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Literature Review and Analysis of Publications on Sustainability & Sustainable Design in The Field of Interior Architecture & Interior Design

İç Mimarlık & İç Tasarım Alanında Sürdürülebilirlik & Sürdürülebilir Tasarım Konulu Yayınların Literatür Taraması ve Analizi

Emine Banu BURKUT[1]

ABSTRACT

The purpose of this article is to examine the publications on sustainability and sustainable design in the fields of interior architecture & interior design. Scientific mapping method was chosen as the method in the research. The reason for this is the creation of detailed statistics, graphics and visuals of the researched subject. Searched words in Web of Science and Scopus databases; (TITLE-ABS-KEY (sustainability AND "interior architecture") OR TITLE-ABS-KEY (sustainability AND "interior design") OR TITLE-ABS-KEY ("sustainable design" AND "interior design") OR TITLE-ABS- KEY ("sustainable design" AND "interior architecture"). The data of the research were collected from Web of Science and SCOPUS database. In the analysis of the data, 1) Percentage, frequency and visuals presented by the databases 2) Analysis results are explained in the Biblioshiny and VOSviewer (science mapping analysis) software program. As a result, sustainability and sustainable design, which has been an important issue in the fields of architecture and design in recent years, have been given a different perspective, the existing literature has been analyzed, and the existing publications have been highlighted and deficiencies have been identified.

Keywords: Sustainability, Sustainable Design, Interior Architecture, Interior Design, Web of Science Database, Scopus Database

ÖZ

Bu makalenin amacı iç mimarlık & iç mekân tasarımı alanlarında sürdürülebilirlik ve sürdürülebilir tasarım ile ilgili yayınları incelemektir. Araştırmada yöntem olarak bilimsel haritalama yöntemi seçilmiştir. Bunun nedeni araştırılan konuya ait detaylı istatistik, grafik ve görsellerin oluşturulmasıdır. Web of Science ve Scopus veri tabanlarında aranan kelimeler; (Başlık-Özet-Anahtar Kelimeler (sürdürülebilirlik VE "iç mimari") VEYA Başlık-Özet-Anahtar Kelimeler (sürdürülebilirlik VE "iç tasarım") VEYA Başlık-Özet-Anahtar Kelimeler ("sürdürülebilir tasarım" VE "iç tasarım") VEYA Başlık-Özet-Anahtar Kelimeler ("sürdürülebilir tasarım" VE "iç mimari")). Araştırmanın verileri Web of Science ve Scopus veri tabanlarından toplanmıştır. Verilerin analizinde 1) Veri tabanlarının sunduğu yüzde, frekans ve görseller açıklanmaktadır 2) Analiz sonuçları Biblioshiny ve VOSviewer (bilim haritalama analizi) yazılım programlarının analizleri açıklanmaktadır. Sonuç olarak son yıllarda mimarlık ve tasarım alanlarında önemli bir konu olan sürdürülebilirlik ve sürdürülebilir tasarıma farklı bir bakış açısı kazandırılmış, mevcut literatür incelenerek mevcut yayınlar tespit edilmiş ve literatürdeki boşluklar tespit edilmiştir.

Anahtar Kelimeler: Sürdürülebilirlik, Sürdürülebilir Tasarım, İç Mimarlık, İç Mekân Tasarımı, Web of Science Veri tabanı, Scopus Veri tabanı

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INTRODUCTION:

Sustainable design means using fewer packaging materials in businesses, using less resources and space, as well as reducing the waste load of the customer. The prominent concepts and points to be considered in sustainable interior design and sustainable interior architecture are as follows, Eco-friendly furniture, green energy, energy efficient lighting, interior design for waste reduction, organic materials, flexibility and longevity, health focus, healthier indoor environment. Sustainable interior design is about using globally beneficial strategies and principles. Sustainable interior architecture and sustainable design, furniture accessories recycled material can be better wood and vintage style furniture made of waste plastic bottles can be used to design spaces. Unlike sustainable construction, it involves the effective use of available space and the use of materials that reduce pollution and energy consumption. Businesses that focus on using sustainable building materials benefit the environment and allow customers to save on maintenance costs. It also strengthens the designer's brand image and demonstrates his commitment to environmental protection.

Publications that can be accessed when the sustainable interior design and sustainable interior architecture literature is examined sustainable materials (Mate, 2006; Mate, 2007; Lee et al., 2013; Arroyo, et al., 2016; Kotradyova, 2019; Alfuraty, 2020), smart technology (Al Khafaji & Kamaran, 2019), smart design (Rashdan, 2016), social sustainability (Smith et al., 2014; Pakravan, 2022; Altamimi et. al., 2023), education (Gürel, 2010; El-Zeiny, 2012, El-Zeney, 2017; Giard & Schneiderman, 2013; Awang et al., 2020; Celadyn, 2020), student (Afacan, 2014; Stark & Park, 2016; Ruff & Olson, 2009; Asadpour, 2021), curriculum (Crane, 2008; Nichols & Adams, 2011; Schneiderman & Freihoefer, 2012; Ibrahim, 2015; Celadyn, 2017), sustainability interior architecture and design books; (Williams, 2007; Kang & Guerin, 2009; Winchip, 2011; Moxon & Moxon, 2012; Smith et al., 2014; Walker, 2017), sustainable interior design (Kang & Guerin, 2009; Guerin, 2009; Bacon, 2011; Lee, 2014; Hayles, 2015; Rashdan & Ashour, 2017), eco crafts (Moubarak & Qassem, 2018), sociocultural sustainability (Kwon, 2014). There are other accessible publications on sustainability in the process of this research (Jones, 2008; Karslı, 2013; Pilatowicz, 2015; McCoys, 2012; Sorrento, 2012; Kim & Heo, 2021; Jones , 2013; Ayalp, 2013; Linhares & Pereira, 2017; Briede & Strode, 2020; Kineber et al, 2023; Chen et al, 2023). The research questions of this research are;

1) How are the concepts of sustainability and sustainable design examined in the field of interior architecture and interior design? Which publications are focused on sustainability and sustainable design?

