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## *Mapping the Evolution and Intellectual Influence of SDG Scholarship in Higher Education: Bibliometric Insights into Patterns, Networks, and Future Directions*

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**Abstract:** *This study conducts a comprehensive bibliometric analysis of Sustainable Development Goals (SDGs) research in higher education, focusing on the intellectual, conceptual, and thematic evolution of the field. Data were retrieved from the Scopus database for 2015–2025, yielding a final sample of 200 publications after systematic screening using the PRISMA framework. Bibliometric analysis was carried out through Biblioshiny (R Bibliometrix package), incorporating performance indicators such as publication trends, citation impact, authorship productivity, and country contributions, along with scientific mapping techniques including keyword co-occurrence, thematic mapping, thematic evolution, and collaboration networks. Findings indicate a sharp rise in SDG-related research after 2018, reflecting growing institutional and policy commitment to the 2030 Agenda. A small group of core journals and productive authors shape the field's intellectual structure, while collaboration networks reveal a globally connected research community. The study also highlights gaps, including the need for longitudinal impact assessment, stronger cross-regional partnerships, improved governance evaluation, and integration of digital transformation perspectives.*

**Keywords:** *bibliometric analysis, Sustainable Development Goals, higher education, sustainability, education for sustainable development.*

## I. INTRODUCTION

Over the past two decades, escalating concerns over climate change, social inequality, ecological degradation, and economic volatility have compelled governments, institutions, and global organizations to rethink conventional development models. The realization that social justice and environmental preservation are essential to economic growth led to the formulation of sustainable development as a key tenet of international policy (United Nations, 2015). By introducing the Sustainable Development Goals (SDGs) as an integrated framework for tackling the world's most pressing issues in a cogent

and indivisible way, the 2030 Agenda for Sustainable Development formally institutionalized this paradigm (UNDP, 2023). With 17 interconnected goals and 169 targets, the Sustainable Development Goals (SDGs) seek to end poverty, lessen inequality, advance high-quality education, guarantee gender parity, safeguard the environment, and create inclusive and peaceful institutions.

In contrast to previous development methodologies, the SDG framework recognizes clearly the interconnectedness of social, economic, and environmental systems, necessitating concerted efforts across all societal sectors and levels of governance (United Nations, 2015). As a result, sustainable development is now a multifaceted agenda focused on institutional accountability, innovation, and long-term societal resilience rather than just being an environmental issue. As a result of this change, higher education is now a key component of sustainable development. A special place is held by Higher Education Institutions (HEIs), which produce scientific knowledge, develop future leaders, impact public opinion, and promote evidence-based policies (Serafini et al., 2022; Bui et al., 2024). Through the integration of SDG concepts into governance frameworks, research goals, curriculum, and campus operations, universities are increasingly serving as laboratories for sustainability in addition to their position as instructional institutions (Jungbadoor et al., 2025). In this way, HEIs are active participants in the SDGs' implementation rather than only disseminating sustainability ideals.

Scholarly interest in SDG integration in higher education and Education for Sustainable Development (ESD) has grown significantly in response to this change. A significant increase in publications since 2018 is indicated by bibliometric data, indicating the consolidation of this discipline as a separate study area (Pedraja-Rejas et al., 2023; Tafese & Kopp, 2025). The expansion of the literature has not, however, been matched by a proportionate topic balance; economic and environmental aspects predominate, while social inclusion, equity, governance, and well-being continue to be relatively underdeveloped. There is also conceptual fragmentation in research on SDG implementation in HEIs, with many studies concentrating on discrete topics such as sustainability governance, curriculum reform, stakeholder engagement, or institutional reporting. The comprehensive integration of SDGs across education, research, and operational systems has only been partially explored in the literature (Alfathy et al., 2024; Leal Filho et al., 2024). This makes it more difficult to see the main research gaps, the development of SDG study, and its philosophical framework.

Variations in institutional agendas, governance frameworks, resource endowments, and policy settings also influence the adoption of SDGs in universities, according to review-based studies (Alfathy et al., 2024; Jungbadoor et al., 2025). Although these studies offer insightful conceptual information, they hardly ever provide systematic mapping of publishing trends, citation impact, cooperation patterns, and thematic evolution—all of which are critical components in comprehending a research field's knowledge architecture (Kaloutsa et al., 2025). SDG-aligned assessment tools and multi-criteria evaluation frameworks are two recent methodological advancements that have improved the measurement of institutional sustainability (Jungbadoor et al., 2025; Kaloutsa et al., 2025). However, these advancements focus more on practice and performance than on the global research structure of SDG scholarship in higher education.

This gap is filled by bibliometric analysis, which uses quantitative methods to find collaboration structures, citation networks, publication trends, and keyword co-occurrences in vast amounts of literature (Donthu et al., 2021; Ellegaard & Wallin, 2015). As a result, the current study uses bibliometrics to analyze the evolution of the scholarly literature on the SDGs in higher education. According to Blanco-Mesa et al. (2017), the analysis exposes the structure and growth of this subject and indicates emerging research avenues by analyzing publication outputs, citation dynamics, intellectual underpinnings, and theme trajectories.

This study's main goal is to present a thorough bibliometric synthesis of SDG research in higher education by identifying significant contributions, mapping out themes, and evaluating scholarly impact. Even though earlier research has looked at sustainability and education from a variety of angles, there hasn't been any bibliometric research specifically focused on SDGs

in HEIs. This paper fills that knowledge gap by providing an evidence-based summary of the history, present state, and future prospects of SDG scholarship in higher education.

### Research Questions

1. Which authors, institutions, countries, and journals have been the most prolific and influential in advancing research on the Sustainable Development Goals (SDGs) in higher education, as reflected through publication output, citation impact, and productivity indicators?
2. What are the key intellectual foundations and thematic structures of the literature on the Sustainable Development Goals (SDGs) in higher education, and how have these themes evolved over time, as revealed through co-citation analysis, keyword co-occurrence, and thematic clustering?

To address these questions, the study employs a bibliometric research design structured around two core dimensions: performance analysis and scientific mapping. Performance analysis evaluates scholarly productivity and impact through citation metrics, author contributions, institutional affiliations, and journal outputs. Scientific mapping uncovers the conceptual and thematic landscape of the field using co-citation networks, keyword co-occurrence, and thematic evolution analysis. Together, these techniques provide a systematic and comprehensive understanding of how SDG research in higher education has developed and where future scholarly inquiry should be directed.

## II. LITERATURE REVIEW

### 2.1 Intellectual and Behavioral Foundations of Sustainability in Higher Education

Early research examined how environmental knowledge influences sustainability attitudes and behaviors in higher education. Despite encouraging positive attitudes, foundational research indicates that information alone rarely guarantees long-lasting behavioral change (Vicente-Molina et al., 2013). Subsequent research placed sustainability behavior into a larger socio-psychological framework by incorporating psychological concepts as self-efficacy, perceived behavioral control, and subjective standards (Liu et al., 2018).

Further, empirical studies show that perceived agency, biospheric values, sustainability literacy, and institutional support all enhance the transformation of attitudes into quantifiable action (Hastuti et al., 2024; Sehar et al., 2025; Maulana et al., 2025). Key moderating elements include campus infrastructure, peer influence, leadership commitment, and institutional atmosphere (Maleki et al., 2025; Correia et al., 2022; Yuriv, 2020). While ethical responsibility emphasizes the normative aspect of sustainable behavior, universities that are conceived as "living laboratories" encourage experiential participation (Leal Filho et al., 2018; Yu et al., 2017). (Tamar et al., 2021). The behavioral and conceptual underpinnings of SDG-related scholarship in higher education are established by this stream taken together.

