

Mapping Research Trends and Collaborations in Sustainable Development Goals: A Bibliometric Analysis

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ABSTRACT

The present study is a comprehensive bibliometric analysis to represent existing research developments and collaborations within Sustainable Development Goals (SDGs). As the world is witnessing an ever-increasing importance attached with the United Nations' SDG framework, understanding SDG-related research is essential for guiding future studies and policymaking. This study utilizes bibliometric methods on dataset retrieved from Scopus database covering publications over a decade from 2015 to 2024. The data size included 578 articles from Scopus database by employing PRISMA guidelines. The study utilizes co-citation, co-authorship, and keyword analyses to uncover influential publications, leading institutions, and examines regional collaborations. Key findings of the study reveal emerging research trends, with significant growth in topics related to climate action (SDG 13), sustainable cities and communities (SDG 11), and responsible consumption and production (SDG 12). The analysis further stresses the rise in interdisciplinary and international collaborations, revealing contributions by authors across various fields. From the analysis, it was revealed that Europe, North America, and Asia lead in publication output and international partnerships, which reflects a global effort to tackle sustainability related challenges. The findings of this study offer valuable insights to policymakers, academicians, and practitioners through a revelation of the state of SDG research, popular themes, and collaborative opportunities. By mapping these developments, the study supports the effective distribution of resources and the identification of key partnerships necessary to move progressively toward achieving the Sustainable Development Goals.

Keywords: Bibliometric Analysis, Citation Analysis, Global Collaboration, Research Trends, Sustainability, Sustainable Development Goals (SDGs).

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INTRODUCTION

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, constitute a comprehensive and universally endorsed framework designed to address the world's most pressing challenges, including poverty, environmental degradation, social exclusion, and threats to peace by the year 2030 (Gyimah *et al.*, 2025). Comprising 17 interrelated goals, the SDGs articulate an ambitious and multidimensional agenda that reflects the inherent complexity of achieving sustainable development at a global scale. The 2030 Agenda for Sustainable Development operationalizes this vision through 169 specific targets and 231 indicators, thereby providing a systematic blueprint for monitoring progress across diverse socio-economic

and environmental domains (United Nations Development Group, 2017; Perevoznic and Dragomir, 2024). Notably, substantial progress has been documented since the agenda's inception, particularly in areas such as poverty reduction, declines in child mortality, expanded access to affordable energy, and intensified efforts toward combating major diseases (United Nations, 2023). The goals ranging from poverty eradication, food security, health, education, gender equality, and clean water, to climate action, sustainable cities, responsible consumption, and global partnerships collectively embody a holistic and integrative vision for human and planetary well-being (United Nations, 2015). Parallel to these global developments, scholarly engagement with sustainable development has expanded markedly in recent years. Research output has grown substantially, reflecting heightened academic commitment to addressing multifaceted global challenges (Kumar *et al.*, 2024). This body of scholarship increasingly converges on the SDGs as an organizing framework, as evidenced by extensive studies examining environmental sustainability, public health, education systems, and gender equity (Raman *et al.*, 2024; Kumar *et al.*, 2024; Yamaguchi *et al.*,



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2022; Kumar *et al.*, 2024). Among the individual goals, SDG 12 Sustainable Consumption and Production has emerged as the most extensively researched, while SDGs 3, 7, and 13 continue to attract significant scholarly attention due to their pressing global relevance (Raman *et al.*, 2024). Importantly, the growth of SDG-related research within underdeveloped countries underscores a broader global commitment to inclusive and geographically diverse knowledge production (Yumnam *et al.*, 2024). Given the inherent interdependence among the goals, advancing sustainable development requires interdisciplinary and cross-sectoral collaboration. Academic inquiry has increasingly clustered around themes such as business sustainability, sustainable finance and investment, and the transformative role of digitalization and artificial intelligence in achieving development outcomes (Gyimah *et al.*, 2025). Simultaneously, emerging technologies including immersive analytics, data-driven decision platforms, and advanced business intelligence systems have substantially enhanced the capacity of researchers to assess and quantify the societal impacts of their work. The integration of these technologies with the SDGs, along with their numerous sub-dimensions, has facilitated significant theoretical, empirical, and practical contributions. These alignments have proven particularly valuable in addressing critical social challenges such as financial literacy promotion, women's entrepreneurship, and other domains central to equitable and sustainable development (Financial Times, 2024). Through these advancements, contemporary research not only reinforces the relevance of the SDGs as a global developmental compass but also demonstrates the expanding potential of scholarly innovation in shaping a more just, resilient, and sustainable world.

Though there were significant rise in research, and publications on the Sustainable Development Goals (SDGs), but there were still insufficient cross-disciplinary integration, examination of collaborative patterns, and global interconnectedness in the SDGs. This research is an attempt to fill the existing gap related to fragmented research coverage. The objective of this bibliometric study is to outline academic research and collaboration activities relating to the SDGs, offering a robust depiction of the scholarly work in this direction. In order to address these gaps, this work applies an innovative bibliometric approach to systematically outline research trends relating to the SDGs, revealing critical collaborative networks and thematic relationships among the literature related to the SDGs. This analysis claims to illustrate the transforming research landscape of SDGs with the help of underrepresented research topics (Meitei *et al.*, 2025).

In between 2015 to 2024, scholarly on Sustainable Development Goals (SDGs) has resulted in the publication of 6,142 documents distributed across 2,514 academic sources, including journals and edited volumes. Annual growth rate of SDG-related publications stands at 6.14%, which demonstrates a consistent upward trajectory in research output in the past decade. It was

observed that the average document age is approximately 1.96 years, indicating a predominance of recent contributions and reflecting the dynamic and evolving nature of this domain. The citation data reveal that each publication receives, on average, 10.55 citations, indicating to a moderate scholarly impact. Furthermore, the collective body of work cites a total of 323,775 references, underscoring a high level of engagement with prior research and demonstrating a well-established and actively developing academic discourse on the SDGs (Figure 1).

This paper aims to support stakeholders, researchers, and policymakers by identifying the most productive contributors, impactful authors, influential journals, active institutions, and predominant thematic clusters. By connecting the dots through collaborations and an analysis of published work, we attempt to optimize strategic resource allocation and advancing research to support the 2030 Agenda for Sustainable Development.

Research Questions: We attempt to highlight specific questions, such as:

What are the main areas of SDG research?

Which countries and institutions are leading the research?

What is the citation impact of SDG research?

How do collaboration networks develop around SDG-related topics?

LITERATURE REVIEW

The Sustainable Development Goals (SDGs) have gained attention in the academic, institutional, and policy landscapes since the adoption of the United Nations 2030 Agenda (Sorooshian, 2024; Gyimah *et al.*, 2025). These 17 goals are intended to work as a force multiplier in advancing development under a single framework. This in turn, open new avenues for integrating economic growth, environmental protection, and social inclusion (UN, 2015). There is an increase in research related to SDGs, making it equally important to comprehend the structure, development, collaboration frameworks, and interrelations for researchers, practitioners, and policymakers. Driven by the United Nations' 2030 Agenda, The quantity of publications on SDGs progressed continuously over the years (Donthu *et al.*, 2021; Sorooshian, 2017). The interest of the readers can be accessed through the rise in citations for these scholarly contributions (Fire and Guestrin, 2019). Studies on SDG 3 good health and well-being, SDG 4 (Quality Education), and SDG 13 (Climate Action) are more prominent studies conducted during this period (Choudhury *et al.*, 2022). As already mentioned, there is lack of balance when it comes to research related to SDGs. This deficit highlights the need to analyze the less represented SDGs, particularly with regard to global equity and environmental resilience (Rafols *et al.*, 2021). Available bibliometric analyses offer more sophisticated visions on the research about SDG achievements (Alfirević *et al.*, 2023).

Conducted a detailed study on the Scopus publications from 2017 to 2022, noting an upsurge of interest towards SDG based research with important input from USA, UK and China. Their work showed that SDG 3 (Good Health and Well-being) and SDG 4 (Quality Education) received considerable attention in published literature. Similarly, Indana and Pahlevi (2023) studied 347 scientific articles and highlighted important research themes such as economic and social repercussions of implementing SDGs and also called for research using diverse methodologies. The significance of sustainable entrepreneurship for the achievement of the SDGs is receiving attention. A bibliometric analysis of Arora *et al.*, (2024) examined the effectiveness of corporate sustainability practices towards the SDGs and identifying some of the underdeveloped concepts and setting pace for further research. The result shows that there is an increasing focus on the integration of sustainability into corporate frameworks that aim to meet the SDGs. Higher education is an area that remained largely under researched. Tafese and Kopp (2025) examined trends in education for sustainable development research, highlighting the rising integration of SDG principles in educational curricula and the leadership role of institutions of learning towards sustainability. They found that the number of publications on SDG 4 has increased, testifying to the industry's adherence to ensuring sustainable development through education. Even as the literature continues to multiply, issues remain with effectively mapping and assessing contributions against diverse goals. Zhao *et al.*, (2024) critically evaluated the quality of the SDG classification system within the Web of Science database, reporting discrepancies and emphasizing the need for improved classification methodologies. Their analysis indicated that some of the SDGs, like SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action), had higher percentages of mislabeled topics, pointing towards the need for ongoing improvement in labeling systems. Global patterns in sustainability research display pronounced geographic, thematic, and authorship asymmetries. These imbalances visible in bibliometric data across sustainability science, environmental studies, development research, and SDG-related scholarship reflect deep structural characteristics of the contemporary knowledge economy. A conceptual examination of these patterns reveals not only how scientific authority is unevenly distributed, but also how such disparities interact with the normative commitments embedded in the sustainable development agenda.