2) What is the distribution of publications focusing on sustainability and sustainable design by years?

3) What kinds of science maps are created when authors, publishers, institutions and concepts are visualized through software programs in publications focusing on sustainable design and sustainable design?

4) How is the citation status of the authors whose articles are published in the sources within the scope of sustainability and sustainable design?

5) How are the relations between the countries, journals and keywords in which the articles in the database are published within the scope of sustainability and sustainable design?

METHODOLOGY

The aim of this research is to make a bibliometric analysis of the sustainability and sustainable design conceptual framework within the scope of examining the literature by using a holistic approach. While bibliometric analysis enables the examination of the relationship between the number of bibliographic data and patterns, it can be defined as the examination of the usage patterns of data sources. Bibliometric analysis can be interpreted as a methodology in which the communicative activity in the literature related to a defined concept can be explained and interpreted (Borgman & Furner, 2002). Quantitative literature analysis is performed to evaluate trends in scientific research on a particular topic or concept, examine publication impact values, or map quantitative literature networks in various ways (Ahmi, 2022).

Data Collection

The data of this research were collected between 1 July and 15 August 2023. The data of the research were accessed from the publications in the Web of Science and Scopus database. The words sought during the data collection process (TITLE-ABS-KEY (sustainability AND "interior architecture") OR TITLE-ABS-KEY (sustainability AND "interior design") OR TITLE-ABS-KEY ("sustainable design" AND "interior design") OR TITLE-ABS- KEY ("sustainable design" AND "interior architecture").

Data Analysis

The analysis of the data of this research was visualized through bibliometric analysis software programs. Graphics showing percentages and frequencies were obtained using scientific maps and software programs. The software programs used in the science mapping analysis of the data of this research are 1) R Studio Biblioshiny software and 2) VOSviewer software.

RESULTS

1. Results of Web of Science Database

According to the findings of the research, 143 documents on sustainability were accessed in the Web of Science database. The figures below show the graphics and frequencies of the Web of Science database. The most publications are at their peak in 2021. 15 documents were published in 2021. 11 documents in 2015, 2020, 2022, 2023 equally, 10 documents in 2016. There are 9 documents in equal number in 2012- 2014-2017-2018-2019 years.

According to the Web of Science analysis results, the most document type is the article. Document types "article" 90 documents, "proceeding paper" 47 documents, "review article" 4 documents, "editorial material" 3 documents and "book chapters" 2 documents.

A total of 143 publications were published, 36 in the category of "Environmental Studies". Moreover, "Green Sustainable Science Technology" category has 32 publications, "Architecture" category has 28 publications, and "Environmental Studies" category has 28 publications. "Education Educational Research" category has 24 publications. Also "Art" category has 14 publications, "Construction Building Technology" category has 12 publications, "Engineering Civil" category has 12 publications, "Social Sciences Interdisciplinary" category has 8 publications, "Ecology" category has 7 publications,

and “Multidisciplinary Sciences” category has 7 publications. “Engineering Environmental” category has 6 publications; “Urban Studies” category has 5 publications.

WoS (Web of Science) database with the highest number of publications is indexing “Science Citation Index Expanded (SCI-EXPANDED)” 39 documents. “Social Sciences Citation Index (SSCI)” has 36 documents, “Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH)” has 34 documents, “Emerging Sources Citation Index (ESCI)” has 25 documents, and “Arts & Humanities Citation Index (A&HCI) has 23 documents.

According to the results of Web of Science analysis, the affiliations that have publications are as follows; “Egyptian Knowledge Bank (EKB”) 8 documents, “Ihsan Dogramacı Bilkent University” 5 documents (Afacan, 2014; Gurel, 2010; Ashour et al.,2022; Pektas et al, 2015;Demirkan & Afacan, 2018), “Near East University” 5 documents (Beyaz & Asilsoy, 2019; Alhmoud et al., 2020; Altamimi et al., 2023; Oncel & Turkan, 2021; Miralay, 2012), “Michigan State University” 4 documents, “Ajman University” 3 documents.

Web of Science database in countries/regions; the highest number of publications is “USA” has 33 documents. Also “Turkey” 20 documents, “China”10 documents, “Egypt” 8 documents, “United Arab Emirates” 8 documents, “South Korea” 7 documents, “England” 6 documents, “Saudi Arabia” 6 documents, “Germany” 5 documents, “Italy” 5 documents, “Malaysia” 5 documents, “Cyprus” 4 documents, “Poland” 4 documents.

The publishers with the most publications are “Mdpi” 23 documents, “Elsevier” 15 documents, “Wiley” 14 documents, “Taylor & Francis” 10 documents, “Wit Press” 8 documents, “Emerald Group Publishing” and “Sage” 6 documents. Table 1 shows the categories of 143 results from Web of Science Core Collection.

