**EPH-International Journal of Business & Management Science**

# RENEWABLE ENERGY TRANSITION FOR SUSTAINABLE DEVELOPMENT: A COMPREHENSIVE BIBLIOMETRIC ANALYSIS FOR BUSINESS, MANAGEMENT, AND POLICY RESEARCH TRENDS

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***Article History***
***Received :*** *2026-07-29*
***Revised :*** *2026-08-30*
***Accepted :*** *2026-09-11*
***Published :****2026-09-21*

***Abstract***
*The transition to renewable energy cannot be ignored in the pursuit of sustainable development, since energy is recognised as a driver of economic development, industrialisation, and social change. The rapidly growing body of literature is dispersed across various fields, requiring an overview of specific trends in the business, management, and policy domains. The current study is a thorough bibliometric analysis of the academic literature on renewable energy and its role in sustainable development, with a particular focus on business, management, and policy perspectives. Based on the PRISMA 2020 protocol, 3,491 peer-reviewed journal articles published in 1996-2025 were observed in the Scopus and Web of Science databases. The trends in publications, journals with impact, authors, country-specific contributions, collaboration networks, and the evolution of thematic focus were examined using Bibliometric analysis procedures implemented in Biblioshiny (R). The results indicate a rapid increase in research output after 2015, attributable to global climate commitments and the Sustainable Development Goals (SDGs). China, India, and the United States are becoming leading contributors and the dominating countries in the field through interdisciplinary journals. Thematic analysis suggests a shift from technological research to research on policy instruments, governance frameworks, business models, and adoption dynamics. However, the problem of energy justice and equity has not been investigated extensively. It was determined that there are five major thematic areas: adoption drivers, policy incentives, technological innovation, SDG linkages, and inclusivity. The present research clarifies the field's intellectual framework and outlines future research directions to support integrated, inclusive, context-specific renewable energy transitions.*

***Keywords:*** *Renewable energy; Sustainable development; Bibliometric analysis; Energy transition; Energy policy; Business and management*

*Vol. 12 Issue 5s (September, 2026)*
*ISSN: 2208-2190 Pages- 41-71*
*DOI: https://doi.org/10.69980/bh82yf48*

## 1. Introduction

Energy has long been recognised as one of the pillars of economic growth, industrialisation and societal transformation (Smith, 1998). Earlier studies show that access to and effective exploitation of energy sources were determining factors in the Industrial Revolution and the subsequent growth of modern economies (Stern & Kander, 2012). For most of the twentieth century, economic development paths were intimately linked to the use of fossil fuels, specifically coal, oil and natural gas. Although this energy paradigm enabled an unparalleled increase in productivity and living standards, it also created massive environmental and social externalities. Fossil fuel consumption has contributed to increasing vulnerability to climate change, environmental degradation, and rising greenhouse gas concentrations (Adnan et al., 2017). The energy sector is a major contributor to climate change and environmental stress, as energy-related activities account for a sizable share of global carbon dioxide emissions (Dincer, 2000; Güney, 2019). Energy poverty still affects a sizable fraction of the world's population, limiting socioeconomic growth and exacerbating inequality. At the same time, energy availability remains unbalanced and uneven among regions (Du et al., 2019).

To support sustainable development, renewable energy sources (RES), such as solar, wind, hydropower, biomass, and geothermal energy, have been developed (Duroha & Macht, 2023). Renewable energy has two advantages: it reduces environmental pressures linked to fossil fuels and advances social and economic development objectives. Adopting renewable energy sources lowers emissions and improves employment, long-term economic stability, and energy security, according to numerous studies (Dincer, 2000; Gueney, 2019). As a result, national and international development plans now prioritise renewable energy rather than treating it as a cutting-edge technological alternative (Radomes et al., 2015). The United Nations Sustainable Development Agenda 2030, particularly Sustainable Development Goal (SDG) 7 (Affordable and Clean Energy), also explicitly recognises the importance of renewable energy. Its contribution, however, goes well beyond this goal. SDGs like SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action) are strongly correlated with the implementation of RES, according to empirical and conceptual research (Brent, 2021; Marco-Lajara et al., 2023). These connections show that renewable energy is not a technological solution for carbon emissions but rather a systemic enabler of sustainable development (Alhaddi, 2015; United Nations, 2015; Gómez et al., 2025).

Over the past 30 years, research on sustainable development and renewable energy has increased significantly. The first studies concentrated more on environmental performance, resource availability, and technical efficiency (Collins, 1998; Nakicenovic, 1999). Subsequently, as the importance of institutions and markets in energy transitions became more widely acknowledged, the research was expanded to include economic viability, policy instruments, and innovation dynamics (Kajikawa & Takeda, 2008; Shi & Lai, 2013). More contemporary works are increasingly covering behavioural, managerial, and governance-related aspects, including consumer adoption, social perception, policy credibility, and business model innovation (Claudy et al., 2013; Kapoor et al., 2014; Sheikh et al., 2016). A large percentage of research aligns with techno-economic views, typically treating social, institutional, and managerial variables as secondary determinants. Also, current review papers often focus on a particular technology (such as solar photovoltaics or biofuels), a geographical area, or a policy instrument, thereby failing to reflect the intellectual system and the development of renewable energy studies as a whole (Owusu & Asumadu-Sarkodie, 2016; Prete et al., 2017). In terms of business and management, very little systematic knowledge exists on how the research in renewable energy has progressed with respect to firm strategies, investment choices, governance structures, and policy formulation. Bibliometric analysis is a rigorous and objective way of mitigating these limitations. Bibliometric techniques allow the identification of trends in publications, preeminent journals and authors, collaboration groups, and thematic groups by quantitatively analysing large volumes of academic literature (Aria & Cuccurillo, 2017). These types of analyses have been effectively used to trace the research paths in renewable energy and sustainability (Paananen & Mäkinen, 2013; Marco-Lajara et al., 2023). Nonetheless, the literature that explicitly anticipates the business, management, and policy lenses in the renewable energy-sustainable development nexus is rather limited (Doğan et al., 2025).

To address these gaps, this paper presents a comprehensive bibliometric review of the literature on renewable energy and its role in promoting sustainable development, with a specific focus on trends in business, management, and policy research. The study aims to (i) investigate the chronological dynamics and development trends of academic work; (ii) find out the predominant journals, authors, institutions and

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*ISSN: 2208-2190 Pages- 41-71*
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countries that dominate the field; (iii) review the dynamics of collaboration, and knowledge networks; and (iv) trace dominant and emerging research themes that apply to sustainable business and policy formulations. This study can contribute to a deeper understanding of the progress of research in renewable energy and its role in informing sustainable development strategies by offering a structured, data-based synthesis of the literature. The results are likely to be used by researchers to identify research gaps, by policymakers to formulate evidence-based energy policies, and by business executives to invest in renewable energy to achieve long-term sustainability goals. To a greater extent, the given study is an important source of information to be referenced by scholars and researchers because it presents a stepwise systematic methodology that can be utilised to perform the bibliometric analysis of a wide variety of research areas and themes (Naicker & Thopil, 2019; Bennett et al., 2020; Foroudi et al.,2023)

## 2. Methodology:

### 2.1 Research Design:

The current research employs a quantitative bibliometric study design, accompanied by systematic science-mapping methods, to analyse the intellectual framework and growth history of RES as a means of sustainable development. Bibliometric analysis is especially relevant to this goal because it enables an objective examination of large volumes of academic output using repeatable statistical and network-based procedures (Aria & Cuccurullo, 2017). Unlike traditional narrative reviews, bibliometric approaches reduce subjectivity and provide meaningful insights into research trends, knowledge domains, and emerging themes. The methodological schema is based on the well-established bibliometric workflows used in the research on the topic of renewable energy and sustainability (Kajikawa & Takeda, 2008; Paananen & Mäkinen, 2013; Marco-Lajara et al., 2023) and includes four stages: (i) database selection and search strategy construction; (ii) data cleaning and screening; (iii) performance analysis; and (iv) science mapping and thematic analysis.