Additionally, bibliometric analysis has immensely contributed towards revelation of geographic and institutional collaboration. Some of the countries that consistently appear as major players in global SDG research networks, publishing immensely in the literature, include the United States, United Kingdom, China, and India (Aria and Cuccurullo, 2017; Mohanty 2026; Zyoud and Fuchs-Hanusch, 2020). Regional representation shortfalls exist with minimal scholarly work originating from low-income and developing countries, raising knowledge equity and inclusivity

issues in sustainability studies (Bene *et al.*, 2021). Furthermore, the integration of Artificial Intelligence (AI) (Singh *et al.*, 2023) and visualization tools such as VOSviewer and Bibliometrix has enhanced the analytical depth of bibliometric research.

These tools were widely used as it provides a graphical as well as thematic representation, offered a visual and interpretative framework a better understanding of the intricacies of SDGs, and also reflected the co-authorship, and co-occurrence (Van Eck and Waltman, 2014; Moral-Muñoz *et al.*, 2020). There is a requirement of comprehensive updated bibliometric study on various SDGs and their impact on the future global landscape. The objectives of this review is to make a comprehensive bibliometric analysis to fill this methodological and empirical gap. Through the systematic review of many global SDG literature, this study aims to find new dimensions in research, identify underdeveloped fields, and offer inputs towards future scholarly and policy work. In total, these new studies add to our understanding of the evolving SDG research agenda, highlighting areas of progress and areas to be advanced through future scholarly work.

METHODOLOGY

We have used bibliometric analysis as the tool to map the intellectual structure and the dynamics of collaboration within the ambit of SDG. The methodological approach was disseminated by established bibliometric method (Donthu *et al.*, 2021; Aria and Cuccurullo, 2017). It encompasses a systematic way of data, extraction, processing, and visualization. We have chosen Scopus as the primary data source because of its comprehensive indexing of high-quality, peer reviewed literature, and the robust metadata which was essential for bibliometric investigations (Elsevier, 2023). It covers border disciplinary coverage, more extensive citations enhancing its utility for research impact, mapping the collaboration networks, and identifying the keywords trends (Singh *et al.*, 2021). This study utilizes bibliometric methods on dataset retrieved from Scopus database covering publications over a decade from 2015 to 2024. Choosing this period logical and meaningful choice for studying SDG research because 2015 marks the moment when the Sustainable Development Goals were formally adopted by the United Nations, giving researchers a shared global framework for sustainability. Extending the timeframe to 2024 allows the study to trace how SDG research has grown, adapted, and matured in response to funding priorities, global crises, and the increasing urgency of the 2030 deadline. The data size included 578 articles from Scopus database by employing PRISMA guidelines. The study utilizes co-citation, co-authorship, and keyword analyses to uncover influential publications, leading institutions, and examines regional collaborations. The dataset was extracted using a systematic search query designed to encompass a broad range of publications related to the SDGs. The final search string was constructed using Boolean operators and covered multiple

conceptual terms linked to the 2030 Agenda. Specifically, the keywords included were: ("Sustainable Development Goals" OR "SDGs" OR "Agenda 2030" OR "Global Development Goals" OR "UN SDGs" OR "United Nations SDGs") AND ("Goal 1: No Poverty" OR "Goal 2: Zero Hunger" OR "Goal 3: Good Health and Well-being" OR "Goal 4: Quality Education" OR "Goal 5: Gender Equality" OR "Goal 6: Clean Water and Sanitation" OR "Goal 7: Affordable and Clean Energy" OR "Goal 8: Decent Work and Economic Growth" OR "Goal 9: Industry, Innovation and Infrastructure" OR "Goal 10: Reduced Inequalities" OR "Goal 11: Sustainable Cities and Communities" OR "Goal 12: Responsible Consumption and Production" OR "Goal 13: Climate Action" OR "Goal 14: Life Below Water" OR "Goal 15: Life on Land" OR "Goal 16: Peace, Justice and Strong Institutions" OR "Goal 17: Partnerships for the Goals") AND ("sustainable development" OR "sustainability" OR "environmental sustainability" OR "economic sustainability" OR "social sustainability" OR "sustainable policy" OR "sustainable innovation" OR "sustainable tourism" OR "sustainable agriculture" OR "climate change adaptation" OR "green economy" OR "blue economy" OR "circular economy")

The search was conducted for documents published between January 1, 2015, the official launch year of the SDGs, and December 31, 2024. This time frame ensures the analysis captures the evolution of SDG-related research throughout the implementation period of the 2030 Agenda. Articles published before 2015, which largely correspond to the Millennium Development Goals (MDGs) or general sustainability discourses, were excluded to maintain conceptual clarity. We have covered

the timeline from 2015-2024 as the SDG research has gained its traction from 2015 onwards only (Figure 2).

To ensure quality and relevance, only peer-reviewed journal articles, including research articles and review papers, were included. Additionally, peer-reviewed conference proceedings indexed in Scopus were considered where applicable. Excluded documents consisted of editorials, book reviews, commentaries, white papers, opinion pieces, and other non-academic sources such as blogs or news articles. Furthermore, the analysis was limited to publications written in English, in line with standard bibliometric practices, to ensure consistency in text mining and keyword standardization (Zyoud and Fuchs-Hanusch, 2020). The bibliographic metadata including title, authors, keywords, abstract, source, citations, and affiliations were exported in BibTeX and CSV formats. Data cleaning and preprocessing were performed using Bibliometrix (Aria and Cuccurullo, 2017) in RStudio, complemented by VOSviewer (Van Eck and Waltman, 2014) for network visualization.

RESULTS

The distribution of publication types shows that research articles has dominated with 3,655 entries, highlighting the importance of peer-reviewed journals in publication research on SDGs (Figure 3). Book chapters (990) and books (93) also contribute significantly, indicating that researchers provide comprehensive insights through edited volumes and individual research. Conference papers (728) are notable, reflecting the importance of presenting emerging research at academic gatherings. Reviews

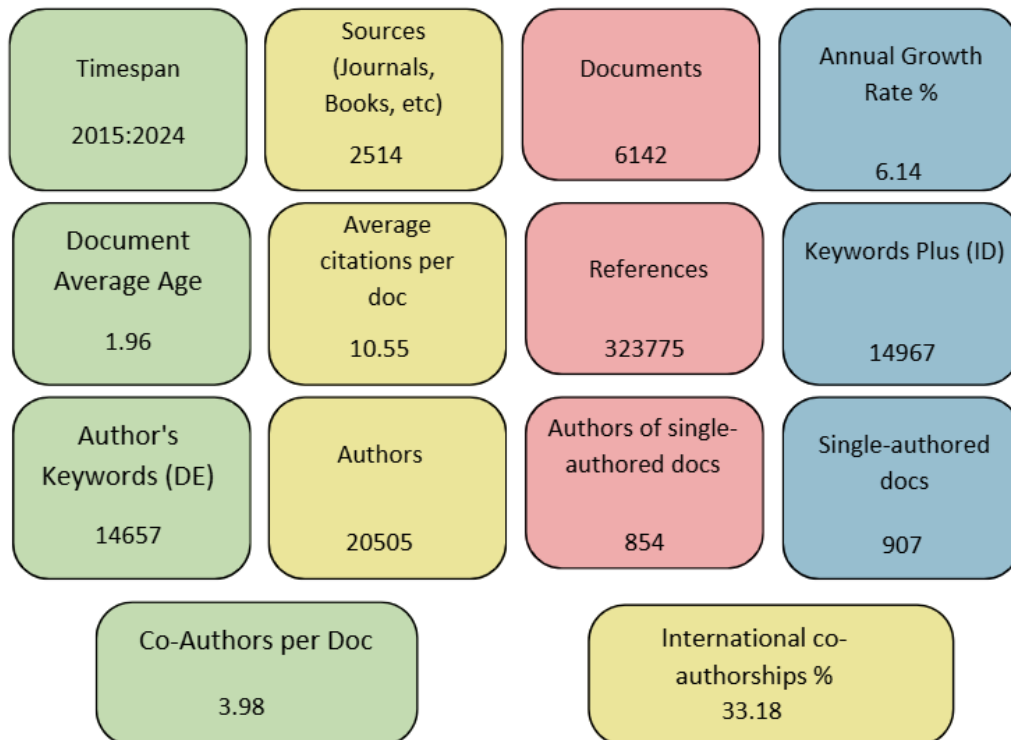


Figure 1: Summary of Research on Sustainable Development Goals (2015-2024).

