Global Research Trends in Sustainability and Environmental Issues: A Sustainable Environment and Future Directions

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Abstract

Global rapid economic growth is a cause of significant environmental issues threatening the welfare of current and future generations in the 21st century. The issues show the need for sustainable environmental development, which correlates with the importance of the Sustainable Development Goals (SDGs) program. Therefore, this research aimed to identify and examine global trends in sustainability and environmental issues, as published in Scopus-indexed journals from 1982 to 2022. Data on sustainability and environmental issues over the past 40 years were collected from the Scopus database. These included 1,324 English-language documents examined through bibliometric analysis performed with VOSviewer. The analysis explored the evolution of publications over time, categorized by classification, citations, subject areas, document types, authors, countries, institutions, journals, documents, and keywords. The results provided insights and discussions on sustainability and environment investigations, guiding future publications. This research would serve as a resource for scholars interested in collaborative projects in environmental sustainability, facilitating the exchange of ideas and results with academics, non-governmental organizations (NGOs), government agencies, and other stakeholders. The objective was to provide practical directions for advancing sustainability to ensure long-term social resilience and planetary health.

Keywords

Bibliometric analysis; environmental management; global; sustainable development

Introduction

Sustainable development in various fields over the past five centuries is increasingly focusing on environmental issues, often intersecting with related topics in global databases (Abdillah, 2023; Fox, 1993; Pratama & Zubaidah, 2023; Reid et al., 2010). The scope covers several areas, which include (1) biological publications exploring the interconnectedness between human survival and natural resources, (2) geophysical investigation examining the earth system, such as the relationship between climate and biogeochemical cycles, and responses to human activities, (3) social research analyzing the influence of institutions, economic systems, and cultural values on interactions between society and environment, and (4) technological review aimed at designing systems and equipment that minimize environmental impacts while enhancing societal benefits. These interconnected themes reflect the broader context of global environmental issues (Abdillah, 2023; Fox, 1993; Pratama & Zubaidah, 2023; Reid et al., 2010).

Environmental management has become a significant concern in recent discussions, specifically with the growing global issues (Muganyi et al., 2021; Pratama & Zubaidah, 2023). Meanwhile, scholars, policymakers, and practitioners are showing increasing interest in the diverse complexities of sustainable development, driven by the need to address social, economic, and environmental degradation (Baloch et al., 2023; Fox, 1993; Ramcilovic-Suominen & Pülzl, 2018; Reid et al., 2010). This research examined global trends in environmental management by clarifying the main themes, methods, and evolving priorities influencing academic inquiry in related fields (Bibri & Krogstie, 2017; Parmentola et al., 2022).

During the rising environmental crises, empirical evidence confirmed a significant increase in sustainability-related research globally. Additionally, the information from academic databases such as Scopus showed a steady increase in publications on environmental management in the past decade. For example, peer-reviewed documents on this topic grew by approximately 35% from 2010 to 2020, reflecting increased scholarly engagement with environmental issues.

Global distribution of research output showed that publications on sustainability had spread widely across different areas, reflecting the international relevance of environmental issues (Parmentola et al., 2022; Richey & Klein, 2014). Although the majority of academic research regarding environmental management previously focused on the Northern part of the world, recent years have witnessed increased interest from various areas. Significant growth in publications from developing countries and economies represented a broader and more inclusive research landscape.

The current trends in sustainable development showed significant growth and diversity, which used various methods to address urgent issues (Abdillah, 2023; Richey & Klein, 2014). The methods consisted of quantitative analysis to identify social vulnerability trends, economic issues, and environmental degradation, including urbanization, poverty, food insecurity, greenhouse gas emissions, habitat loss, and pollution. Furthermore, qualitative analysis explored the sociocultural, economic, and political dimensions of sustainability, including examining community perceptions, policy development, and governance structures (Elder & Olsen, 2019; Zhang et al., 2020).

Interdisciplinary research gained prominence by integrating diverse fields such as geology, biology, sociology, technology, and economics to develop comprehensive solutions. Action-

oriented investigation, including participatory and community-based methods, empowered stakeholders to co-create sustainable practices. Additionally, modeling and simulation publications provided insights into future scenarios and potential interventions to reduce environmental impacts (Henriksson et al., 2019). These research trends collectively represented diverse methods to advance knowledge, leading to informed policy and positive change toward sustainability.
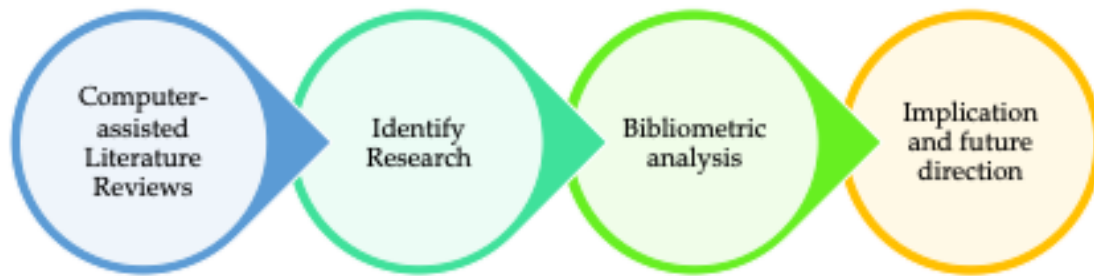
Preliminary research showed that the growing sustainable development of environmental justice and equity has led to significant issues (Ramcilovic-Suominen & Pülzl, 2018; Scharlemann et al., 2020). In addition, scholars are increasingly recognizing the uneven impact of environmental issues on marginalized communities, which intensifies existing social and economic inequalities. There is an increasing analysis regarding equity, justice, and inclusivity principles to ensure fair distribution of environmental benefits (OECD, 2021). The strategic importance of climate change mitigation and adaptation continues to be a main focus, with preliminary research prioritizing innovative strategies, resilience-building, and related policies. The increased frequency and intensity of natural disasters suggested the urgent need for collaborative efforts to reduce greenhouse gas emissions, therefore enhancing resilience to climate impacts (Basnet, 2021; Opoku, 2019).

The purpose of this research included the exploration of the thematic aspect and methods that characterize contemporary sustainable development. However, the evolving discussions on sustainability were analyzed, leading to the identification of potential paths for future investigations and innovation by combining empirical data with qualitative insights from literature (Opoku, 2019; Scharlemann et al., 2020; Vardopoulos et al., 2023).