Web of Science (WoS) and Scopus were chosen as two of the most extensive and popular academic databases for extracting the bibliographic corpus to address the bibliometric questions in the energy, sustainability, and management literature. The search was done using the keywords RES and SDG. Because of their extensive journal coverage, excellent data integrity, and compatibility with contemporary bibliometric methods, these databases were chosen (Aria & Cuccurullo, 2017). To meet the needs of business, management, and policy research, a systematic search query was developed to identify studies at the nexus of sustainable development, renewable energy, and adoption-related factors (Elmustapha et al., 2018). Additionally, Boolean operations and truncation were used to maximise the inclusion of pertinent terminology. The search period covered the evolution and maturity of renewable energy research from 1996 to 2025. To maintain academic rigour and consistency with prior bibliometric research, only English-language articles and review papers published in peer-reviewed journals were included; conference papers, book chapters, editorial publications, and non-academic documents were excluded (Paananen & Mäkinen, 2013; Marco-Lajara et al., 2023).

The first database query returned a wide variety of records. The bibliometrix package's automated matching features were used to identify and remove overlapping entries between the Web of Science and Scopus databases. Later on, they were developed by assessing their thematic relevance to the business, managerial, policy, or socioeconomic facets of renewable energy. This screening adhered to the procedures outlined in prior bibliometric research on renewable energy and aligned with the goals of the current study (Owusu & Asumadu-Sarkodie, 2016; Brent, 2021). A superior, thematically cohesive corpus suitable for further bibliometric study resulted.

The bibliometric analysis was performed using the bibliometrix package in R, along with its web-based interface, Biblioshiny, which provides an extensive range of functionalities for performance analysis and science mapping (Aria & Cuccurullo, 2017). These tools are used for their transparency, flexibility, and reproducibility. The analysis was well-defined as covering two complementary parts.

### 2.2 Performance Analysis and Science Mapping:

Performance analysis focuses on descriptive measures of research productivity and contribution. The metrics studied included annual scientific output to identify the trends in growth and research phases; most productive and impactful journals, measured in the number of publications and citations, leading authors, institutions, and countries, as measures of intellectual and geographical impact; and the citation analysis, to

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*ISSN: 2208-2190 Pages- 41-71*
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understand academic impact and knowledge sharing. These indicators provide a quantitative overview of the development of renewable energy and sustainable development studies across time and space.

Science mapping techniques are useful to explore the structural and relational dimensions of the literature. In particular, the co-authorship analysis has examined patterns of collaboration between authors and nations; the co-occurrence of keywords has identified prevalent research themes and conceptual connections; the thematic mapping and evolution analyses have identified shifts in research focus between technology-oriented studies and governance, policy, and socio-economic perspectives. Such network-based methodologies enable the identification of core and peripheral research themes, as well as emerging topics likely to shape the agenda for future research (Kajikawa & Takeda, 2008; Marco-Lajara et al., 2023).

To reflect the dynamic development of the research themes, a time-slicing strategy was selected, which divides the period of analysis into several sub-steps in accordance with critical shifts in the discourse on renewable energy and sustainability. This plan simplifies the comparative approach to thematic priorities between them across temporal intervals, as proposed in the bibliometric foresight literature (Paananen & Mäkinen, 2013). Thematic evolution analysis was conducted using author keywords, revealing emerging, decreasing, and stable themes in the research. The approach provides significant evidence of the growing salience of business, management, and policy perspectives relative to conventional techno-economic research.

### 2.3 Reliability and Validity:

Reliability was also enhanced by ensuring that all data cleaning and analytical functions were run using automated, reproducible scripts in R and validated by relying on established bibliometric measures and methods that have previously been widely validated in past research in the field of renewable energy and sustainability (Aria & Cuccurullo, 2017; Marco-Lajara et al., 2023). The use of two large databases also contributed to the breadth of coverage and helped suppress database-related bias.

This approach combines performance analysis with a modern science-mapping approach to provide a systematic and thorough analysis of the renewable energy literature on sustainable development. The methodology will allow the definition of intellectual frameworks, work group dynamics, and evolving research topics, which will then form a strong base for evidence-based discussion and future research patterns in business, management, and policy disciplines.

A schematic diagram illustrating the role of renewable energy research in the sustainable development process is shown in Figure 1. It shows that the imperative of climate change, the policy and regulation frameworks, socio-economic conditions and technological innovation are some of the key drivers that influence the core research areas, such as renewable energy technologies, policy and governance, business and management strategies and social and behavioural studies, all with a set of principles of energy justice and equity. The eventual outcomes of these interconnected strands of research are climate mitigation, economic growth, energy security, and social inclusion, which, in turn, promote the development of renewable energy to support the achievement of the SDGs (Daka, 2023).


**Figure 1. Conceptual Framework for Renewable Energy and Sustainable Development Research**

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## 3. Bibliometric Analysis

This section presents the findings from the bibliometric analysis using the final dataset. These results are well organised into groups of publications, source analysis, author and country contributions, collaboration network, and thematic structure, as shown in the figures generated in the bibliometric output. Figure 2 summarises the key bibliometric properties of the data set analysed in this paper. The review shows that studies on renewable energy as a means of sustainable development can be traced over the period 1998-2026 and comprise 3,491 documents from various sources, with a substantial annual growth rate of 9.98%, thus indicating continued development in the field. The dataset comprises 9,038 authors, and collaboration strength is high, with an average of 4.7 co-authors per document; however, international co-authorship occurs in only 22.49% of publications. Literature is also conceptually deep as the number of author keywords and the number of cited references is 9,465 and 121,035, respectively; moreover, the average number of citations per document and the average age of the documents, 34.98 and 4.85 years respectively, also shows a high level of scholarly effect and relevance of the studies (Sotnyk et al., 2023; Rezk et al., 2024).

