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To cite this article: Mohamed Ali Osman, Abdirahman Ahmed Sheikh Farah & Abdirahman Ibrahim Abdi (2025) A bibliometric analysis of sustainable development research in higher education institutions (HEIs): key trends, global collaborations and influential contributions (2015–2023), Cogent Education, 12:1, 2490436, DOI: [10.1080/2331186X.2025.2490436](https://doi.org/10.1080/2331186X.2025.2490436)

To link to this article: <https://doi.org/10.1080/2331186X.2025.2490436>



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Published online: 17 Apr 2025.



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# A bibliometric analysis of sustainable development research in higher education institutions (HEIs): key trends, global collaborations and influential contributions (2015–2023)

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## ABSTRACT

This study presents a bibliometric analysis of sustainable development (SD) research in higher education institutions (HEIs) from 2015 to 2023, analyzing 1,122 articles using VOS viewer. Findings reveal a significant rise in publications, from 105 in 2019 to 263 in 2023, reflecting growing academic focus on sustainability in HEIs. The UK emerged as the most prolific contributor, with 5,450 citations, underscoring its scholarly impact. Citation trends peaked at 3,745 in 2019 but declined thereafter. International collaborations and leading Q1 journals highlighted the field's global engagement and research quality. The analysis emphasizes a rapidly expanding body of research, driven by contributions from select countries. Limitations include restricted database sources and the need for broader publication avenues. The study concludes with recommendations for HEIs to strengthen sustainability initiatives through curricular integration of SD concepts, faculty development, cross-institutional partnerships, and policy reforms to institutionalize sustainable practices. These insights offer a comprehensive overview of current research trends, guiding strategies to enhance HEIs' role in advancing sustainability. The findings affirm the field's academic rigor while identifying areas for future exploration, such as expanding data sources and fostering interdisciplinary research. The study emphasises HEIs' vital role in sustainable development and suggests measures to boost their influence.

## IMPACT STATEMENT

In higher education, sustainable development is essential to creating a more just and environmentally friendly future. Global research trends in sustainable development at universities are thoroughly examined in this report. The most influential research is identified, the evolution of sustainability-related studies is reviewed and patterns of international collaboration are highlighted through bibliometric analysis. The results show that sustainability is becoming increasingly important in higher education, with some nations having the most academic contributions. However, there is still a research gap in emerging economies because of a lack of financing and governmental support. To improve sustainability integration, this study highlights the necessity of inclusive worldwide engagement in sustainability research and offers solutions, including faculty training, multidisciplinary programs and digital learning resources. By comprehending these developments, universities, legislators and educators may create more effective plans to integrate sustainability into institutional policies and curricula and promote a more responsible and sustainable society.

## ARTICLE HISTORY

Received 24 September 2024  
Revised 17 March 2025  
Accepted 4 April 2025

## KEYWORDS

Sustainable development;  
higher education;  
bibliometric analysis;  
research trends;  
international collaboration;  
sustainability in education;  
SDGs

## SUBJECTS

Sustainability Education,  
Training & Leadership;  
Teachers & Teacher  
Education; Higher Education

## Introduction

Sustainable development emerged as a pivotal concept during the 1987 Brundtland Conference of the World Commission on Environment and Development, gaining significant traction over time, particularly in educational domains (Hoang et al., 2020). Universities have played a central role in advancing

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sustainability knowledge, allowing students to apply these concepts in real-world scenarios. Through formal and informal learning environments, these institutions encourage students to reflect on their choices and actions concerning sustainability (Godemann et al., 2014).

The introduction of the United Nations' 2030 Agenda in 2015 further elevated sustainable development as a global priority, outlining 17 sustainable development goals (SDGs) to safeguard and enhance global common goods (Mancini et al., 2022). Universities worldwide have committed to supporting these goals, recognizing their critical role in shaping a sustainable future and driving societal progress (Finnveden & Schneider, 2023). Higher Education for Sustainable Development (HESD) has emerged as a transformative educational approach, equipping students with the skills and knowledge to lead meaningful change (Barth, 2011; Lim et al., 2022).

