Assessment: An Overview and Bibliometric Analysis. *European Journal of Investigation in Health, Psychology and Education*, 11(4), Article 4. <https://doi.org/10.3390/ejihpe11040099>
- Gmür, M. (2006). Co-citation analysis and the search for invisible colleges: A methodological evaluation. *Scientometrics*, 57(1), 27–57. DOI: 10.1023/a:1023619503005
- Gong, J. and You, F. (2015). Sustainable design and synthesis of energy systems. *Current Opinion in Chemical Engineering*, 10, 77–86. DOI: 10.1016/j.cocche.2015.09.001
- Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *PNAS*, 102(46), 16569–16572. DOI: 10.1073/pnas.0507655102
- Hota, P. K., Subramanian, B., and Narayanamurthy, G. (2020). Mapping the Intellectual Structure of Social Entrepreneurship Research: A Citation/Co-citation Analysis. *Journal of Business Ethics*, 166(1), 89–114. DOI: 10.1007/

s10551-019-04129-4

- Ismael, D., and Shealy, T. (2019). Industry Perceptions of Sustainable Design and Construction Practices in Kuwait. *Journal of Green Building*, 14(4), 169–193. DOI: 10.3992/1943-4618.14.4.169
- Khahro, S., Kumar, D., Siddiqui, F., Ali, T., Raza, M. and Khoso, A. (2021). Optimizing Energy Use, Cost and Carbon Emission through Building Information Modelling and a Sustainability Approach: A Case-Study of a Hospital Building. *Sustainability*, 13(7). DOI: 10.3390/su13073675
- Kreuzman, H. (2001). A co-citation analysis of representative authors in philosophy: Examining the relationship between epistemologists and philosophers of science. *Scientometrics*, 51(3), 525–539. DOI: 10.1023/A:1019647103469
- Lopez, N., Martin, J., Biedermann, A., Saenz, J., and Fernandez-Vazquez, A. (2021). Projecting More Sustainable Product and Service Designs. *Sustainability*, 13(21), 11872. DOI: 10.3390/su132111872
- Lotka, A. J. (1926). The frequency distribution of scientific productivity. *Journal of the Washington Academy of Sciences*, 16(12), 317–323.
- Luttrupp, C. and Lagerstedt, J. (2006). EcoDesign and The Ten Golden Rules: Generic advice for merging environmental aspects into product development. *Journal of Cleaner Production*, 14(15), 1396–1408. DOI: 10.1016/j.jclepro.2005.11.022
- Milovanovic, J., Shealy, T. and Katz, A. (2021). Higher Perceived Design Thinking Traits and Active Learning in Design Courses Motivate Engineering Students to Tackle Energy Sustainability in Their Careers. *Sustainability*, 13(22). DOI: 10.3390/su132212570
- Morell, M., Espelt, R. and Cano, M. (2020). Sustainable Platform Economy: Connections with the Sustainable Development Goals. *Sustainability*, 12(18). DOI: 10.3390/su12187640
- Park, E. J. and Lee, S. (2022). Creative Thinking in the Architecture Design Studio: Bibliometric Analysis and Literature Review. *Buildings*, 12(6), Article 6. <https://doi.org/10.3390/buildings12060828>
- Pouris, A., and Pouris, A. (2010). Scientometrics of a pandemic: HIV/AIDS research in South Africa and the World. *Scientometrics*, 86(2), 541–552. DOI: 10.1007/s11192-010-0277-6

- Ramani, K., Skerlos, S., and Slocum, A. (2010). Sustainable Design (Guest Editorial). *Journal of Mechanical Design*, 132(9), 2.
- Rowlands, I. (2005). Emerald authorship data, Lotka's law and research productivity. *Aslib Proceedings*, 57(1), 5–10. DOI: 10.1108/00012530510579039
- Rui, L., & Firzan, M. (2023). Bibliometric Overview and Visualization Analysis for Interior Design Research based on CiteSpace. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies*, 14(1), 1–12.
- Sanchez-Carracedo, F., Lopez, D., Martin, C., Vidal, E., Cabre, J., and Climent, J. (2020). The Sustainability Matrix: A Tool for Integrating and Assessing Sustainability in the Bachelor and Master Theses of Engineering Degrees. *Sustainability*, 12(14). DOI: 10.3390/su12145755
- Snaith, B. A. (2013). An evaluation of author productivity in international radiography journals 2004–2011. *Journal of Medical Radiation Sciences*, 60(3), 93–99. DOI: 10.1002/jmrs.21
- Suppipat, S., Teachavorasinskun, K., and Hu, A. (2021). Challenges of Applying Simplified LCA Tools in Sustainable Design Pedagogy. *Sustainability*, 13(4). DOI: 10.3390/su13042406
- Thakker, V. and Bakshi, B. (2021). Toward sustainable circular economies: A computational framework for assessment and design. *Journal of Cleaner Production*, 295. DOI: 10.1016/j.jclepro.2021.126353
- Thakur, V., and Mangla, S. (2019). Change management for sustainability: Evaluating the role of human, operational and technological factors in leading Indian firms in home appliances sector. *Journal of Cleaner Production*, 213, 847–862. DOI: 10.1016/j.jclepro.2018.12.201
- UNSTT. (2012). *Realizing the Future We Want for All: Report to the Secretary-General* Koninklijke Brill NV. DOI: 10.1163/2210-7975_HRD-9823-0056
- van der Velden, M. (2018). Digitalisation and the UN Sustainable development Goals: What role for design. *Interaction Design and Architectures*, 37, 160–174.
- Vite, C. and Morbiducci, R. (2021), "Optimizing the Sustainable Aspects of the Design Process through Building Information Modeling", *Sustainability*, 13(6). DOI: 10.3390/su13063041.
- Yaşar, D. (2022). Trends of Research on Interiors: A Bibliometric Analysis of The Interiors: Design, Architecture, Culture Journal. Y. Aksoy & E. Duyan (Eds.), In

Contemporary Issues in Architecture and Urban Planning Architecture and Exploration (pp. 18–28). DAKAM Books.

Zhao, X., Zuo, J., Wu, G. and Huang, C. (2019). A bibliometric review of green building research 2000-2016. Architectural Science Review, 62(1), 74–88. DOI: 10.1080/00038628.2018.1485548