Table 1: Comparative Analysis with Past Bibliometric Research on SDG.

Authors	Year Covered	Method Used	SDG Covered	Tools Used	Domain Covered
Kumar <i>et al.</i> , 2024	2014-2025	PRISMA	8	Biblioshiny (R-tool) and VOSviewer	Economic
Gyimah <i>et al.</i> , 2024		PRISMA and SLR	17	VOS Viewer and R-Studio	Business Research
Raman <i>et al.</i> , 2024	2016-2022	SPAR-4-SLR protocol Bibliometric	12	VOS Viewer	Social
Singh <i>et al.</i> , 2025 (Current Paper)	2015-2024	Bibliometric PRISMA	17	VOS Viewer and R-Studio	All domains

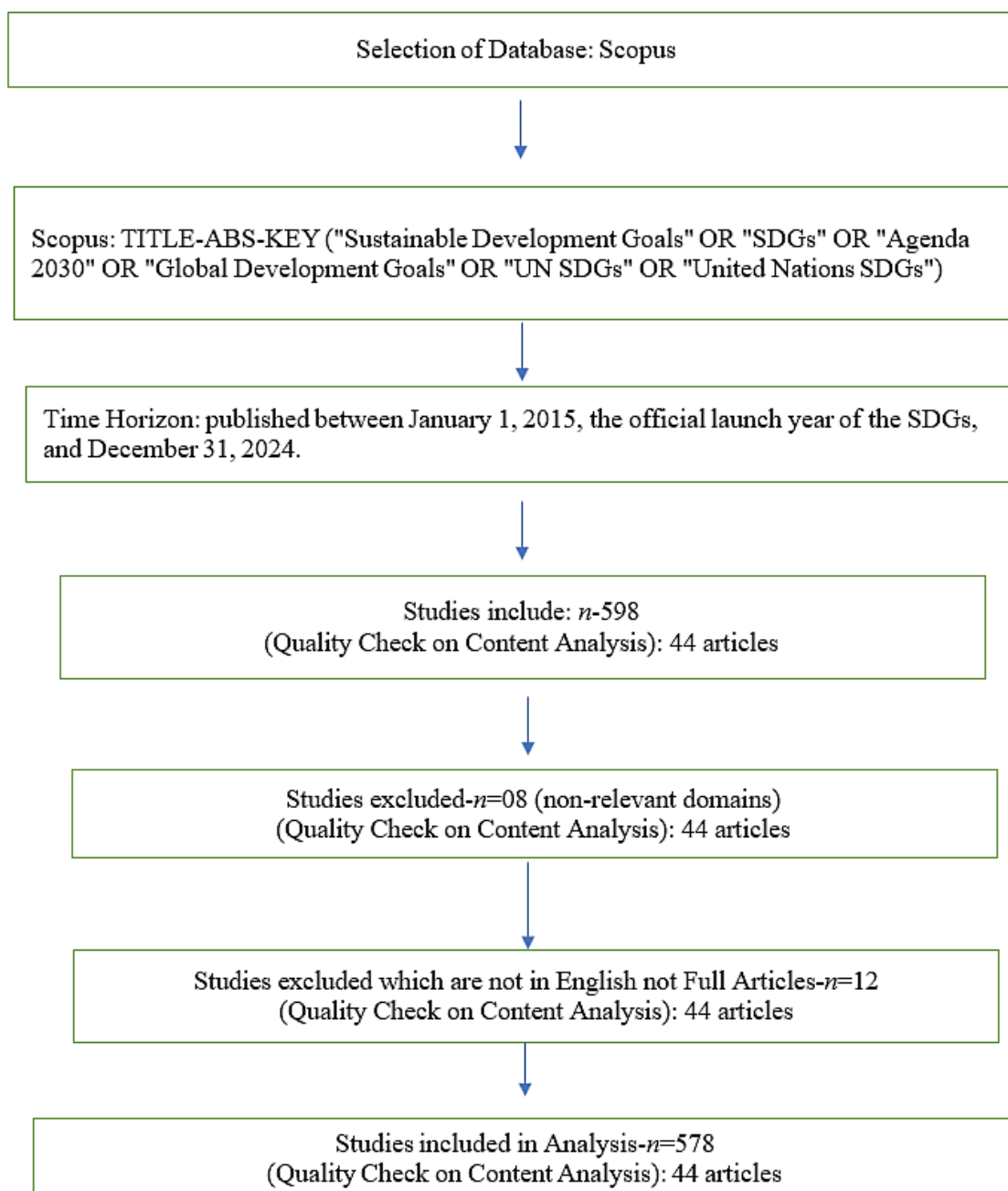


Figure 2: PRISMA Frame Work.

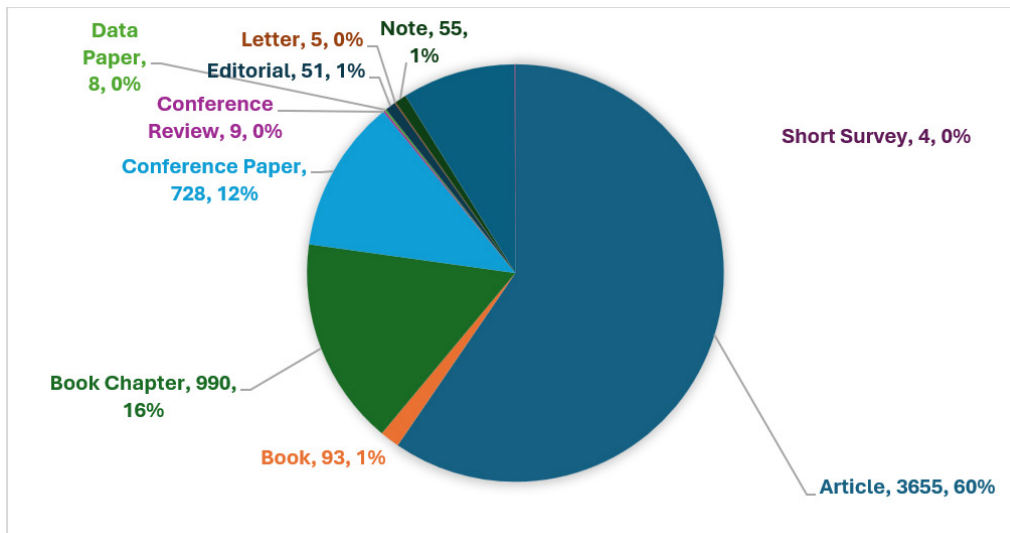


Figure 3: Document Types.

(539) are prevalent, showcasing the ongoing efforts to synthesize existing knowledge in the SDG domain. Less common, but still relevant, are notes (55), editorials (51), and erratum (5), which provide brief communications and corrections. Conference reviews (9), data papers (8), letters (5), and short surveys (4) serve more specialized roles, offering concise research contributions and updates. This distribution underlines the diverse methods of knowledge dissemination within SDG-related research, emphasizing journal articles as the primary medium.

Figure 4 illustrates the growth in scholarly publications related to Sustainable Development Goals (SDGs) across five prominent institutions from 2013 to 2023. Each line represents a different institution, showing the cumulative number of published articles over time. This figure shows the trend in the number of SDG-related research publications over time (2013-2023) for five institutions: Beijing Normal University, Covenant University, University of Pretoria, University of Sharjah, and University of South Africa. A marked increase in the scholarly output in the institutional level was seen over time in the SDG research. It was observed that there were insignificant research between the year 2013 to early 2018. However, from the mid 2018 we marked a continuous upward trend across institutions with a prominent rise in output between 2020 to 2022. This escalation in the output signifies the growing global focus of SDGs due to the adoption of UNs' 2030 agenda, its' funding opportunities and initiatives.

Each institution shows a similar upward trend, though with slight variations in growth rates. Notably:

University of Sharjah experienced the most rapid increase, reaching approximately 100 articles by 2023, making it the leading institution in terms of publication volume.

Beijing Normal University and University of Pretoria closely follow, with steady increases but reaching slightly fewer total publications by 2023.

University of South Africa and Covenant University show lower growth in comparison but still demonstrate a consistent upward trajectory in their SDG-related output.

The data in this figure depicted that it emphasizes a recent and marked surge in SDG-related research activity across the analyzed institutions, culminating in a publication peak in 2022. This upward trend indicates a growing scholarly emphasis on SDG, likely driven by the approaching 2030 Goal set by the UN. The pattern also highlights the academic community's significant engagement with global sustainability challenges, reinforcing the role of research and international collaboration in advancing progress toward the SDGs.