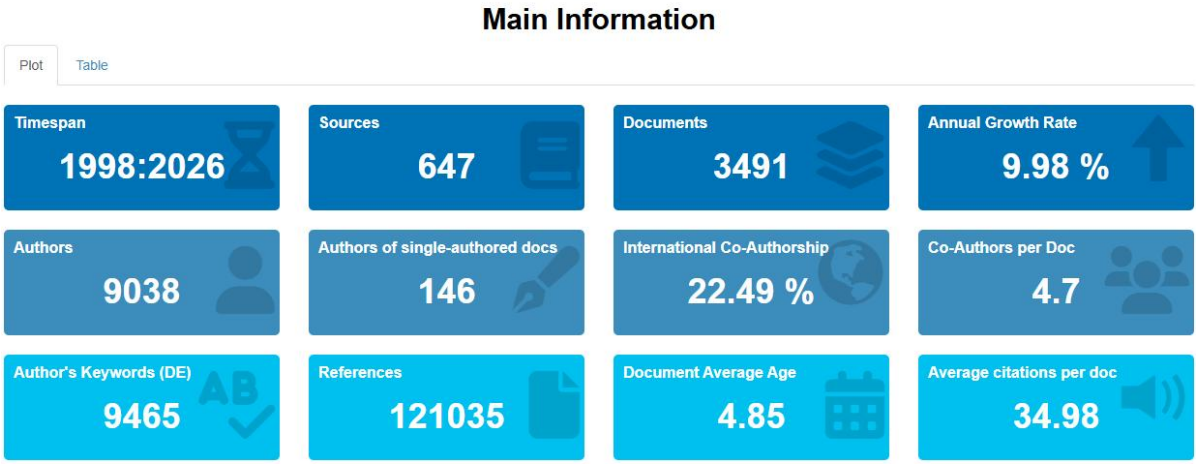


**Figure 2. Main information of the bibliometric analysis**

### 3.1 Performance Analysis: Annual Publication Trends

Figure 3 shows the annual scientific output on renewable energy for sustainable development during the study period. The findings demonstrate a clear upward trend in the number of publications, indicating growing academic interest in the field. It is possible to identify three phases. The initial stage, which is between the late 1990s and the mid-2000s, is characterised by low and intermittent publication levels. Studies at the time were primarily conceptual debates and preliminary assessments of the sustainability of renewable energy technology (Collins, 1998; Dincer, 2000). As early renewable energy policy tools are deployed and global awareness of climate change increases, the second stage shows steady but moderate growth. During this period, publications started to focus more on policy systems, economic viability, and perspectives on innovation (Kajikawa & Takeda, 2008; Shi & Lai, 2013). There has been a considerable increase in research production during the third term, which started in 2015 and is still ongoing. The Paris Agreement and the United Nations Sustainable Development Goals (SDGs), particularly SDG 7, were introduced concurrently with this surge. The substantial rise in publications highlights the consolidation of renewable energy as a central component of research on sustainable development (Brent, 2021; Marco-Lajara et al., 2023).

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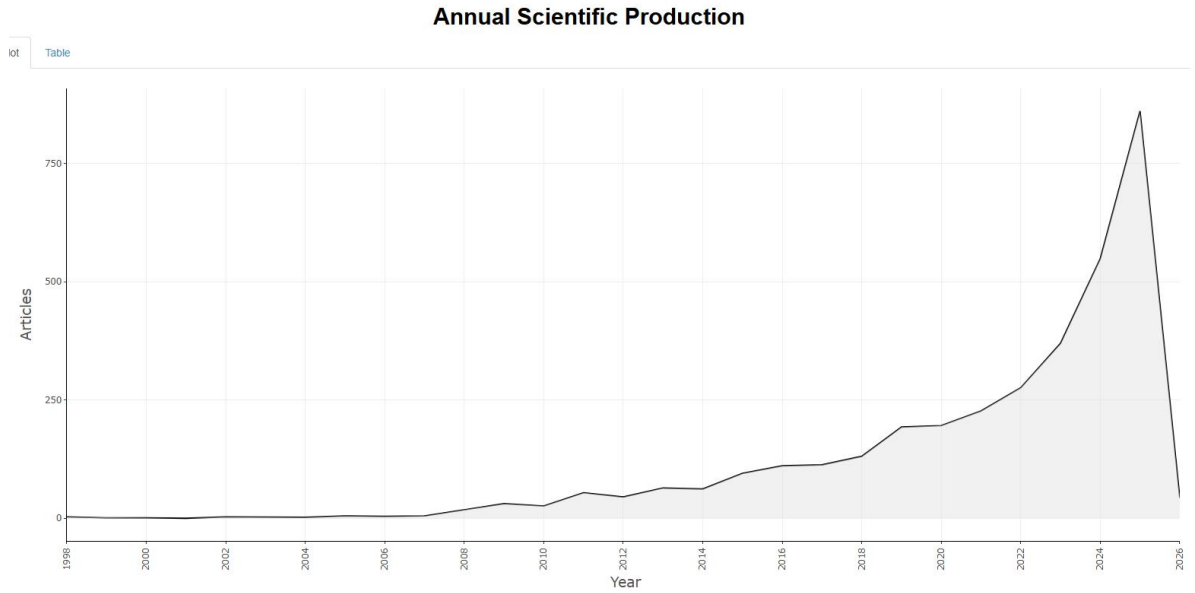


**Figure 3: Annual scientific production on renewable energy for sustainable development**

The average annual citations are displayed in Figure 4, which indicates how the field's scholarly influence has evolved. An immature field of research, with few publications and little coverage, is characterised by much lower citation counts in the early years. This was then followed by pronounced periods in the early to mid-2000s, which included the announcement of seminal, highly impactful studies that have had a significant influence on the field and received substantial academic attention. Slight fluctuations characterise the number of citations in subsequent years, but overall, the research domain remains steady as further studies gradually develop, building on the existing body of knowledge. The slight reduction in recent years can mainly be explained by the citation time-lag effect, as recently published articles have not had sufficient time to receive citations; this does not mean that the quality and relevance of the research have deteriorated (Wang, 2013; Tahamtan et al., 2016).