Table 1 Web of Science categories (WoS, 2023)

Field: Web of Science Categories	Record Count	% of 143
Environmental Sciences	36	25.175 %
Green Sustainable Science Technology	32	22.378 %
Architecture	28	19.580 %
Environmental Studies	28	19.580 %
Education Educational Research	24	16.783 %
Art	14	9.790 %
Construction Building Technology	12	8.392 %
Engineering Civil	12	8.392 %
Social Sciences Interdisciplinary	8	5.594 %
Ecology	7	4.895 %
Multidisciplinary Sciences	7	4.895 %
Engineering Environmental	6	4.196 %
Urban Studies	5	3.497 %
Business	4	2.797 %
Education Scientific Disciplines	4	2.797 %

Figure 1 Tree map visualization of categories of Web of Science (WoS, 2023)

Table 2 The most recent publications on sustainability in the Web of Science database (WoS, 2023)

Authors, Year	Article Title	Publisher	Publication Year
(Indrie et. al., 2023)	"Development of an Algorithm for Textile Waste Arrangement"	Sustainability	2023
(Li & Chen, 2023)	"Research on Green Consumption Based on Visual Evaluation Method-Evidence from Stone Flooring Industry"	Sustainability	2023
(Altamimi et. al., 2023)	"Exploring the Spatial Dimensions of Social Sustainability in the Workplace through the Lens of Interior Architects in Jordan"	Buildings	2023
(Nazmy et. al., 2023)	"Spatial Factors Related to Occupants' Behavioral Beliefs About Window and Blind Use in Multifamily Residential Buildings"	Environment and Behavior	2023
(Kineber et. al., 2023)	"Exploring Sustainable Interior Design Implementation Barriers: A Partial Least Structural Equation Modeling Approach"	Sustainability	2023
(Al-Qahtani & Al-Jumaily, 2023)	"Sustainability and textile ideas implementation"	International Journal of Low-Carbon Technologies	2023
(Teo et. al., 2023)	"A simulation-aided approach in examining the viability of passive daylighting techniques on inclined Windows"	Energy and Buildings	2023
(Barber & Muenster, 2022)	"Aspects of openness in Hong Kong coffee shops"	Interiors-Design Architecture Culture	2022

(Whiting et. al., 2023)	"A New Retail Interior Design Education Paradigm for a Circular Economy"	Sustainability	2023
(Grover et. al., 2022)	"Progress in pre-treatment and extraction of organic and inorganic pollutants by layered double hydroxide for trace-level analysis"	Environmental Research	2022
(Moerman et. al., 2022)	"Encouraging a Modal Shift to Passenger Railway Transportation: A Case Study in Adaptable Rolling Stock Interior Design"	Sustainability	2022
(Ashour. et. al., 2022)	"Barriers to the practice of sustainable interior architecture and design for interior renovations: A Parsimonious-Cybernetic Fuzzy AHP approach"	Journal of Cleaner Production	2022
(Abdel-Razek et. al, 2022)	"Energy Efficiency through the Implementation of an AI Model to Predict Room Occupancy Based on Thermal Comfort Parameters"	Sustainability	2022

Table 3 The most cited publications on sustainability in the Web of Science database (WoS, 2023)

Authors, Year	**Article Title**	**Publisher**	**Publication Year**
El-Zeiny, 2012	"Biomimicry as a Problem-Solving Methodology in Interior Architecture"	Ace-Bs 2012 Bangkok	2012
(Gurel, 2010)	"Explorations in Teaching Sustainable Design: A Studio Experience in Interior Design/Architecture"	International Journal of Art & Desıgn Education	2010
(Arroyo et al., 2016)	"Selecting Globally Sustainable Materials: A Case Study Using Choosing by Advantages"	Journal of Construction Engineering and Management	2016
(Lee et al.,2013)	"Interior Design Practitioner Motivations for Specifying Sustainable Materials: Applying the Theory of Planned Behavior to Residential Design"	Journal of Interior Design	2013
(Hosseini et al., 2020)	"Multi-objective interior design optimization method based on sustainability concepts for post-disaster temporary housing units"	Building and Environment	2020
(Parodi et al.,2018)	"Insights into and Recommendations from Three Real-World Laboratories An Experience-Based Comparison"	Gaia-Ecological Perspectives for Science and Society	2018
(Al-Rashid et al., 2020)	"Gender-Responsive Public Transportation in the Dammam Metropolitan Region, Saudi Arabia"	Sustainability	2020
(Celadyn, 2019)	"Interior Architectural Design for Adaptive Reuse in Application of Environmental Sustainability Principles"	Sustainability	2019
(Pilotti, 2021)	"What Lies beneath Sustainable Education? Predicting and Tackling Gender Differences in STEM Academic Success"	Sustainability	2021
(Ruff & Olson, 2009)	"The attitudes of interior design students towards sustainability"	International Journal of	2009

		Technology and Design Education	
(Asadpour, 2021)	"Student challenges in online architectural design courses in Iran during the COVID-19 pandemic"	E-Learning and Digital Media	2021
(Ozturkoglu et al., 2021)	"A new holistic conceptual framework for sustainability-oriented hospitality innovation with triple bottom line perspective"	Journal of Hospitality and Tourism Technology	2021
(Celadyn, 2020)	"Integrative Design Classes for Environmental Sustainability of Interior Architectural Design"	Sustainability	2020
(Sorrento, 2012)	"A Natural Balance: Interior Design, Humans, and Sustainability"	Journal of Interior Design	2012
(Rossin, 2010)	"Biomimicry: nature's design process versus the designer's process"	Design and Nature V: Comparing Design in Nature with Science and Engineering	2010

2. Results of Scopus Database

According to the findings of the research, 291 documents on sustainability were accessed in the SCOPUS database. The figures below show the graphics and frequencies of the SCOPUS database. The most publications are at their peak in 2021. 31 documents were published in 2021. 28 documents in 2021, 25 documents in 2023, 28 documents in 2022, 21 documents in 2019 and 2018 equally (Figure 2).