Research trends associated with sustainability and environmental issues, focusing on the role of bibliometric analysis in understanding the development of the topics, were further examined (Pimentel & Pimentel, 2003). The process identified major topics, publication trends, authorship, affiliation, and other dynamics in the field. Various statistics and bibliometrics analyzed issues related to sustainability, authorship patterns, and the relationships between topics and interdisciplinary methods (Chaves & Alipaz, 2007). Therefore, this research aimed to identify and examine global trends in sustainability and environmental issues from literature published between 1982 and 2022 in the Scopus database. The results further contributed to understanding the practical applications of sustainability in addressing environmental challenges, including climate change, environmental degradation, and pollution, as well as outlining the need for solutions to ensure feasible growth and development.

Method – Research protocol

Literature review and bibliometric analysis methods were adopted in this research to identify global trends in sustainability and environmental issues. A computer-assisted literature review identified trends, publication evolution, main authors, countries, affiliations, subject areas, and relationship patterns in the field, with Figure 1 presenting the stages of sustainability issues.

Figure 1: Research Stages on Sustainability and Environmental Issues

Data source

The data source was the Scopus database, covering a 40-year duration that ranged from 1982 to 2022. Scopus was selected due to the strict selection policies and processes, ensuring high-quality indexed content. This database was recognized among scholars globally, providing access to a broad range of subject areas. The initial step included searching the Scopus database using the following keywords, namely, sustainability OR sustainable AND environment OR environmental. The search focused on identifying authorship, document influence, citation levels, future research directions, implications, limitations, and recommendations. To minimize bias in identifying the research trends, continuous data verification was included to prevent duplication and discrepancies, while the final data collection was conducted on November 15, 2022.

Data processing

The inclusion of significant documents on sustainability and environmental issues between 1982 and 2022 was collected through predetermined keywords. The search was limited to titles, abstracts, and keywords, specifically TS = environmental OR environment OR ecology AND sustainability OR sustainable. The selected 40-year duration comprised all essential research, specifically published in English, focusing on completeness, consistency, and relevance to sustainability issues, as well as specific types. A total of 1,324 documents were downloaded in Excel CSV format to be analyzed, while metadata were processed using VOSviewer version 1.6.17 to extract the datasets, as well as provide accurate and transparent information.

Statistical method

This research initially quantified the publications relating to sustainability and environmental issues, analyzing the growth patterns, topic areas, and journal types. Additionally, the journal impact factors and H-index were evaluated, with the analysis focusing on three main areas, including (1) publication output, (2) subject categories from the Scopus database (1982 to 2022), as well as (3) the top 10 most influential journals. The impact factors were calculated using the 2020 Journal Citation Reports (JCR), while publication performance and subject categories were analyzed with Microsoft Excel 2016.

Co-authorship patterns were analyzed using VOSviewer software to identify connections between productive authors and countries in the research topic, which helped assess patterns

of national and author-level scientific collaboration. Additionally, a co-occurrence analysis was carried out to examine the evolution of research themes and relationships between keywords in publications. The frequency of author keywords was determined, providing insights into the thematic structure of the field. This facilitated the construction of multidisciplinary networks, offering insights into evolving areas of interest in sustainability and environmental research.

Analysis and data validation

At this stage, 1,324 documents were identified and extracted from the Scopus database, with a relevance-based analysis conducted using CSV file format to refine the metadata, including the assessment of data consistency and reliability. To ensure comprehensive analysis, issues such as varying forms of country names and keyword terms, including singular versus plural and abbreviated forms, were standardized. Furthermore, bibliometric analysis was conducted using VOSviewer, which offered transparent visualization of significant metrics, namely co-authorship, citation networks, and keyword clusters. Microsoft Excel was used to calculate basic statistical data, including publication counts, citation averages, and growth trends.

Result and discussion

The Scopus datasets used in this research were 1,324 documents written by a total of 3,432 authors, which categorized the documents using 2,994 distinct keywords. The average number of citations per document and annual growth rate of publications were 14.29 and 13.36%, respectively, showing strong citation impact and influence in the field. The distribution analysis proved that 401 authors published single-authored documents, as shown in Table 1.

Table 1: Literature Database on Sustainability and Various Related Issues

No	Description	Result	No	Description	Result
1	Timeline-Timespan	1982–2022		**DOCUMENT-TYPES**	
2	Journal Sources, Books, etc	869	15	Articles	684
3	Publications File (Document)	1,324	16	Books	41
4	Production documents by year Growth Rate %	13.36	17	Chapters of book	142
5	Document Average Age	7.27	18	Documents of conference	236
6	Average citations per document	14.29	19	conference review	20
7	References	55,584	20	Editorial	43
	DOCUMENT CONTENTS		21	Erratum	54
8	Keywords Plus (ID)	4,880	22	Letter	5
9	Author's Keywords (DE)	2,994	23	Note	12
	AUTHORS		24	Retracted	1
10	Authors	3,432	25	Review	79
11	Authors of single-authored documents	334	26	short survey	7
	AUTHORS COLLABORATION				
12	Single-authored documents	401			
13	Co-authors per document	2.87			
14	International co-authorships %	19.11			

Production and evolution of documents annually in the area of sustainability and various related fields

The evolution of publications on sustainability and the environment showed a significant increase from 2014 to 2015. Based on Figure 2, various types of documents published on sustainability and environmental issues for over 40 years in the Scopus database were selected.