## 3.2 Most Relevant Journals and Sources

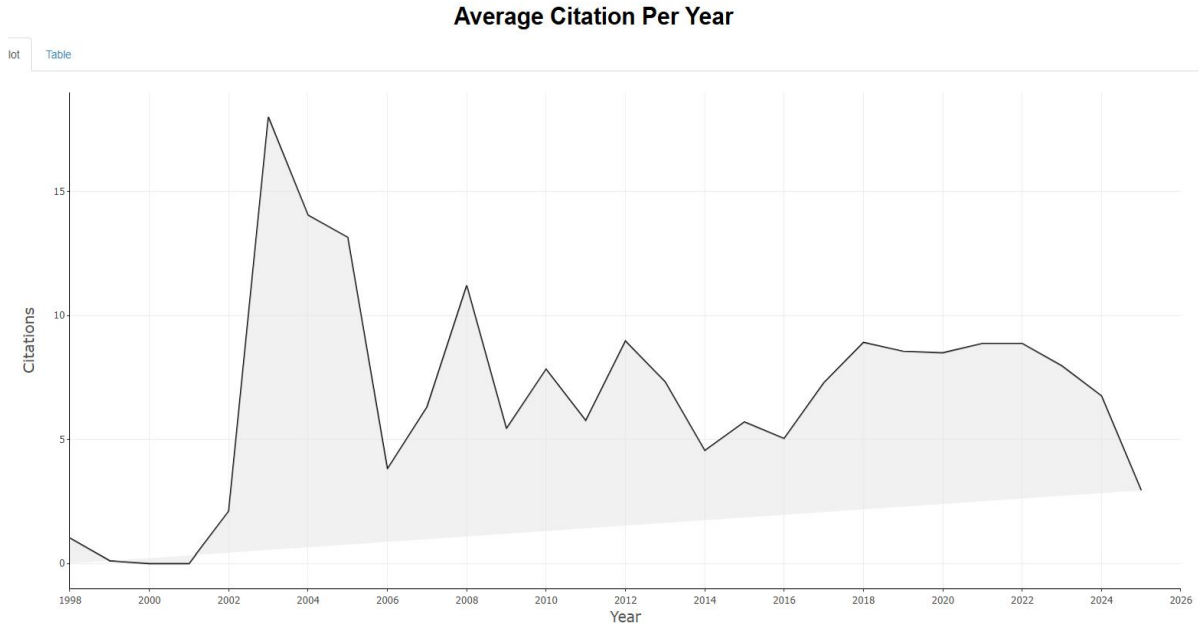


**Figure 4: Trend of average citations per year**

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The most relevant journals and sources are shown in Figure 5 in accordance with the publishing quantity. The findings suggest that studies on renewable energy towards sustainable development are clustered in a few high-impact multi-disciplinary journals. Journal of Cleaner Production ranks highest, followed by Business Strategy and the Environment and Technological Forecasting and Social Change. These journals make up a significant portion of the overall publication, thus indicating their dominant position in the publication of research that combines energy systems with sustainability, policy, and management perspectives. The dominance of interdisciplinary journals reveals that the domain is not limited to engineering and environmental science but also applies to business strategy, governance, and socio-economic analysis. This tendency could be related to the growing policy and managerial relevance of renewable energy transitions (Mishra et. al., 2024).

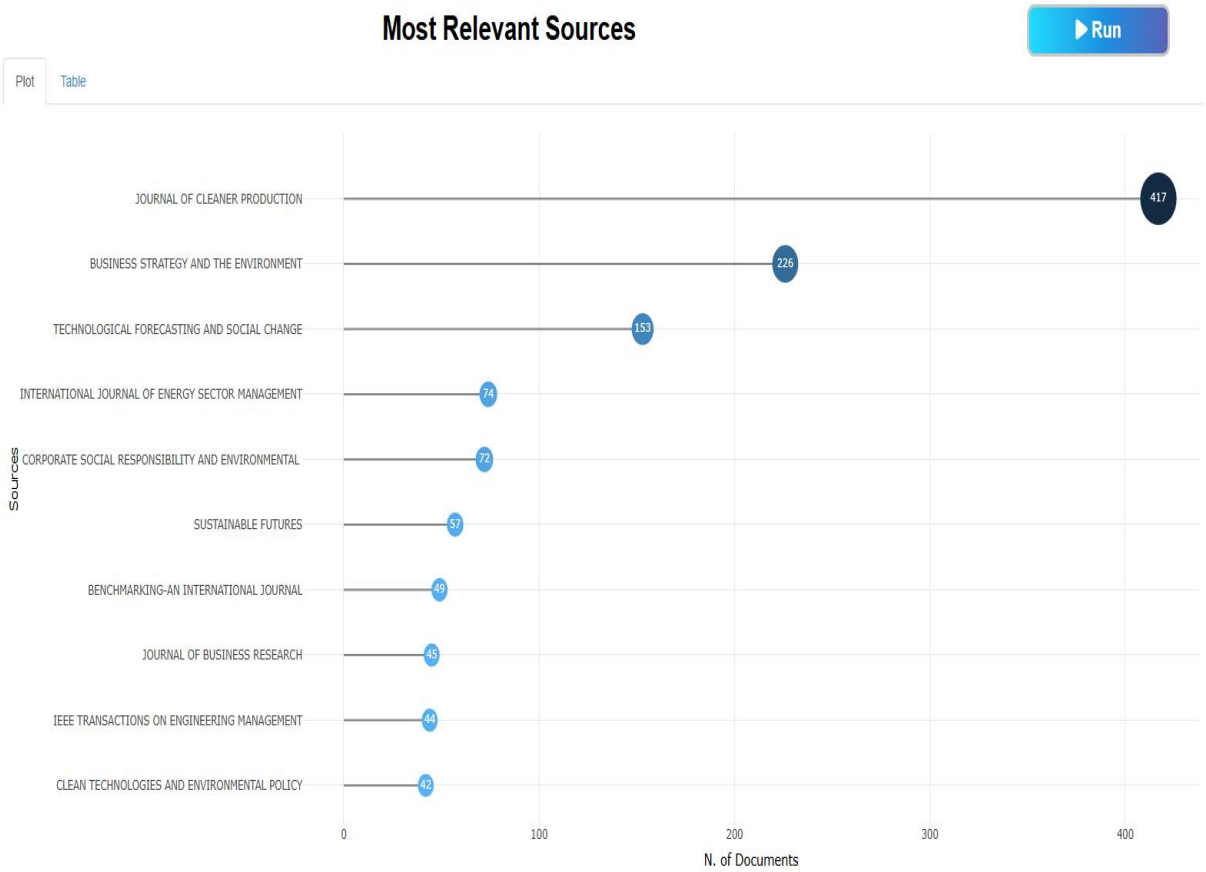


**Figure 5: Most relevant journals and sources**

### 3.3 Leading Authors and Author Productivity

Figure 6 illustrates the most significant figures in the field by number of publications, thereby reflecting existing trends in scholarly production and intellectual leadership. The number of publications by a relatively small group of scholars is Wang Y, Zhang Y, Wang Z and Zhang X, representing the most significant contribution, thus indicating their authoritative interest in the given area of research. Lotka's Law, which states that a small number of writers usually account for a disproportionately large share of publications in an academic area, is consistent with this concentration of academic production (Lotka, 1926). A wider range of authors with intermediate publication rates also points to an active and cooperative research environment and, thus, thematic diversification and the progressive development of knowledge. Together, the distribution points out the author dominance, as well as collaborative research, both of which are conventionally typical of mature and fast-growing scholarly spheres (Price, 1963).