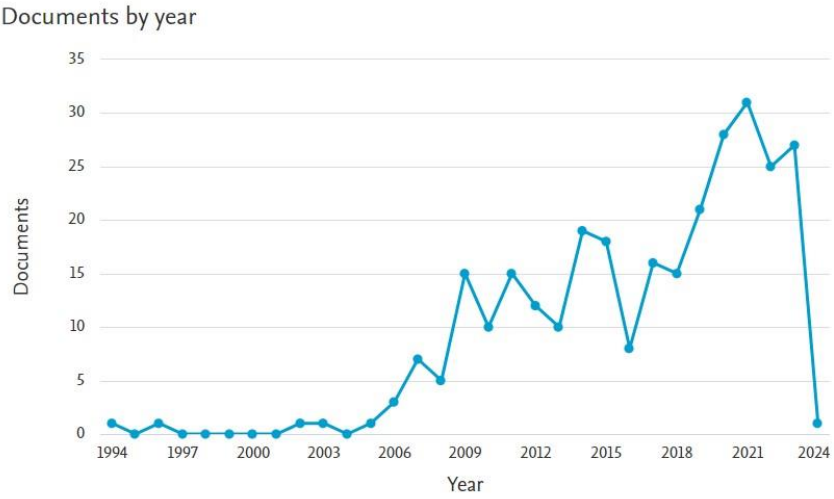

Figure 2 Document by year (Scopus, 2023)

Scopus database in authors "Celadyn", 10 documents, "Rashdan", 7 documents, "Schneiderman" 6 documents, "Freihoefer", "Lommerse", "Roesli", "Smith", "Stark" 3 document . "Afacan" and "Arroyo" 2 document equally (Figure 3).

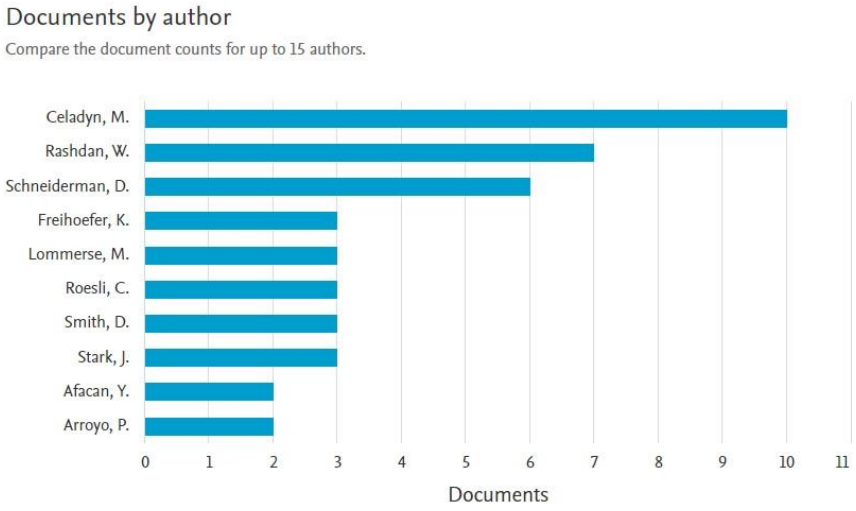

Figure 3 Document by author (Scopus, 2023)

Scopus database in affiliation "Akademia Sztuk Pięknych im. Jana Matejki w Krakowie" and "Bina Nusantara University" 10 documents, "University of Minnesota Twin Cities" 8 documents, "Al Ghurair University" 6 documents, equally number "Bilkent University", "Curtin University" and "University of Sharjah" 5 documents, "Oklahoma State University", "Istanbul Technical University" and "Politecnico di Milano" 4 documents (Figure 4).

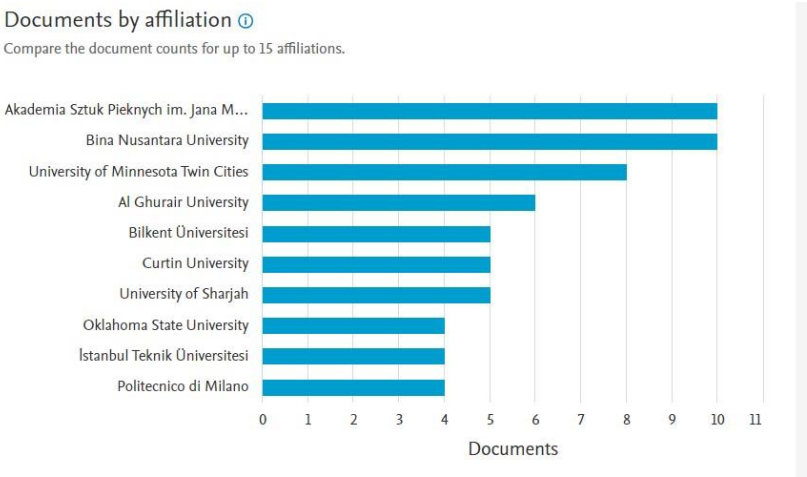

Figure 4 Document by affiliation (Scopus, 2023)

Scopus database in countries/regions; "United States" 75 documents, "Turkey" 22 documents, "United Kingdom" 17 documents, "United Arab Emirates" 13 documents, "Indonesia" and "Poland" 12 documents, "Australia" 11 documents, "Egypt" 10 documents, "Canada", "China" and "Italy" 9 documents (Figure 5).

