Journal of Scientometric Research, 2024; 13(1):1-13.
https://www.jscires.org

Research Article

Mapping the Global Academic Support for Sustainable Development Goal 7: A Bibliometric Analysis and Topic Modelling Approach

Rajkumar Natarajan [1,*], Manoj Kumar Verma[2], Surulinathi Muthuraj [1]

[1]Department of Library and Information Science, Bharathidasan University, Tiruchirappalli, Tamil Nadu, INDIA.
[2]Department of Library and Information Science, Mizoram University, Aizwal, Mizoram, INDIA.

ABSTRACT

The Sustainable Development Goal 7 (SDG-7) promises to ensure the affordable and clean energy to the world. The United Nations (UN) has set a target for 2030, which can only be achieved through academic excellence. The present study aims to analyze the academic research support of SDG 7 from a global perspective by using bibliometric analysis and topic modelling approaches using Orange Python-based software. The present study extracts the scholarly publications from the lens database from 2015 to 2022 and the dataset consisted of 918 publications with 18,377 citations related to the SDG 7. These including 121 single-author and 797 multiple-authors publications. Most of the papers have been published in open-access journals. Environmental Science and Pollution Research International (5343 citations; 225 publications and CPP 23.74) was the most impactful journal, Muntasir Murshed (13 publications, 421 citations, CPP 32.3) was the most influential author, and China was the most productive country. Under co-occurrence analysis, Clean Energy, Environmental Economics, Health, Affordable Energy, Climate Change, and Business, six different denoted clusters were found, while in the topic modeling approach, six key topics were identified, in which three topics were related to economics and the other were energy-related and climate change. Environmental, renewable energy, and economics were the top words used in SDG 7, and six key documents on each topic were identified according to the distribution and weighting of the topics. The Implications of the research findings and addressing research gaps can inform researchers, policymakers, and funding agencies involved in advancing SDG 7 to help accelerate the achievement of the SDGs in the decision-making process.

Keywords: SDG 7, Affordable and Clean Energy, Scientometrics, Text Analysis, Machine Learning, Latent Semantic Analysis.

Correspondence:
Rajkumar N
Department of Library and Information Science, Bharathidasan University, Tiruchirappalli, Tamil Nadu, INDIA.
Email: rajkumarnataraj19@gmail.com
Orchid ID: 0000-0001-5838-0112

Received: x-x-x;
Revised: x-x-x;
Accepted: x-x-x.

INTRODUCTION

There are 17 Sustainable Development Goals (SDGs) and 169 targets adopted by the United Nations (UN) General Assembly in 2015, which aimed to guide public policy and inspire social actors to promote sustainable development globally. The SDGs are framed with the aim of harmonizing the social, economic, and environmental dimensions of development to make the world more equal, healthier, and fair.[1] The SDGs aim to end poverty and hunger; reduce inequality; protect the planet; and ensure that people enjoy health, justice, and prosperity.[2] SDGs are integrated, indivisible, and global in nature to achieve 17 goals, and implementing each SDGs within the framework of a revitalized Global Partnership for Sustainable Development is required.[3]

The seventh SDG focuses on affordable and clean energy to ensure universal access to affordable, reliable, and modern energy services and to increase renewable energy participation in the global energy supply.[4] SDG 7 calls for an effective reform planning and implementation, close collaboration between non-governmental and governmental organizations in rural communities across the country, and involvement of local organizations.[5] Climate change plays a vital role in many aspects such as health, economics, and business, and has a major impact on people's health and livelihoods.[6] Achieving SDG 7 is essential for achieving other SDGs, such as SDG 13 (Climate Action), SDG 14, and SDG 15 (Life on Below Water and on Land), and SDG 10 (Reducing Inequalities).[7]

Research helps us track progress towards the SDGs, identify areas for improvement, and make key decisions.[8] The involvement of researchers from various institutions is essential for tracking

DOI: ["DOI"].11.2.1

progress on the SDGs and making evidence-based decisions. Their research and analysis help us to understand the challenges and opportunities in achieving the SDGs and identify effective strategies for sustainable development.[9] Research on the SDGs also provides the community with advice and non-academic services regarding the progress and challenges related to the SDGs. In addition, researchers have developed innovative solutions and inventions, and have communicated them through publications to various stakeholders, including governments and policymakers. Monitoring and research are essential for achieving the SDGs.[10]

Bibliometric analysis is a research method that uses statistical and computational techniques to analyze patterns in the published literature.[11] Bibliometric analysis can be classified into performance, knowledge structure, and co-occurrence analyses. Performance can be used in many ways, including evaluating research performance, monitoring scientific developments, and analyzing the performance of journals, authors, countries, and institutions.[12] Co-occurrence analysis is a technique that detects thematic trends by counting the number of times words or phrases appear together in a dataset.[13]

Several bibliometric studies have been conducted on SDGs. A bibliometric analysis of Web of Science publications on SDG and education focused on scientific production, evolution of publications, country origins, and productive authors.[14] A bibliographic mapping of scholarly publications on third SDG health from 2015 to 2021 using The Lens database.[15] A bibliometric analysis of literature reviews on sustainable development goals was conducted to assess the evolution and consolidation of scientific literature from 2015 to 2022,[16] which conducted a bibliometric analysis on all SDGs that focused on analyzing only review articles from the Web of Science database. Yet many bibliometric analyses focused the attaining of SDG, the world demand more researches in the aspects of promoting SDG. This paper specifically focused on SDG 7: affordable and clean energy. This choice is important because of the 249 indicators of the United Nations, 92 which are related to the environment in which clean energy is an essential component.[17] The bibliometric extends its analysis by including types of documents such as research articles, conference papers, and book chapters. Consequently, the study provides a more comprehensive and detailed examination of academic literature on SDG 7, furnishes a unique insights and research trends specific to SDG 7.

Topic modeling is a technique used to analyze text data and identify common topics or themes in a document collection,[18] encompasses various techniques. Latent Semantic Analysis (LSA) is a versatile method that can be applied to various text analysis tasks such as topic modeling, summarization, and assessment. Topic modelling using LSA helps uncover hidden themes and semantic relationships within text data.[19] Topic modelling was used for literature reviews in the open-source LDA Shiny package in the R environment, with the green library literature.[20] There are some topic modelling analyses in SDG, Analysis of news documents online media has a crucial role in implementing goal topic modelling through Latent Dirichl *et al.* location (LDA).[21] The LSA played a key role of selecting the accurate issues related to SDG 7 by referring the key topics and documents. The LSA model in the present research, aims to analyse key topics and identify key documents in the context of SDG 7. By revealing the most important themes and key research contributions, the LSA model is helpful in providing academic support for achieving the goal.

Objectives of the Study

This study aimed to analyze the contributions of academic support to the seventh SDG through bibliometric and topic modelling approaches of scholarly publications between 2015 and 2022. This study had the following objectives: To assess citation and publication trends during this period. To identify productive and impactful authors, leading institutions, and countries. To identify research themes and trends by assessing keywords. To understand scientific understanding and research area trends by identifying the most-cited articles and references. To obtain this bibliometric results, mapping and visualization software were used. To identify the key topics and emerging themes and top words in SDG 7 research through topic modelling using the Latent Semantic Analysis (LSA) algorithm. The key documents associated with the key topics were identified by reviewing the literature on SDG 7 research using the LSA model. Python-based data mining software was used to achieve this. To determine the altmetric score for the top-cited articles and references, we identified popular and socially impactful articles using an altmetric bookmarklet. The findings of this study provide insights into research gaps related to SDG 7 indicators and help policymakers accelerate the achievement of SDGs in the decision-making process.

This is the first study on the seventh SDG affordable and clean energy research that combines bibliometric and topic modelling approaches using an LSA model in Python.

Research Philosophy and Methodology

We used a mixed research methods that combined bibliometric and topic modeling to analyze effectively to achieve the objectives of the study. Bibliometric analysis has been used to assess journal performance, author contributions, institutional participation, country-level research activities, Highly Cited Papers (HCPs), top-cited references, and the intellectual structure of thematic trends within the field. Simultaneously, topic modeling analysis was used to identify the key themes and key documents, reflecting the underlying themes and important contributions to the research landscape. This integrated approach enables an overall exploration of the research landscape related to the study objectives.