### 2.2 Institutional Governance, Research Alignment, and SDG Implementation

As sustainability discourse evolved, research shifted from individual behavior to institutional implementation of the SDGs. Curriculum integration, research alignment, governance systems, and stakeholder involvement all acknowledge higher education institutions as key players (Ankareddy & Dorfleitner, 2025; Leal Filho et al., 2025). SDG outcomes are strengthened by extracurricular activities, research-policy alignment, and open governance frameworks (Nassar et al., 2025; Filho et al., 2024; Rossikhina & Rossikhin, 2025).

Comparability across institutions is, however, limited by disparities in sustainability reporting and measurement systems (Caputo et al., 2021). To improve organized monitoring and implementation, discipline-specific integration techniques and context-sensitive evaluation systems are suggested (Handayani and Anggara, 2024; Angelaki & Karvounidis, 2023). The SDGs' operationalization and shift toward institutional responsibility are reflected in this body of work.

### 2.3 Structural Gaps and the Need for Systematic Mapping

Despite growing institutional commitment to the 2030 Agenda, structural fragmentation persists. Universities often lack unified SDG research frameworks, resulting in discipline-specific and fragmented efforts (Mori Junior et al., 2019; Fia et al., 2022). It is still possible to see gaps between policy commitments and quantifiable results (Caputo et al., 2021). Integration of SDGs is further hampered by low institutional support, limited finance, and low awareness (Mawonde & Togo, 2021; Mawonde & Togo, 2019).

According to Bidarbakhtnia (2019), Griebeler et al. (2021), and Martinis et al. (2024), framework-driven approaches prioritize multi-stakeholder involvement, inclusive indicators, and organized monitoring tools in order to improve accountability. Research visibility and societal relevance are increased when external stakeholders collaborate (Hong et al., 2022; Raimo et al., 2024). Uneven production and theme fragmentation, however, continue to exist (Mawonde et al., 2019; Raimo et al., 2024; Caputo et al., 2021).

Although previous studies offer valuable conceptual and empirical understandings, the literature is still scattered. Productivity, intellectual structure, collaboration patterns, and topic evolution in SDG research in higher education must thus be systematically evaluated using a bibliometric research approach that combines scientific mapping and performance analysis.

## III. RESEARCH METHODOLOGY

This study employs a bibliometric analysis by utilizing the Scopus database for data collection. The analysis is conducted using R software through the Biblioshiny interface of the bibliometrix package (version 4.4.3).

### 3.1 Database for Retrieving Articles

This study utilizes **Scopus** as the primary data source due to its extensive coverage of peer-reviewed literature, rigorous indexing standards, and established credibility in academic research. Scopus is recognized for its extensive database and strong citation tracking features, both of which facilitate excellent bibliometric analysis. One of the most reputable and popular bibliographic databases in the academic world, according to Prancutè (2021), is Scopus, which provides trustworthy information on research performance and intellectual influence (Burnham, 2006). A comprehensive search was conducted using the following search string in the Scopus database: **TITLE-ABS-KEY ("education for sustainable development" OR "sustainable development goals") AND ("higher education" OR "higher education institutions") AND (implementation OR integration)**.

Initially, **1,202 documents** were identified from the Scopus database. After limiting the publication period to **2015–2025**, the dataset was refined to **1,145 documents**.

This period was selected because scholarly publications on education for sustainable development and SDG implementation in higher education began to gain consistent visibility in Scopus from 2015 onward.

### 3.2 Technique Used for Filtering Out Data

The **PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)** approach was adopted to ensure a transparent and systematic process for identifying, screening, and selecting relevant documents for bibliometric analysis (Figure 1). Initially, 1,202 records were pulled from the Scopus database. The following predetermined inclusion criteria were used to filter these records: language (English), publication stage (final), subject area, document type (articles and reviews), and publication year (2015–2025). After screening by subject area, the dataset was further reduced to 958 documents, of which 397 were in environmental science and 856 were in social sciences. A further document type filter produced 707 documents (653 articles and 54 reviews). Following the publication stage, 648 papers were kept. 609 documents remained after restricting the dataset to English-language publications. To determine their applicability to teaching for sustainable development and SDG implementation in higher education, titles and abstracts were examined in the second screening stage. 365 of the 609

records were kept beyond this phase. 165 articles were eliminated after these were subjected to full-text analysis. When the bibliometric review was finished, 200 studies were included.

### 3.3 Software Used for Analysis

This study employed **Biblioshiny**, the web interface of the **Bibliometrix R package (version 4.4.3)**, for bibliometric analysis (Lajeunesse, 2016). Biblioshiny is a widely used tool that enables advanced bibliometric analysis without the need for coding, offering an intuitive interface for researchers (Linnenluecke et al., 2020). It facilitates the import of data from well-known databases like Scopus, enabling multifaceted study of theme evolution, authorship, documents, and sources. By using visualizations like co-authorship networks, keyword co-occurrence, theme maps, and cooperation networks, the tool makes it easier to map the conceptual, intellectual, and social structures of a research topic visually. Its capacity to examine and display subject development, citation patterns, author productivity, and publishing trends makes it a strong platform for thorough performance analysis and literature review.

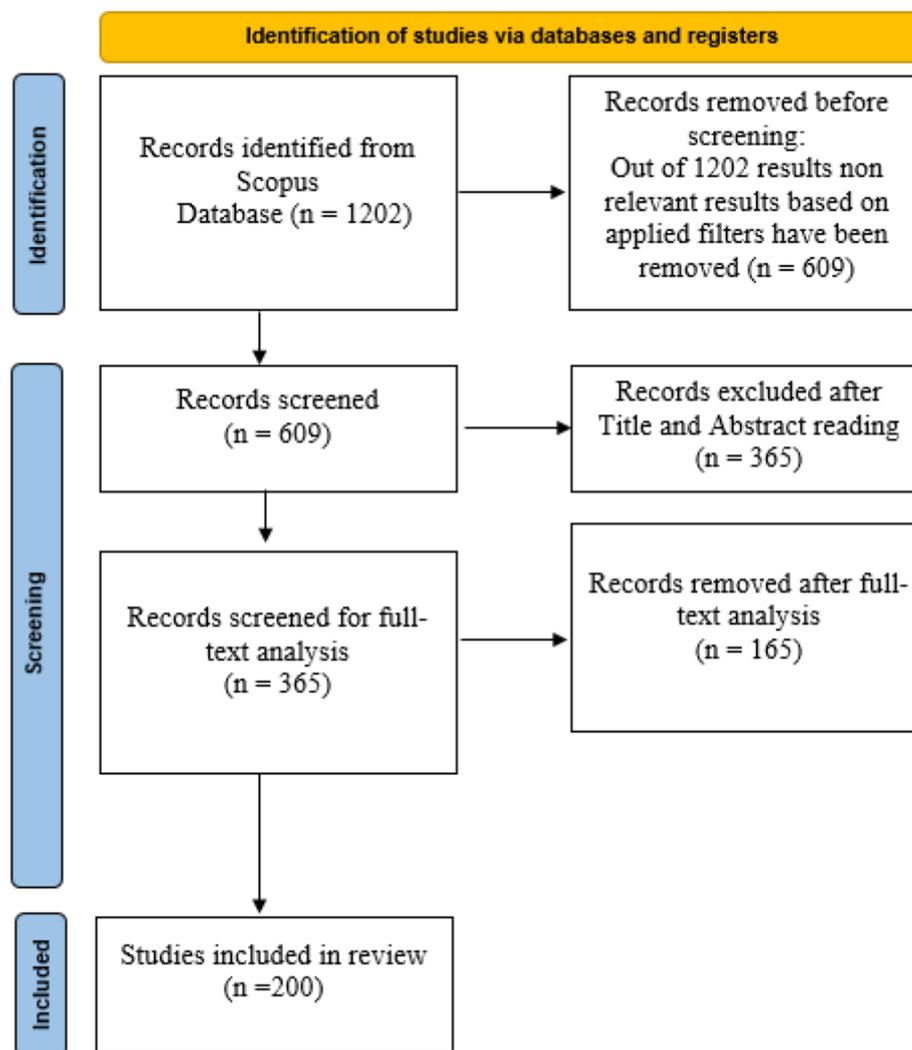


FIGURE 1: The process of collecting and filtering the data.