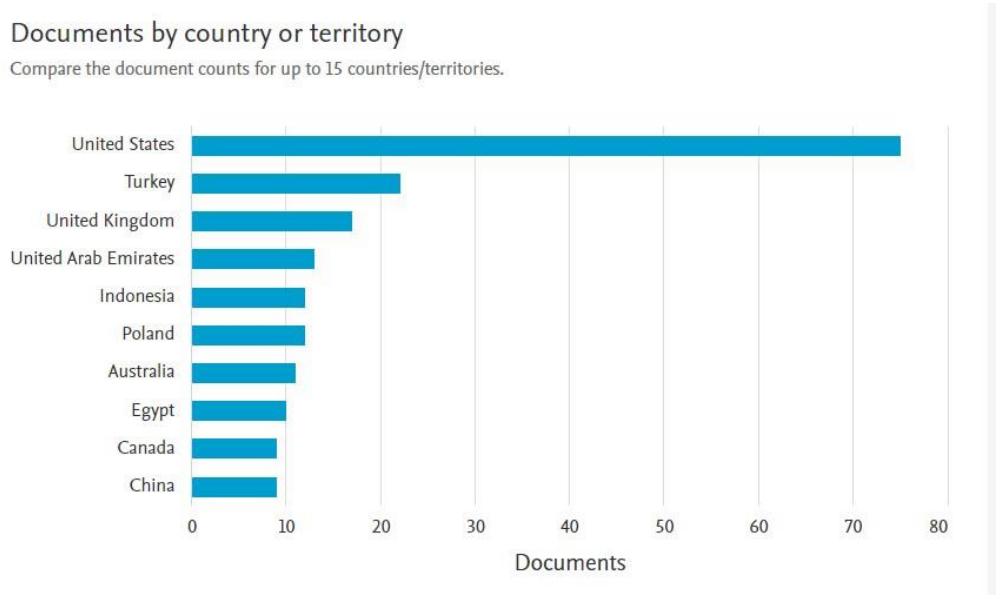

Figure 5 Document by country or territory (Scopus, 2023)

Scopus database in document type “article” 175 documents (60.1 %), “conference paper” documents 68(23.4 %), “book chapter” 20 documents (6.9 %), “review” 8 documents (2.7 %), “book and conference review” 7 documents (2.4 %), “short survey” 4 documents (1.4 %), “editorial and letter” 1 document (0.3 %)(Figure 6).

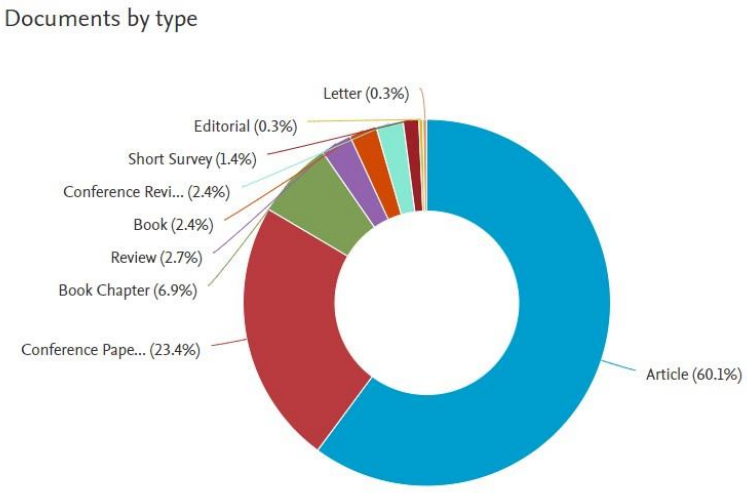

Figure 6 Document by type (Scopus, 2023)

Scopus database in subject area “Engineering” 122 documents (21 %), “Social Sciences” 104 documents (17.9 %), “Environmental Science” 76 documents (13.1 %), “Art and Humanities” 68 documents (11.7 %), “Energy” 54 documents (9.3 %), “Computer Sciences” 42 documents (7.2 %), “Medicine” 17 documents (2.9 %), “Material Sciences” 16 documents (2. 8 %), “Earth and Planetary Sciences” 14 documents (2. 4 %), “Business, Management and Accounting” 13 documents (2. 2 %) (Figure 7).

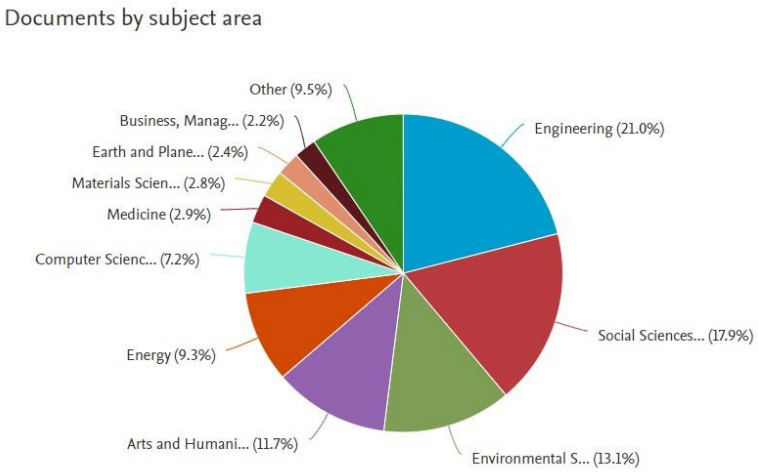

Figure 7 Document by subject area (Scopus, 2023)

3. Analysis of Biblioshiny Software

Analysis results from the Biblioshiny software program most relevant words title behavior (8), buildings (8), sustainability (8), impact (5), model (5), performance (5), architecture (4), comfort (4), management (4), attitudes (3), construction (3), consumption (3), design (3), energy (3), environment (3), interior design (3), optimization (3), perception (3), policy (3), energy efficiency (3) (Figure 8).