Bibliometric Method: Data Collection and Analysis

We adopted a bibliometric approach and used quantitative methods to analyze the bibliographic and bibliometric data.[22] We followed Goodell *et al.*[23] for bibliometric analysis to identify the productive and influential of journals, authors, institutions, countries, and Highly Cited Papers (HCPs), most cited references, thematic evolution, and a bibliometric review of the year-wise trends of the global and intellectual structure of trending topics by co-occurrence analysis.

Bibliographic and bibliometric data were collected from a lens database (https://www.lens.org/), an open-source database, and scholarly publications covering various fields of research and it as open-source principles to analyse data for scholarly community. The database includes data collaboration with CrossRef, Microsoft Academic, ORCID, PubMed, CORE, and others. These partnerships not only ensure comprehensiveness but also uphold rigorous quality. Compared with commercial databases, they do not support open science.[15] However, the lens database's support for open science, multidisciplinary coverage, and commitment to open access make it an ideal choice to align with our research objectives, enhancing data reliability and credibility. The search string "SDG 7" OR SDG AND "Clean Energy" (these keywords are chosen to make a focused search to retrieve only SDG 7) queries used in the title, abstract, and keywords for the period from 2015 to 2022. The time period is based on the implementation of the SDGs and the transition of the MDGs to the SDGs. The year 2023 was excluded because the data acquisition is still in progress. The collected data were limited to peer-reviewed publications articles, conference proceedings, and book chapters. This is a systematic process for retrieving the final dataset of 918 documents, as shown in Figure 1. The bibliographic and bibliometric data were analyzed using bibliometrix and Vosviewer Bibliometrix is web-based software with a user-friendly interface and flexibility in handling bibliometric data. This allows for efficient data processing and visualization. VOSviewer is a useful tool for bibliometric analysis, especially for cluster analysis and visualization of research trends in various areas. The data were collected in a CSV file, and comprehensive analysis of bibliometric indicators and performance analysis were performed using the bibliometrix package in the R environment.[24] VOSviewer was used to visualize the connection between the articles and determine the intellectual structure of thematic trends assessed using co-occurrence (co-word) analysis.[25]

Topic Modelling Approach: Data Collection and Analysis

In the topic modelling approach, the LSA model is used to analyze the bibliographic data. We follow Verma and Yuvaraj[20] for topic modelling analysis to identify the topic words and latent and emerging topics and review the documents to find the key documents by the distribution of topic words and topics.

Bibliographic data collected from the lens database (https://www.lens.org/). Figure 1 shows the systematic process of collecting data from the lens database and retrieving the 918 documents. We recorded the titles, years of publication, authors, links, and abstracts of 918 documents in an Excel file and performed topic modelling from the database. The topic modelling LSA analysis was performed using Orange, an open-source software data-mining toolbox in Python scripting.[26] It provides flexibility with data preprocessing, visualization, and topic modelling techniques in single software and also uses machine learning algorithms to evaluate the results for accuracy.[27]

The lengths of all five exported metadata, where 918 documents are imported to orange data mining software for topic modelling LSA, involves four steps, as shown in Figure 2: (1) preprocessing, which involves cleaning data (transformation, tokenization, normalization, filtering, N-grams range) text preprocessing technique that reduces a word to its root form, which can help reduce the dimension of the data and improve efficiency, stop words, and remove URLs and accents. The Stop words approach in text mining helps reduce the complexity of calculation and improve performance by removing words such as "if," "the," and "or" etc. Before the dimensions of preprocessing, it contains 92411 words and postprocessing 2415 words in that the (2) topic modelling widget is chosen. (3) The LSA model was used to analyse the top words and key topics. (4) The LSA model, which also identifies key documents, was analysed by topic weights, which means that the distribution of topics in documents is present in SDG 7 scholarly literature.

Findings

Performance Analysis

Publication and Citation Trends of SDG 7 Research

The publication and citation trends of the SDG 7 research are shown in Figure 3. The data reveal an increasing trend in the number of publications and citations over the years, indicating growing interest and attention towards SDG 7 within the academic community. 2018–2022 was the most productive period, with 890 publications. The researches are helpful to combat climate change and achieve the SDG 7 targets, as well as to deal with the impact of the emergence of innovative policies and technologies. The most impactful studies were conducted from 2017 to 2021 with remarkable citations. Progress towards achieving the target has been slow but steady. However, increased awareness of the importance of clean, affordable energy access, and advances in technologies and policy changes have increased the impact of SDG 7 research during this period. The year 2022 has fewer citations than the previous year. The epidemic, affected many countries and undermined their ability to achieve the Sustainable Development Goals (SDGs) of 2030, including SDG 7, due to limited activities, slowing economies, and declining investment

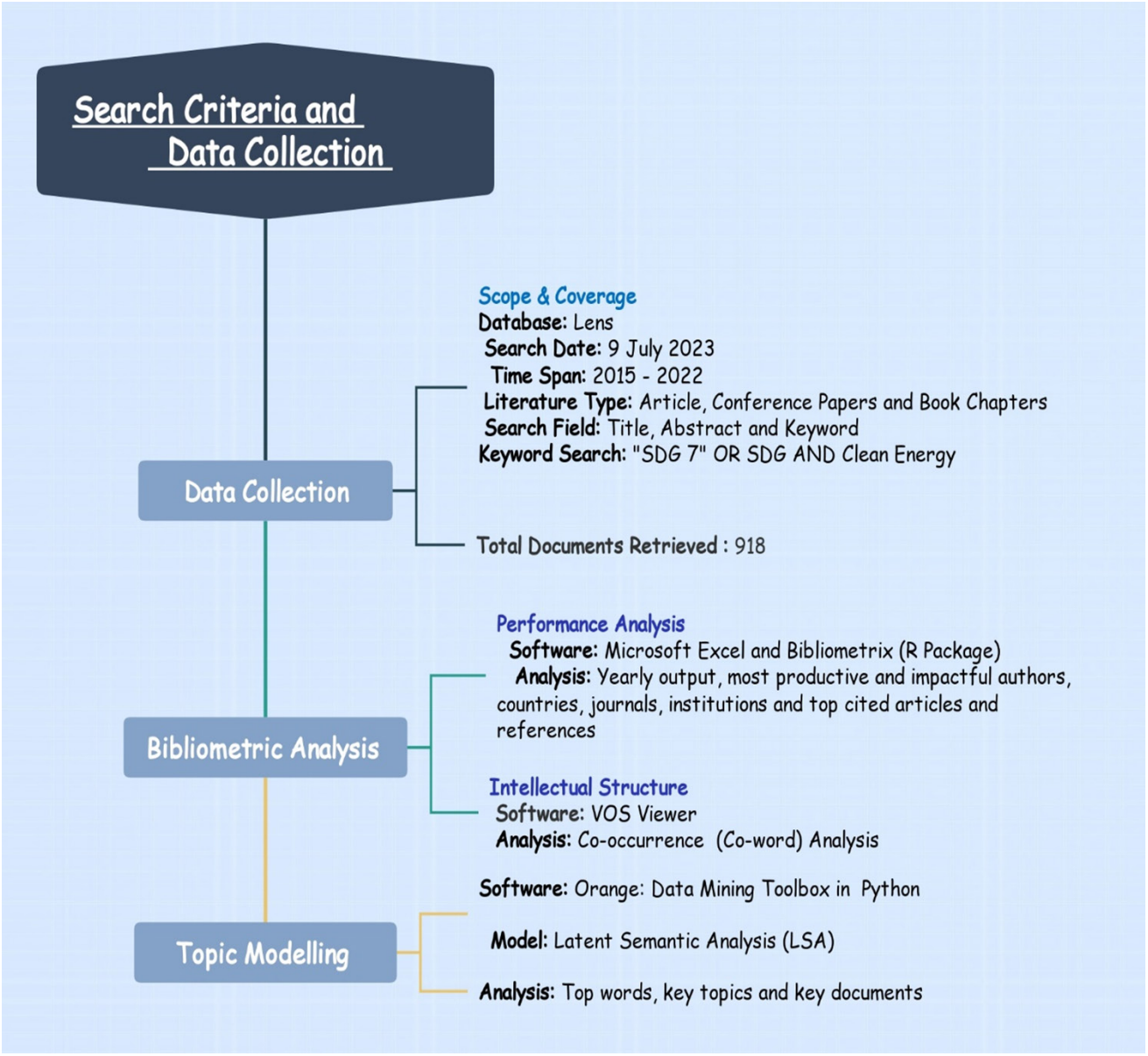

Figure 1: Search Criteria and Data Collection.