## IV. RESULTS AND DISCUSSION

This part shows the results of the bibliometric analysis that was done with Biblioshiny (R-Studio) on a group of literature that Scopus has indexed. The data are systematically analyzed to ascertain publishing trends, citation patterns, principal sources, and emerging thematic frameworks.

#### 4.1 Primary Information from the Scopus Database



FIGURE 2: Primary information from the Scopus database. Source: By Biblioshiny using R Studio.

Figure 2 Presents the key research metrics extracted from the Scopus database (2015–2025), summarizing publication trends, author collaboration patterns, and research impact in the domain of SDGs and higher education. This figure aids in understanding the collaborative structure of the subject, assessing the impact of publications, and tracking the increase of scholarly production. It gives scholars, researchers, and policymakers a concise and organized summary that they may use to evaluate new developments and the general progress of this field of study. Between 2015 and 2025, 200 documents from 69 sources were published, with 685 authors contributing, as shown in Figure 2. The literature is quite recent and in line with current sustainability discourse, as indicated by the average document age of 3.62 years and the average number of citations per document of 36.98, which indicates good academic impact. The 34.24% yearly growth rate is indicative of the fast growing scholarly interest in SDGs in higher education. A strong collaborative research culture is also highlighted by the data, which show an average of 4.01 co-authors per document and only 10 single-authored publications. A significant degree of cross-border research collaboration is indicated by the fact that international co-authorship appears in about 33.5% of the articles. SDGs and higher education research are rising dynamically, with increasing academic impact and worldwide participation, as the chart illustrates overall.

#### 4.2 Performance Analysis

Performance analysis examines the scholarly output and impact of authors, institutions, and countries using bibliometric indicators such as total publications, authorship contributions, and citation metrics. The most productive and significant contributions to the subject of SDGs and higher education can be identified according to this analytical technique, which also offers insights into academic visibility, publication trends, and collaboration patterns (van Raan, 2014).

Citation metrics use the frequency and distribution of citations to assess academic influence and research effect, whereas publication metrics show the volume of research output and the degree of collaborative involvement (Donthu et al., 2021). In the context of the SDGs and higher education, these metrics collectively offer a systematic evaluation of research output and intellectual contribution.

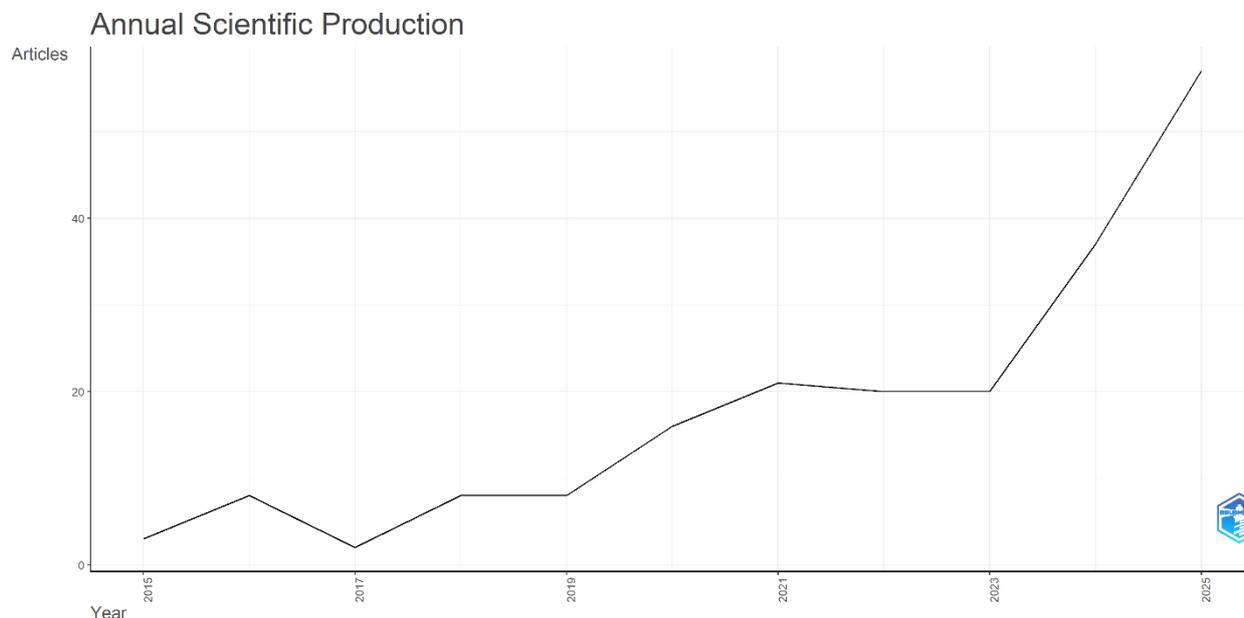


FIGURE 3: Annual scientific production. Source: By Biblioshiny using R Studio.

**Figure 3** illustrates the annual scientific output, showing how research on the Sustainable Development Goals (SDGs) in higher education has evolved over time. The early stage of scholarly activity, which lasted from 2015 to 2017, shows a moderate amount of publication activity, with yearly production staying below 10 documents. Conceptual conversations and early institutional responses started to develop during this period, which is representative of the exploratory stage of SDG-focused higher education research. There has been a steady rise in publishing production since 2018, which suggests that academics are becoming more interested in bringing higher education institutions into line with the global SDG agenda. After 2019, the increasing trend becomes more noticeable and lasts until 2021. Publication levels level out at about 20 papers annually between 2022 and 2023, indicating a period of consolidation and ongoing intellectual activity in the field. There is a notable uptick that starts in 2024 and peaks sharply in 2025 with around 55 publications. This significant increase demonstrates increased scholarly impetus and the more thorough institutional integration of SDGs into research in higher education. All things considered, the publishing trend shows a distinct shift from a new field of study to one that is quickly growing and becoming more institutionalized.

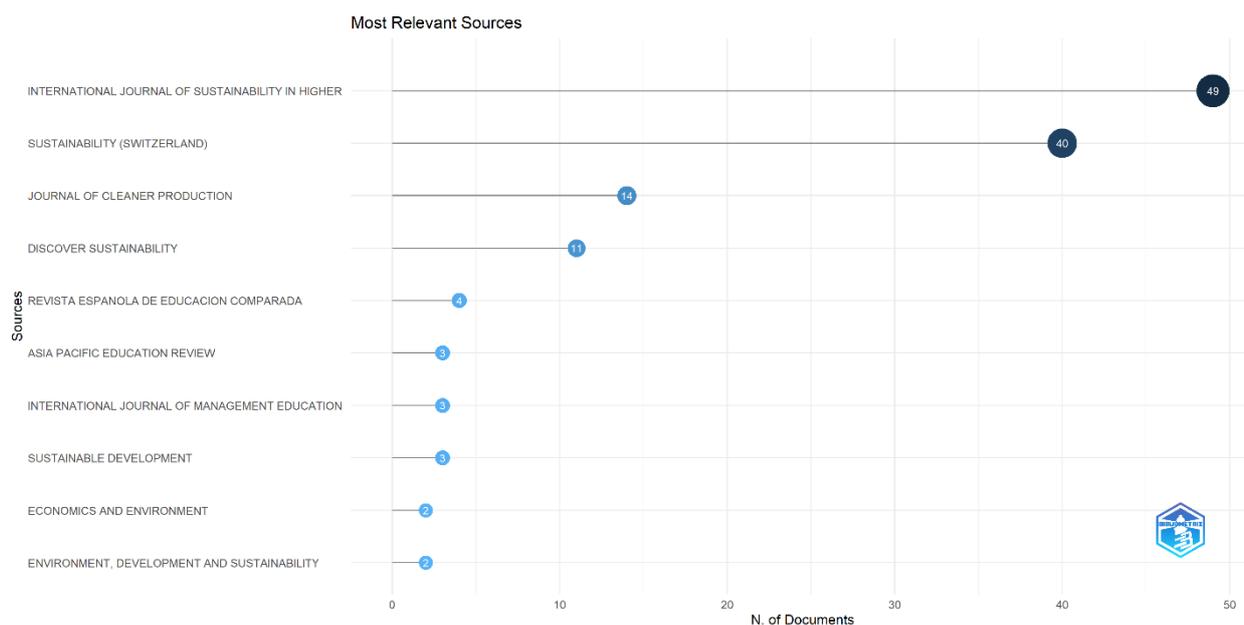


FIGURE 4: Most relevant sources. Source: By Biblioshiny using R Studio.