While higher education institutions (HEIs) increasingly prioritize sustainable development, existing research often focuses on specific areas, such as Sustainable Higher Education Management (Ramos et al., 2015; Lambrechts et al., 2013; Dehtjare & Uzule, 2023), integrating SDGs into teacher training (Gómez-Gómez & García-Lázaro, 2023; Daniloska et al., 2022) and sustainability teaching methods in sectors like tourism (Chen et al., 2022; Shareefa & Moosa, 2020; Matthys et al., 2024). Other key areas include student engagement and leadership in sustainability (Lee et al., 2023; Mac-Lean et al., 2021; Mittal & Bansal, 2024), indigenous knowledge for sustainable development (Breidlid, 2009; Zidny et al., 2020; Demssie et al., 2020) and cross-institutional collaboration for sustainability (Yarime et al., 2012; Christiansen et al., 2023; Christou et al., 2024). Additionally, the research explores measuring the environmental impact of HEIs (Marques et al., 2019; Srivastava et al., 2019), financial strategies for sustainability in higher education (Al-Filali et al., 2024; Mustafazada, 2024) and faculty development for sustainability education (Beynaghi et al., 2016; Lozano et al., 2013; Holgaard et al., 2016).

Despite the extensive research in these areas, synthesizing the literature on sustainable development in higher education remains challenging due to the sheer volume of publications across diverse journals. This fragmentation makes it difficult to identify critical works and overarching trends. To address this challenge, bibliometric analysis, including mapping and clustering, provides a systematic approach to organizing and understanding this dense body of literature. This method allows researchers to identify significant trends and developments in sustainable development research within higher education (Shareefa & Moosa, 2020).

Recent bibliometric studies have documented a significant increase in research on sustainable development within HEIs. For instance, Hallinger and Chatpinyakoo (2019) analyzed 1459 Scopus-indexed documents from 1998 to 2018, highlighting a rapidly growing knowledge base primarily driven by scholars in developed countries. Similarly, Chusniah et al. (2025) examined 811 documents from 2000 to 2023, identifying intense development in sustainable development research within higher education management, particularly between 2013 and 2023. However, a gap remains in comprehensive studies examining the holistic progression of sustainable development research in HEIs, especially regarding integrating various SDGs into academic curricula and institutional policies.

This study aims to address this gap by conducting an extensive bibliometric analysis of sustainable development research in HEIs from 2015 to 2023. By systematically examining publication trends, citation networks and key thematic clusters, this study provides critical insights into the development and significance of sustainability research in higher education. Furthermore, it identifies highly influential works, co-authorship patterns and emerging research frontiers, offering a structured framework for future research and policy initiatives in sustainability education (Strielkowski et al., 2024).

As the global urgency for sustainability grows, HEIs are increasingly recognized as pivotal players in advancing sustainable development (Gomes et al., 2022). This study contributes to the field by bridging the research gap through a large-scale bibliometric analysis, providing a clearer understanding of the trajectory of sustainability research in higher education and informing strategies for its future development.

Bibliometric analysis is a powerful tool in advancing sustainable development within higher education. Dissecting research trends, authorship and citation patterns provide a detailed landscape of academic contributions to sustainability (Finnveden & Schneider, 2023; Strielkowski et al., 2024). It helps identify influential publications and critical contributors to the field, enabling educators and policymakers to understand the evolving landscape of sustainable development and its integration into HEIs. By mapping out the most-

cited articles and their impact over time, bibliometric studies provide insights into how SDGs are being addressed, allowing HEIs to refine their strategies for fostering sustainability (Hu et al., 2023; Shareefa & Moosa, 2020; Mohamed et al., 2020). Furthermore, applying theoretical frameworks like Sustainability Transition Theory and Systems Theory underscores the transformative role of higher education in societal shifts toward sustainability. These frameworks and bibliometric insights can guide institutions in aligning their efforts with the broader SDGs, fostering an academic environment conducive to sustainability. (Geels, 2004; Grin et al., 2010; Von Bertalanffy, 1972; Uhl-Bien & Marion, 2011).