The Figure 5 illustrates the division of SDG-related publications among the leading countries contributed, it was categorized by different collaborations such as Single Country Publications (SCP), representing domestic collaborations, and Multiple Country Publications (MCP), reflecting international co-authorship. Each bar corresponds to a country's total publication output, with SCPs and MCPs visually distinguished to indicate the extent of national versus international engagement. It was also observed that India emerges as the most prolific contributor, with a significant majority of its output classified as SCPs. This pattern indicates a strong domestic research focus on the SDGs, while suggesting comparatively lower levels of international collaboration in this area. China and the United Kingdom follow closely, also showing a predominance of SCPs but with a larger proportion of MCPs than India, indicating more international collaborations.

The data also showed that the USA and Spain are among the leading contributors to SDG-related research output. A significant proportion of the United States' publications were MCPs, indicating a strong orientation toward international collaboration, which potentially broadens the scope and impact of its research. Similarly, countries such as Australia, Malaysia,

and South Africa demonstrate a relatively balanced distribution between SCPs and MCPs, suggesting a dual emphasis on domestic research capacity and global scholarly partnerships. European nations like Italy, Germany, and Portugal displayed a particularly significant number of MCPs, reflecting the region's well-established culture of cross-border academic collaborations. Collectively, these patterns underpin the growing importance of global cooperation in SDG research. The prominence of MCPs across regions such as Europe and North America established the critical role of globally coordinated efforts, as such collaborations enable the integration of diverse knowledge systems and foster more comprehensive approaches to address the sustainability challenges.

A dominant share of sustainability scholarship originates from research institutions in the Global North, including North America, Western Europe, and increasingly East Asia. Multiple structural factors underpin this concentration. The most fundamental is the unequal distribution of scientific infrastructure: well-resourced universities, competitive funding agencies, and robust publication ecosystems create conditions for sustained research productivity. These regions also maintain strong incentives to publish in high-visibility English-language journals, reinforcing their positional advantage within globally indexed databases. This pattern is consistent with established theories of global science as a stratified system, where "core" regions accrue epistemic authority and shape prevailing intellectual frameworks.

The co-authorship network map revealed that international collaboration trends in SDG research, it highlighted global partnerships through inter-country co-authorships. Countries like India, the USA, the UK, and China found as central nodes, indicating both high research output and extensive international

collaboration. Distinct regional clusters are evident like the red cluster, led by India, reflects partnerships across Asia and the Middle East, while the green cluster links sub-Saharan African countries like South Africa, Ghana, Tanzania, and Zimbabwe. These clusters underscore growing regional engagement and the evolving global structure of SDG scholarship through increased collaboration and cross-border research efforts. The blue and purple clusters feature European and Latin American countries, respectively, with notable collaboration between Spain, Colombia, and Peru. Countries such as Namibia and Sudan appear more peripheral, indicating limited international engagement in SDG research. The visualization underscores an uneven but interconnected global collaboration structure, suggesting the need for broader participation and integration of underrepresented regions to enhance the inclusivity and global impact of SDG-focused research (Figure 6).

Figure 7 highlights that from 2015 to 2024, the graph shows the average number of citations per article (Mean Total Citation per Article,) and the number of publications annually. Research production has been steadily increasing, as seen by the linear upward trend in the number of publications, which increased from 4 in 2015 to nearly 1500 in 2024 (Table 1). The Mean of Total Citation per Article, on the other hand, has an inverse pattern, peaking in 2018-2019 and then declining steadily until 2024, when it fell to its lowest point. This implies that even if the number of publications has grown, the average citation impact per article has declined over time. This might be because of a variety of reasons, including a change in the quality and relevance of the research, a drop in the lifespan of citations, or increasing competition.

Table 2 presents the core sources of publications identified using Bradford's Law, which highlights the most frequently

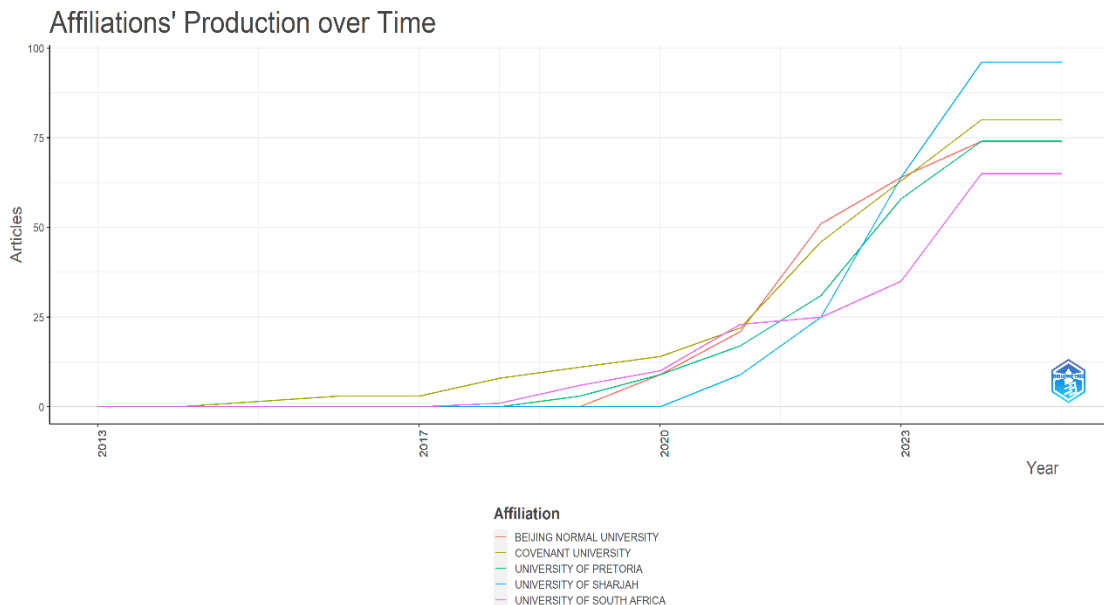


Figure 4: Affiliations' Publication Growth in SDG Research Over Time (2013-2023).

cited or utilized journals in each research domain. Sustainability (Switzerland) is the most dominant source with 417 articles, followed by the Sustainable Development Goals Series (148 articles) and the Journal of Cleaner Production (100 articles). Other notable sources include IOP Conference Series: Earth and Environmental Science (97 articles) and Sustainable Development (47 articles). The ranking indicates a concentration of publications in a few high-impact journals, reinforcing the applicability of Bradford's Law, which suggests that a small set of core sources contributes the majority of relevant literature within a field. Figure 8 illustrates the frequency of publications and the citation impact of different authors over the years. In 2024, Raman Raghu exhibited the highest publication frequency, totalling 10, with a cumulative citation count of 11. He was succeeded by Aigbavboa, Clinton, and Nedungadi, Prema, each with 9 publications and 10 citations. In 2023, Mohammad Ali Abdelkareem achieved the highest citation impact (TCpY=153.5) with a relatively low publication count (6), signifying the significant influence of his work. With 88 citations and a TCpY of 44 in 2023, Raman, Raghu likewise had a remarkable citation record. Although their citation effect was lesser, some writers such as Birdthistle, Naomi, and Hales, Rob, made consistent contributions over several years. Raman Raghu, Nedungadi Prema, Obaideen Khaled, Nhamo Godwell and Hales Rob are the top 5 authors publishing papers in this category. Higher publication frequency does not necessarily translate into greater citation impact, as the data demonstrates, highlighting the variance in both research production and influence.

Table 3 presents key indicators measuring the research impact of various authors. Obaideen Khaled has the highest h-index (10)

and *g-index* (17), indicating consistent high-impact publications. His *m-index* (2.5) suggests a strong research trajectory since 2021, with a total of 847 citations. Abdelkareem Mohammad Ali and Olabi A.G. have identical citation metrics, with an h-index of 9, *g-index* of 11, and Total Citations (TC) of 960, signifying impactful contributions since 2021. Sayed Enas Taha has a notable *m-index* of 2.667, reflecting rapid academic growth since 2022, with 796 citations. Other authors such as Baena-Morales Salvador and Leal Filho Walter exhibit moderate impact, while Nhamo Godwell, despite an early research start in 2018, has relatively lower citation numbers. The data highlights the variation in research influence and productivity across different authors.

Figure 9 emphasizes the productivity of various universities across different years. The University of Sharjah leads in publication output, producing 96 articles in both 2024 and 2025, followed by Covenant University with 80 articles in the same years. The University of Pretoria and Beijing Normal University also maintain strong publication records, each contributing 74 articles annually in 2024 and 2025. The University of South Africa follows with 65 articles in 2024 and 2025. A notable trend is the steady increase in research output from 2022 to 2025, with most universities showing an upward trajectory. However, earlier years such as 2022 and 2023 reflect lower outputs, especially for University of South Africa and University of Sharjah, indicating potential growth in research activities over time.