**Figure 4** shows that the primary journals of higher education research on the Sustainable Development Goals (SDGs) are identified by the distribution of the most pertinent sources. The International Journal of Sustainability in Higher Education is the most active publication, with 49 publications (Figure 4). In academic settings, its prominence underscores its critical role in fostering sustainability-focused research. Sustainability follows in second with 40 papers, and the Journal of Cleaner Production contributes 14 articles, indicating their significant engagement with research themes connected to the SDGs. These journals collectively help to ground the field's intellectual underpinnings by connecting the debate on environmental sustainability with higher education studies. Discover Sustainability, Revista Española de Educación Comparada, Asia Pacific Education Review, and the International Journal of Management Education have contributed more to the literature as its multidisciplinary scope broadens to encompass educational policy, institutional strategy, and sustainability governance. Larger publications allow for thematic extension in SDG-focused higher education research, whereas a small number of prestige journals shape scholarly conversation. Combined with its diversity, the source structure provides a comprehensive view of the publication environment.

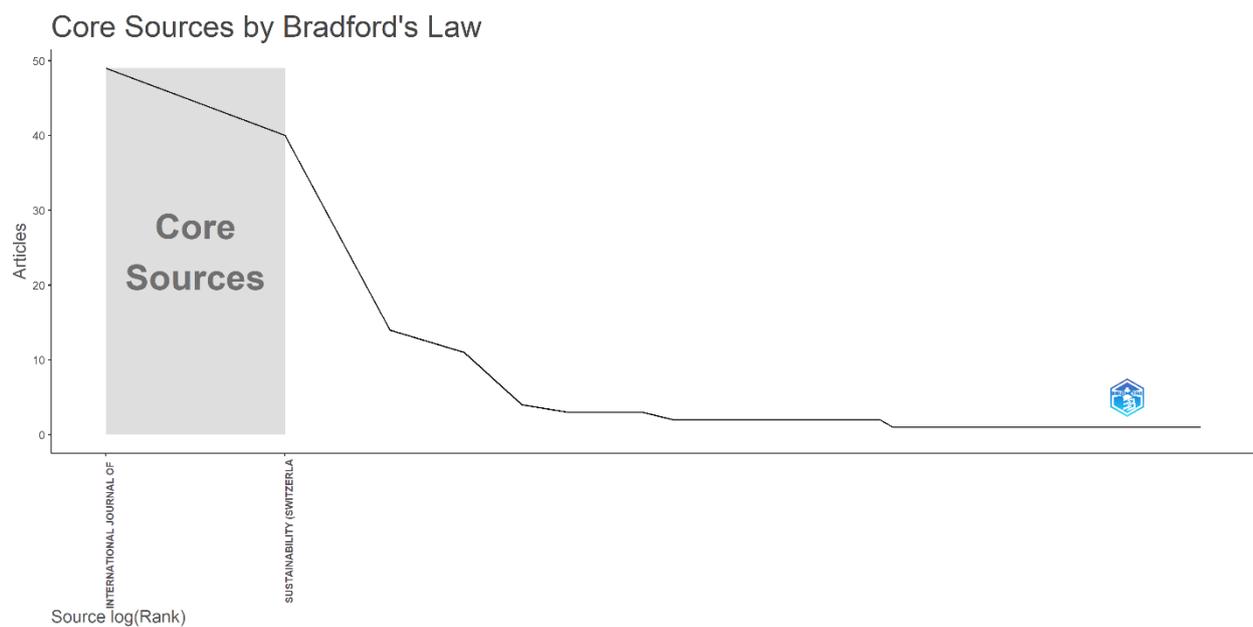


FIGURE 5: Bradford's law. Source: By Biblioshiny using R Studio.

**Figure 5 illustrates how scientific literature is distributed according to Bradford's Law by ranking journals based on their productivity on a central research topic and dividing them into successive zones with a comparable number of articles, typically following the ratio 1: n: n<sup>2</sup> (Brookes, 1969; de Souza et al., 2019).** The Bradford plot shows that a small number of journals account for a small portion of the published material on the Sustainable Development Goals (SDGs) in higher education. This pattern confirms the existence of the concentrated core zone in the dataset. One of the primary sources for this analysis is the International Journal of Sustainability in Higher Education and Sustainability, which has the most publications overall. These journals are regarded as the most significant platforms for exchanging research and encouraging scholarly involvement in higher education studies that focus on the SDGs since they serve as the center of academic communication in the subject.

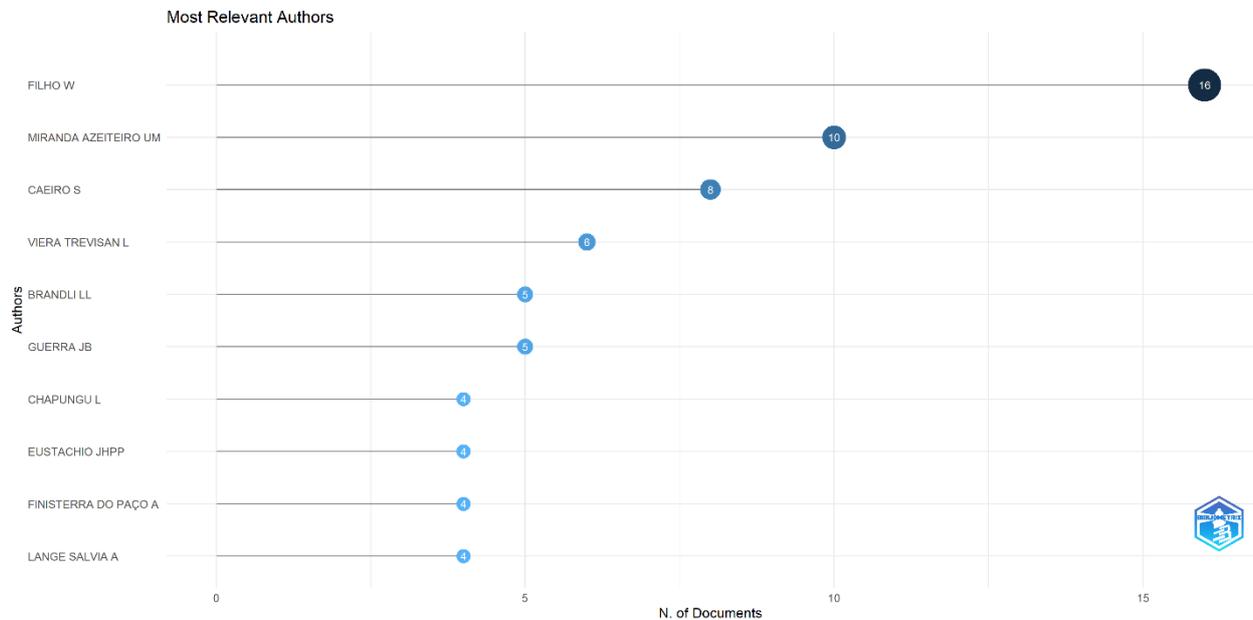


FIGURE 6: Most relevant authors. Source: By Biblioshiny using R Studio.