This research aims to i) investigate the publication and citation patterns of numerous influential articles on sustainable development in higher education by performing a comprehensive bibliometric analysis.

ii) Examine the contributions and collaborations of specific countries globally in publishing the Top 100 articles on sustainable development in higher education.

iii) Explore the leading journals that cite the top 100 articles on sustainable development in higher education.

## Methodology

The writers have employed bibliometric methodology to track the progression of research in sustainable development in HEIs and determine how it has evolved. Bibliometric analysis is a quantitative method used to assess the growth of existing literature and identify prominent research patterns (Yadav et al., 2023). By utilizing bibliometrics, we can gain a new perspective on the current status and emerging trends in advancing knowledge within a specific field (Luo et al., 2022).

This research aims to identify relevant terminology associated with sustainable development in higher education and use it to search the Scopus database systematically. The search resulted in 1122 scholarly articles published between 2015 and 2023, encompassing a range of international publications. It is important to note that data collection was explicitly confined to 2023, deliberately excluding any data from the subsequent year, 2024. This approach was adopted to ensure that the collected annual data provides a comprehensive and inclusive overview of the state of research in the field throughout an entire year, spanning from January to December.

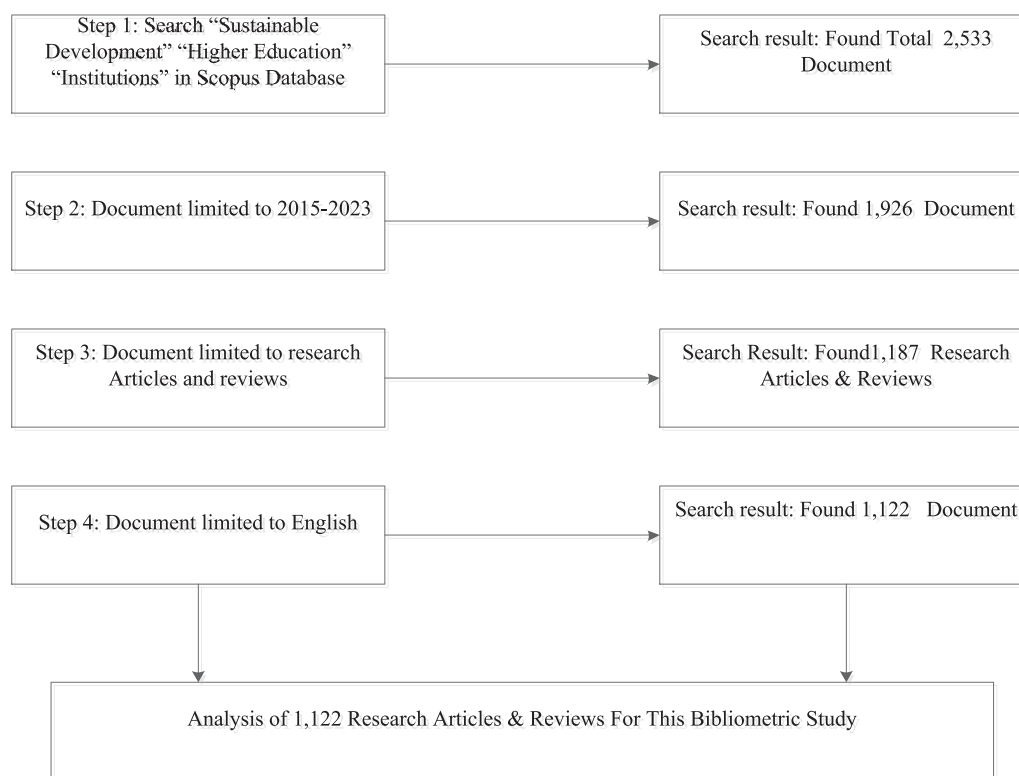
This study explores and analyzes co-authorship patterns within the research community. The analysis focused on individual authors as the units of analysis, and the collaboration network among them was visualized using VOS Viewer. Furthermore, a co-occurrence analysis was conducted to examine the relationships between keywords, employing the complete calculation method. VOS Viewer was again employed to generate a network visualization illustrating the interconnectedness among the keywords.