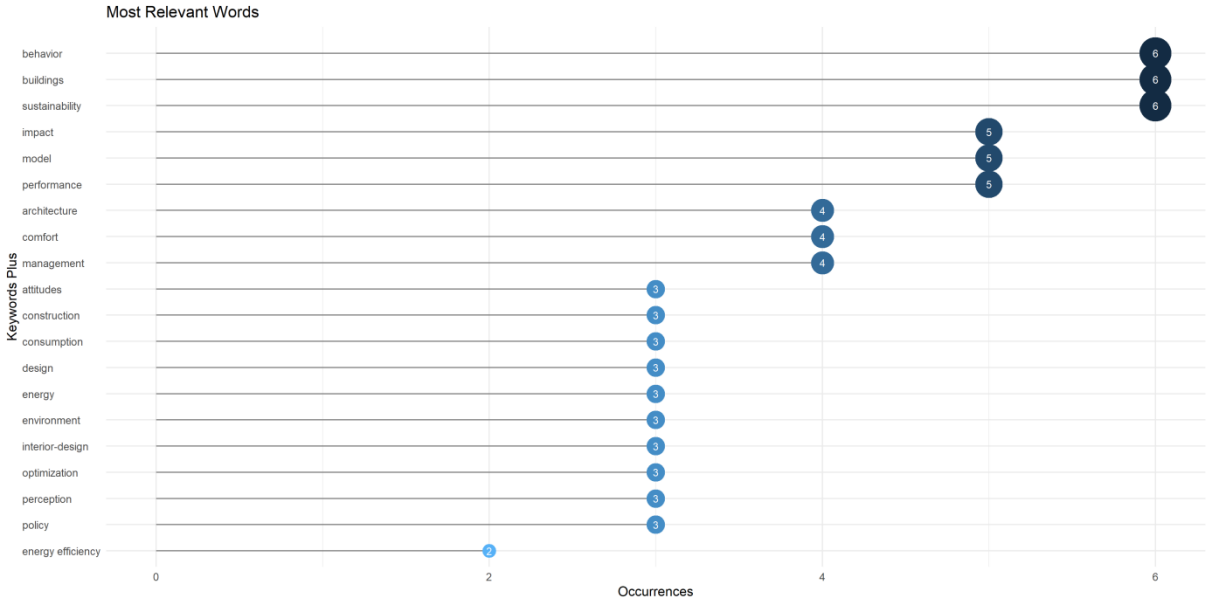

Figure 8 Most relevant words using Biblioshiny software created by author (Biblioshiny, 2023)

Figure 9 WordCloud analysis using Biblioshiny software created by author (Biblioshiny, 2023)

As seen in Figure 9 wordcloud analysis using Biblioshiny software. The most effective words according to this figure; sustainability, behavior, buildings, impact, performance, model, architecture, environment, energy efficiency, green buildings, comfort in Figure 9.

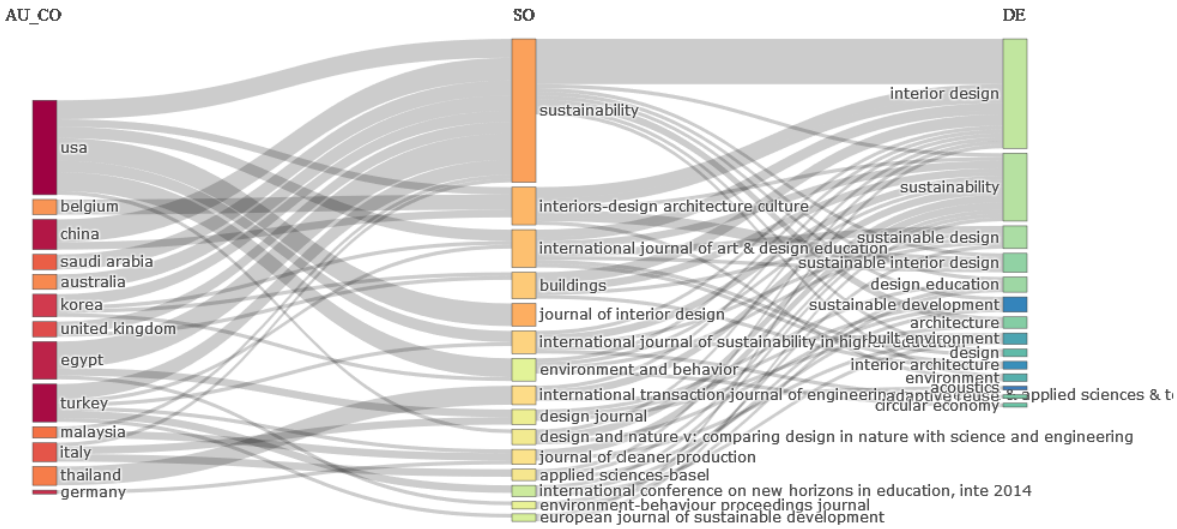

Figure 10 Three-field plot using Biblioshiny software created by author (Biblioshiny, 2023)

Figure 10 above is the Three-field plot analysis. The three-field plot is "a bibliometric analysis tool that visualizes the distribution of publication output, cooperation patterns, and publication impact in a certain field of study or scientific community". (Koo, 2021). According to this analysis, the most influential countries are USA, Turkey, Egypt, China and Korea, the most influential words are interior design, sustainability, sustainable design, interior design, design education, sustainable development, architecture, built environment and finally the most influential sources are; "Sustainability", "Interiors-Design Architecture Culture", "International Journal of Art & Design Education (IJADE), Buildings", "Journal of Interior Design", "International Journal of Sustainability in Higher Education", "Environment and Behavior", "International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies", "Design Journal", "Design and Nature IV. Comparing Design in Nature with Science and Engineering" and the "Journal of Cleaner Production" is an

international, transdisciplinary journal focusing on environmental and sustainability research and practice.