Figure 6 presents the most prolific authors in the research domain based on total publication count. With 16 articles, Filho W is by far the most prolific writer, exhibiting a steady and notable commitment to advancing the field's study. Caeiro S's eight publications and Miranda Azeiteiro UM's ten publications show consistent scholarly activity. Other notable contributors include Guerra JB, Brandli LL, and Vieira Trevisan L. Their consistent writing patterns and continuous intellectual commitment are demonstrated by their five or more publications. The four publications written by the other authors—Chapungu L, Eustachio JHPP, Finisterra do Paço A, and Lange Salvia A—show a consistent group of active researchers. The overall authorship distribution shows a small but expanding research community where a few highly productive scholars play a critical role in shaping the intellectual development of the topic.

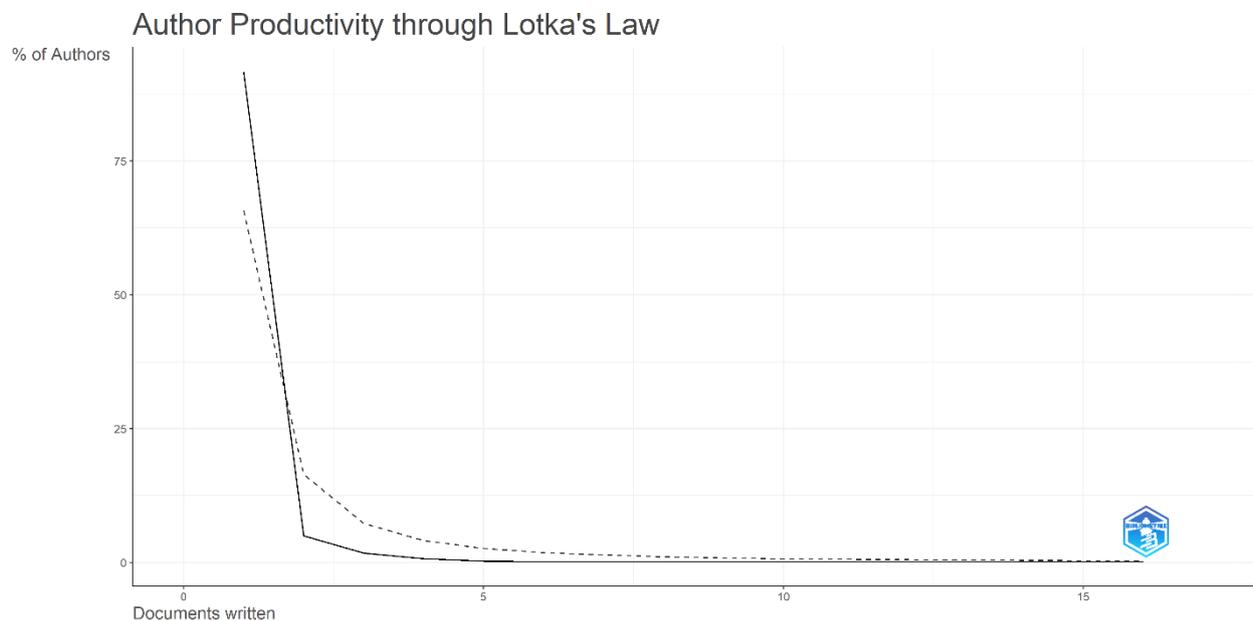


FIGURE 7: Lotka's law. Source: By Biblioshiny using R Studio.

Figure 7 illustrates the application of Lotka's Law in the context of SDG-focused higher education research. Lotka's Law characterizes author production in scientific publishing as follows: a large proportion of authors contribute only one publication, whereas a tiny percentage produce a disproportionately high number of publications (Alvarado et al., 2002; de Souza et al., 2019). In established research domains, an inverted power distribution pattern is typical. The theoretical Lotka curve closely reflects the productivity distribution of authors in higher education with respect to the Sustainable Development Goals (SDGs). Very few authors have published five or more publications, whereas the vast majority have only written one.

Because it matches the expected bibliometric model, the observed pattern validates Lotka's principle in the dataset. This glaring discrepancy implies that a small group of highly successful researchers have a significant impact on all research output. Core contributors play an important role in shaping theoretical growth and guiding scholarly debate in higher education research that is centered on the SDGs in academic domains that are structured and continuously changing.

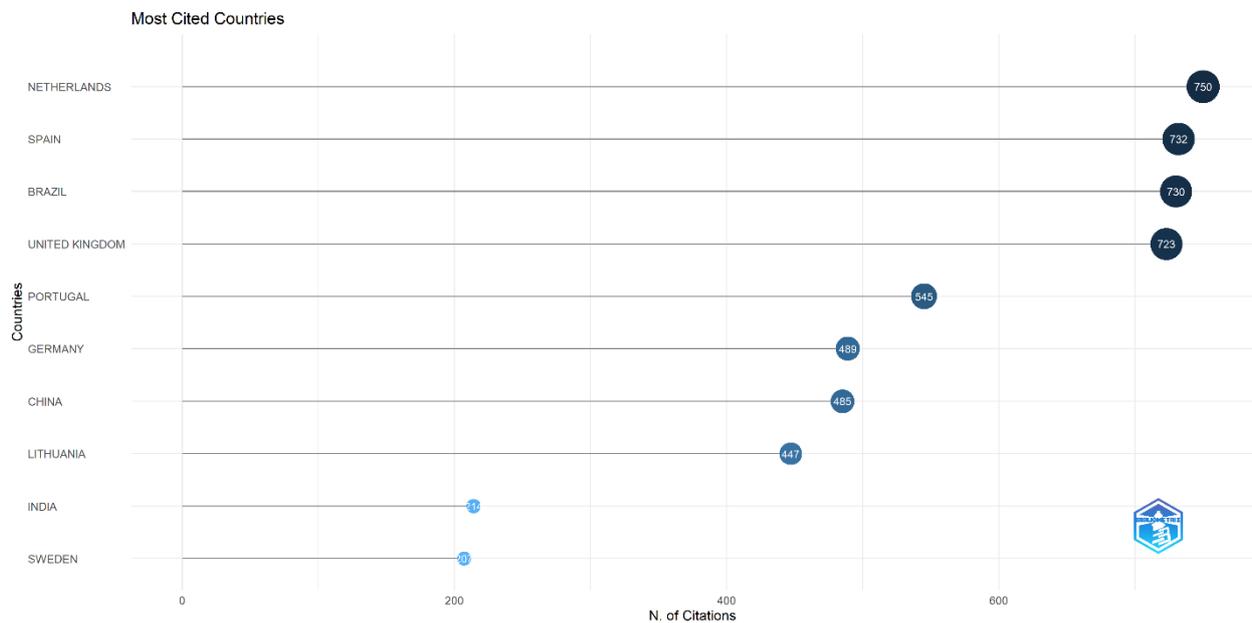


FIGURE 8: Most cited countries. Source: By Biblioshiny using R Studio.

**Figure 8** demonstrates the geographical distribution of scholarly influence in the field of Sustainable Development Goals (SDGs) in higher education through the analysis of the most cited countries. With 750 citations, the Netherlands is the most influential country, as Figure 8 illustrates, underscoring the prominence and scholarly importance of its research contributions. Strong participation from the European and Latin American academic community is demonstrated by the close following countries: Spain (732 citations), Brazil (730 citations), and the United Kingdom (723 citations). Notable citation performances are also shown by Portugal (545 citations), Germany (489 citations), and China (485 citations), indicating their significant contributions to the advancement of SDG-related higher education research. Further evidence of the worldwide reach of influential scholarship in this field comes from further contributions from Sweden, Lithuania, and India. All things considered, the distribution of citations shows a highly scattered but organized worldwide research environment, with a number of nations significantly advancing the area. This trend demonstrates that SDG-focused higher education research is influenced by numerous academic groups rather than being limited to a specific geographic area, thereby reaffirming its global reach and multidisciplinary significance.