## Selection of manuscript and data analysis

We can observe the process of document navigation and find a summarized list of documents related to sustainable development in HEIs. The Scopus database, provided by Elsevier Ltd., was utilized for this purpose. Initially, a search was conducted using the keywords 'sustainable development,' 'higher education' and 'institutions', resulting in a total of 2533 documents in the first step. To refine the search, we proceeded to the second step, where the documents were narrowed down to include only those published between 2015 and 2023, leading to a reduced count of 1926 documents. In the third step, we refined the selection by limiting it to research articles and reviews, resulting in a final pool of 1187 documents. To ensure linguistic consistency, the fourth step involved filtering the documents to include only those written in English, leaving us with 1122 research articles and reviews. These 1122 articles and reviews were then subjected to bibliometric analysis using the VOS viewer software. As we demonstrated in Figure 1.

## Cleaning data

After retrieving the data from the SCOPUS database, the researcher exported it as Comma-Separated Values (.csv) files. However, due to limitations on the SCOPUS website, only the complete bibliometric



**Figure 1.** Flowchart of the study selection process.

data for the first 1122 entries could be initially exported. Since the analysis focused on the 100 most-cited articles, only those initial 1122 entries were exported and the remaining entries were disregarded. To ensure the accuracy of the data, the researcher conducted a data cleaning process to identify and eliminate any incorrect or missing entries. Following the data cleaning, the cleaned data was transferred to a separate Microsoft Excel (.xls) file. The new file was saved as a Text (tab-delimited) file for analysis, simplifying its import into the VOS viewer.

## Results and discussions

### *Publications and citations in sustainable development research*

This section describes the results of the bibliometric analysis of the total number of publications and citations at a HEI specializing in sustainable development from 2015 to 2023. The data evinces a consistent augmentation in the total publications, signaling a burgeoning research endeavor in this institution's sustainable development field. The growth of the number of publications has accelerated in recent years. The number of total publications surged from 105 in 2019 to 145 in 2020, and this upward trajectory has persisted in the subsequent years, reaching 263 publications by 2023. This indicates a sustained and intensifying research focus on sustainable development topics at this HEI. Concurrently, the total number of citations has also exhibited an upward trend over the years. Commencing from 1473 citations in 2015, the institution attained a pinnacle of 3745 citations in 2019. However, after this peak, the total citations have experienced a slight decline, reaching 748 citations by 2023. This trend suggests that while earlier publications gained more recognition and impact, recent publications require further visibility and engagement. The decline in citations may be attributed to shifting research interests, emerging methodologies and evolving policy frameworks within sustainable development studies. A deeper exploration into citation trends across journals and regional influences can provide further insights into this phenomenon.

Analyzing publications and citations provides valuable insights into research productivity and influence within this HEI's sustainable development programs. The steadily growing number of publications underscores the institution's commitment to advancing knowledge and solutions in sustainable