Table 4 presents the distribution of research articles by corresponding authors from various countries, highlighting their Single-Country Publications (SCP) and Multi-Country

Table 2: Core Sources along with their metrics.

Name of Source	h_index	g_index	m_index	Total Citation	No. of Publications	PY_start
Sustainability (Switzerland)	42	63	6	7009	417	2018
Sustainable Development Goals Series	5	9	1	169	148	2020
Journal of Cleaner Production	37	68	4.111	4763	100	2016
IOP Conference Series: Earth and Environmental Science	6	9	1	163	97	2019
Sustainable Development	11	21	1.833	471	47	2019
Sustainability (Switzerland)	5	10	2.5	120	47	2023
World Sustainability Series	5	8	0.714	110	45	2018
Environmental Science and Pollution Research	12	22	1.714	525	40	2018
E3S Web of Conferences	4	5	0.571	43	40	2018
AIP Conference Proceedings	1	1	0.2	9	38	2020
Science of the Total Environment	18	36	3	1824	36	2019
Heliyon	10	13	3.333	208	36	2022
International Journal of Speech-Language Pathology	5	6	2.5	109	34	2023
Energies	12	20	2	458	32	2019

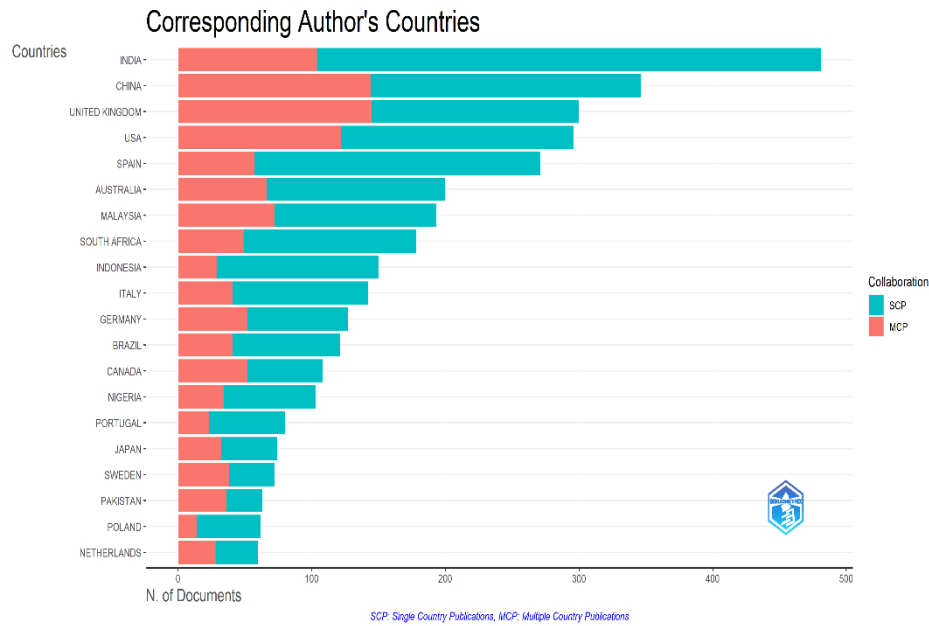


Figure 5: Top Countries by Corresponding Author's Contribution to SDG Research and Collaboration Type (SCP vs. MCP).

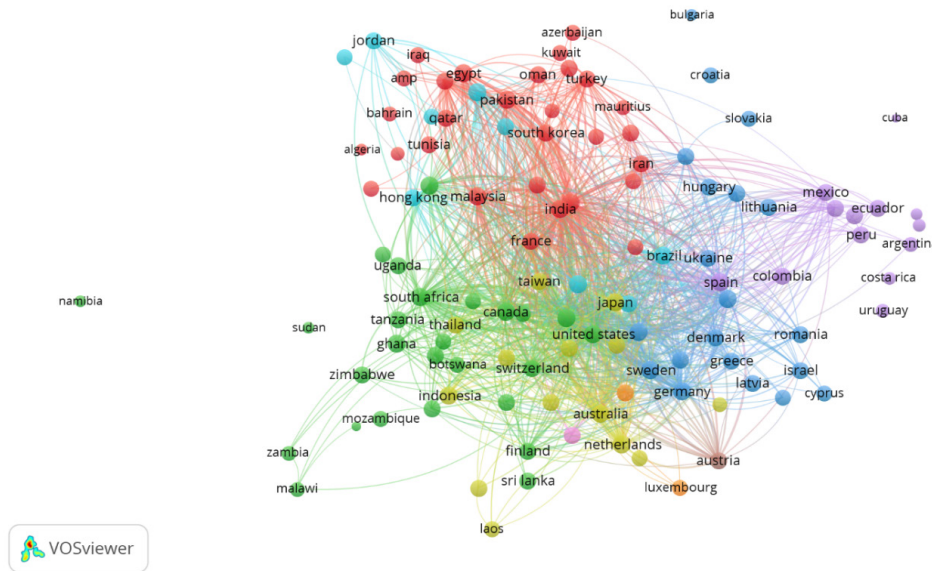


Figure 6: Country Collaboration Network in SDG-Related Research.

Publications (MCP). India leads with 481 articles (7.8% of the total), but only 21.6% are MCPs, indicating a relatively lower level of international collaboration. China (346 articles) and the USA (296 articles) have higher MCP percentages (41.6% and 41.2%, respectively), reflecting stronger international partnerships. The United Kingdom has the highest MCP percentage (48.3%), showing a significant inclination towards global research collaborations. Spain, Indonesia, and India exhibit lower MCP percentages (21%, 19.3%, and 21.6% respectively), indicating more nationally focused research output. The countries such as the UK (48.3%), China (41.6%), and Germany (40.9%)

demonstrate strong international research engagement through higher MCP rates, enhancing global visibility and collaboration. However, countries like India (21.6%), Spain (21%), and Indonesia (19.3%) show a preference for SCPs, showing robust domestic networks but limited international outreach. Malaysia (37.3%), Australia (33%), and South Africa (27.5%) have moderate MCP levels, suggesting a balanced approach to both national and global partnerships. These patterns highlight varying degrees of international collaboration, which influence research dissemination, cross-border knowledge exchange, and overall contribution to Sustainable Development Goals (SDG)

Table 3: Authors' Local Research Impact and Citation Metrics.

Author	h_index	g_index	m_index	Total Citation	No of Publications	PY_start
Raman Raghu	9	17	2.25	291	23	2021
Nedungadi Prema	8	15	2	254	19	2021
Obaideen Khaled	10	17	2.5	847	17	2021
Nhamo Godwell	5	11	0.714	130	16	2018
Abdelkareem Mohammad Ali	9	11	2.25	960	11	2021
Olabi A.G.	9	11	2.25	960	11	2021
Sayed Enas Taha	8	10	2.667	796	10	2022
Baena-Morales Salvador	5	9	1	97	10	2020
Leal Filho Walter	5	10	1.25	123	10	2021
Anwar Ahsan	4	10	1.333	147	10	2022

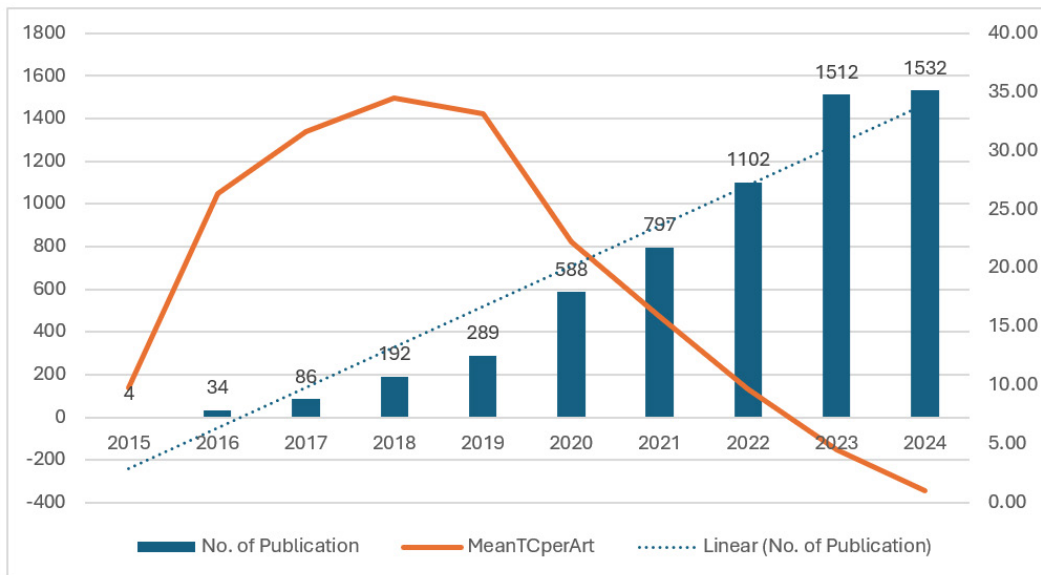


Figure 7: Trends in Research Output and Citation Impact (2015-2024).

scholarship. These countries may be strategically balancing local research priorities with global networking. Countries with higher MCP percentages tend to have greater global research impact. India and Indonesia, despite high publication numbers, need to enhance international collaboration to improve research influence. Balanced collaboration strategies, as seen in Australia and Malaysia, might be the best approach for sustainable research growth. Authorship concentration is another salient feature of the bibliometric landscape. Prominent scholars and research groups occupy central nodes in collaborative networks, benefiting from cumulative advantage the well-documented “Matthew Effect.” Their intellectual frameworks, methodological preferences, and institutional affiliations thus become disproportionately influential in shaping the contours of sustainability research. Gatekeeping mechanisms, including editorial positions, leadership in global assessments, and participation in influential scientific panels, further consolidate these advantages.