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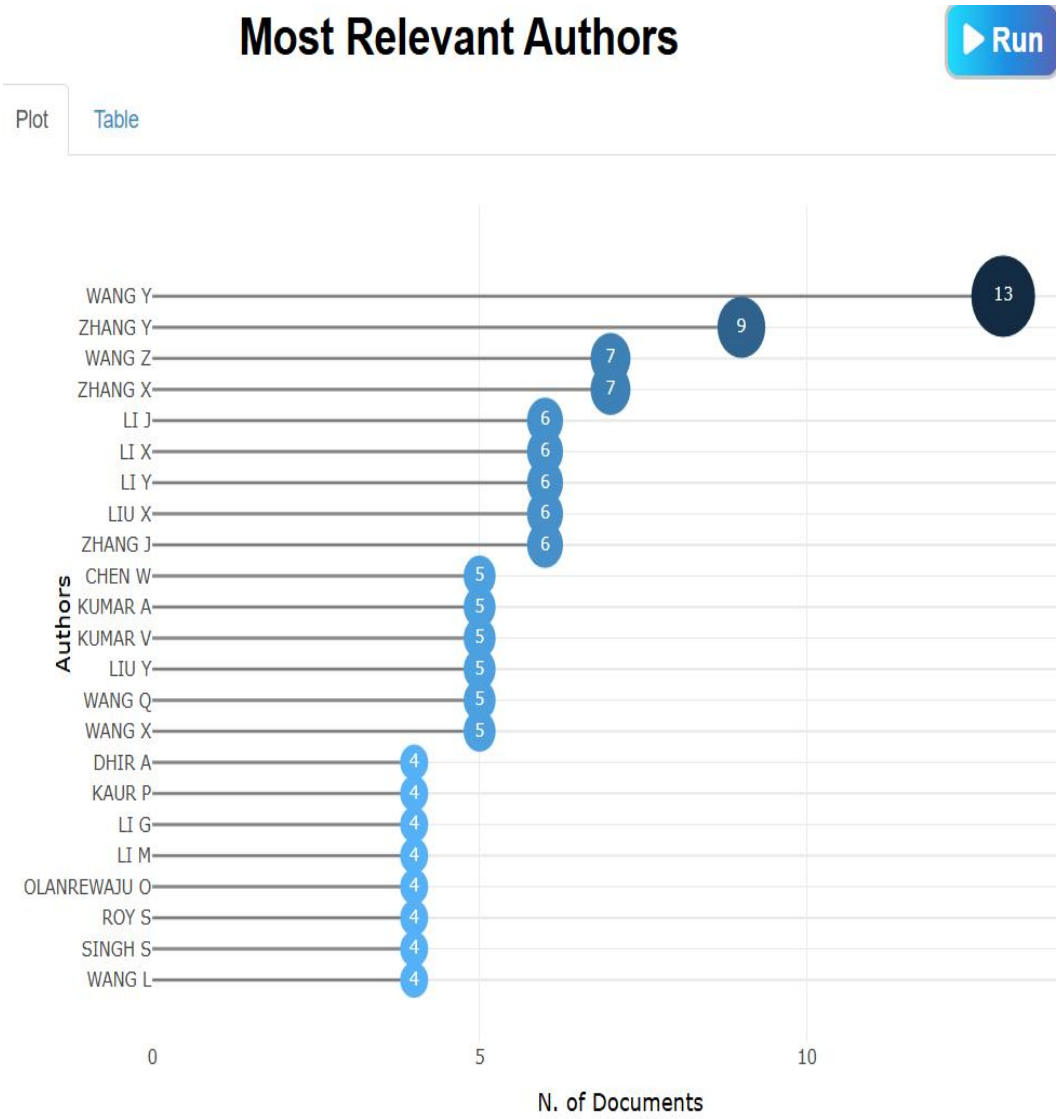


**Figure 6: Most Relevant authors**

Figure 7 shows the most prominent institutional affiliations in publication output, thereby identifying the institutions that have the greatest impact on research development processes in this field. Hong Kong Polytechnic University is ranked the most dynamic institution, followed by Jiangsu University and Shandong University; this ranking reflects strong research strength and institutional prioritisation. Those conspicuous instances of universities located in China, the United States, and Australia can be used to emphasise the global distribution of research activity and the increasing internationalisation of scientific cooperation. This trend is not unrelated to bibliometric studies that reveal research productivity is often highly concentrated in a limited group of well-endowed institutions that serve as knowledge centres and loci of cooperation. Cumulatively, the network distribution of affiliations highlights the importance of institutional research ecosystems, funding levels, and global relations as critical contributors to academic production in fast-growing research areas (Price, 1963; Wagner et al., 2011).

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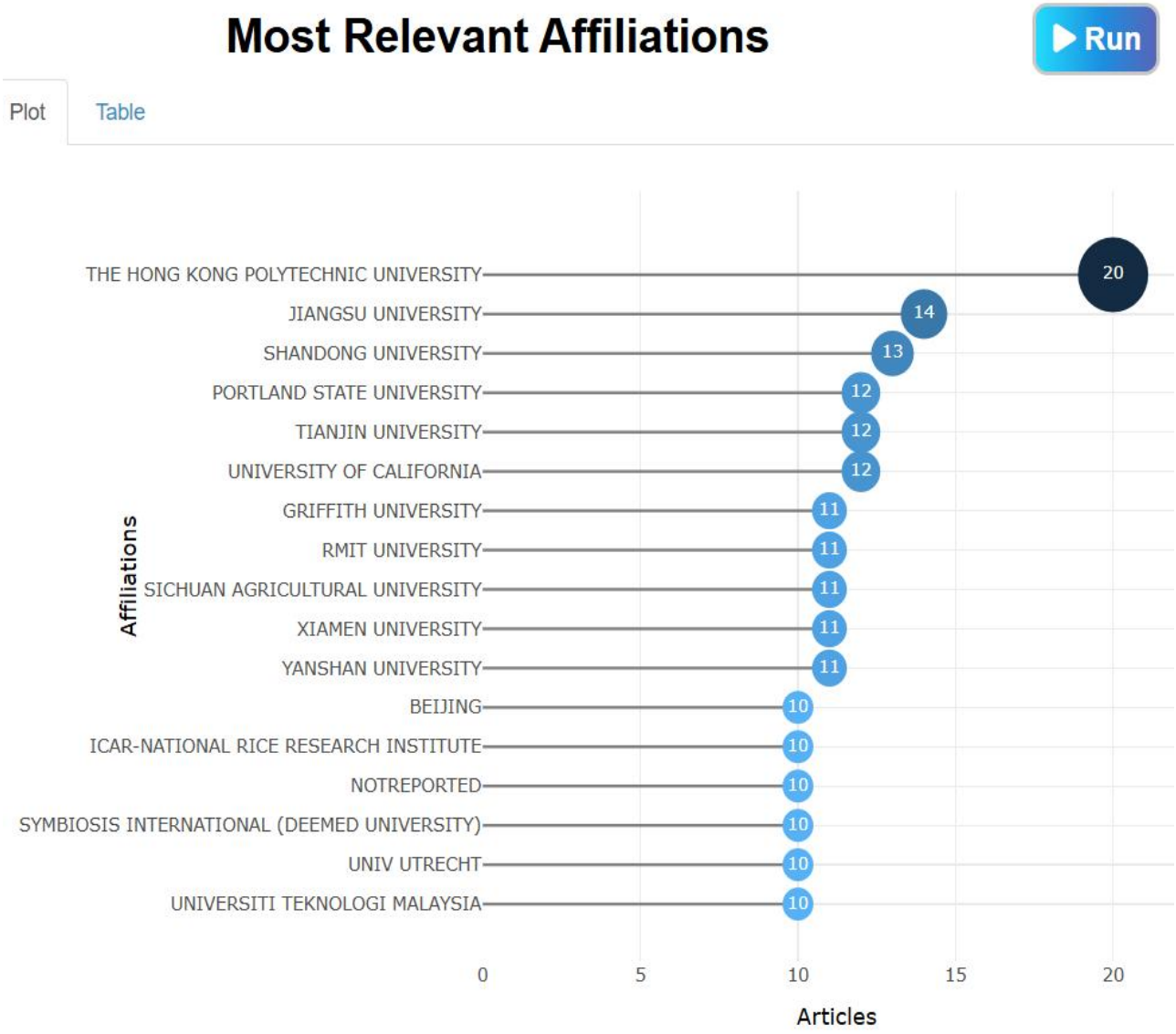