4. Analysis of VOSviewer Software

VOSviewer, to create maps based on the network, bibliographic and textual data of the studies in the literature, and to create maps based on these maps. Visualized and explored in various contexts detailed in the following sections is a free, open-source bibliometric mapping program (VOSviewer, 2023). The following figures show the VOSviewer analysis maps. Analysis of the VOSviewer software program Network Visualization (Figure 11), Overlay visualization (Figure 12), and Density visualization (Figure 13). In these network maps, colors and circle sizes differ according to the effective word frequency and cluster.

Table 4 Author' keywords cluster

Keywords		
acoustics	furniture design	prefabrication
adaptive reuse	globalization	recycling
architectural design	green building	smart interior design
architectural education	hospitality	smart technology
architecture	ındustry collaboration	social sustainability
bio mimicry	ınterior architecture	student
built environment	ınterior architecture education	sustainability
care	ınterior design	sustainable design
circular economy	ınterior design education	sustainable development
collaboration	innovation	sustainable interior design
collaborative design	interdisciplinary	sustainable mobility
day lighting	interior	technology
design	interior architecture	thermal comfort
design education	interior design	trans disciplinarily
design process	interior environment	visual comfort
design studio	life cycle assessment	environmental sustainability
ecology	lighting	environmental contextualization
education	material selection	energy efficiency
	nature	environment

Table 4 above shows author's keywords cluster. These terms are the words used by authors in academic publications. In academic studies, this concept is very important for understanding concepts, themes and trends. The authors, methodology, findings and conclusions associated with these concepts form the basis for comparative analysis of publications. In addition, these concepts and publications should be carefully examined when creating educational curricula for sustainability and sustainable design. It should be remembered that these are fundamental concepts. Network maps provide an interesting visualization to understand this relationship.

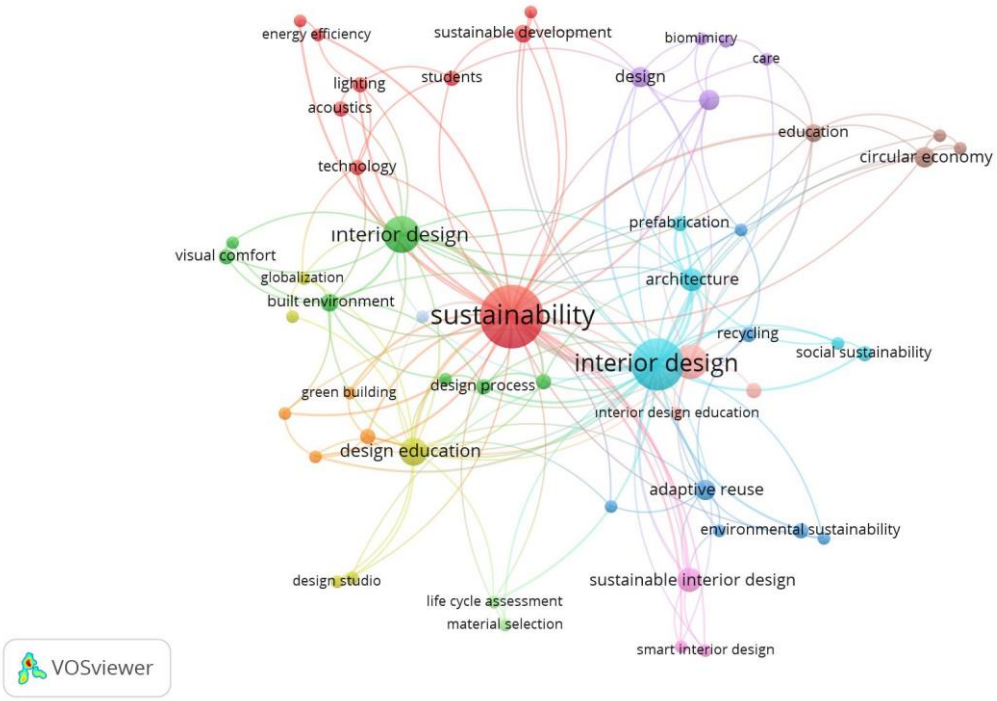

Figure 11 Network visualization using VOSviewer software (VOSviewer, 2023)