The visualization in Figure 10 displays the thematic structure of research on Sustainable Development Goals (SDGs), generated

using author keywords from Scopus-indexed publications. The co-occurrence network map generated through VOSviewer illustrates the intellectual and thematic structure of SDG-related research based on author keywords. Central concepts such as “sustainable development goals,” “sustainable development,” “gender equality,” and “quality education” appear as the largest nodes, indicating their high frequency and pivotal role across the literature. The map reveals distinct clusters: the red cluster emphasizes food security, health, poverty, and malnutrition, reflecting SDGs 2 and 3 with a regional focus on countries like Ghana and Ethiopia; the blue cluster centers on gender equality, human rights, and diversity, indicating strong attention to SDG 5 and social equity themes; the green cluster, focused on environmental sustainability, biodiversity, and the circular economy, highlights interdisciplinary work on SDGs 6, 12, and 13, often integrating advanced tools like remote sensing and machine learning; the purple and yellow clusters emphasize quality education (SDG 4) and basic infrastructure needs such as sanitation, water, and energy. Bridging terms like “economic growth,” “technology,” and

“Agenda 2030” reflect the interconnected nature of SDG research. The emergence of keywords such as “industry 4.0,” “mental health,” and “bibliometrics” further signals methodological evolution and cross-cutting innovations in this domain (Figure 10).

The thematic analysis generated by Scopus AI suggested that a complex, hierarchical framework underlying SDG research. Central to this structure is the concept of “Sustainable Development Goals,” which branches into four primary themes: Equality, Education, Hunger and Nutrition, and Poverty Reduction. Each theme contains focused subtopics such as Gender Equality and Social Inclusion under Equality; Quality and Access to Education; Macroalgae and Agriculture within Nutrition; and Corporate Responsibility and Developing Countries in Poverty Reduction (Figure 11). This structure underpins the multidisciplinary nature of SDG research while demonstrating the emerging micro-level topics shaping current sustainability discourse and informing future scholarly inquiry.

Thematic imbalances across the Sustainable Development Goals (SDGs) further illustrate the political economy of sustainability research. Goals such as climate action (SDG 13), clean energy (SDG 7), and sustainable cities (SDG 11) attract high levels of scholarly attention because they align closely with strategic funding streams, measurable technical challenges, and well-established quantitative methodologies. In contrast, SDGs that foreground equity, governance, or social protection such as SDGs 1, 5, 10, and 16 often receive comparatively less scholarly investment, despite their centrality to sustainable development. This disparity illustrates a persistent mismatch between global research production and the lived realities of many low-income and marginalized communities.

The bibliometric assessment of SDG-related research in the energy domain (2021-2024), based on Elsevier data, reveals a significant concentration of research activity was around a select few goals. SDG 7: Affordable and Clean Energy stands out as the

most studied and addressed, with 8,357 publications and 181,481 citations, indicating its central role in sustainability discourses and high interdisciplinary impact. SDG 13: Climate Action and SDG 3: Good Health and Well-being follow in the second place, with 2,666 and 174 publications, showing high academic focus on climate resilience and health. However, goals such as SDG 2: Zero Hunger, SDG 5: Gender Equality, SDG 14: Life Below Water, and SDG 15: Life on Land have very few studies, each recording not more than 100 publications. This disparity marked a notable imbalance in research efforts, and concern, despite the ecological and social significance of these underrepresented goals. Moreover, the field-weighted citation impact (FWCI) highlights the influence of research on less frequently studied SDGs; for instance, SDG 6: Clean Water and Sanitation and SDG 10: Reduced Inequality report high FWCI scores of 2.46 and 2.91 respectively, suggesting that while these areas are less populated in terms of volume, their contributions are impactful. Overall, the data underscore the need for more equitable research distribution across all SDGs to ensure comprehensive and inclusive progress toward sustainability. Strategic efforts should be made to bridge current gaps and foster interdisciplinary engagement in underexplored yet critical areas (Figure 12).

DISCUSSION

The present bibliometric analysis provides an in-depth understanding of the evolving intellectual landscape and collaborative dynamics within the field of Sustainable Development Goals (SDGs). The keyword co-occurrence network reveals a dense thematic clustering around core areas such as sustainable development, gender equality, quality education, food security, climate action, and poverty alleviation, reflecting the interdisciplinary and integrative nature of SDG research. Notably, the prominence of terms like renewable energy, circular economy, and machine learning within the sustainability cluster underscores the convergence of technological innovation with environmental stewardship, echoing recent calls for data-driven and adaptive

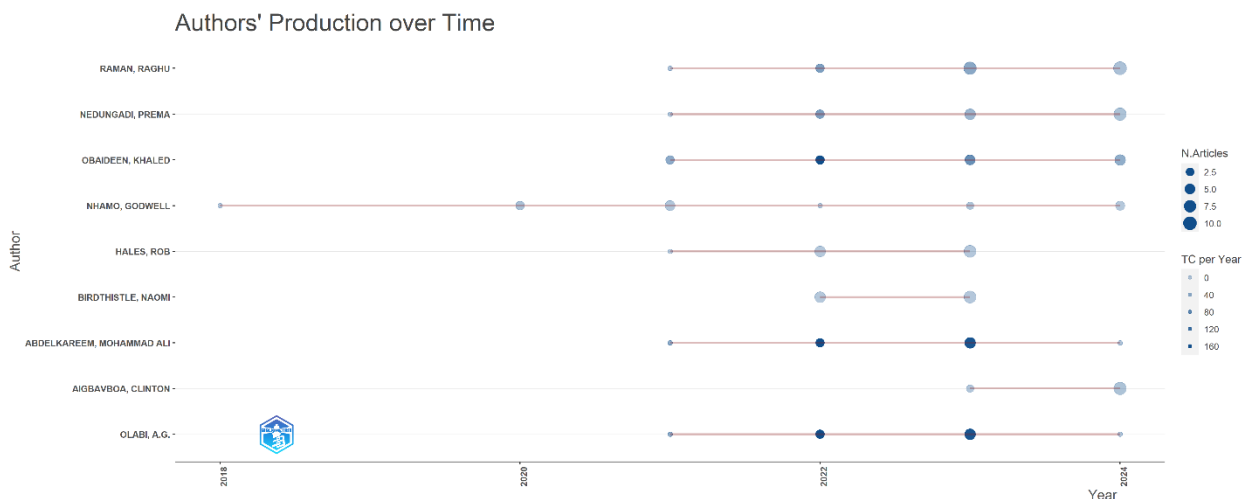


Figure 8: Top 10 Authors' Research Output and Citation Impact Over Time.

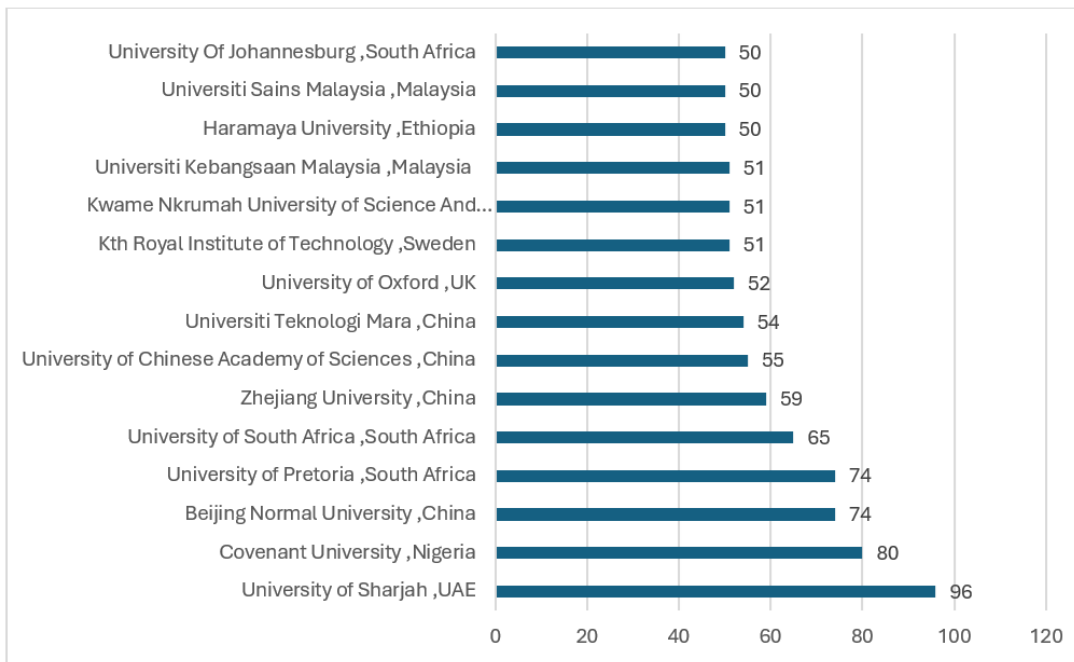


Figure 9: Research Output by University Affiliations.