in non-health systems. The cumulative data for the period show a total of 918 publications on SDG 7, garnering 18,377 citations. Analyzing annual publications and citation trends provides researchers with a comprehensive understanding of the research landscape.[28]

Top Authors, Institutions and Countries of SDG 7 Research

Table 1 lists the top authors, institutions and countries. Based on these publications, Festus Victor Bekun ranked top, authoring impressive total of 13 publications followed by Muntasir Murshed with the contribution of 13 publications in the branch of sustainable economics. In terms of citations, Muntasir Murshed was the most influential author in SDG 7 research, with 421 citations, followed by Haider Mahmood, which is centered on environmental economics with 328 citations. Among the institutions, based on publications, the Beijing Institute of Technology and Chinese Academy of Sciences are the most productive institutions, with 16 and 14 publications, based on citations, and the most productive institutions are the most influential institutions with 792 and 558 citations, respectively. Among the countries, the most productive are China and the United States, with 142 and 90 publications, respectively, and the most influential countries are the United Kingdom and the United States, with 5393 and 4342 citations, respectively. The productive and influential developed countries like China, the US, and the UK have more resources and advanced infrastructure supportive policies for encouragement in the SDG 7 research. The commitment of acquiring knowledge and driving progress in the pursuit of sustainable energy solutions ensures access to affordable, reliable, sustainable, and modern energy for all. The collective efforts of authors, institutions, and countries contribute to advance the sustainable energy access and

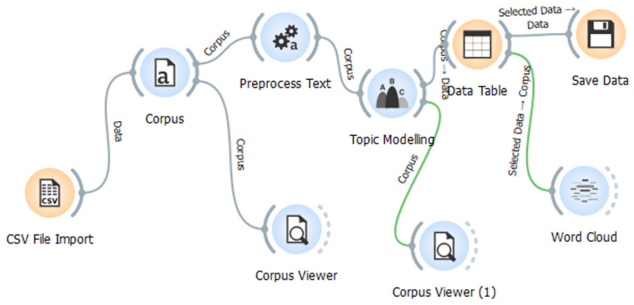

Figure 2: Steps involved in Topic Modelling using Orange Software.

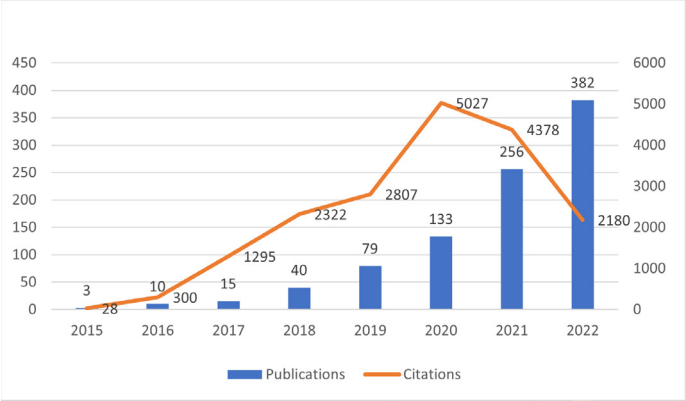

Figure 3: Publication and Citation Trends of SDG 7 Research.

development, facilitating global collaboration, and supporting the achievement of the targets set by SDG 7.[28]

Top Cited Publications for Scientific Understanding on SDG 7

The Highly Cited Papers (HCPs) on SDG 7 research have 31 articles, with citations ranging from 103 to 630. The top-cited articles are listed in Table 2. Schroeder *et al.*[29] was the most influential article, with the highest number of citations (630), followed by Fuso Nerini *et al.*[30] with 565 citations. Schroeder *et al.*[29] Circular economy practices can be applied as a "toolbox" and specific implementation approaches for achieving a large number of SDG targets. It provides circular economy practices related to waste management and suggestions on how to overcome them. Fuso Nerini *et al.*[30] Synergies and trade-offs between efforts to achieve SDG7 and the 2030 Agenda for Sustainable Development as a whole and identify 113 targets requiring action to change energy systems. Energy plays a fundamental role in efforts to end poverty.

Further examination of the top-cited articles on SDG 7 research reveals (Schroeder *et al.*;[29] Thacker *et al.*;[34] Gao and Bryan)[39] were the most influential articles in the field of environment-related economics in SDG 7 research. Climate change is an important environmental factor and is very important in SDG 7; therefore, (Creutzig *et al.*[32] and Bossio *et al.*;[36] Fuso Nerini *et al.*)[35] they have attracted considerable scholarly attention. Other impactful and influential articles were in the fields of top-cited publications on marine conservation,[31] hydrogen fuel,[33] political science[37] and SDG after COVID 19.[39] There are many dimensions at the intersection of SDG 7 and other sustainability areas such as climate change, environmental economics, and water protection. These articles contribute to the scientific understanding and progress towards achieving SDG 7 in a global context.

Altmetric Score (AS), a useful tool for tracking the attention and interest of academic articles received from social media, calculated by sharing and mentioning articles in social media. High altmetric scores improve the visibility and discovery of social media, whereas low scores indicate limited involvement from social media sources. Among these studies, Duarte *et al.*[31] stood out with a substantial AS of 2967, indicating significant societal engagement and impact. Similarly, Bossio *et al.*[36] exhibited a notable AS of 575, highlighting its influence beyond academia. In contrast, Fuso Nerini *et al.*,[30] while having a high citation of 565, had a relatively modest AS of 101. This suggests that the study has received significant academic recognition, but may benefit from increased engagement with broader audiences. Several studies, including Creutzig *et al.*,[32] Tong *et al.*,[33] Thacker *et al.*,[34] Fuso Nerini *et al.*[35] and Gao and Bryan[39] strike a balance between citations and AS, indicating their relevance in both academia and society. On the other hand, Barbier and Burgess[38] received a citation of 213 but lacked social media engagement, highlighting the potential for wider dissemination to increase societal impact. Finally, Schroeder *et al.*[29] had a high citation of 630 but a lower AS of 37, suggesting an opportunity for the authors to enhance the societal engagement of their work. This analysis emphasizes the diversity of research effects within SDG 7. Although citations represent academic recognition, the altmetric attention score represents a broader social media attention.

Top References for Trends and Areas of Research Interest on SDG 7

Top-cited references were used to uncover foundational topics in this research field. A totally of 14651 documents were referred to in the SDG 7. The top-cited references in SDG 7 are shown in Table 3. The most cited references were Gielen *et al.*[40] and Ferronato and Torretta,[41] with 1831 and 843 citations, respectively. Uncovering the technical and economic characteristics of an accelerated energy transition by 2050 using a new renewable energy dataset[40] has been highly cited in the fields of energy and environmental economics. Ferronato and Torretta[41] reported that the severe environmental impacts of improper management of solid waste in developing countries are widespread worldwide, including marine litter, air, soil, and water pollution, and direct contact between waste collectors and hazardous wastes. That emerge the interactions to solve the issues.