### 4.3 Scientific Mapping

Science mapping enables the visualization and analysis of the intellectual structure and evolution of a research field. It uses a number of methods, such as co-citation analysis to find influential publications, bibliographic coupling to connect related documents, co-word analysis to look at thematic connections, co-authorship analysis to evaluate collaborative networks, and citation analysis to find influential publications (Deng et al., 2021; Donthu et al., 2021). The conceptual and social dynamics of scientific knowledge are shown by the network visualizations produced by these techniques used together (Baker et al., 2020; Tunger & Eulerich, 2018).

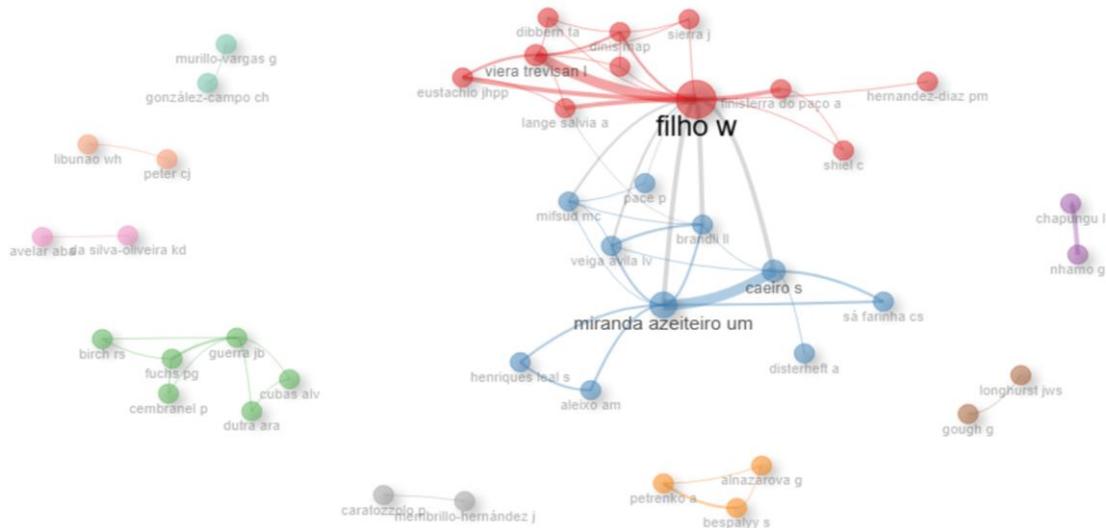


FIGURE 9: Co-authorship analysis. Source: By Biblioshiny using R Studio.

An analysis of co-authorship looks at how two or more authors work together to develop scientific knowledge. Finding intellectual linkages is made possible by the quantity and caliber of collaborative publications. Figure 9 illustrates the co-authorship network for the Sustainable Development Goals (SDGs) in higher education. The graphic's nodes represent the many authors, while the connecting lines depict the collaborative bonds created by co-writing papers. Various author clusters may be seen in the network topology, suggesting that some solid research groups have emerged. A small number of writers occupy important positions within the network, indicating a higher level of connection intensity and a broader level of collaboration. By creating links between different subgroups and encouraging conceptual coherence within the field, these important actors facilitate knowledge dissemination. Concurrently, several smaller clusters and dyadic partnerships are discernible, suggesting focused collaboration among certain academic communities. It appears that certain writers' research contributions are rather specialized or isolated because they are positioned at the perimeter and have few links. A few major groups shape the research landscape, whereas peripheral clusters are less linked. Overall, the co-authorship structure demonstrates a pattern of collaboration that is somewhat broken but relatively connected. This distribution reflects an increasingly collaborative structure in higher education research that focuses on the SDGs.



FIGURE 10: Co-occurrence of authors' keywords. Source: By Biblioshiny using R Studio.

Co-occurrence analysis examines at the frequency with which writers' keywords follow one another in the literature on SDGs and higher education. The research in this topic is organized thematically, as illustrated by the keyword co-occurrence network in Figure 10. As the primary nodes in the network, "sustainability," "sustainable development," "higher education," and "sustainable development goals (SDGs)" exhibit their superiority in establishing the sector. Due to the focus on the pedagogical and institutional integration of SDGs, the term "higher education" is intimately linked to ideas such as curriculum, instruction, students, and institutions of higher learning. Strong ties to "sustainability," as defined by the 2030 agenda, quality education, and education for sustainable development, demonstrate alignment with global policy frameworks. Emerging terminology on the periphery of the area hint at shifting research priorities. Apart from steadily expanding subject areas, the co-occurrence network exhibits a strong conceptual foundation centered on SDGs and higher education.

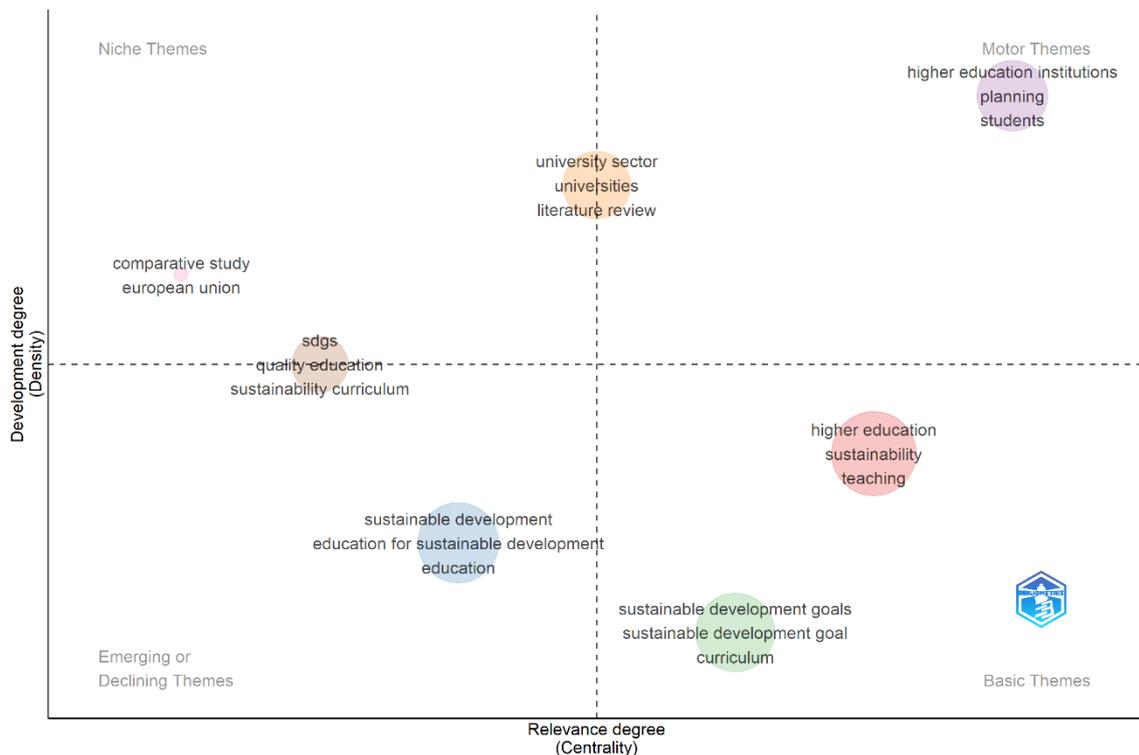


FIGURE 11: Thematic map analysis. Source: By Biblioshiny using R Studio.

Figure 11 presents the thematic map of author keywords in the domain of Sustainable Development Goals (SDGs) and higher education. Basic themes contain the cluster that includes the terms "sustainable development goals," "curriculum," and "sustainable development goals," which is located in the basic themes quadrant, indicating that it is highly central yet somewhat low in detail. These themes have a central position in the field, indicating their profound importance in shaping scholarly discussions and curriculum integration related to the SDGs.