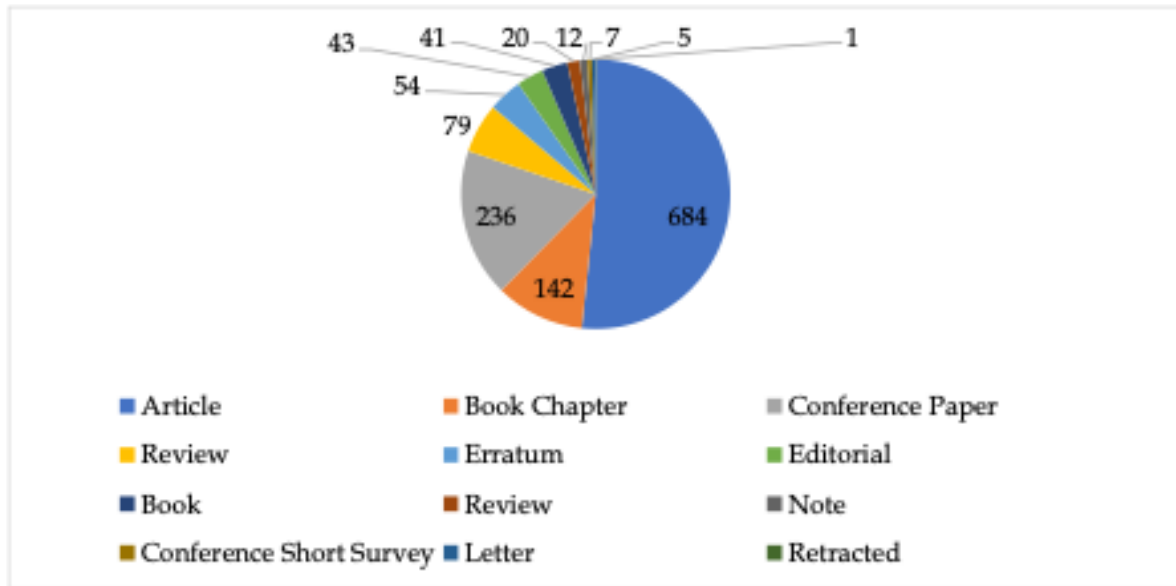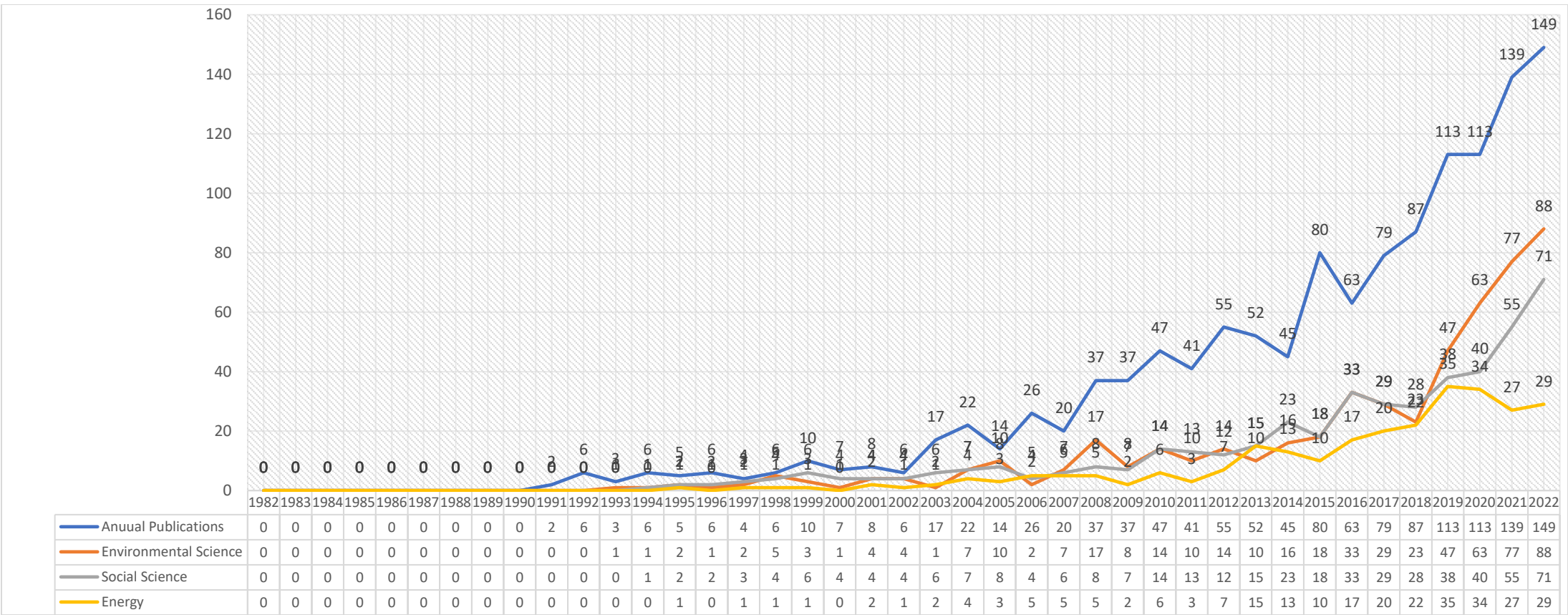**Figure 2:** The Types of Documents Published on Environmental and Sustainability Issues

Figure 3 shows the absence of publications related to sustainability and the environment in Scopus before 1991. The number of publications from 1992 to 2002 remained low, with fewer than 50 documents per year, but significant growth was observed between 2016 and 2022, where the publications reached 149 in 2022.
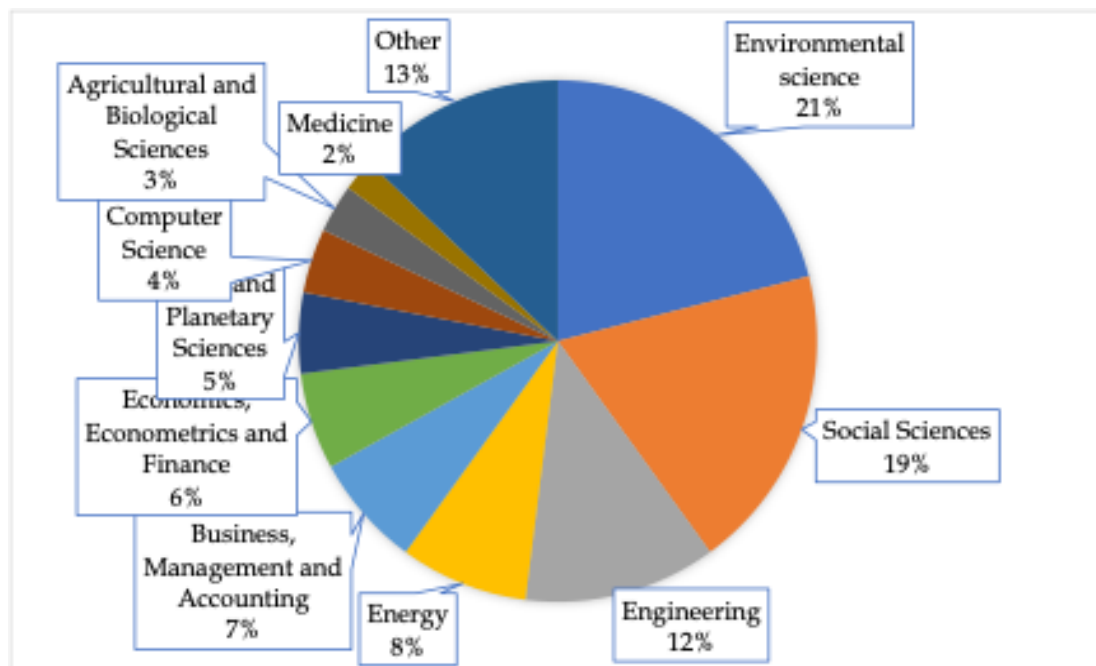
Figure 3: Sustainability and Environmental Issues Document Trends and Evolution by Years

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Anual Publications	0	0	0	0	0	0	0	0	0	2	6	3	6	5	6	4	6	10	7	8	6	17	22	14	26	20	37	37	47	41	55	52	45	80	63	79	87	113	113	139	149
Environmental Science	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	1	2	5	3	1	4	4	1	7	10	2	7	17	8	14	10	14	10	16	18	33	29	23	47	63	77	88
Social Science	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	3	4	6	4	4	4	6	7	8	4	6	8	7	14	13	12	15	23	18	33	29	28	38	40	55	71
Energy	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	2	1	2	4	3	5	5	5	2	6	3	7	15	13	10	17	20	22	35	34	27	29

The documents were often categorized under multiple fields of research, and the main subject areas identified for sustainability and environmental issues were Environmental and Social Sciences (Figure 4). There were no initially established main topics, but from 1991 onwards and specifically since 2006, Environmental Science was recognized as the dominant field above Social Science, with Energy categorized as the third most common field.