Further examination of the table for foundational topics. Additionally, Sachs *et al.*[42] Sustainable Development Goals

(SDGs), and the Paris Agreement on Climate Change call for deep transformations in every country that will require complementary actions by governments, civil society, science, and business. Other foundational inquiries include the topics of environmental economics on equity and poverty[43] and the economic growth of the country.[44] How the Artificial Intelligence (AI) helps us achieve the SDGs[45] and greenhouse gas emissions in agriculture and food systems.[47] The cited references provide insights into global research trends and areas of research interest.[51]

Gielen *et al.*[40] with the citations of 1831, received significant academic recognition. However, the AS of 279 indicates that there is room for broader social media attention. Similarly, Ferronato and Torretta[41] achieved a high citation of 843, which indicated academic recognition, but their AS of 126 suggested the possibility of increasing social media attention. Sachs *et al.*[42] balanced 743 citations and 426 AS and demonstrated their relevance in both academic and social media. O'Neill *et al.*[43] reached 727 citations and 1487 AS, which emphasizes its influence on academia and attention in social media. Bryan *et al.*[44] citation was 661, but AS was 106, suggesting the possibility of more. Vinuesa *et al.*[45] is notable for its AS of 838, surpassing its citations of 642, which indicates a significant influence outside the academics. Sovacool *et al.*[46] receives 586 citations, but relatively low AS, with the potential for a wider social involvement. Crippa *et al.*[47] an investigation into the impact of food systems on greenhouse gas emissions yielded a significant citation of 573 and an impressive AS of 2845, showing significant impacts in both academic and social contexts. Watts *et al.*[48] guarantees 539 citations and AS 2098, which means substantial recognition and impact in academia and social media.

Top Journals for SDG 7 research

The top journals that published SDG 7 research are listed in Table 4. In terms of publications, Environmental Science and Pollution

Table 1: Top Authors, Institutions and Countries of SDG 7 Research.

TC	Author	TP	TC	Institution	TP	TC	Country	TP
307	Festus Victor Bekun	13	792	Beijing Institute of Technology	16	4020	China	142
421	Muntasir Murshed	13	558	Chinese Academy of Sciences	14	4342	United States	90
119	Mohammed Musah	9	513	Cyprus International University	11	5393	United Kingdom	86
229	Bright Akwasi Gyamfi	8	235	Jiangsu University	8	1682	India	59
328	Haider Mahmood	8	290	Lagos State University	7	1378	Pakistan	44
179	Muhammad Tariq Majeed	8	304	Quaid-i-Azam University	7	1861	Australia	38

Note(s): TC=Total Citations; TP=Total Publications.

Table 2: Top Cited Publications on SDG 7 Research.

Author(s)	Title	TC	AS
Schroeder *et al.*[29]	The Relevance of Circular Economy Practices to the Sustainable Development Goals.	630	37
Fuso Nerini *et al.*[30]	Mapping synergies and trade-offs between energy and the Sustainable Development Goals.	565	101
Duarte *et al.*[31]	Rebuilding Marine Life.	423	2967
Creutzig *et al.*[32]	Towards demand-side solutions for mitigating climate change.	420	299
Tong *et al.*[33]	Electrolysis of low-grade and saline surface water.	391	94
Thacker *et al.*[34]	Infrastructure for Sustainable Development.	273	95
Fuso Nerini *et al.*[35]	Connecting climate action with other Sustainable Development Goals.	265	67
Bossio *et al.*[36]	The role of soil carbon in natural climate solutions.	262	575
Kroll *et al.*[37]	Sustainable Development Goals (SDGs): Are we successful in turning trade-offs into synergies?	245	63
Barbier and Burgess.[38]	Sustainability and development after COVID-19.	213	0
Gao and Bryan.[39]	Finding pathways to national-scale land-sector sustainability.	208	70

Note(s): TC=Total Citations; AS=Altmetric Score.

Research International and Environment Development and Sustainability were the most productive journals, with 225 and 38 publications, respectively. The two most influential journals were Environmental Science and Pollution Research International and Nature Sustainability, with 5343 and 1797 citations, respectively, and its CPP was 23.7 and 13.3, respectively. Examining the table, in recent years, research on SDG 7 has increased, and the top journals shown in Table 10531 (57%) of citations are received; in terms of productive 359 (39%) articles in the cumulative growth in the years 2021 and 2022, 262 (28%) publications were published in the top journals. These journals and special issues will contribute to the dissemination of research and knowledge on SDG 7 and facilitate progress towards affordable and clean energy.[51] Publishing premier journals can motivate scholarly interest.[52]

Intellectual and Influence Structure

Thematic Trends of SDG 7 through Co-occurrence Analysis

A co-word analysis can be used to identify research trends and thematic patterns in various research areas. Co-occurrence analysis helps researchers understand the relationships and ideas presented in a research field by analyzing keywords.[53] The co-occurrence analysis Figure 4 obtained from VOS Viewer provides visual representations of the relationship and associations between the different keywords and terms in the academic literature on Sustainable Development Goal 7 (SDG 7). It provides a comprehensive overview of the thematic trends in SDG 7 research using a co-occurrence analysis. Totally 16671 words appeared, and a minimum of five occurrence keywords are 1246 are taken to identify thematical and conceptual structures.

Examining the figure 4 six clusters are identified six themes in that Cluster 1 (red) denotes the clean energy and Cluster 2 (green) Environmental Economics, Cluster 3 (blue) Health, Cluster 4 (violet) Affordable Energy, Cluster 5 (yellow) Climate Change and Cluster 6 (sky blue) Business. These were the conceptual structures and thematic trends used to understand the research areas of SDG 7.

Topic Modelling

Top Words and Key Topics in SDG 7 Research

The identified topics and themes can provide directions for future research and inform researchers and experts in a particular field.[54] Table 5 shows the topics and top words obtained from the LSA model using the Orange data-mining tool in Python. A review of 918 articles on the SDG 7 LSA model yielded six topics, which means six themes in the field. The top words indicate the most frequently used words for a particular topic. We found that most of the topics were related to economics in the SDG 7. Potential to identify key themes and topics that can inform policymakers' policies and decision making.[55]

Table 3: Top References on SDG 7.

Author(s)	Title	TC	AS
Gielen *et al.*[40]	The role of renewable energy in the global energy transformation.	1831	279
Ferronato and Torretta.[41]	Waste Mismanagement in Developing Countries: A Review of Global Issues.	843	126
Sachs *et al.*[42]	Six Transformations to achieve the Sustainable Development Goals.	743	426
O'Neill *et al.*[43]	A good life for all within planetary boundaries.	727	1487
Bryan *et al.*[44]	China's response to a national land-system sustainability emergency.	661	106
Vinuesa *et al.*[45]	The role of artificial intelligence in achieving the Sustainable Development Goals.	642	838
Sovacool *et al.*[46]	Promoting novelty, rigor, and style in energy social science: Towards codes of practice for appropriate methods and research design.	586	92
Crippa *et al.*[47]	Food systems are responsible for a third of global anthropogenic GHG emissions.	573	2845
Watts *et al.*[48]	The 2018 report of the Lancet Countdown on health and climate change: Shaping the health of nations for centuries to come.	539	2098
Qian *et al.*[49]	MOF-Based Membranes for Gas Separations.	522	13

Note(s): TC=Total Citations; AS=Altmetric Score.

Key Documents Associated with the themes in SDG 7 Research

Topic modeling is a tool that helps identify key documents and uncovers potential thematic structures within large document collections. It can be used to analyze topics contained in large volumes of scholarly articles.[56] According to the weighting of the topics, six key documents were identified using LSA with the Orange Python-based software, as shown in Table 6. The LSA clarifies six different themes in the body of key documents relating to Sustainable SDG 7. These key documents encompass multifaceted aspects of sustainable economic development, including technological innovation, renewable energy, and international perspectives on SDG, the interaction between financial inclusion and environmental results, the integration and trade-offs of SDGs, energy consumption dynamics, and the effects of nuclear energy consumption on global carbon dioxide emissions. This analytical framework provides valuable insight into the numerous aspects of SDG 7, both in local and global contexts, and enhances our understanding of its broad objectives and challenges. This can be used as a reference for researchers and policymakers interested in SDG 7 on clean and affordable energy. Topic modeling allows the identification of key documents based on topic distribution and hidden topics as well as by analyzing the theme structure in the research area.[57]

Table 4: Top Journals for SDG 7 research.