The motor themes are represented by "planning," "students," and "higher education institutions," all of which exhibit high density and high centrality. The focus of SDG-oriented higher education research suggests that institutional practices and student participation are established and significant research topics.

Niche themes like "comparative study" and "European Union," which are characterized by strong internal development but little outside connectivity, imply specialized and regionally focused research streams. Despite being in the emerging or decreasing quadrant, the terms "education for sustainable development," "sustainable development," and "education" all refer to ideas that are either conceptually shifting or developing within the context of the SDGs. Overall, the thematic arrangement highlights the dominance of curriculum-based and institutional perspectives while demonstrating the changing pedagogical and policy-focused research orientations in SDG–higher education studies.

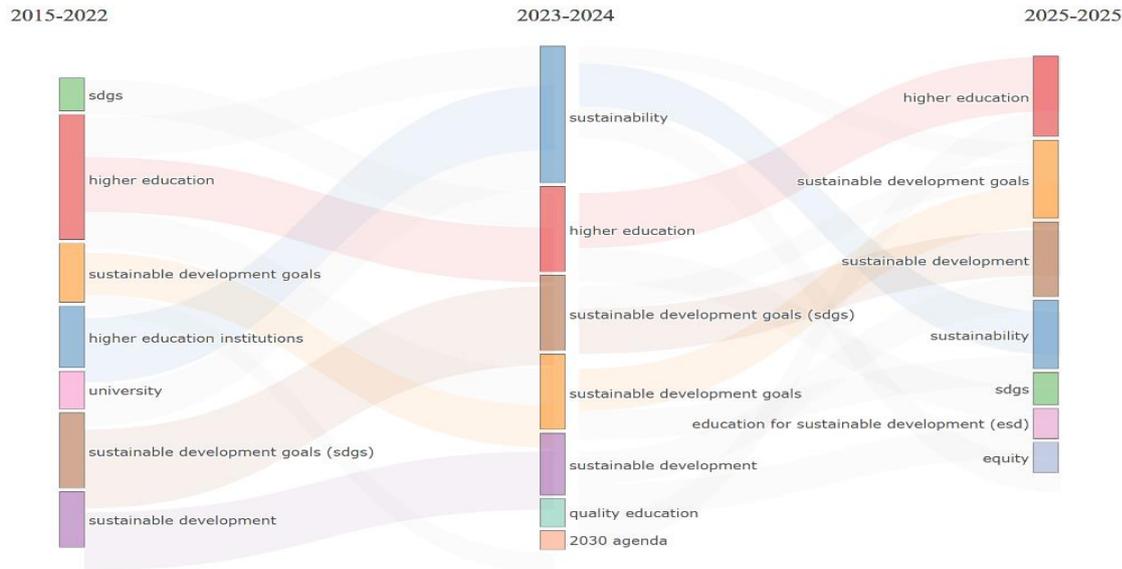


FIGURE 12: Thematic evolution. Source: By Biblioshiny using R Studio.

Figure 12 presents the thematic evolution of research on Sustainable Development Goals (SDGs) in higher education across three time periods: 2015–2022, 2023–2024, and 2025. During the first phase (2015–2022), the phrases "university," "sustainable development," "sustainable development goals (SDGs)," "higher education," and "higher education institutions" are frequently used. There has been a significant emphasis on integrating SDGs into university systems and developing the theoretical framework for the discussion of sustainability in higher education during this period. In the next phase (2023–2024), these themes grow into more structured and policy-focused concepts, such as "quality education," "sustainable development (ESD)," "sustainability," and "the 2030 agenda." According to this shift, institutional environments are becoming more congruent with global sustainability frameworks and are also giving implementation and educational quality greater consideration. Themes that are more effective and applicable, such as "equity," "sustainability," "SDGs," "sustainable development," and "higher education," have more recently surfaced (2025). Given their significance, it is probable that more focus will be paid to outcome-based educational approaches, institutional accountability, and social inclusion. The prominence of "sustainable development goals" and "higher education" across all three periods demonstrates its applicability to the topic of study. The theme progression generally demonstrates the shift from conceptual integration to operationalization and impact-oriented research in SDG-related higher education studies.

### Country Collaboration Map

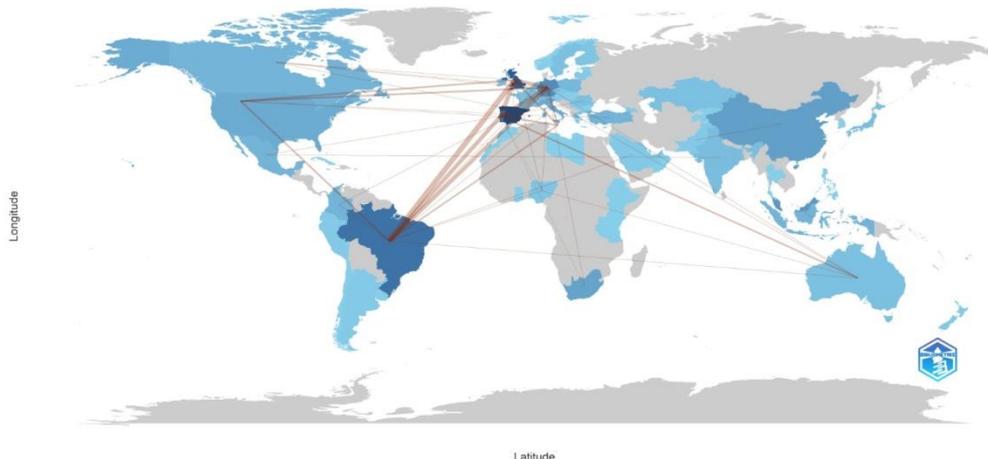


FIGURE 13: Country collaboration map. Source: By Biblioshiny using R Studio.

The country collaboration network is a representation of the worldwide pattern of higher education research collaborations according to the Sustainable Development Goals (SDGs). Figure 13 illustrates the key nodes of the network, which are a few strongly interconnected countries that are the focus of international collaboration. With strong, cross-regional partnerships, European nations—particularly Spain, Italy, and the United Kingdom—occupy important positions. Because of their central location, they are positioned as key coordinators within the global academic network, reflecting their extensive cross-border contacts and strong research production. Notable cooperative relationships also exist between European countries and their allies in Asia, Oceania, and Latin America. Australia and Brazil are notable non-European contributors who actively participate in international research partnerships. On the other hand, several Asian and African countries have less connections, suggesting that they are not fully integrated into the broader cooperation framework. When all is said and done, the network shows a targeted but expanding tendency of worldwide cooperation. Even while a few core countries dominate collaborative interactions, the emergence of new relationships indicates that SDG-focused higher education research is becoming more internationally interconnected.

## V. FINDING

This study provides a comprehensive bibliometric assessment of research on the Sustainable Development Goals (SDGs) in higher education, uncovering the intellectual, conceptual, and collaborative dynamics of this expanding academic domain. The performance analysis shows that scholarly output increased significantly after 2018, then sharply between 2024 and 2025. Higher education systems are quickly institutionalizing the SDG discourse, as seen by the 34.24% yearly growth rate. Despite a recent explosion in publishing production, earlier works continue to garner significant citation counts, indicating their fundamental impact in developing the theoretical and policy frameworks of research on higher education that is focused on the SDGs.

Sustainability, the *International Journal of Sustainability in Higher Education*, and the *Journal of Cleaner Production* are the most fruitful and significant sources. The conversation surrounding sustainability in educational settings is consolidated by these journals, which serve as fundamental intellectual forums. By confirming the existence of a concentrated core of journals that make up a sizable fraction of all publications, Bradford's Law further supports the organized character of information diffusion in this area. While the main academic discussion is shaped by a small number of top journals, the existence of diverse outlets suggests that theme expansion toward governance, curriculum reform, and institutional strategy is occurring.