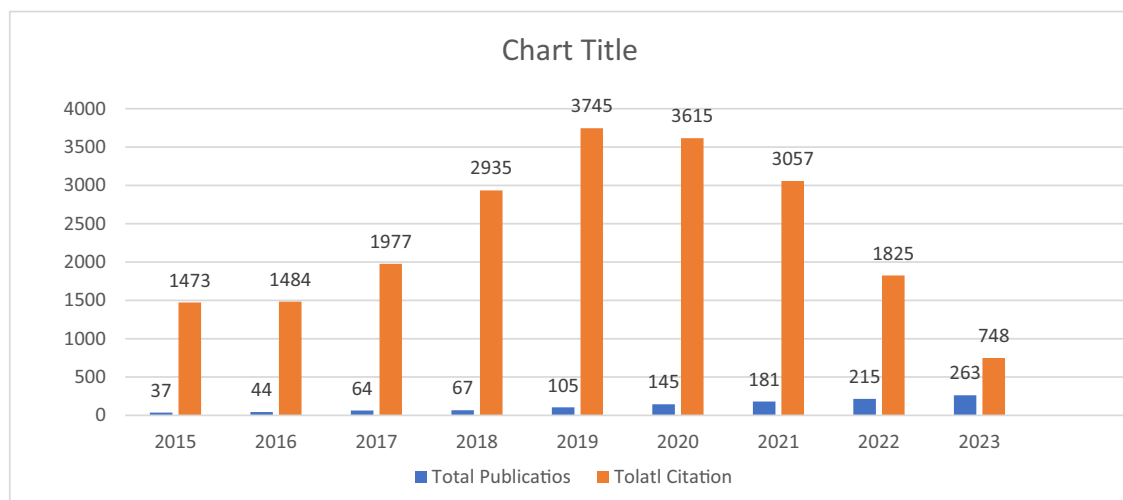
development. However, the discrepancy between the increase in publications and the decline in citation counts raises important questions about research impact. Future investigations should consider interdisciplinary collaborations and innovative dissemination strategies to enhance citation potential (Figure 2).

### *International corporations and contributions*

The authors present the distribution of the top 100 most cited publications in this domain, categorized by the countries of the contributing authors. Recent studies, such as Gardelle (2025), highlight the growing emphasis on interdisciplinary and international approaches to sustainability education, particularly in engineering, where educators increasingly prioritize global collaborations and cross-institutional partnerships to address complex sustainability challenges. The figure focuses on countries with at least 500 contributions to provide a simplified yet comprehensive overview. The data reveals that the United Kingdom has made significantly more significant contributions, with 5450 citations, than other countries. Surprisingly, the United Kingdom has surpassed Spain, the following prominent contender, in the number of citations. The leading countries, the United Kingdom and Spain, account for 9700 citations, indicating their substantial dominance in the highly cited literature on sustainable development within HEIs.

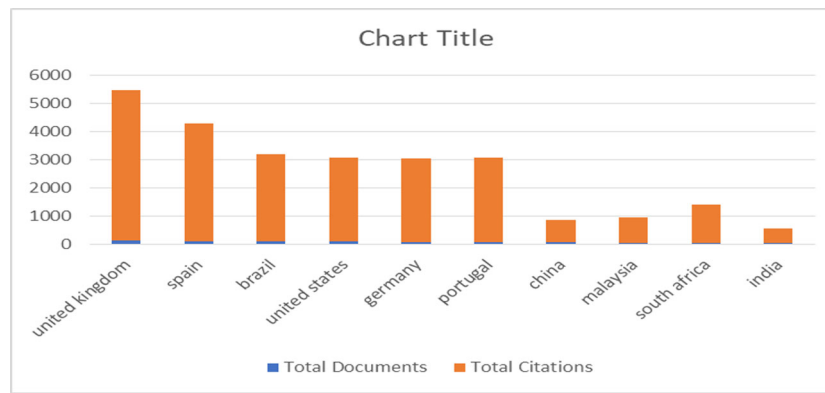
In contrast, the analysis shows that a few countries, such as China, Malaysia and India, have contributed fewer than 1000 publications each. This finding suggests a need for increased research efforts and engagement in sustainable development within HEIs across the globe, particularly in emerging economies and developing regions. Notably, the total number of contributions from all countries exceeds 100 (the number of publications examined in this study), indicating collaborative efforts among the contributing nations. To further enhance global research efforts, initiatives, such as funding programs, academic mobility and interdisciplinary research clusters should be promoted, especially in underrepresented regions. Moreover, we demonstrated the details in Figure 3.

To further explore these collaborative patterns, the analysis utilized VOSviewer and the results are depicted in Figure 4. The findings demonstrate that India and the United Kingdom have collaborated significantly with other countries. The United Kingdom emerges as the top collaborator, with a link strength of 289, followed by Brazil, with a link strength of 219. While Portugal occupies the third position regarding the number of collaborations, Germany surpasses the United States in terms of collaboration strength. Germany's collaboration strength is measured at 188, compared to the United States' 147. These results underline the significance of international research cooperation in generating highly impactful publications on sustainable development within HEIs. Future studies should analyze how collaboration networks influence research quality, knowledge dissemination and policy implementation at the institutional level.