Journal	TC	TP	CPP	Publisher	2015 - 2016	2017 - 2018	2019 - 2020	2021-2022
Environmental Science and Pollution Research International.	5343	225	23.7	Springer	1	3	31	190
Environment Development and Sustainability.	504	38	13.3	Springer	0	3	7	28
Sustainability	461	25	18.4	MDPI AG	0	2	6	17
Nature Sustainability	1797	23	78.1	Springer Nature	0	4	14	5
Clean Technologies and Environmental Policy.	153	20	7.7	Springer Nature	2	1	6	11
Nature Energy	1406	15	93.7	Springer Nature	0	4	5	6
Nature	867	13	66.7	Springer Nature	2	2	4	5
Total	10531	359	301.7		5	19	73	262

Note(s): TC=Total Citations; TP=Total Publications; CPP=Citations Per Publication.

Table 5: Top Words and Key Topics in SDG 7 Research.

Topic (T)	Topics	Top Words
Topic 1	Renewable Energy for Economic Development.	Development, Sustainable, Energy, Sustainable_Development, Goals, Development_Goals, Environmental, Renewable, Renewable_Energy, Economic.
Topic 2	Renewable Energy for Environmental and Economic Progress.	Energy, Sustainable_ Development, Sustainable, Development, Goals, Development_ Goals, Environmental, Renewable, Renewable_Energy, Economic.
Topic 3	Economic Growth and Environmental Protection.	Environmental, Energy, Economic, Growth, Countries, Evidence, Economic_ Growth, Clean, Clean_Energy, Degradation.
Topic 4	Carbon Emissions through Responsible Energy Consumption.	Environmental, Economic, Growth, Economic_ Growth, Carbon, Emissions, Consumption, Sustainability, Energy_ Consumption, Dioxide.
Topic 5	Affordable and Clean Renewable Energy.	Renewable, Renewable_ Energy, Clean, Clean_Energy, Economic, Green, Growth, Energy, Economic_ Growth, Affordable
Topic 6	Energy Consumption in Climate Change.	Green, Role, Consumption, Climate, Energy_ Consumption, Countries, Emissions, Analysis, Renewable, Change.

Table 6: Key Documents Associated with the themes in SDG 7 Research.

Author(s)	Key Documents on SDG 7	Topics	Topic Weights
Font Vivanco and Makov.[58]	Science, Technology, and Innovation for Sustainable Development Goals - The Role of Technology and Rebound Effects in the Success of the Sustainable Development Goals Framework.	Topic 1	3.79
Wang *et al.*[59]	Cross-national Perspectives on Using Sustainable Development Goals (SDGs) Indicators for Monitoring Sustainable Development: A Database and Analysis.	Topic 2	2.04
Chaudhry *et al.*[60]	Financial inclusion-environmental degradation nexus in OIC countries: new evidence from environmental Kuznets curve using DCCE approach.	Topic 3	2.23
Ngankam,[61]	Sustainable Development Goals Synergies/Trade-offs: Exploring Long- and Short-Run Impacts of Economic Growth, Income Inequality, Energy Consumption and Unemployment on Carbon Dioxide Emissions in South Africa.	Topic 4	2.25
Islam *et al.*[62]	Renewable and non-renewable energy consumption driven sustainable development in ASEAN countries: do financial development and institutional quality matter?	Topic 5	2.28
Majeed *et al.*[63]	A comparative analysis of nuclear energy consumption and CO2 emissions nexus: empirical evidence from the global economy and income groups.	Topic 6	1.26

DISCUSSION

The key findings and summary of the study are presented in Table 7. The findings provide valuable insights and meaningful progress for the seventh SDG related to affordable and clean energy. It is found that most research on SDG 7 has been published since 2018-2022, which may be due to an increase in greenhouse gas emissions, global warming, harming the overall health of our planet, and ensuring universal access to affordable and clean energy to expand sustainable energy services in developing countries.[64] The impact of SDG 7 research on 2022 is less the energy progress report of 2022, the expected impact is not gained due to COVID 19 pandemic, slowing economies, and declining investment in non-health systems.[65] However, in pandemic situations productivity and citations increases expect in 2022. The most productive and impactful countries are China, US and UK as they have more resources and advanced infrastructure supportive policies, regulations. They have higher demand for sustainable energy solutions factor such as environmental and population density crisis for encouragement in the SDG 7 research.[66-68]

The results of our citation analysis suggest that some of the articles shape SDG 7 research. In Schroeder *et al.*[29] this paper focuses on circular economy as a highly cited study and is very prominent in the field, followed by Fuso Nerini *et al.*[30] which focuses on energy-related studies. The foundational knowledge is referenced articles in which Gielen *et al.*[40] related to renewable energy are the most referenced articles, followed by Ferronato and Torretta,[41] focusing on waste management. In HCPs, social media attention articles through the AS are Duarte *et al.*[31] Creutzig *et al.*[32] and Bossio *et al.*[36] which focused on climate change. The social media attention articles in the referenced article are Crippa *et al.*[47] and Watts *et al.*,[48] which emphasize climate change in food and health systems. Climate-related and environmental articles focus on social media because climate change is a complex interdisciplinary problem that has attracted global attention.[69]

Co-Occurrence Analysis suggested thematic trends in SDG 7 research. This analysis attempts to determine the intellectual structure of research in SDG 7. The research consists of six clusters related to various aspects of SDG 7. Six clusters' addresses (1) clean energy, (2) environmental economics, (3) health, (4) affordable energy, (5) climate change and (6) business. These are the thematic trends and related research. These clusters show that SDG 7 intersects with the other SDGs. Investing in action under SDG 7 can bring several benefits and promote progress in other SDGs.[70] In keyword analysis, AI-related word occurrence is less needed to improve research on Artificial Intelligence (AI) and its connection to SDG 7. AI can help achieve SDG 7 in various ways, such as adjusting electricity supply demand, improving climate models, and improving energy efficiency.[45] The impact of SDG 7 research on 2022 is less the energy progress report of 2022 also says expected impact is not gained was COVID 19 pandemic set progress back due to limited activities, slowing economies, and declining investment in non-health systems[65] the impact of the COVID-19 pandemic on sustainable energy.

Using a topic modelling analysis of the literature, key topics and documents were identified. Topic modelling is a text analysis that uses the LSA technique through Python because a large corpus of

Table 7: Summary of Bibliometric Review and Topic Modelling on SDG 7 Research.

Performance Analysis **Based on Bibliometric data** **Reflect research performance**	**Co-occurrence (Co-word Analysis** **Based on Bibliometric data** **Reflect the intellectual structure**	**Topic Modelling** **LSA** **Reflect the thematic structure**
Publication Activity • Totally 918 articles, conference and review papers published in the journals between 2015 to 2022. • 2022 was the most prolific year with 382 articles. • 2020 is the most influential year with 5027 citations. • Average Citation Per Paper (ACPP): 19 Authors • Total: 3220 authors • Single Author Articles: 121 • Top Authors • Most Citations: Muntasir Murshed. (421 citations) • Most Publications: Festus Victor Bekun, (13 publications) Institutions • Total: 100 Institutions • Top Institutions • Most Productive and Influential: Beijing Institute of Technology (16 publications and 792 citations). Countries • Total: 87 Countries • Top Countries • Most Citations: United Kingdom (5393 citations). • Most Publications: China (142 publications). Journals • Total: 351 Journals • Top Journals • Most Cited and Productive: Environmental Science and Pollution Research International (5343 citations and 225 publications). Top HCPs • Schroeder *et al.*:[29] 630 citations • Fuso Nerini *et al.*:[30] 565 citations • Highest Altmetric Scored HCP: Duarte *et al.*[31] Top References • Gielen *et al.*:[40] 1831 citations • Ferronato and Torretta:[41] 843 citations • Highest Altmetric Scored Reference: Crippa *et al.*[47]	Themes • Clean Energy (Cluster 1) • Environmental Economics (Cluster 2) • Health (Cluster 3) • Affordable Energy (Cluster 4) • Climate Change (Cluster 5) • Business (Cluster 6)	Key Topics (T) and Insights • T1: Renewable Energy for Economic Development. • T2: Renewable Energy for Environmental and Economic Progress. • T3: Economic Growth and Environmental Protection. • T4: Carbon Emissions through Responsible Energy Consumption. • T5: Affordable and Clean Renewable Energy. • T6: Energy Consumption in Climate Change. Key Documents in Topics (T) • T1: Font Vivanco and Makov.[58] • T2: Wang *et al.*[59] • T3: Chaudhry *et al.*[60] • T4: Ngankam,[61] • T5: Islam *et al.*[62] • T6: Majeed *et al.*[63]