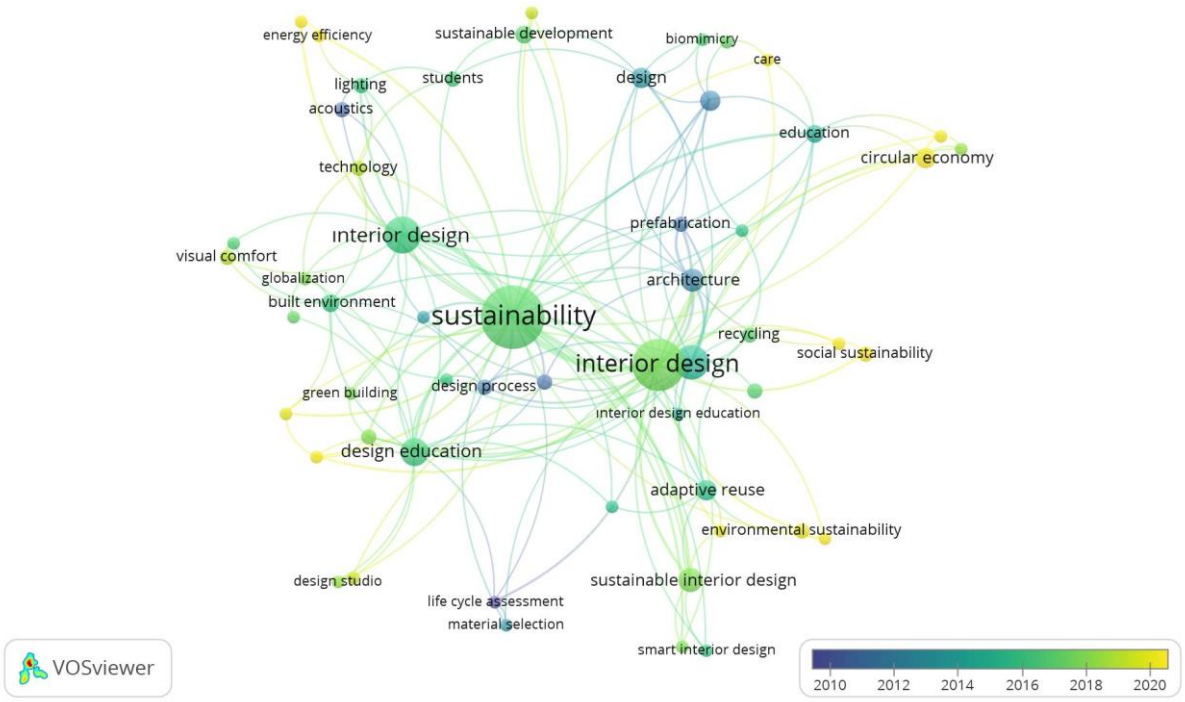

Figure 12 Overlay visualization using VOSviewer software (VOSviewer, 2023)

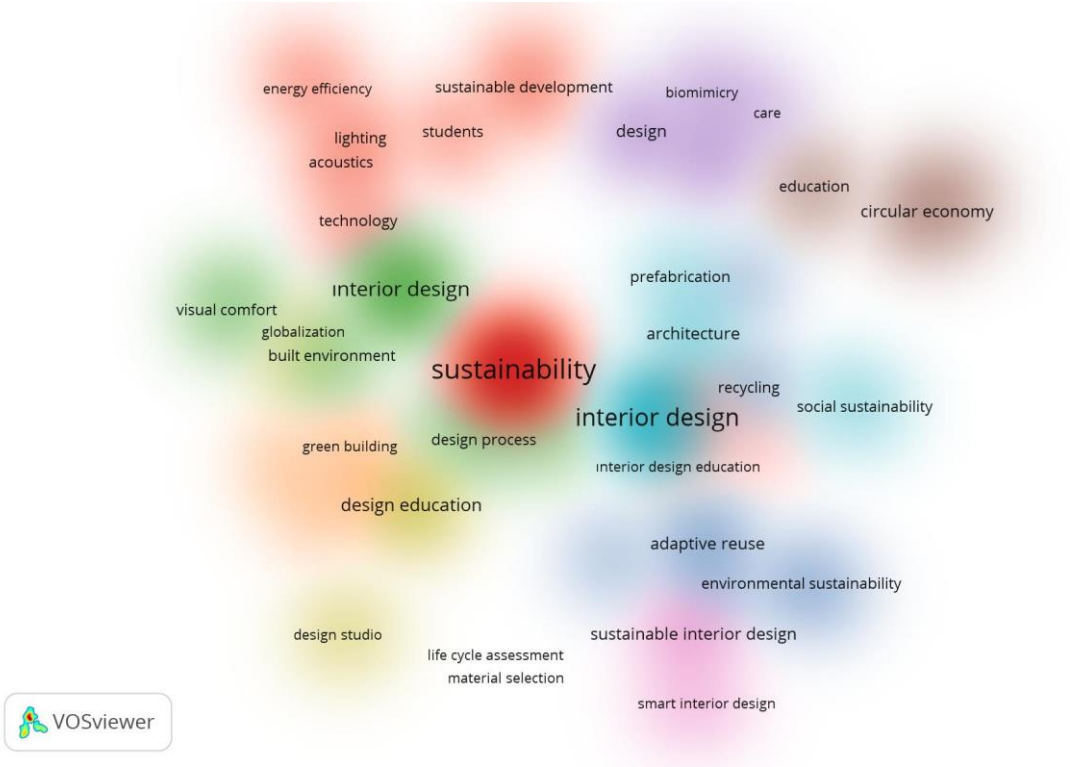

Figure 13 Density visualization using VOSviewer software (VOSviewer, 2023)

DISCUSSIONS AND CONCLUSION

The purpose of this article is to examine the publications on sustainability and sustainable design in the fields of interior architecture & interior design. Scientific mapping method was chosen as the method in the research. The reason for choosing the scientific mapping method is to create detailed statistics, graphics and visuals of the researched subject.

In this article, publications on sustainability and sustainable design in the fields of interior architecture and interior design are examined. The data of the article were accessed from the Web of Science and Scopus databases. According to the research results of the research, statistics and frequencies are visualized by author, publication year, publisher affiliation, category, and country/region.

This study's limitations and recommendations research dates are limited to July 1 and August 15, 2023. The data of the research is limited to Web of Science and Scopus databases. In addition, search keywords impose some limitations on accessible publications.

The analysis of the data is based on images, frequencies and statistics provided by the software programs Biblioshiny and VOSviewer. Therefore, it offers impartial and objective independent, mathematical and statistical analysis.

As a result, sustainability and sustainable design, which has been an important issue in the fields of architecture and design in recent years, have been given a different perspective, the existing literature has been analyzed, and the existing publications have been highlighted and deficiencies have been identified.

Future research will examine keywords that can be examined with different combinations or can be examined in other academic research databases. The research can be examined by limiting it to a

certain category, year, institution and author. The more widespread use of software programs in the future will make it easier for academics, students and researchers to access data.

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