The search using the keywords Sustainability and Environment Issues identified approximately 1,324 documents. The major areas were Environmental Science (21%), Social Science (19%), Engineering (12%), and Energy (8%), including Business, Management, and Accounting (7%). Additionally, the complete distribution of all the documents across these subject areas is shown in Figure 4.

Figure 4: Top 10 Subject Areas on Sustainability and Environment Issues

Main authorships

The authors with the most significant contribution to the topic were ranked highest in Table 2, although the field remained open to further exploration where certain individuals evolved as main contributors. C. T. Salame, M. Aillerie, and P. Papageorgas published 11, eight, and five documents, respectively. The authors focused on research related to sustainability and environmental issues with the most-cited publications in these areas. U. Iyer-Raniga developed the highest average citations (51) per document, with publications covering 2001 to 2017. The most significantly cited work was Transformative Learning: Innovating Sustainability Education in the Built Environment, and Aillerie, M. had only one citation despite publishing eight documents.

Table 2: Authors with the Most Significant Contribution to the Topic were Ranked Highest in Sustainability and Environment Research
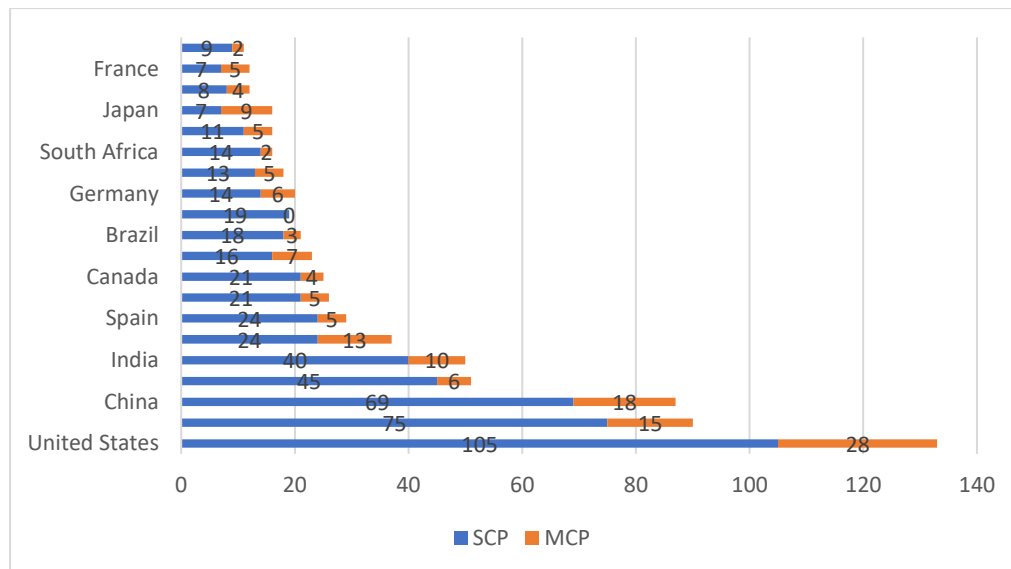
Ranking/Level	Name of Authors	TD[1]	F[2] (%)	TC[3]	TC/TD
1st	Salame, C. T.	11	0.831	3	0.273

Ranking/Level	Name of Authors	TD[1]	F[2] (%)	TC[3]	TC/TD
2nd	Aillerie, M.	8	0.604	1	0.125
3rd	Papageorgas, P.	5	0.378	1	0.200
4th	Iyer-Raniga, U.	4	0.302	51	12.750
5th	Jabur, A.	4	0.302	1	0.250
6th	Martie, J. V.	4	0.302	19	4.750
7th	Navarro, I. J.	4	0.302	19	4.750
8th	Ng, E.	4	0.302	30	7.500
9th	Wan, L.	4	0.302	30	7.500
10th	Yepes, V.	4	0.302	19	4.750

Note: [1]TD: Total documents, [2]F: Frequency = TD/1,324 (documents retrieved) x 100, [3]TC: Total Citations.

An average of 0.393 authors per document stated growing trends of collaborative research in this area. The top 10 countries with the highest number of corresponding authors in sustainability and environment publications are shown in Figure 5. These included the United States, the United Kingdom, China, Australia, India, Italy, Spain, Iran, Canada, and Malaysia. Additionally, Indonesia was featured prominently, being among the only two Southeast Asian countries in the top 10 from 1982 to 2022.

Figure 5: Top 10 Countries of Corresponding Authors on Sustainability and Environment Issues
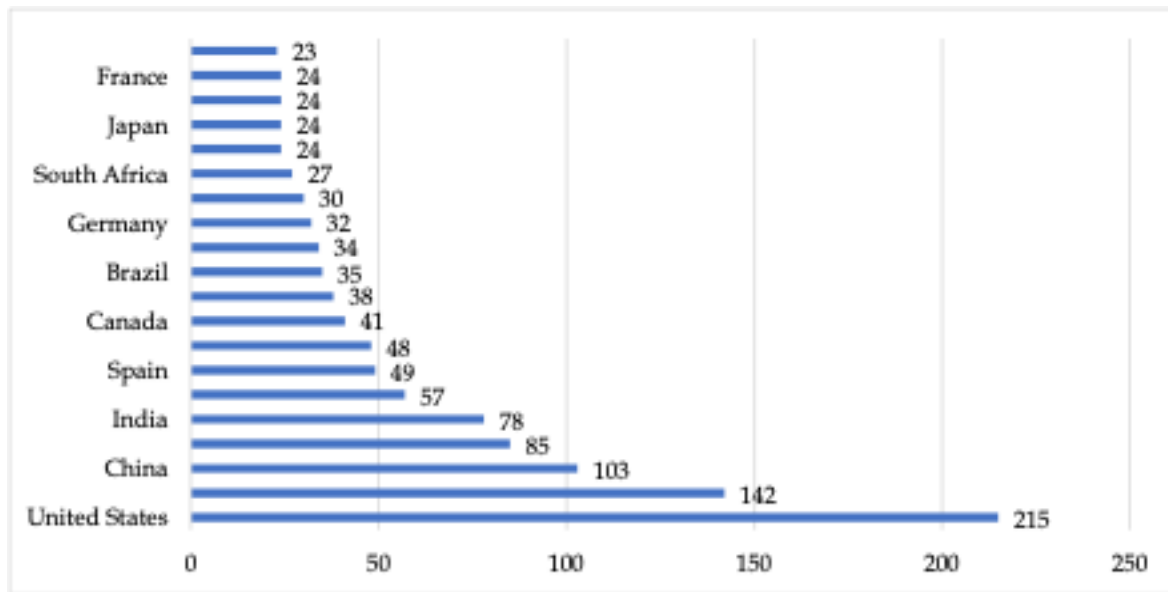