Author-level performance analysis shows a research environment with a large base of sporadic contributors and a small number of very prolific researchers. The utilization of Lotka's Law validates an inverse distribution of productivity: most writers have only generated one publication, while a small number of researchers have produced five or more. This pattern shows a research community that is maturing yet still consolidating, with key contributors crucial in directing scholarly conversation and theoretical refinement. SDG-focused higher education research is supported by a strong collaborative culture, as seen by the average of 4.01 co-authors per document and the presence of international co-authorship in 33.5% of publications.

Geographically speaking, citation analysis reveals a dispersed yet organized research environment. Significant citation influence is shown by nations like the United Kingdom, Brazil, Spain, and the Netherlands, which establish Europe and Latin America as key hubs in the worldwide academic network. Portuguese, German, Chinese, Swedish, Lithuanian, and Indian contributions further substantiate the global interest in higher education scholarships tied to the SDGs. While new connections in Asia, Oceania, and Latin America indicate growing global interconnectedness, the country collaboration network exemplifies robust cross-regional ties, especially among European countries. Some regions' poorer integration, however, points to potential for further global involvement.

According to scientific mapping, there is a clear conceptual core that is focused on SDGs, sustainability, sustainable development, and higher education. Keyword co-occurrence analysis shows that themes like curricular integration, quality

education, education for sustainable development (ESD), and institutional planning are strongly related to the SDGs. Curriculum-oriented research and research based on institutional practices are identified as the two main and most important themes in the thematic map. Higher education institutions, planning, and student involvement are highlighted in motor themes, suggesting that implementation-focused scholarship has matured. Comparative studies and region-specific analyses are examples of niche themes that show specialized yet internally cohesive research streams.

A three-phase intellectual advancement is evident from thematic evolution analysis. During the early years (2015–2022), the main focus was on developing a sustainability discourse in higher education and integrating the SDGs into university systems. Through topics like the 2030 Agenda and high-quality education, the intermediate phase (2023–2024) demonstrates a greater operationalization and alignment of policies. As a shift toward accountability, social inclusion, and quantifiable institutional impact, the most recent phase (2025) emphasizes outcome-oriented and equity-driven viewpoints. In higher education research that focuses on the SDGs, this trajectory shows a move from intellectual advocacy to implementation and impact assessment.

Overall, the findings depict a rapidly expanding and increasingly institutionalized field characterized by strong collaborative networks, concentrated core journals, and a stable conceptual foundation. Curriculum integration and institutional governance continue to be important foundations, but the sector is gradually shifting toward equity considerations, outcome-based evaluation, and global policy alignment. In the context of sustainability activities in higher education, future research should enhance longitudinal evaluations of SDG implementation outcomes, increase cross-regional collaboration, and investigate new areas like digital transformation, equity frameworks, and institutional performance measurement.

## VI. FUTURE RESEARCH DIRECTION

Although research on the Sustainable Development Goals (SDGs) in higher education has grown rapidly and demonstrated increasing conceptual maturity, several important gaps remain that warrant further scholarly attention. The quantifiable institutional results of SDG integration in higher education should be the focus of future research, going beyond descriptive and publication-based evaluations. To evaluate the impact of sustainability initiatives on curricular change, student competencies, research agendas, and community participation, empirical frameworks must be developed. When assessing whether adopting the SDGs results in long-term structural change as opposed to merely symbolic alignment, longitudinal studies would be very helpful.

Additionally, more focus should be put on comprehending how the SDGs are operationalized at the institutional and policy levels. Research comparing different nations, areas, and kinds of universities may shed further light on how contextual elements like funding schemes, governance structures, and regulatory frameworks influence the way the SDGs are implemented. Future studies should investigate strategies that enhance cross-regional collaborations, especially incorporating underrepresented regions, in light of the unequal global cooperation patterns found in the analysis. This will help to foster a more diverse and internationally connected research network.

Further, the outcomes of thematic evolution point to a move toward perspectives that are outcome-oriented, accountable, and balanced. Therefore, future research should look at how colleges incorporate teaching quality, social inclusion, and institutional responsibility into quantifiable sustainability plans. Examining sustainability reporting schemes, rating schemes, and performance metrics associated with SDG accomplishment would improve theoretical development and policy applicability. The comparatively small number of topics related to digital transformation also suggests a new area for study. Future research ought to examine the ways in which data-driven governance tools, digital technologies, and smart campus projects might expedite stakeholder involvement, institutional transparency, and SDG monitoring. Examining cross-disciplinary connections among educational administration, sustainability science, and technology innovation would enhance the field's capacity for integration.

Overall, future research should prioritize longitudinal designs, cross-regional comparisons, and collaborative models connecting academia, policymakers, and society. By following these directions, academics can develop a more impactful and evidence-based understanding of how universities make significant contributions to the global SDG agenda.

## VII. LIMITATIONS OF THE STUDY

This study has certain limitations that should be acknowledged. First, Biblioshiny (the R-Bibliometrix package) was the only tool used for the bibliometric study; CiteSpace and VOSviewer, which could have offered better clustering validation and alternate network representations, were not included. Comparative robustness in mapping co-authorship, co-citation, and thematic structures may be limited by the use of a single analytical platform.

Second, the search approach only used keywords associated with higher education and the Sustainable Development Goals (SDGs) and the Scopus database. This strategy might have missed pertinent research indexed in other databases or those employing alternative or emerging terminologies, even if Scopus guarantees high-quality and peer-reviewed coverage. As a result, the dataset might not have included all relevant contributions to the subject.

Third, older publications that have had more time to amass citations are naturally given preference by citation-based measures. Because of this, current research that has the potential to have a significant impact—especially those released in 2024 and 2025—may seem underrepresented. When analyzing citation performance and country-level influence, this temporal bias should be taken into account.

Lastly, because bibliometric analysis is a strictly quantitative method, it can only detect structural patterns, productivity trends, and thematic evolution; it cannot offer more profound qualitative understandings of theoretical viewpoints, methodological rigor, or contextual implementation difficulties in individual studies. These drawbacks highlight the necessity of supplementary methods to provide a more thorough grasp of SDG research in higher education, such as content-driven assessments, meta-analyses, or systematic literature reviews.

## VIII. CONCLUSION

This bibliometric study highlights the rapid expansion and evolving focus of research on the Sustainable Development Goals (SDGs) in higher education. Over the past decade, the area has evolved from conceptual and foundational conversations on integrating sustainability in higher education to more organized, impact-focused, and policy-aligned methods. Higher institutional embedding, accountability frameworks, and quantifiable educational results are reflected in modern studies, while theoretical alignment and curriculum discourse were the main focus of early research. Publications increased significantly after 2018, reaching a notable peak in 2024–2025, indicating an increasing institutional and scholarly commitment to promoting the SDG agenda in higher education systems.

While citation trends show significant contributions from European and Latin American nations, a small number of extremely productive writers and core publications are crucial in determining the field's intellectual trajectory. With cross-border relationships growing stronger over time, the collaboration network reveals a focused but internationally distributed research community. Sustainability, higher education, and the SDGs continue to be the key concerns at the conceptual level, but new emphasis on fairness, quality education, and institutional planning indicates that the field of study is maturing. Further demonstrating a distinct shift from conceptual integration to operationalization and outcome-based evaluation is the theme evolution.

In evaluating the long-term institutional impact of SDG implementation, enhancing inclusive global collaboration, and incorporating digital transformation into sustainable governance frameworks, significant gaps still exist despite the growing amount of literature. Future research should put an emphasis on comparative and longitudinal studies, a more thorough assessment of accountability and policy mechanisms, and cooperative strategies that connect communities, governments, and

universities. Overall, this study offers a solid basis for academics and policymakers to promote more successful and empirically supported sustainability strategies within academic institutions by providing a systematic understanding of the intellectual, thematic, and collaborative structure of SDG research in higher education.

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