**Figure 7: Most relevant affiliations**

### 3.4 Country-Level Contributions

Figure 8 shows the distribution of peer-reviewed articles by the citizenship of the corresponding author, thereby shedding light on the overall global contribution and the dynamics of global interaction in the area of study. China is cited as the major contributor; next in line are India and the United States, based on growing research capabilities, policy focus, and continued investment in science and technology relevant to these countries' sustainability and energy transitions. The European States, such as the United Kingdom, Italy, Spain, and Germany, as well as Australia and Malaysia, are also recording high participation rates, thereby reflecting the geographically diverse and widely distributed global research environment. The delimiting bars show the prevalence of single-country versus internationally co-authored products, which supports earlier empirical findings that international cooperation is a significant factor in research visibility, knowledge dissemination, and citation impact, particularly in extremely complex interdisciplinary fields (Wagner et al., 2011; Glanzel & Schubert, 2004).

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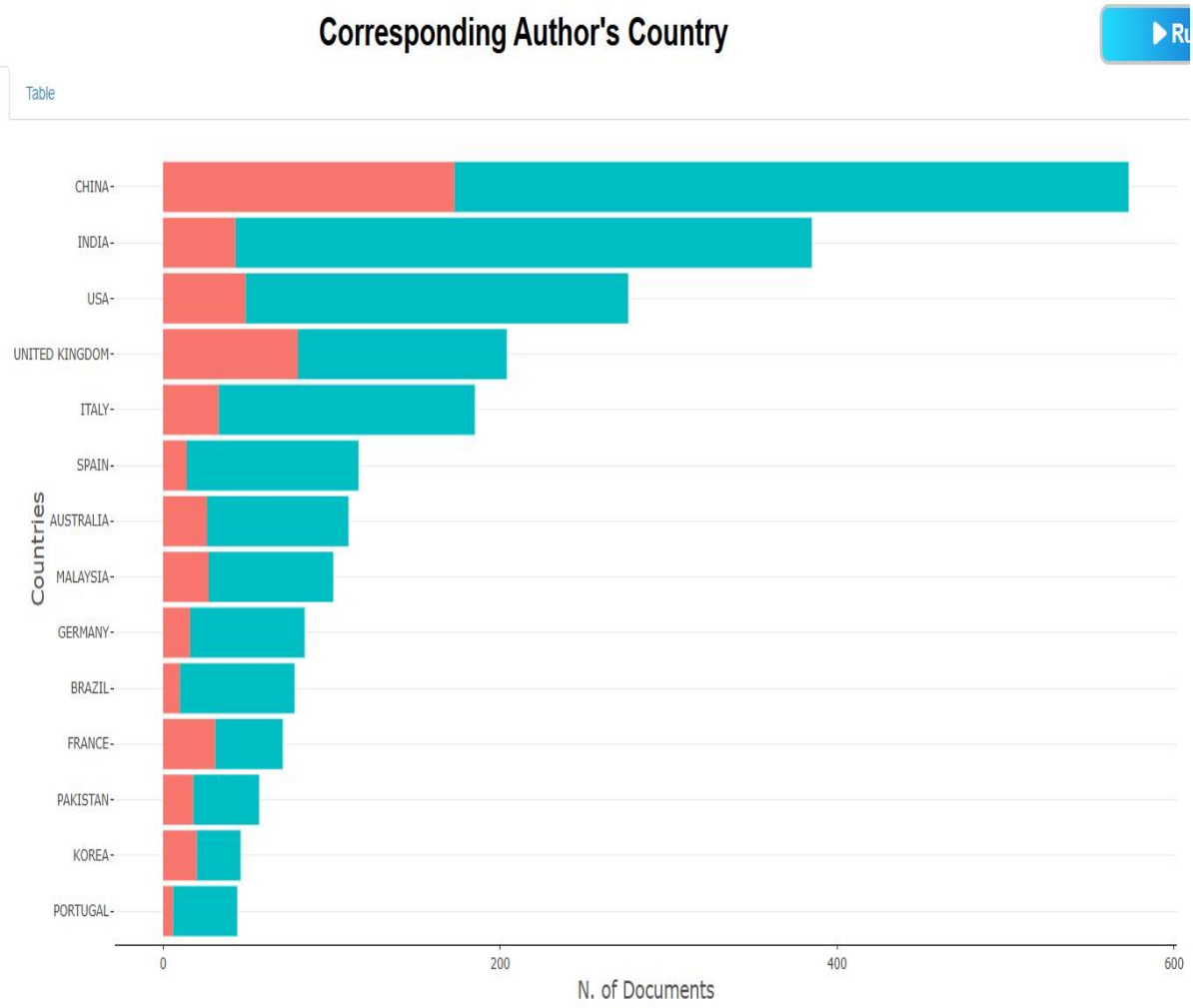


**Figure 8: Corresponding author's country**

### 3.5 International Collaboration Networks

The global co-authorship network is depicted in Figure 9, the collaboration globe map, with particular attention paid to the strength and geographic dispersion of international research collaborations within the field. There are strong links of collaboration among major regions of research production, such as China, the United States, Europe, India, and Australia, which highlight their pivotal role in global knowledge production. The global system of transcontinental relations reflects the growing international and interdisciplinary nature of modern studies, especially in complex areas such as energy and sustainability, where knowledge, information, and resources are distributed worldwide. This finding is consistent with the premortem bibliographic literature, which has shown that international scientific cooperation increases the visibility of research, innovation, and citation impact through cross-border knowledge sharing (Glanzel & Schubert, 2004; Wagner et al., 2011; Lucchi et al., 2024).