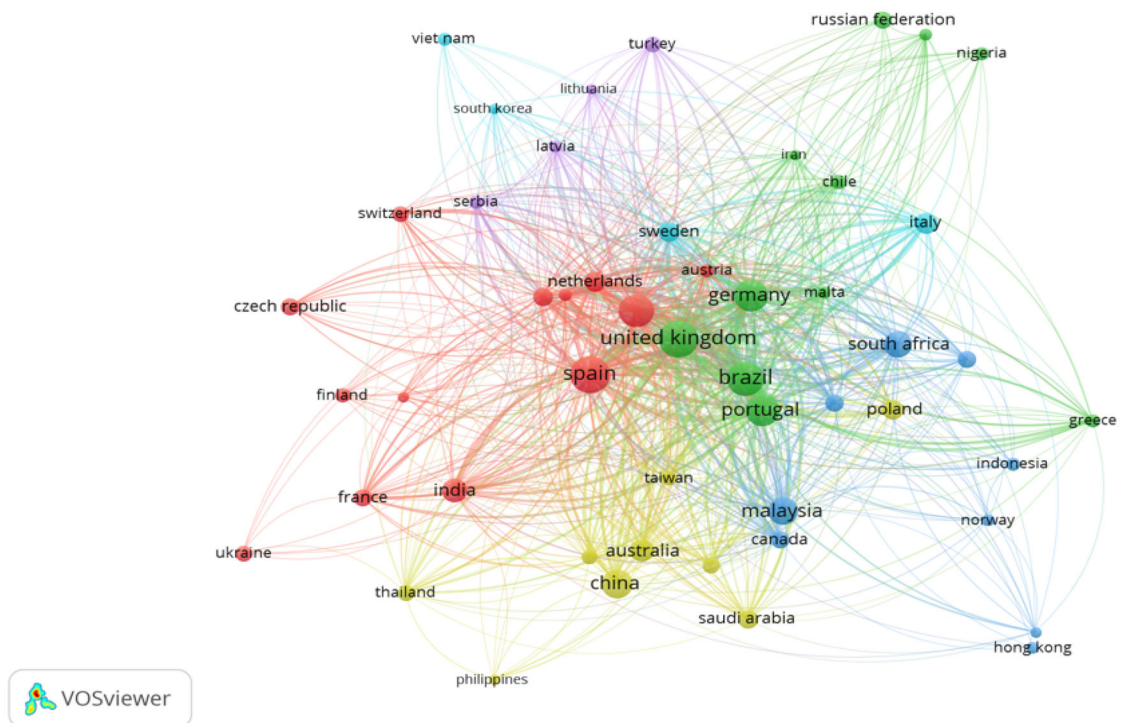


**Figure 2.** Total publications and citations.





**Figure 3.** The contribution of numerous nations.



**Figure 4.** Contribution network of numerous nations.

### Key journals

Table 1 summarizes the top 10 journals in sustainable development research within HEIs, detailing their publication counts, citation metrics and Scimago JR rankings. Notably, nine of the 10 journals are classified as Q1, reflecting their high academic quality and influence. This dominance of Q1 journals highlights the field's reliance on reputable, high-impact platforms for disseminating influential research.

The source-normalized impact per article (SNIP) scores, which measure a journal's citation impact relative to its subject field, further underscore the intellectual influence of these journals. Most journals in Table 1 exhibit SNIP scores above one, with the highest score reaching 2.236. This indicates that articles in these journals consistently exceed the expected citation norms for their subject areas, reinforcing their role as key contributors to advancing sustainable development research in higher education.

These findings emphasize the strategic importance of targeting high-impact journals for future research dissemination. Researchers should prioritize journals with strong thematic alignment to sustainability topics, robust audience engagement and open-access options to maximize visibility and impact.