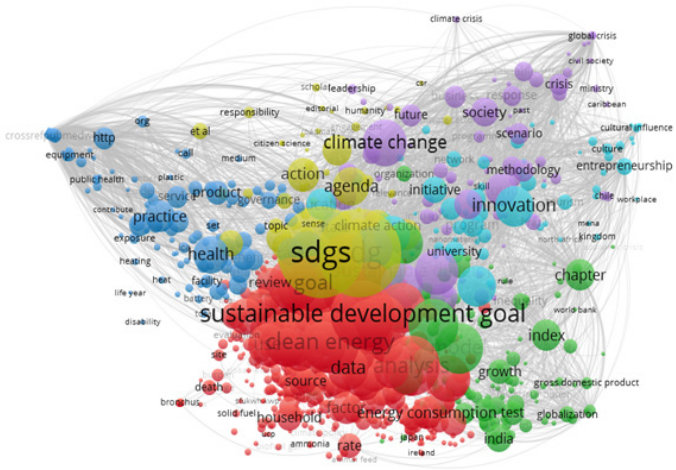

Figure 4: Thematic Trends of SDG 7 through Co-occurrence Analysis.

literature is examined and six topics and top keywords in SDG 7 on the topics and the distribution of keywords according to the topic weights; six key documents, each with a key topic, were identified as reference articles for research in SDG 7. It is found that most of the topics were related to economics in the SDG 7. SDG 7 ensures that clean and modern energy of all is mostly related to economics which is a key driver in economics.[67] The lack of access to energy and transformation systems is a problem for human and economic development,[71] and the highly cited article is also focused on economics.[29] These key documents encompass multifaceted aspects of sustainable economic development, including technological innovation by Font Vivanco and Makov,[58] renewable energy and international perspectives on SDG[59,60] the interaction between financial inclusion and environmental results, the integration and trade-offs of SDGs,[61] energy consumption dynamics,[62] and the effects of nuclear energy consumption on global carbon dioxide emissions.[63]

By overcoming research gaps and highlighting research priorities, this study provides crucial guidance to policymakers, funding bodies, stakeholders, and researchers working to advance the SDG 7 agenda.

CONCLUSION

Research is essential mechanism to track the progress of SDG, inform decisions, and foster sustainable development. Collaboration among researchers from diverse institutions enhances our understanding and offers effective strategies.[8,9] This study integrates the bibliometric analysis and topic modeling approach based on the database from 2015 to 2022. Though many researches were attempted to attain SDG 7, the attainment of affordable energy is needed to be focused more. The results of the present study suggest that authors globally have contributed to SDG 7 research. Identified influential and prestigious studies are found in SDG 7. Social media attention articles are on top cited, and the top-referred articles are identified. Our keyword and co-occurrence analysis showed that SDG 7 intersects with several research areas in other SDGs. Through co-occurrence analysis, the six clusters of literature on SDG 7, were used to understand the thematic trends in SDG 7.

This study results several contributions to the SDG 7 field. It examines the publication patterns in this area by yearly publications, as well as the performance analysis of authors, countries, institutions, and journals; the most influential studies by citation analysis and the social media attention articles in SDG 7 are found; Mapping the intellectual structure of SDG 7 by identifying the thematic trends using co-occurrence analysis to help the researchers; the topic modeling study provides a detailed investigation using Python-based software and gives six topics and key documents for each topic. These studies are used as references for the researchers. Through collective efforts inspired by these findings, the goals and targets of SDG 7 of the United Nations, can be achieved, ensure affordable and clean energy, and promote sustainable development worldwide.

Hence, the study provides a clear picture of research on SDG 7 using bibliometric and topic modeling analysis. However, like other studies, it has limitations. Keyword selection is based on our bibliometric and topic modeling analysis of SDG 7. Other keywords could emerge in the future. Open-access databases Lens is taken for study; PubMed and Dimensions are not included in the study; use them as a basis for further investigation and analysis in the field of sustainable energy access and environmental sustainability. SDG is interring connected with many requirements of world. In order to achieve, each countries play a pivotal role in the field of energy, health, justice, economic and so on. This study renders the help to monitor, identify and demand the need of an attaining clean energy.

Suggestions for future research

SDGs studies are interrelated. They need to be frequently addressed to the world. Utilizing bibliometric analysis, collaboration networks of authors, institutions, and countries can be key partnerships. The dynamics of knowledge production for future collaboration were analyzed using performance analysis, and research gaps were identified in the intellectual structure of thematic clusters assessed by keywords. This can help prioritize investigations and contribute to unveiling research gaps. Employing topic modelling, the LSA model was used to identify the latent topics and uncover the thematic trends, and reviews of the article key documents were identified by the distribution of topics. These research findings based on bibliometric and topic modelling analysis using the LSA model enable researchers and policymakers to assess influence and guide future investigations. Additionally, exploring the interdisciplinary connections, analyzing the research and implementation strategies, and fostering collaborative research networks, all of which can

come together and contribute, will advance SDG 7 research and show the path to achieving UNs SDG 7 targets and its goals on affordable and clean energy. Indeed, the integration of commercial databases such as the Web of Science and Scopus in future research could significantly improve the scope of research on Sustainable Development Goal 7.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