*Note: *SCP: Single Country Publications: MCP: Multiple Country Publications*

Countries with the highest contribution to sustainability and environmental issues

The United States and the United Kingdom had the highest number of research on sustainability and environmental issues published between 1982 and 2022, with 215 and 142 documents, respectively. Meanwhile, China, India, Malaysia, Indonesia, Iran, and Japan were ranked among the top 10 countries contributing to this field, as shown in Figure 6.

Figure 6: The Important 10 Countries based on Publication File (Documents) related to Sustainability and Environmental Issues

Institutions with the highest contribution to sustainability and environmental issues

Approximately 62% of the documents were published by the top 10 institutions in the field of sustainability and environmental research, as shown in Table 3. Furthermore, the Chinese Academy of Sciences was ranked first, publishing 13 documents, followed by Arizona State University and the Ministry of Education, China, with ten and eight documents, respectively.

Table 3: The Highest Number of Institutions/Affiliations of Authors in Research on Sustainability and Environmental Issues

Ranking/level	Institution/Affiliation	Country/Countries	TD[1]	F[2] (%)	TC[3]	TC/TD
1st	Chinese Academy of Sciences	China	13	0.983	155	11.923
2nd	Arizona State University	United States	10	0.756	291	29.100
3rd	Ministry of Education China	China	8	0.605	101	12.625
4th	Chinese University of Hong Kong	Hong Kong	8	0.605	42	5.250
5th	Deakin University	Australia	8	0.605	247	30.875
6th	Monash University	Australia	8	0.605	38	4.750
7th	The University of Tokyo	Japan	8	0.605	104	13.000
8th	Universitas Indonesia	Indonesia	8	0.605	12	1.500
9th	Wageningen University & Research	Netherlands	7	0.529	62	8.857
10th	RMIT University	Australia	7	0.529	64	9.143

Note: [1]TD: Total documents: [2]F: Frequency = TD/1,324 documents-retrieved x 100; [3]TC: Total Citations

Journals with the highest contribution to sustainability and environmental issues

VOSViewer showed that the highest number of documents (66) was published in the Sustainability Journal. This was followed by Environment, Development, and Sustainability (47), Institute of Physics (IOP) Conference Series: Earth and Environmental Science (31), Journal of Cleaner Production (22), and American Institute of Physics (AIP) Conference Proceedings (14). Meanwhile, the other most productive journals by publication volume are presented in Table 4.

Table 4: The Highest Production Sources (Journals) Based on the Total Publications Related to Sustainability and Environmental Issues

Rank	Source	No. Of Publication	Country	Publisher	H-Index	Publication Type	Q¹
1st	Sustainability	66	Switzerland	MDPI AG	109	Journals	Q1
2nd	Environment Development and Sustainability	47	Netherlands	Springer Netherlands	62	Journals	Q1
3rd	IOP Conference Series Earth and Environmental Science	31	United Kingdom	IOP Publishing Ltd.	34	Conferences and Proceedings	-
4th	Journal of Cleaner Production	22	United Kingdom	Elsevier Ltd.	232	Journals	Q1
5th	AIP Conference Proceedings	14	United States	American Institute of Physics	75	Conferences and Proceedings	-
6th	Environmental Science and Pollution Research	11	Germany	Springer Science + Business Media	132	Journals	Q1
7th	E3s Web of Conferences	9	France	EDP Sciences	28	Conferences and Proceedings	-
8th	International Journal of Sustainability in Higher Education	8	United Kingdom	Emerald Group Publishing Ltd.	66	Journals	Q1
9th	Journal of Environmental Management	7	United States	Academic Press Inc.	196	Journals	Q1
10th	ACM International Conference Proceedings Series	6	United States	Association for Computing Machinery (ACM)	128	Conferences and Proceedings	-

Note: ¹Q: Quartiles.

Based on citations, Table 5 shows the most influential sources, with the leading periodical focusing on Sustainability with 833 citations, followed by the Journals of Cleaner Production (629), Business Ethics (389), Science of The Total (235), and Local Environments (218). Among these, one of the journals was from Germany and Switzerland, three were published in the Netherlands, and five originated from the United Kingdom.

The majority of documents on Sustainability and Environment were published in Scopus quartiles Q1, accounting for approximately 100% of the six journals identified. This suggested that the topic was considered of significant interest (Q1), as well as frequently published in high-quality and reputable journals.

Table 5: The Important Influential Sources (Journals) and Countries by Citation Level Analysis

Rank	Source	Cited by	Country	Quartile
1st	Sustainability	833	Switzerland	Q1
2nd	Journal of Cleaner Production	629	United Kingdom	Q1
3rd	Journal of Business Ethics	389	Netherlands	Q1
4th	Science of The Total Environment	235	Netherlands	Q1
5th	Local Environment	218	United Kingdom	Q1
6th	Building and Environment	179	United Kingdom	Q1
7th	Environmental Science and Pollution Research	168	Germany	Q1
8th	Sustainable Cities and Society	165	Netherlands	Q1
9th	Business Strategy and Environment	142	United Kingdom	Q1
10th	Environmental Education Research	109	United Kingdom	Q1

Most cited documents and keywords on sustainability and environmental issues

The most influential documents based on citations found in the Scopus database are shown in Table 6. The leading documents were Environment and Development Sustainability Science, as well as Sustainability of Meat and Plant-based Diets including Environment, with 1,985 and 646 citations, respectively. Other significant documents included Environment and the Entrepreneurial City Seeking the Urban Sustainability Fix in Manchester and Leeds (401 citations) and the Energy-water-environment Nexus Strengthening Future Desalination Sustainability (383 citations). Additionally, Managing Supplier Sustainability Risks in a Dynamically Changing Environment Sustainable Supplier Management in the Chemical Industry received 293 citations. The research outlined global interest in sustainability and environmental issues, including the connections to several other topics.