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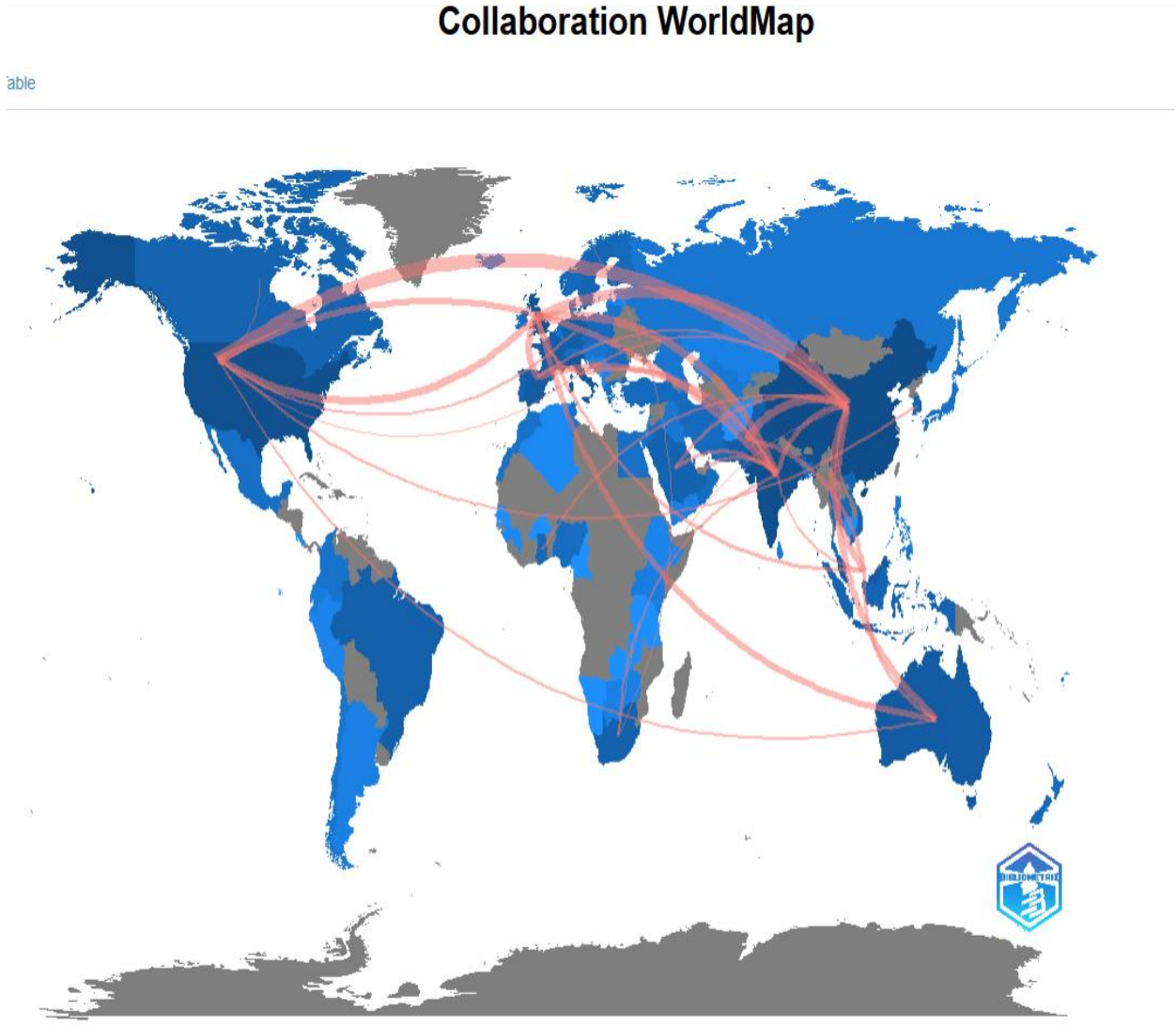


**Figure 9 Collaboration world map**

### 3.6 Keyword Co-occurrence Analysis

The most prevalent and recent research issues in the literature are shown in the word cloud in Figure 10, where the size of each term corresponds to its frequency. Lexical phrases such as sustainability, sustainable energy, and sustainable development are translated with emphasis, highlighting their importance in the topic. The strong integration of environmental, technological, and economic perspectives is evident in the associated theme areas, including climate change, energy efficiency, green innovation, environmental performance, and the circular economy. The growing managerial, policy, and application-based focus in contemporary studies is reflected in keywords such as corporate social responsibility, green supply chain management, electric vehicles, and environmental management. All things considered, the term "cloud" refers to an interdisciplinary research setting that synchronises energy transitions with sustainability objectives, supporting earlier bibliometric and thematic analyses of sustainability and renewable energy studies (van Waltman, 2010; Claudy et al., 2013; Sheikh et al., 2016).

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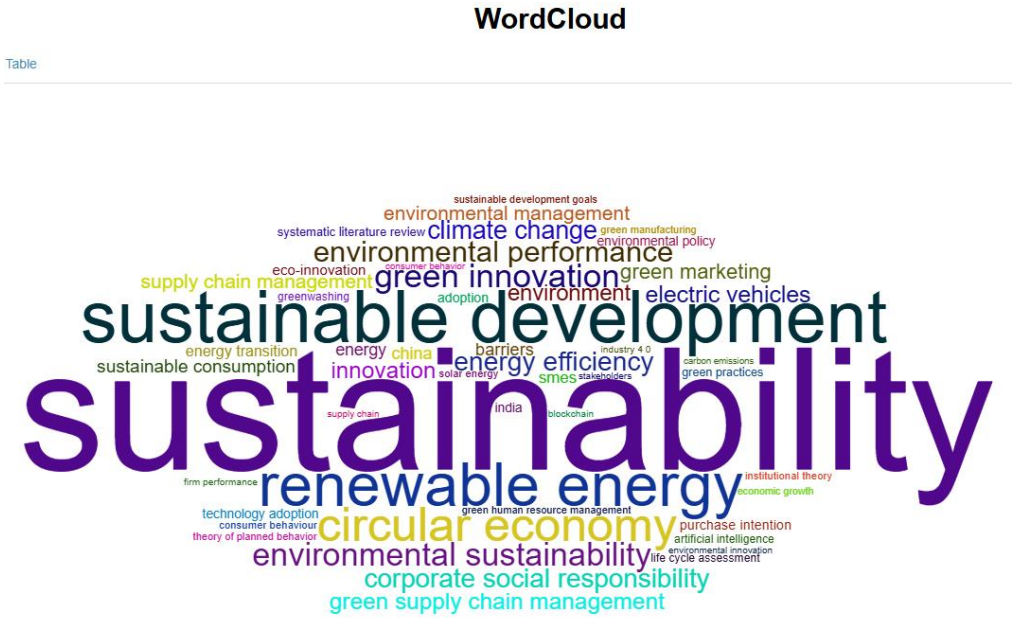
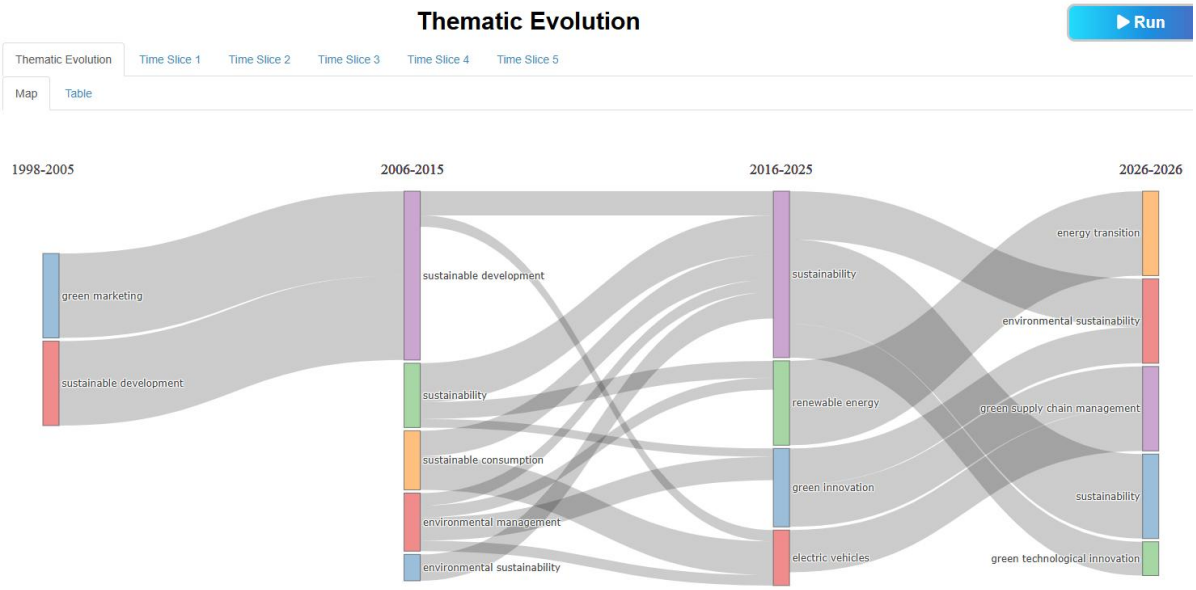