1. Biermann F, Hickmann T, Sénit CA, Beisheim M, Bernstein S, Chasek P, *et al.* Scientific evidence on the political impact of the Sustainable Development Goals. Nat Sustain. 2022; 5(9): 795-800. doi: 10.1038/s41893-022-00909-5.
2. United Nations. The 17 goals. Sustain Dev.
3. United Nations. Transforming our world: the 2030 Agenda for Sustainable Development. Department of Economic and Social Affairs [internet] [cited Jul 16 2023]. Available from: https://sdgs.un.org/2030agenda.
4. Van Loenhout R, Ranasinghe C, Degbelo A, Bouali N. Physicalizing sustainable development goals data: an example with SDG 7 (affordable and clean energy). In: New Orleans: ACM. 2022; 1-7. CHI Conference on Human Factors in Computing Systems Extended abstracts [internet] [cited Jul 17 2023]. Available from:https://dl.acm.org/doi/10.1145/3491101.3519638. doi: 10.1145/3491101.3519638.
5. Katoch OR, Sehgal S, Sharma R, Nawaz A. Analysis of the targets and progress toward meeting the 2030 Agenda for SDG 7 on affordable and clean energy: evidence from India. J Energy Res Rev. 2022: 92-102. doi: 10.9734/jenrr/2022/v12i4251.
6. van Daalen KR, Romanello M, Rocklöv J, Semenza JC, Tonne C, Markandya A, *et al.* The 2022 Europe report of the Lancet Countdown on health and climate change: towards a climate resilient future. Lancet Public Health. 2022; 7(11): e942-65. doi: 10.1016/S2468-2667(22)00197-9, PMID 36306805.
7. Hub ISK. UN-energy plan of action sends SDG 7 road map into implementation phase | News | SDG knowledge Hub. International Institute for Sustainable Development [internet] [cited Jul 17 2023]. Available from: https://sdg.iisd.org:443/news/un-energy-plan-of-action-sends-sdg-7-roadmap-into-implementation-phase/.
8. Wernecke B, Mathee A, Kunene Z, Balakrishna Y, Kapwata T, Mogotsi M, *et al.* Tracking progress towards the sustainable development goals in four rural villages in Limpopo, South Africa. Ann Glob Health. 2021; 87(1): 16. doi: 10.5334/aogh.3139, PMID 33633927.
9. Trane M, Marelli L, Siragusa A, Pollo R, Lombardi P. Progress by research to achieve the sustainable development goals in the EU: A systematic literature review. Sustainability. 2023; 15(9): 7055. doi: 10.3390/su15097055.
10. Ishtiaque A, Masrur A, Rabby YW, Jerin T, Dewan A. Remote sensing-based research for monitoring progress towards SDG 15 in Bangladesh: a review. Remote Sens. 2020; 12(4): 691. doi: 10.3390/rs12040691.
11. Briones de Araluze GK. Cassinello Plaza N. Open banking: A bibliometric analysis-driven definition. Wang T (David), editor. PLOS ONE. 2022; 17(10): e0275496. doi: 10.1371/journal.pone.0275496.
12. Farrukh M, Shahzad IA, Meng F, Wu Y, Raza A. Three decades of research in the technology analysis and strategic management: a bibliometrics analysis. Technol Anal Strateg Manag. 2021; 33(9): 989-1005. doi: 10.1080/09537325.2020.1862413.
13. Yanti Y, Ismail T, Hanifah IA, Muschlish M. Bibliometric analysis of the concept of using enterprise resource planning in the micro, small and medium enterprises (MSME) sector. TEM J. 2022: 1229-34. doi: 10.18421/TEM113-31.
14. Prieto-Jiménez E, López-Catalán L, López-Catalán B, Domínguez-Fernández G. Sustainable development goals and education: A bibliometric mapping analysis. Sustainability. 2021; 13(4): 2126. doi: 10.3390/su13042126.
15. Raji SA, Demehin MO. 'Long walk to 2030': A bibliometric and systematic review of research trends on the UN sustainable development goal 3. Dial Health. 2023; 2: 100132. doi: 10.1016/j.dialog.2023.100132.
16. Yamaguchi NU, Bernardino EG, Ferreira MEC, de Lima BP, Pascotini MR, Yamaguchi MU. Sustainable development goals: a bibliometric analysis of literature reviews. Environ Sci Pollut Res Int. 2023; 30(3): 5502-15. doi: 10.1007/s11356-022-24379-6, PMID 36418837.
17. Jiao B, Xu Z, Zheng K, Yan X, Feng J. Evaluation method of clean power grid development mode. E3S Web Conf. E3S Web of Conference. 2021; 236: 02002. doi: 10.1051/e3sconf/202123602002.
18. Liu L, Tang L, Dong W, Yao S, Zhou W. An overview of topic modeling and its current applications in bioinformatics. Springerplus. 2016; 5(1): 1608. doi: 10.1186/s40064-016-3252-8, PMID 27652181.
19. Amala IA, Richasdy D, Purbolaksono MD. Telkom university news topic modeling using latent semantic analysis (LSA) method on online news portal. Build Inform Technol Sci Bits. 2022; 4(1). doi: 10.47065/bits.v4i1.1584.
20. Verma MK, Yuvaraj M. AI-based literature reviews: A topic modeling approach. J Inf Knowl. 2023: 97-104. doi: 10.17821/srels/2023/v60i2/170967.
21. Fitri H, Widyawan W, Soesanti I. Topic modeling in the news document on sustainable development goals. IJITEE. 2021; 5(3): 82. doi: 10.22146/ijitee.67467.
22. Pritchard. Pritchard: statistical bibliography or bibliometrics – Google Scholar [internet]; 1969. Google [cited May 20 2023]. Available from: https://scholar.google.com/scholar_lookup?title=Statistical%20bibliography%20or%20bibliometrics and author=A.%20Pritchard and publication_year=1969 and pages=348-349.
23. Goodell JW, Kumar S, Lim WM, Pattnaik D. Artificial intelligence and machine learning in finance: identifying foundations, themes, and research clusters from bibliometric analysis. J Behav Exp Fin. 2021; 32: 100577. doi: 10.1016/j.jbef.2021.100577.
24. Aria M, Cuccurullo C. bibliometrix: an R-tool for comprehensive science mapping analysis. J Inf. 2017; 11(4): 959-75. doi: 10.1016/j.joi.2017.08.007.
25. Van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics. 2010; 84(2): 523-38. doi: 10.1007/s11192-009-0146-3, PMID 20585380.
26. Demšar J, Curk T, Erjavec A, Gorup Č, Hočevar T, Milutinovič M, *et al.* Orange: data mining toolbox in python. J Mach Learn Res. 2013; 14(71): 2349-53.
27. Vaishnav D, Rao BR. Comparison of machine learning algorithms and fruit classification using orange data mining tool. In: Coimbatore, India: IEEE Publications. 2018; 603-7. 3rd International Conference on Inventive Computation Technologies (ICICT) [internet] [cited Sep 24 2023]. Available from: https://ieeexplore.ieee.org/document/9034442/. doi: 10.1109/ICICT43934.2018.9034442.
28. Sau K, Nayak Y. Scopus based bibliometric and scientometric analysis of occupational therapy publications from 2001 to 2020. F1000Res. 2023; 11. doi: 10.12688/f1000research.108772.2.
29. Schroeder P, Anggraeni K, Weber U. The relevance of circular economy practices to the sustainable development goals. J Ind Ecol. 2019; 23(1): 77-95. doi: 10.1111/jiec.12732.
30. Fuso Nerini F, Tomei J, To LS, Bisaga I, Parikh P, Black M, *et al.* Mapping synergies and trade-offs between energy and the Sustainable Development Goals. Nat Energy. 2017; 3(1): 10-5. doi: 10.1038/s41560-017-0036-5.
31. Duarte CM, Agusti S, Barbier E, Britten GL, Castilla JC, Gattuso JP, *et al.* Rebuilding marine life. Nature. 2020; 580(7801): 39-51. doi: 10.1038/s41586-020-2146-7, PMID 32238939.
32. Creutzig F, Roy J, Lamb WF, Azevedo IML, Bruine de Bruin W, Dalkmann H, *et al.* Towards demand-side solutions for mitigating climate change. Nat Clim Change. 2018; 8(4): 260-3. doi: 10.1038/s41558-018-0121-1.
33. Tong W, Forster M, Dionigi F, Dresp S, Sadeghi Erami R, Strasser P, *et al.* Electrolysis of low-grade and saline surface water. Nat Energy. 2020; 5(5): 367-77. doi: 10.1038/s41560-020-0550-8.
34. Thacker S, Adshead D, Fay M, Hallegatte S, Harvey M, Meller H, *et al.* Infrastructure for sustainable development. Nat Sustain. 2019; 2(4): 324-31. doi: 10.1038/s41893-019-0256-8.
35. Fuso Nerini F, Sovacool B, Hughes N, Cozzi L, Cosgrave E, Howells M, *et al.* Connecting climate action with other Sustainable Development Goals. Nat Sustain. 2019; 2(8): 674-80. doi: 10.1038/s41893-019-0334-y.
36. Bossio DA, Cook-Patton SC, Ellis PW, Fargione J, Sanderman J, Smith P, *et al.* The Role of soil carbon in natural climate solutions. Nat Sustain. 2020; 3(5): 391-8. doi: 10.1038/s41893-020-0491-z.
37. Kroll C, Warchold A, Pradhan P. Sustainable Development Goals (SDGs): are we successful in turning trade-offs into synergies? Palgrave Commun. 2019; 5(1): 140. doi: 10.1057/s41599-019-0335-5.
38. Barbier EB, Burgess JC. Sustainability and development after COVID-19. World Dev. 2020; 135: 105082. doi: 10.1016/j.worlddev.2020.105082, PMID 32834381.
39. Gao L, Bryan BA. Finding pathways to national-scale land-sector sustainability. Nature. 2017; 544(7649): 217-22. doi: 10.1038/nature21694, PMID 28406202.
40. Gielen D, Boshell F, Saygin D, Bazilian MD, Wagner N, Gorini R. The role of renewable energy in the global energy transformation. Energy Strategy Rev. 2019; 24: 38-50. doi: 10.1016/j.esr.2019.01.006.
41. Ferronato N, Torretta V. Waste mismanagement in developing countries: a review of global issues. Int J Environ Res Public Health. 2019; 16(6): 1060. doi: 10.3390/ijerph16061060, PMID 30909625.
42. Sachs JD, Schmidt-Traub G, Mazzucato M, Messner D, Nakicenovic N, Rockström J. Six Transformations to achieve the Sustainable Development Goals. Nat Sustain. 2019; 2(9): 805-14. doi: 10.1038/s41893-019-0352-9.
43. O'Neill DW, Fanning AL, Lamb WF, Steinberger JK. A good life for all within planetary boundaries. Nat Sustain. 2018; 1(2): 88-95. doi: 10.1038/s41893-018-0021-4.
44. Bryan BA, Gao L, Ye Y, Sun X, Connor JD, Crossman ND, *et al.* China's response to a national land-system sustainability emergency. Nature. 2018; 559(7713): 193-204. doi: 10.1038/s41586-018-0280-2, PMID 29995865.
45. Vinuesa R, Azizpour H, Leite I, Balaam M, Dignum V, Domisch S, *et al.* The role of artificial intelligence in achieving the Sustainable Development Goals. Nat Commun. 2020; 11(1): 233. doi: 10.1038/s41467-019-14108-y, PMID 31932590.
46. Sovacool BK, Axsen J, Sorrell S. Promoting novelty, rigor, and style in energy social science: towards codes of practice for appropriate methods and research design. Energy Res Soc Sci. 2018; 45: 12-42. doi: 10.1016/j.erss.2018.07.007.