Table 6: The Important Influential Documents/Publications by Citation Analysis on Sustainability and Environmental Issues

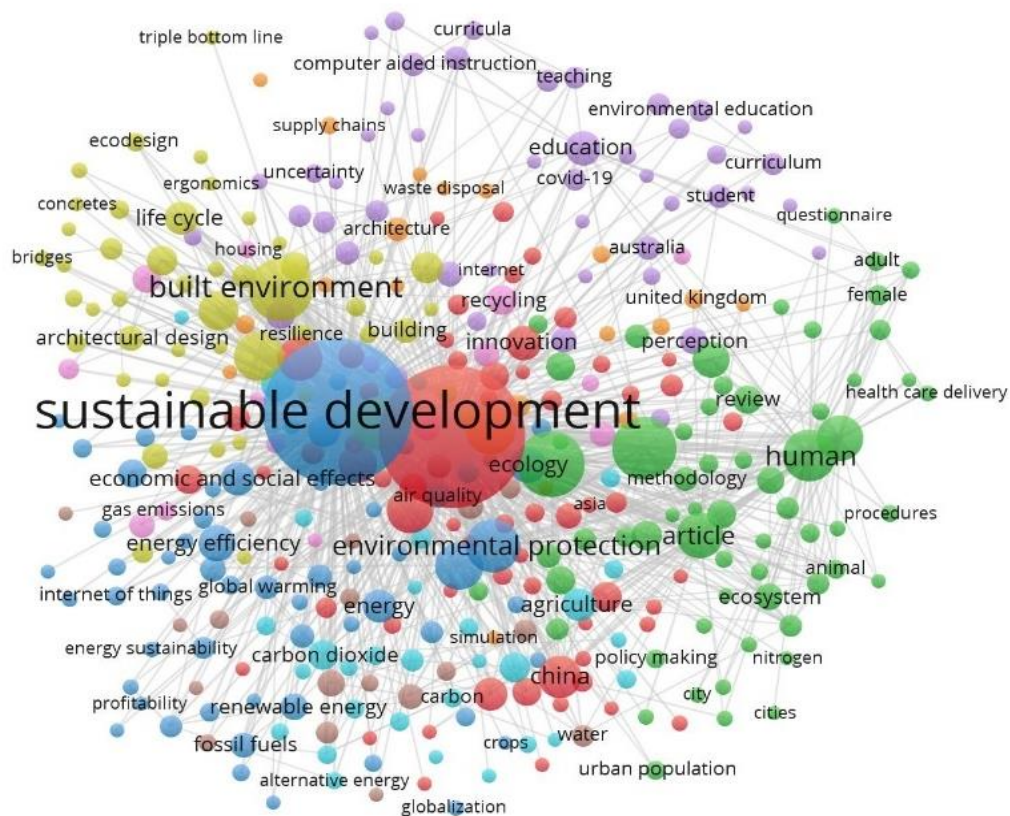| Rank/Level	Topics of Documents	Source Title	Cited by
1st	Environment and Development Sustainability Science	Science	1,985
2nd	Sustainability of meat and plant-based diets and environment	American Journal of Clinical Nutrition	646
3rd	Environment and the entrepreneurial city: Searching for the urban sustainability fix in Manchester and Leeds	International Journal of Urban and Regional Research	401

Rank/Level	Topics of Documents	Source Title	Cited by
4th	Energy-water-environment nexus strengthening future desalination sustainability	Desalination	383
5th	Managing Supplier Sustainability Risks in a Dynamically Changing Environment-Sustainable Supplier Management in the Chemical Industry	Journal of Purchasing and Supply Management	293
6th	Institutional Environment, Managerial Attitudes, and Environmental Sustainability Orientation of Small Firms	Journal of Business Ethics	197
7th	An integrated indicator based on basin hydrology, environment, life, and policy: The watershed sustainability index	Water Resources Management	184
8th	The Classic Period Collapse of the Central Maya Lowlands Insights about Human-Environment Relationships for Sustainability	Proceedings of the National Academy of Sciences of the United States of America	176
9th	Selected physicochemical aspects of poly- and perfluoro alkylated substances relevant to performance, environment, and sustainability-part one	Chemosphere	161
10th	Soil salinization and waterlogging: A threat to the environment and agricultural sustainability	Ecological Indicators	161
11th	Empowering Employee Sustainability Perceived Organizational Support toward Environment	Journal of Business Ethics	150
12th	Geothermal energy Sustainability and environment	Geothermics	146
13th	The criticality of growth, urbanization, electricity, and fossil fuel consumption to environment sustainability in Africa	Science of the Total Environment	142
14th	Aquaculture environmental prospects for sustainability	Ocean and Coastal Management	140
15th	Assessing the Sustainability of Urbanization using a Coordinated Development Index for an Urbanization-Resources-Environment Complex System: A case study of Jing-Jin-Ji region, China	Ecological Indicators	138
16th	Ecological restoration for future sustainability in a changing environment	Ecoscience	137
17th	Sustainability environment and management accounting	Management Accounting Research	135
18th	Developing sustainability assessment model: The sustainable infrastructure, Land-use, environment, and transport model	Sustainability	132
19th	Relation of Environmental Sustainability to CSR and Green Innovation: A case of the Pakistani manufacturing industry	Journal of Cleaner Production	128
20th	Sustainability and resilience in agrifood systems Reconnecting agriculture, food, and environment	Sociologia Ruralis	118

Co-occurrence analysis

After arranging the 1,324 documents according to relevance, a content analysis was conducted. Subsequently, VOSviewer was used to perform a co-occurrence analysis by adopting the full counting method with all keyword units. The analysis set a minimum occurrence threshold of five times per keyword, identifying 365 out of 6,894 keywords that met the criteria, as shown in Figure 7.

The top three most frequently occurring terms were Sustainable Development (466 occurrences), Sustainability (446), and Environmental Sustainability (95). However, nine-term clusters were identified, each represented by different colors and containing various keywords, as shown in Figure 7.

Figure 7: The Analysis Results Based on Keywords in Sustainability and Environmental Issues from Various Published Literature

Note: Visualization of Networks by VOSviewer

The first cluster, shown by the red color, and 55 keywords focused on Sustainability, Human Well-Being, Education, Community, Accessibility, and Competitiveness. The cluster presented the interconnectedness between sustainability and social-economic research topics. The relationship among these elements describes the general nature of sustainable development, focusing on environmental, social, and economic resilience (Ahmed et al., 2020). However, sustainable practices were related to economic, social, and ecological requirements without compromising the ability of future generations to meet personal needs. Human well-

being was enhanced through access to clean air, water resources, food security, education, healthcare, and economic prosperity. Education empowered individuals with the knowledge and skills relevant to sustainable practices, while community engagement fostered collective and social efforts (Frisk & Larson, 2011). Accessibility helped to ensure all individuals could participate and benefit from sustainable initiatives (Gillovic & McIntosh, 2020). Moreover, competitiveness drove innovation and efficiency in sustainable practices, contributing to economic growth as well as maintaining environmental and social integrity. This interconnectedness formed the basis for achieving sustainable development, which led to improved environmental, economic, and social well-being globally (Costantini & Mazzanti, 2012; Emina, 2021).