policy frameworks in achieving Agenda 2030. The country collaboration map highlights robust international networks, with India, the United States, and the United Kingdom occupying central positions, engaging extensively with both developed and Global South nations. This pattern not only reflects the globalized character of sustainability research but also suggests a strategic alignment of national academic priorities with global development targets. However, the relatively sparse presence of certain low-income countries points toward persistent geographical asymmetries in research capacities and knowledge production, reinforcing earlier findings on the unequal distribution of scientific output across regions. The thematic mapping powered by Scopus AI further validates and refines the understanding of conceptual structures underpinning SDG-related scholarship. The emergence of four major thematic branches Equality, Education, Hunger and Nutrition, and Poverty Reduction each linked to more specific topics such as gender equality, macroalgae, and corporate responsibility, reflects a deepening of research engagement with social, economic, and environmental dimensions of sustainability. These linkages indicate a paradigmatic shift from siloed studies to more integrated and systems-oriented inquiries, which are vital for achieving long-term development goals. Collectively, these findings suggest that SDG research is becoming increasingly interdisciplinary, globally networked, and conceptually structured around both macro-level goals and micro-level implementation challenges. However, the analysis also reveals certain underrepresented yet critical themes, such as mental health, digital equity, and indigenous knowledge systems, which remain on the periphery of mainstream discourse despite their relevance to inclusive sustainability. Addressing these gaps would not only broaden the

scope of SDG research but also enhance its contextual relevance and policy applicability. In sum, this study contributes to the literature by offering a holistic, visual, and data-driven synthesis of the SDG knowledge domain, highlighting core research themes, international collaboration patterns, and emerging conceptual trajectories. It provides actionable insights for researchers, policymakers, and funding bodies to foster more equitable, inclusive, and impact-driven SDG research ecosystems. Future studies could build upon these findings through longitudinal analyses, altimetric integration, and in-depth content exploration of emergent clusters to further unpack the dynamics of global sustainability science. Despite the increasing scholarly attention toward the Sustainable Development Goals (SDGs), the bibliometric analysis reveals notable disparities in research intensity across different goals. While SDG 4 (Quality Education), SDG 5 (Gender Equality), and SDG 2 (Zero Hunger) dominate the academic landscape, critical yet under-researched goals such as SDG 14 (Life Below Water), SDG 15 (Life on Land), and SDG 16 (Peace, Justice, and Strong Institutions) receive comparatively less attention. Emerging topics such as macroalgae in the context of food security, social inclusion within equality discourses, and corporate responsibility in poverty reduction are gaining momentum but remain fragmented in the literature. This uneven distribution of research focus signals a need for a more holistic and balanced scholarly agenda. For policymakers, these insights underscore the urgency of encouraging research funding and interdisciplinary collaboration in neglected SDG areas to ensure comprehensive and equitable progress. Strengthening institutional support for evidence-based policymaking, especially around biodiversity conservation, ocean governance, and institutional capacity-building can catalyze systemic

Table 4: Global Research Contributions by Corresponding Authors.

Corresponding Author's Countries					
Country	Articles	Articles %	SCP	MCP	MCP %
India	481	7.8	377	104	21.6
China	346	5.6	202	144	41.6
United Kingdom	300	4.9	155	145	48.3
USA	296	4.8	174	122	41.2
Spain	271	4.4	214	57	21
Australia	200	3.3	134	66	33
Malaysia	193	3.1	121	72	37.3
South Africa	178	2.9	129	49	27.5
Indonesia	150	2.4	121	29	19.3
Italy	142	2.3	101	41	28.9
Germany	127	2.1	75	52	40.9

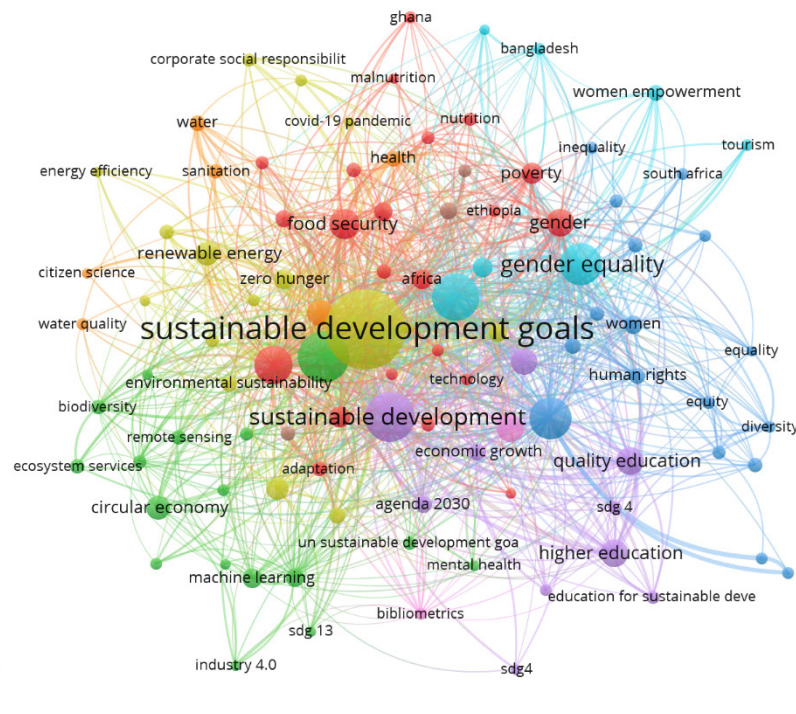


Figure 10: Keyword Co-occurrence Network of SDG-Related Research Based on Author Keywords.

transformations toward achieving Agenda 2030 in its entirety. Bibliometric insights can inform national SDG policy frameworks by assessing the alignment between scientific output and development priorities, thereby promoting more evidence-driven policymaking. Ultimately, while methodologically limited, bibliometric analysis remains indispensable for understanding sustainability knowledge architectures and directing investments that accelerate SDG progress, especially within developing-country contexts. These patterns carry significant implications for sustainability science and policy. First, the capacity of a small set of regions and actors to steer research agendas risks narrowing

the conceptual horizon of sustainability, privileging technocratic or model-driven approaches over context-rich, socially embedded forms of knowledge. Second, the concentration of scholarly output in regions with comparatively fewer sustainability challenges can weaken the relevance of global research to communities confronting acute ecological and socio-economic vulnerabilities. This dynamic accentuates the “implementation gap”, the disconnect between global knowledge production and local sustainability needs. Furthermore, these asymmetries are at odds with the normative foundations of the SDGs, which emphasize inclusivity, equitable participation, and recognition of

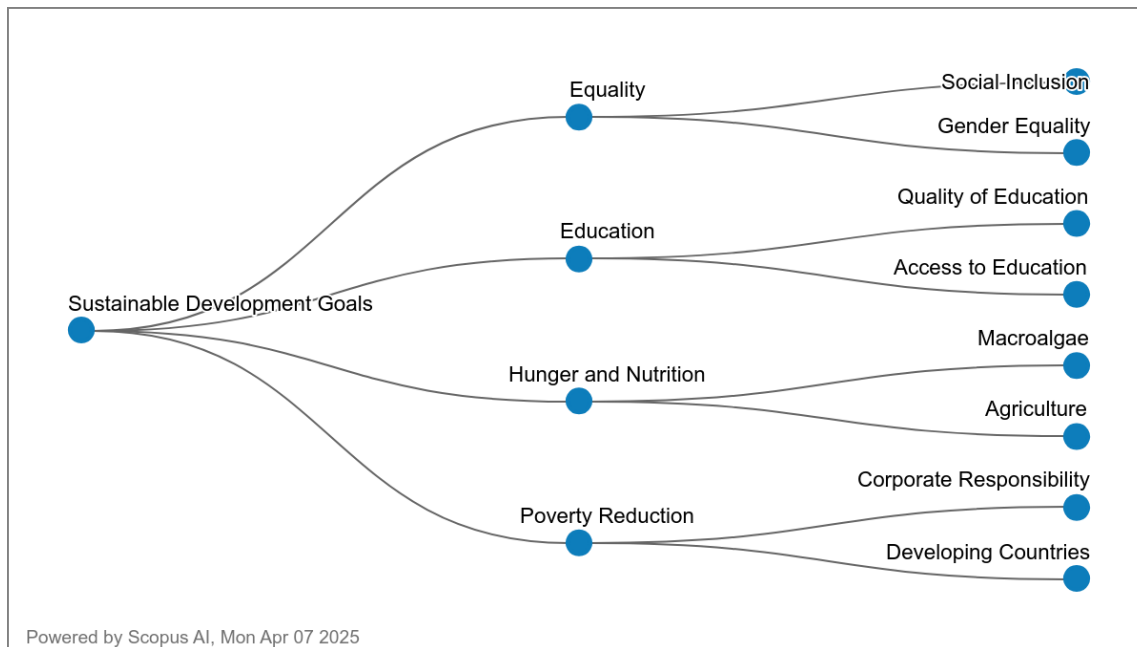


Figure 11: Thematic Mapping of Sustainable Development Goals Using Scopus AI.