47. Crippa M, Solazzo E, Guizzardi D, Monforti-Ferrario F, Tubiello FN, Leip A. Food systems are responsible for a third of global anthropogenic GHG emissions. Nat Food. 2021; 2(3): 198-209. doi: 10.1038/s43016-021-00225-9, PMID 37117443.
48. Watts N, Amann M, Arnell N, Ayeb-Karlsson S, Belesova K, Berry H, *et al.* The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come. Lancet. 2018; 392(10163): 2479-514. doi: 10.1016/S0140-6736(18)32594-7, PMID 30503045.
49. Qian Q, Asinger PA, Lee MJ, Han G, Mizrahi Rodriguez K, Lin S, *et al.* MOF-based membranes for gas separations. Chem Rev. 2020; 120(16): 8161-266. Available from. doi: 10.1021/acs.chemrev.0c00119, PMID 32608973.
50. Kalantari A, Kamsin A, Kamaruddin HS, Ale Ebrahim N, Gani A, Ebrahimi A, *et al.* A bibliometric approach to tracking big data research trends. J Big Data. 2017; 4(1): 30. doi: 10.1186/s40537-017-0088-1.
51. Elsevier SDG 7. Affordable and clean energy [internet] [cited Jul 13 2023]. Available from: https://www.elsevier.com/research-intelligence/societal-impact-and-sdg-guide/goal-7-research-highlights.
52. Thomas SP. From the Editor-Introducing the Guest Editor of this Special Issue, Dr. Mona M. Shattell. Issues Ment Health Nurs. 2008; 29(6): 547-8. doi: 10.1080/01612840802046547.
53. Lin TC, Tang KY, Lin SS, Changlai ML, Hsu YS. A co-word analysis of selected science education literature: identifying research trends of scaffolding in two decades (2000-2019). Front Psychol. 2022; 13: 844425. doi: 10.3389/fpsyg.2022.844425, PMID 35250784.
54. Dantu R, Dissanayake I, Nerur S. Exploratory analysis of Internet of things (IoT) in healthcare: A topic modelling and co-citation approaches. Inf Syst Manag. 2021; 38(1): 62-78. doi: 10.1080/10580530.2020.1746982.
55. Debnath R, Bardhan R, Darby S, Mohaddes K, Coelho ACV, Isa A, *et al.* Energy justice, built environment and poverty: A deep-narrative analysis of energy cultures in Brazil, India and Nigeria for policy modelling [internet]. engrXiv; 2020 mar [cited Jul 15 2023]. Available from: https://engrxiv.org/index.php/engrxiv/preprint/view/894.
56. Hengchen S, Coeckelbergs M, Van Hooland S, Verborgh R, Steiner T. Exploring archives with probabilistic models: topic modelling for the valorisation of digitised archives of the European Commission. In: Washington, DC: IEEE Publications. 2016; 3245-9. IEEE International Conference on Big Data (Big Data) [internet] [cited Jul 15 2023]. Available from: http://ieeexplore.ieee.org/document/7840981/. doi: 10.1109/BigData.2016.7840981.
57. Minhaj M [cited Jul 15 2023]. Available from: https://www.semanticscholar.org/paper/Clustering-of. In: Clustering of conference papers using LDA based topic modelling conference-papers-using-LDA-based Minhaj/a5512f1c826d04fa14be0a875c93a317427fc114; 2017.
58. Font Vivanco D, Makov T. The role of technology and rebound effects in the success of the sustainable development goals framework. Science, and Innovation for Sustainable Development Goals [Internet]. 2020: 192-7.
59. Wang X, Song C, Cheng C, Ye S, Shen S. Cross-national perspectives on using Sustainable Development Goals (SDGs) indicators for monitoring sustainable development: A database and analysis. Chin Geogr Sci. 2021; 31(4): 600-10. doi: 10.1007/s11769-021-1213-9.
60. Chaudhry IS, Yusop Z, Habibullah MS. Financial inclusion-environmental degradation nexus in OIC countries: new evidence from environmental Kuznets curve using DCCE approach. Environ Sci Pollut Res Int. 2022; 29(4): 5360-77. doi: 10.1007/s11356-021-15941-9, PMID 34417974.
61. Ngankam BT. Sustainable development goals synergies/trade-offs: exploring Long- and short-run impacts of economic growth, income inequality, energy consumption and unemployment on carbon dioxide emissions in South Africa. J Sustain Dev. 2019; 12(4): 40. doi: 10.5539/jsd.v12n4p40.
62. Islam MdM, Ali MdI, Ceh B, Singh S, Khan MK, Dagar V. Renewable and non-renewable energy consumption driven sustainable development in ASEAN countries: do financial development and institutional quality matter? Environ Sci Pollut Res Int. 2022; 29(23): 34231-47. doi: 10.1007/s11356-021-18488-x, PMID 35037147.
63. Majeed MT, Luni T, Tahir T. A comparative analysis of nuclear energy consumption and CO2 emissions nexus: empirical evidence from the global economy and income groups. Environ Sci Pollut Res Int. 2022; 29(40): 61107-21. doi: 10.1007/s11356-022-20140-1, PMID 35435544.
64. Arora NK, Mishra I. Progress of sustainable development goal 7: clean and green energy for all as the biggest challenge to combat climate crisis. Environ Sustain (Singap). 2022; 5(4): 395-9. doi: 10.1007/s42398-022-00257-2, PMID 37520243.
65. World B, World B. Tracking SDG 7-The energy progress report 2022. [cited Sep 25 2023]. Available from: https://www.worldbank.org/en/topic/energy/publication/tracking-sdg-7-the-energy-progress-report-2022.
66. Tucho GT, Kumsa DM. Challenges of achieving sustainable development Goal 7 from the perspectives of access to modern cooking energy in developing countries. Front Energy Res. 2020; 8. doi: 10.3389/fenrg.2020.564104.
67. United Nations, United Nations. Goal 7—ensure access to affordable, reliable, sustainable and modern energy for all; [cited Sep 28 2023]. Available from: https://www.un.org/en/chronicle/article/goal-7-ensure-access-affordable-reliable-sustainable-and-modern-energy-all.
68. Martin. Energy [internet]. United Nations Sustainable Development [cited Sep 28 2023]. Available from: https://www.un.org/sustainabledevelopment/energy/.
69. Safrina R, Yurnaidi Z. Social media analysis on ASEAN energy transition trends. IOP Conf S Earth Environ Sci. 2023; 1199(1): 012012. doi: 10.1088/1755-1315/1199/1/012012.
70. United Nations policy briefs; 2022. Energy's interlinkages with other SDGs.pdf [internet] [cited Oct 3 2023]. Available from: https://sdgs.un.org/sites/default/files/2022-06/Policy%20Briefs%20-2022%20Energy%27s%20Interlinkages%20With%20Other%20SDGs.pdf.
71. UNEP-UN Environment Programme. GOAL 7: affordable and clean energy; 2017 [cited Sep 29 2023]. Available from: http://www.unep.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-7.

Cite this article: Rajkumar N, Verma MK, Surulinathi M. Mapping the Global Academic Support for Sustainable Development Goal 7: A Bibliometric Analysis and Topic Modelling Approach. J Scientometric Res. 2023;12(3):585-95.