The second cluster, shown by the green color, had 54 keywords related to sustainable development, built environment, ecodesign, life cycle, and sustainability performance. This cluster focused on the importance of integrating eco-design principles across the life cycle of built environments to enhance sustainability, thereby contributing to the general Sustainable Development Goals (SDGs) (Munaro et al., 2022). The method enabled the planning, development, and management of infrastructure and buildings to minimize environmental impact and conserve resources, including enhancing social and economic well-being. The consideration of sustainability principles from the design phase through careful construction, operation, maintenance, and decommissioning allowed for the optimization of resources, reduction of waste, and environmental degradation, as well as improved quality of life for both present and future generations (Akadiri et al., 2012).

The third cluster, shown by the blue color, has 49 keywords focused on economics, water resources, globalization, ecology, and energy sustainability. This cluster describes the complex relationship between human activities, natural systems, and economic development (Liu et al., 2015). Prior research stated that economic factors and globalization influenced water resource management and ecological patterns, respectively, while energy sustainability impacted economic growth as well as ecological balance (Jamean & Abas, 2023). Understanding the connections between the clusters was crucial for maintaining the balance between human activities, natural systems, and economic progress, which is responsible for influencing the sustainability and resilience of societies worldwide. Neglecting the connections caused environmental degradation, resource depletion, and socioeconomic disparities, which could damage the well-being of current and future generations (Sabran & Azlan, 2021).

The fourth cluster, shown by the yellow color and 45 keywords, focused on Economic and Ecological Development, Energy Policy, Environmental Quality, and Urbanization. This cluster presented the relationship between human activities, ecosystem health, energy usage, environmental impact, and urban growth (Bai et al., 2017). Furthermore, economic development influenced urbanization and energy policies, which affected ecological health and environmental quality (Jamean & Abas, 2023). The management of these connections was essential for balancing environmental preservation with economic growth and advancing the welfare of individuals and the planet in general. According to Maddalene et al. (2023), failure to manage these relationships led to negative effects such as unsustainable resource extraction and environmental degradation, including threats to human health and well-being.

The fifth cluster, shown by the purple color, and 41 keywords were centered on Environmental Sustainability, Innovation, Information Management, Health, and Tourism Development. The interconnection in this cluster presented the complex relationships between conservation, creativity, knowledge sharing, well-being, and economic growth

(Ilham & Yustianto, 2024; Matteucci et al., 2021). Environmental sustainability drove innovation and information management practices that influenced public health outcomes and tourism development. Moreover, the effective management of these relationships was essential for promoting sustainable tourism, fostering economic growth, protecting public health, and preserving ecosystems for future generations (Baloch et al., 2023). The relationships had critical implications on ecosystems, human well-being, economic prosperity, and sustainability of tourism destinations. The efficient identification and management of the relationships inspired creative solutions that supported public health, environmental preservation, and sustainable economic growth through tourism. However, failure to address the connections could lead to negative environmental impacts, public health risks, and economic vulnerabilities, destroying the long-term viability as well as the resilience of tourism destinations and communities (Cochrane, 2010).

The sixth cluster, shown in a light blue color, has 37 keywords addressed: Energy, Energy Efficiency, Intelligence Buildings, Renewable Energy, and Energy Use. This cluster presented the relationships between energy production, consumption, and sustainability (Nižetić et al., 2019). Energy efficiency measures optimized the usage in intelligent buildings, reducing demand and promoting the integration of renewable energy sources. The management of these relationships was crucial for transitioning toward a sustainable energy system, which further reduced carbon emissions, thereby ensuring reliable and affordable energy access (Kabeyi & Olanrewaju, 2022). The relationships directly impacted global energy consumption patterns, environmental sustainability, and economic development. Promoting energy efficiency and renewable energy use was essential for reducing greenhouse gas emissions and climate change, as well as enhancing security (Wang et al., 2018). Additionally, integrating intelligent building technologies optimized energy usage, reducing operational costs as well as improving occupant comfort and well-being.

The seventh cluster, shown by the orange color, has 35 keywords focused on Environment, Ecosystem, Agriculture, Biodiversity, and Society. The connection among these elements describes the intricate relationship between natural systems, human activities, and societal well-being (Sabran & Abas, 2021). Furthermore, agriculture impacts ecosystems and biodiversity, which influence environmental health and societal resilience. These relationships significantly affect the ecosystem, resource availability, and societal well-being. For example, agriculture relies on healthy ecosystems for crop pollination, soil fertility, and water regulation. Biodiversity maintains ecosystem resilience, providing essential services such as disease prevention, and climate regulation, and air and water purification. Societies depend on these ecosystems and the services to sustain the stability of climate, clean water supplies, and food security (Richardson, 2010).

The eighth cluster, shown by the brown color, has 30 keywords centered on Planning, Benchmarking, Energy Requirements, Sustainability Criteria, and Uncertainty. This presented the complex relationship between strategic decision-making, performance measurement, energy management, sustainability objectives, and risk assessment (Nižetić et al., 2019). The planning process included setting objectives and strategies while benchmarking compared performance against established standards. Energy requirements influenced planning decisions and sustainability criteria as organizations pursued the optimization of energy usage to meet environmental objectives (Govindan, 2018). However, uncertainty led to a complexity that required flexible planning and strong benchmarking in the adaptation of changing circumstances, promoting sustainable outcomes. These relationships guided strategic decision-making, performance evaluation, and goal-setting in sectors including business, urban planning, and environmental management (Maddalene et al., 2023).

Organizations used planning initiatives to set objectives and develop strategies while benchmarking measured progress and identified areas for improvement. Furthermore, energy requirements and sustainability criteria were crucial in planning and benchmarking efforts because organizations aimed to minimize environmental impacts as well as maximize resource efficiency. The uncertainty introduced risks into decision-making, necessitating careful consideration of potential challenges and the adoption of flexible strategies (Ilham & Yustianto, 2024; Kabeyi & Olanrewaju, 2022).

The ninth cluster, shown by the violet color, and 19 keywords focused on Sustainability Indicators, Urban Environment, Land Use Change, Urban Planning, and Sustainability. This described the complex relationship between urban development, environmental quality, and societal well-being (Khalil, 2012). Sustainability indicators provided metrics for the assessment of progress towards SDGs. Meanwhile, urban environments affected by land use patterns and planning decisions influenced the quality of life, resource usage, and environmental impacts on populations (Jamean & Abas, 2023). Urban planning plays a critical role in impacting land use, infrastructure development, and community resilience, contributing to the general sustainability of cities (Rosehan et al., 2020). Effective planning and management were essential to promoting sustainable growth, reducing environmental degradation, and enhancing the standard of living (Khalil, 2012). Sustainability indicators offered a framework for measuring progress and identifying areas for improvement in urban settings.