**Table 1.** Topmost frequently cited sources.

Journal name	TP	TC	CPP	Cite score	SNIP	SJR	PB
Sustainability (Switzerland)	233	4677	20.1	80	1.086	0.672	Multidisciplinary Digital Publishing Institute (MDPI)
International journal of sustainability in higher education	163	3484	21.4	81	1.369	0.83	Emerald Publishing
Journal of cleaner production	107	6439	60.2	90	2.236	2.058	Elsevier
International journal of environmental research and public health	14	207	14.8	83	1.077	0.808	Multidisciplinary Digital Publishing Institute (MDPI)
International journal of sustainable development and planning	12	193	16.1	58	0.637	0.27	International Information and Engineering Technology Association
Frontiers in education	10	72	7.2	34	0.697	0.36	Higher Education Press
International journal of management education	10	435	43.5	83	1.981	1.257	Elsevier
Journal of teacher education for sustainability	9	234	26.0	73	1.404	0.568	Walter de Gruyter
Frontiers in psychology	8	69	8.6	71	1.071	0.8	Frontiers Media SA
Frontiers in sustainability	233	4677	20.1	63	0.585	0.505	Frontiers Media SA

Note: TP: total publications; TC: total citations; CPP: citations per publication; SNIP: source normalized impact per paper; SJR: Scimago journal ranking; PB: publisher

Additionally, leveraging academic social networking platforms can further enhance the published work's reach and citation potential. By aligning with these high-performing journals, researchers can contribute more effectively to the growing knowledge of sustainable development in higher education.

### Keywords

We conducted a research study to determine the main themes explored in the 100 most-cited articles. VOSviewer was utilized to analyze the co-occurrence of phrases, considering both those selected by the authors and those highlighted by the journals. The findings are shown in [Figure 5](#). The information presented in these publications can be categorized into six primary clusters based on the results. These clusters can be ranked by their size, and the most significant keywords within each group include 'sustainable development,' 'higher education,' 'sustainable campus' and 'educational institutions.' The keyword analysis strongly focuses on institutional sustainability efforts, governance and teaching strategies. However, certain emerging areas, such as digital transformation in sustainability education and climate adaptation policies in HEIs, are underrepresented. Future research should address these gaps by integrating interdisciplinary approaches and exploring novel frameworks.

### Citation network

In the analysis, the researchers examined the references cited in the top 100 articles on sustainable development in HEIs to identify any overlaps among the works cited. This analysis was conducted using VOSviewer and bibliometric coupling techniques, and the outcomes are presented in [Figure 6](#). Based on the cited works from the top 100 publications, the results indicate that they can be categorized into five distinct groups. For instance, the red cluster on the bottom represents those who have explored the integration of sustainable development principles within higher education. Similarly, the light green cluster in the top-right corner signifies the application of sustainable approaches in the broader context of educational institutions and systems. The clustering of citations highlights the fragmentation within the field, suggesting that different research strands are developing in parallel without significant cross-referencing. Future research should aim for integrative approaches that combine best practices from various disciplines to bridge this divide. Fostering thematic special issues in journals and organizing interdisciplinary conferences could facilitate more cohesive scholarly discourse.





**Figure 5.** Matching network for the most common keywords.



**Figure 6.** Collaborative network connections among renowned authors.

The significant distance between these two clusters and the limited connections between their respective nodes suggest that the cited works in these groups exhibit dissimilarities in their thematic focus and orientation. This finding implies that the scholarly discourse on sustainable development in HEIs has not been fully integrated with the broader research on sustainability in educational settings. Addressing this gap requires a more concerted effort in cross-disciplinary collaborations and institutional knowledge-sharing practices.