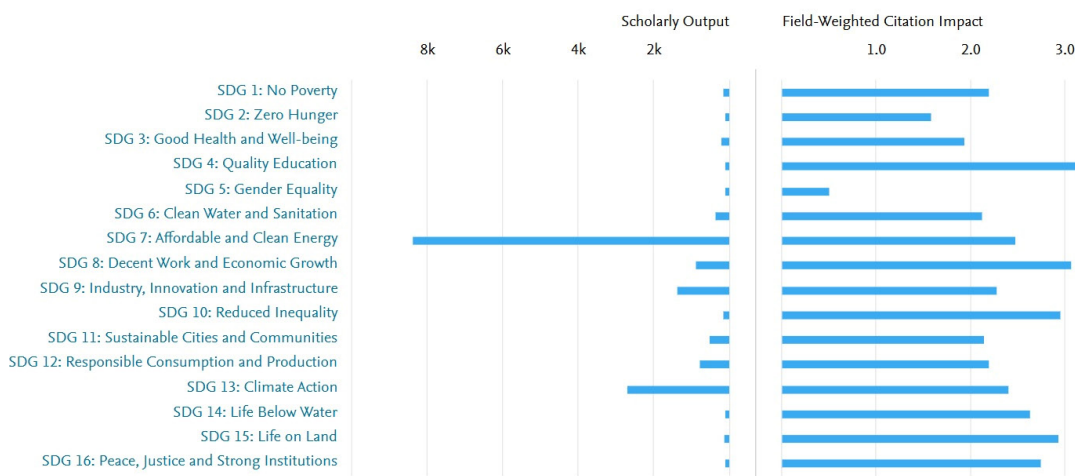


Figure 12: SDG scholarly Research output and field-weighted citation impact.

diverse knowledge systems. A sustainability science dominated by a limited set of epistemic centers risks reproducing the very inequities the SDGs aim to redress. From a systems perspective, such concentration also reduces the resilience and adaptive capacity of the global knowledge system, limiting the circulation of novel methodologies, culturally embedded insights, and alternative sustainability imaginaries. The analysis shows that research on the Sustainable Development Goals (SDGs) has rapidly evolved into a central and institutionalized area of global scholarship, marked by strong growth after the adoption of the UN2030 Agenda. Academic output is dominated by peer-reviewed journal articles, reflecting prevailing evaluation systems, while books, reviews, and conference papers play complementary roles in shaping conceptual depth and early dissemination. Although publication volume has increased sharply, average citation impact has declined, suggesting a growing tension between quantity and

influence. This trend points to an increasingly crowded research landscape in which scholarly attention is fragmented, highlighting the need for more theoretically grounded, integrative, and impactful contributions rather than further expansion in output alone. At the same time, the findings reveal persistent structural and thematic inequalities within SDG scholarship. Research production and influence remain concentrated in well-resourced institutions and countries in the Global North, while international collaboration emerges as a key driver of visibility and impact. Thematic attention is uneven, with climate action, clean energy, and urban sustainability receiving far greater focus than equity-oriented goals such as poverty reduction, gender equality, and governance. This imbalance reflects the political economy of research funding and methodological preferences rather than the relative importance of the goals themselves. Collectively, the results suggest that the transformative potential of SDG research

depends not only on continued growth, but on more inclusive collaboration, greater attention to underrepresented goals, and a deliberate effort to align scholarly priorities with the social realities and inequalities that sustainable development seeks to address.

CONCLUSION

This bibliometric study offers a structured overview of the research landscape surrounding the Sustainable Development Goals (SDGs), presenting key insights into publication trends, thematic focus areas, and global collaboration patterns.

IMPLICATIONS

By applying advanced visualization techniques to Scopus-indexed literature, the paper identifies dominant themes and highlights critical areas that remain underexplored. The analysis contributes to the growing field of sustainability studies by providing an empirical foundation for understanding how scholarly attention is distributed across the 17 goals, and by exposing the thematic imbalances that exist within the broader SDG research ecosystem. What sets this study apart is its integrated approach to mapping both conceptual structures and collaboration networks, offering a dual lens that enriches our understanding of how knowledge flows and clusters around specific sustainability themes. This paper not only reinforces the value of bibliometric analysis in sustainability science but also equips researchers and institutional stakeholders with a strategic view of where academic investment and international cooperation are most needed.

LIMITATIONS AND FUTURE RESEARCH

Bibliometric analyses of SDG scholarship are constrained by structural biases inherent in major indexing databases, which often under-represent research from developing countries, non-English publications, and regionally disseminated knowledge. Citation-based indicators further privilege established scholarly communities, thereby overlooking policy reports, community-based evidence, and other grey literature central to SDG implementation. Moreover, bibliometric techniques provide limited insight into the qualitative and contextual dimensions of research influence, particularly its translation into policy or societal impact. The study also excluded articles which are not in English, not full article, and are not from relevant discipline within the time period 2015-2024.

Future research trajectories should be broadened through the integration of longitudinal citation analytics, enabling a more nuanced understanding of the temporal evolution, scholarly influence, and epistemic consolidation of SDG oriented research. Such analyses would further illuminate the emergence of novel interdisciplinary convergences particularly those at the nexus of environmental governance, technological innovation, public

health, and socio-economic equity which collectively define the intellectual architecture of contemporary sustainability science. A more rigorous examination of how SDG-focused research translates into policy implementation and measurable societal outcomes is also imperative, as it provides the empirical grounding necessary for enhancing the efficacy, accountability, and contextual relevance of sustainable development policies. Moreover, advancing this research agenda requires systematic attention to funding allocation mechanisms and policy initiatives that directly influence the production, dissemination, and utilization of SDG scholarship. Targeted investments, such as competitive grant schemes, mission-oriented research programs, and coordinated national funding frameworks, are essential for strengthening research infrastructure and enabling scholars particularly in low- and middle-income contexts to pursue high-impact sustainability research. Equally important are governmental and intergovernmental policy instruments that incentivize evidence-based decision-making, promote open-science practices, and integrate academic findings into national SDG action plans.

Crucially, the trajectory of SDG progress in developing countries is shaped by the patterns of academic collaboration that underpin knowledge co-creation and capacity building. Transnational and South-South research partnerships facilitate the transfer of methodological expertise, enhance access to advanced technologies, and foster the co-production of locally relevant solutions to sustainability challenges. Collaborative networks also mitigate structural research asymmetries by enabling more equitable authorship, resource sharing, and agenda-setting processes. In contexts where institutional capacities and research ecosystems remain uneven, such partnerships serve as indispensable conduits for amplifying scientific visibility, mobilizing resources, and producing context-sensitive innovations aligned with national development priorities. Taken together, these research extensions, funding and policy interventions, and collaborative dynamics will be critical in refining the scholarly foundations and practical implementation pathways of the global sustainability agenda, thereby strengthening the transformative potential of SDG-driven research in the decades ahead. Addressing these disparities requires coordinated transformations in global knowledge governance: rebalancing research funding, expanding multilingual publication practices, strengthening research capacity in underrepresented regions, and diversifying decision-making structures within major journals and international scientific bodies. Only through such measures can sustainability research more fully embody the principles of justice, inclusivity, and plurality that lie at the heart of sustainable development.

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ABBREVIATIONS

SDGs: Sustainable Development Goals; **UN:** United Nations; **PRISMA:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses; **AI:** Artificial Intelligence; **SCP:** Single Country Publications; **MCP:** Multiple Country Publications; **TCpY:** Total Citations per Year; **h-index:** Hirsch Index; **g-index:** g-Index; **m-index:** m-Quotient Index; **FWCI:** Field-Weighted Citation Impact; **MDGs:** Millennium Development Goals; **VOSviewer:** Visualization of Similarities Viewer; **R:** Programming Language for Statistical Computing.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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