Figure 8: The Analysis Results were Based on Keywords in Sustainability and Environmental Issues from Various Published Literature

Note: Visualization of overlay by VOSviewer

An overlay representation of the literature on sustainability and environmental issues, as well as the average number of publications from 2010 to 2018, is shown in Figure 8. Topics such as sustainable development, built environment, and environmental protection were frequently discussed in 2012. In the early 2010s, there was a strong focus on sustainable development and environmental protection driven by increased awareness of the environmental impacts of human activities and the need for sustainable solutions to address these challenges. The terms were central to discussions on strategies for reducing degradation and promoting long-term environmental stewardship.

Discussions in the past three years have shifted toward topics such as COVID-19, Innovation, and Policy Making. This shift reflected significant global events and evolving trends, influencing priorities in the sustainability and environmental domain. The COVID-19 pandemic caused unprecedented disruptions to economies, societies, and ecosystems, which presented the interconnectedness of human health, environmental sustainability, and socioeconomic well-being. This prompted discussions on system resilience and the need for adaptive strategies during crises. Concurrently, rapid technological advancements and innovations in renewable energy, clean technologies, and sustainable practices gained prominence in discussions on environmental protection and sustainable development. Policymaking is an essential area with intensified discussions due to the need for coordinated, evidence-based strategies used to address environmental issues while promoting resilience in the face of global issues.

Future research direction

Sustainable environmental development is increasingly crucial in the 21st century due to numerous interconnected factors. In addition, rapid global economic growth led to environmental issues that threatened the well-being of current and future generations (Ghosh et al., 2022; Hashemizadeh, 2023; Přívara & Přívarová, 2019). Issues such as climate change, environmental degradation, and pollution led to a shift towards sustainable practices to ensure the long-term maintenance of the planet and all inhabitants. Therefore, various future research directions were suggested for advancing publications on sustainability and environmental issues.

1. **Climate Change Adaptation and Mitigation:** Future research needs to continually explore methods for reducing and adapting to climate change impacts, which have remained the most significant threat facing global sustainability. This should include examining the effectiveness of adaptation strategies, developing technologies to reduce greenhouse gas emissions, and evaluating the socioeconomic impacts of climate policies.
2. **Biodiversity Conservation and Ecosystem Restoration:** Preserving biodiversity and restoring degraded ecosystems should be critical priorities. Future research can assess conservation strategies, the impact of habitat fragmentation, and the role of ecosystem services in supporting human well-being with an increased focus on rewilding and ecosystem-based restoration methods.
3. **Circular Economy and Sustainable Resource Management:** The transition towards a circular economy focused on resources reused, recycled, and repurposed will be the main research focus. This includes investigating sustainable production and consumption patterns, designing closed-loop systems, and evaluating the environmental and economic benefits of circular methods.
4. **Urban Sustainability and Smart Cities:** Future research needs to address issues related to sustainable urban development and the creation of smart, resilient cities because of the

continuous rise in development. Subsequent research efforts can explore inventive methods of urban design, the amalgamation of sustainable infrastructure, and renewable energy sources, including the advancement of intelligent technology to improve sustainability and standard of living.

5. **Environmental Justice and Equity:** The research on addressing environmental injustices and advancing social justice should be carefully conducted. This includes analyzing the disproportionate effect of environmental degradation on marginalized communities, assessing the effectiveness of environmental policies in terms of advancing equity, and investigating methods for strengthening inclusive and participatory decision-making processes.

6. **Global Governance and Policy Innovation:** The research on global governance mechanisms and policy innovation tends to be essential for addressing transboundary environmental issues and promoting international cooperation. Future research needs to focus on improving the effectiveness of international environmental agreements, thereby enhancing policy coherence across different sectors and fostering multi-stakeholder partnerships for sustainability.

7. **Technological Innovation and Green Solutions:** Technological developments will be essential in promoting sustainability across various industries. Future research should examine how cutting-edge technologies such as biotechnology, blockchain, and artificial intelligence contribute to SDGs, including addressing environmental issues.

Future research on the environment and sustainability needs to be interdisciplinary, collaborative, and solutions-oriented, thereby generating knowledge and innovation to address pressing environmental issues as well as improve the well-being of both humans and the planet. Scholars should consider these topics when exploring sustainability and environmental issues.

Conclusion and limitations

In conclusion, a comprehensive bibliometric analysis was conducted to confirm that a total of 1,324 documents were published from 1982 to 2022. The publications on Sustainability and Environment have shown a significant increase since 2016. Furthermore, the analysis results provided valuable insights, suggesting a potential roadmap for future research. Through examination of the most prolific publications, institutions, and countries that contributed the highest documents, the research served as a potential guide for aspiring scholars and fostered networking. The results could assist scholars in understanding the relationships between sustainability and the environment, facilitating collaborative projects, idea exchanges, and engagement with Non-Governmental Organizations (NGOs) as well as government bodies for future planning and development.

The field of environmental and sustainability research would be expected to address numerous complex challenges and opportunities in the subsequent years. Prospective research on innovative solutions and evidence-based strategies to promote a more sustainable and resilient future should be conducted to address increasingly apparent issues such as climate change, biodiversity loss, and environmental degradation. The main areas requiring exploration included climate change adaptation and mitigation, biodiversity conservation, circular economy concepts, sustainable urban development, environmental justice, global governance, and technological innovation. These areas presented the interconnected nature

of environmental issues, as well as the need for comprehensive solutions considering social, ecological, and economic factors.

Future research on environmental and sustainability issues was characterized by stakeholder engagement, interdisciplinary collaboration, and a commitment to addressing the needs of current and future generations. Scholars possessed the potential to make a significant impact by driving technological innovations, supporting policy development, and sharing knowledge.

The success of future research efforts was found to depend on collective action, political will, and societal commitment to prioritize environmental protection, social equity, and economic prosperity. However, concerted efforts and a shared vision for a sustainable future led to the possibility of overcoming environmental issues, including developing a world where humans and nature thrive together.

Limitations of the conducted literature review should be addressed through a qualitative method to obtain more in-depth results regarding global research trends in sustainable development and environmental management. Additionally, Scopus was the only platform used for data collection, signifying that future analyses could benefit from incorporating various databases such as Web of Science (WOS), Google Scholar, Dimensions, and EBSCO. A combination of these sources would enhance the capacity to identify and comprehensively analyze global research trends in sustainability and environmental issues.

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