## Conclusions

The study reveals a significant increase in international publications on sustainable development within HEIs, with the United Kingdom leading by contributing 137 documents. This trend underscores the growing recognition of sustainability in higher education as a vital research area. The bibliometric analysis highlights various research opportunities for universities, regulatory bodies and scholars. However, a notable gap exists in comprehensive bibliometric studies examining the holistic progression of sustainable development research in HEIs, particularly regarding integrating different SDGs into curricula and institutional policies. Future research should focus on embedding sustainability into interdisciplinary programs, evaluating the effectiveness of faculty development in sustainability education and exploring the role of digital technologies in disseminating sustainable development knowledge among students.

Additionally, while developed countries dominate current publications, there is a lack of in-depth analysis on the barriers hindering emerging nations from contributing more substantially. Addressing challenges, such as limited financial resources, inadequate policy support and insufficient research infrastructure is crucial. HEIs in emerging economies are essential in tackling local sustainability issues like climate change adaptation, resource management and social equity. Enhancing international collaboration, providing funding opportunities and promoting open-access initiatives can empower scholars from underrepresented regions, leading to a more inclusive global perspective on sustainable development in higher education. Furthermore, incorporating qualitative assessments and examining regional disparities in sustainability research will offer a more nuanced understanding of sustainable development within HEIs.

## Limitations

One of the critical limitations in the current bibliometric research on sustainable development in HEIs is the reliance on a single database, namely SCOPUS. While SCOPUS is a reputable and widely used source, neglecting other databases, such as Dimensions, PubMed and Web of Science could yield different results. Incorporating data from a combination of these databases could provide a more comprehensive perspective on the research landscape in this field. Additionally, the analysis was restricted to the top 100 most-cited articles, which may not capture the complete spectrum of research on sustainable development in higher education. The outcomes and insights could have been significantly different had the researchers considered all the articles obtained in the initial search.

Furthermore, while the study effectively highlights publication trends, it lacks a critical discussion on the underlying drivers of this growth and their broader implications for sustainable development in HEIs. Identifying such drivers, including global policy shifts, funding mechanisms or institutional strategies, could enhance understanding these trends. This omission underscores the need for a deeper exploration of causative factors in future research. Acknowledging these limitations when interpreting the study's conclusions is crucial. Future research in this domain should explore additional sources of information, such as book chapters in edited volumes and conference proceedings. Examining these alternative publication outlets has the potential to generate different understandings and uncover nuances in the field of sustainable development within HEIs.

## Ethics statement

This study did not include any human participants, animals, or personal information that would require ethical approval. Because it is a bibliometric analysis of existing literature, the study followed all ethical data usage and publication norms. All data sources were made publicly available or accessed through licensed databases, and academic standards correctly attributed the original authors and publications.

## Disclosure statement

The authors state no conflicts of interest in publishing this research. The findings and interpretations reported in this study are based on objective analysis, and no personal or financial link might have impacted the study's conclusion.

## About the authors



**Mohamed Ali Osman** work as an administrative assistant and a mathematics and physics lecturer at SIMAD UNIVERSITY's Faculty of Education. The research areas include quality education, educational technology and STEM education. <https://orcid.org/0000-0002-3320-8786>



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The research team specializes in higher education sustainability, focusing on bibliometric analysis, policy integration, and data-driven decision-making. Mohamed Ali Osman oversaw the study's conceptualization, methodology and data curation and used VOSviewer for bibliometric mapping. Abdirahman Ahmed Sheikh Farah offered critical supervision, project management and manuscript assessment. Abdirahman Ibrahim Abdi helped with data analysis and visualization while also securing funds for the project. Their combined study seeks to examine global trends in sustainability education and guide institutional policy for incorporating sustainability into curricula. This study is part of a more extensive program to improve information distribution, international collaboration and evidence-based solutions for sustainable education. Their work helps universities, politicians, and educators design sustainable education frameworks that match with global development goals by identifying gaps and major contributors. Their findings contribute to global conversations about how higher education may play a more significant role in promoting sustainability.

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## Data availability statement

The data that support this study's findings are available from the Scopus database, but restrictions apply. The data were used under license for this study and are not publicly available. However, access to the data can be obtained directly from Scopus upon request. The bibliometric analysis was conducted using the VOSviewer software, which is openly available for academic use.

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