**Figure 10: Word cloud of the most important keywords**

### 3.7 Thematic Mapping and Evolution

The temporal dynamics of the discipline's intellectual architecture are depicted by the thematic evolution map in Figure 11, which shows the historical evolution and diversity of research topics. Sustainable development and green marketing dominated the corpus in its early years (1998 to 2005), indicating a preliminary trend toward higher-order sustainability ideas and environmentally conscious market strategies. During the next stage (2006 to 2015), the underlying themes were clustered into more organised and connected issues, such as sustainability, sustainable consumption, environmental management, and environmental sustainability, representing conceptual integration and theoretical improvement. During the latest period (2016 to 2025), one can observe a distinct thematic development of the field towards more practical, technology-oriented areas in green energy, green innovation, electric vehicles, and the energy transition, as well as managerial areas such as green supply chain management. This shift represents a move toward solution-based and policy-relevant research and aligns with well-known theories of scientific field development and thematic change in bibliometric research (Callon et al., 1991; Cobo et al., 2011; Waris et al., 2023).



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*ISSN: 2208-2190 Pages- 41-71*

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**Figure 11: Thematic Evolution in the last three decades (1996 to 2025)**

The frequency of keywords in a tree map, as illustrated in Figure 12, shows the relative significance of the research themes in terms of their contribution to the overall corpus, as indicated by the size of each rectangle. The representation is led by renewable energy and sustainability, which are treated as the most important pillars of the research sphere, followed by sustainable development and climate change, which seem to be solidly driven by international environmental and policy needs. Themes at the intermediate scale, such as the energy transition, circular economy, energy efficiency, electric vehicles, and solar energy, underscore the growing interest in technological interventions and systemic changes towards low-carbon directions. Bigger but less substantively relevant clusters, e.g., green energy, innovation, decarbonization, energy policy, and carbon emissions, reflect nascent and specialised research streams that inform applied, policy-swerving, and interdisciplinary scholarship. Together, the tree map indicates a well-established and diversified research structure in which essential ideas of sustainability coexist with rapidly advancing technology-based and policy-oriented themes, as confirmed by bibliometric mapping studies (Cobo et al., 2011; Reyes-Mercado et al., 2017).

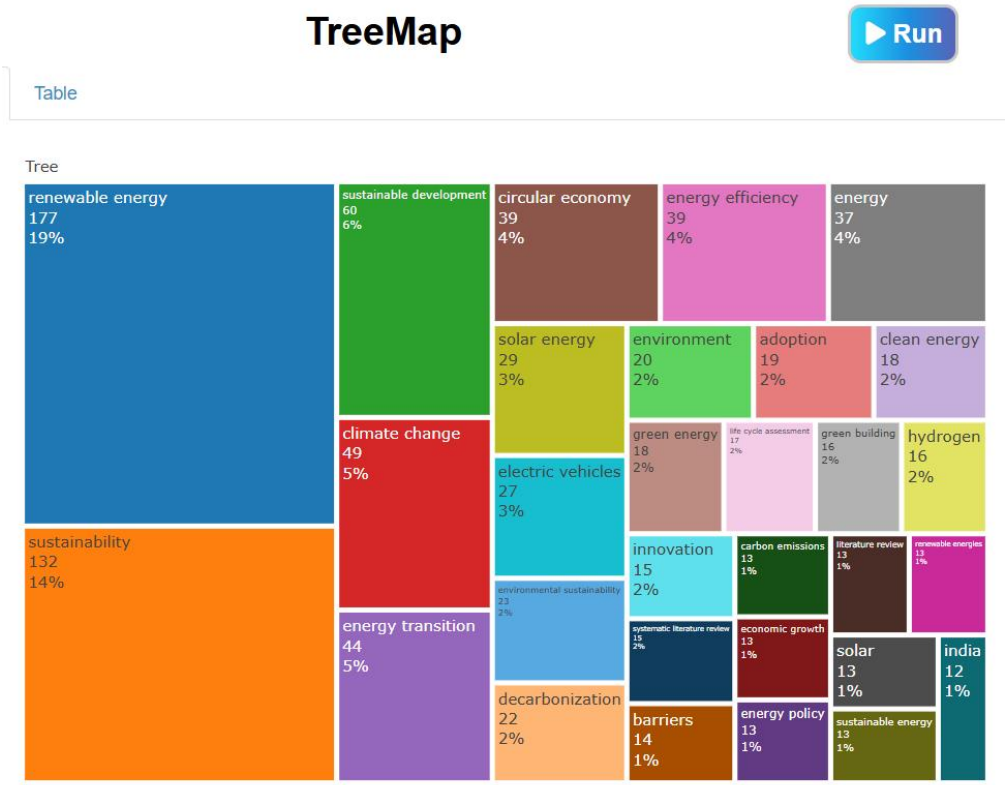


**Figure 12: Tree Map of important themes**

Figure 13 illustrates the countries, most frequently cited in the field of research, and hence the influence of any country in science at the national level, in terms of total citations. China has a sizable lead, followed by the United States and the United Kingdom, suggesting that academic production from these countries has already attained considerable international reputation and impact. Spain, Italy, and India make up a supplementary set of significant players. Despite comparatively modest publication counts, other nations, including Australia, Germany, Malaysia, and France, also show notable citation success. This pattern demonstrates that the quality of research, international collaboration, and topicality all affect scientific influence, in addition to output volume. The findings corroborate bibliometric research demonstrating that countries with robust research environments and extensive, well-established international collaboration networks typically have greater citation effect (Glanzel & Schubert, 2004; Wagner et al., 2011).

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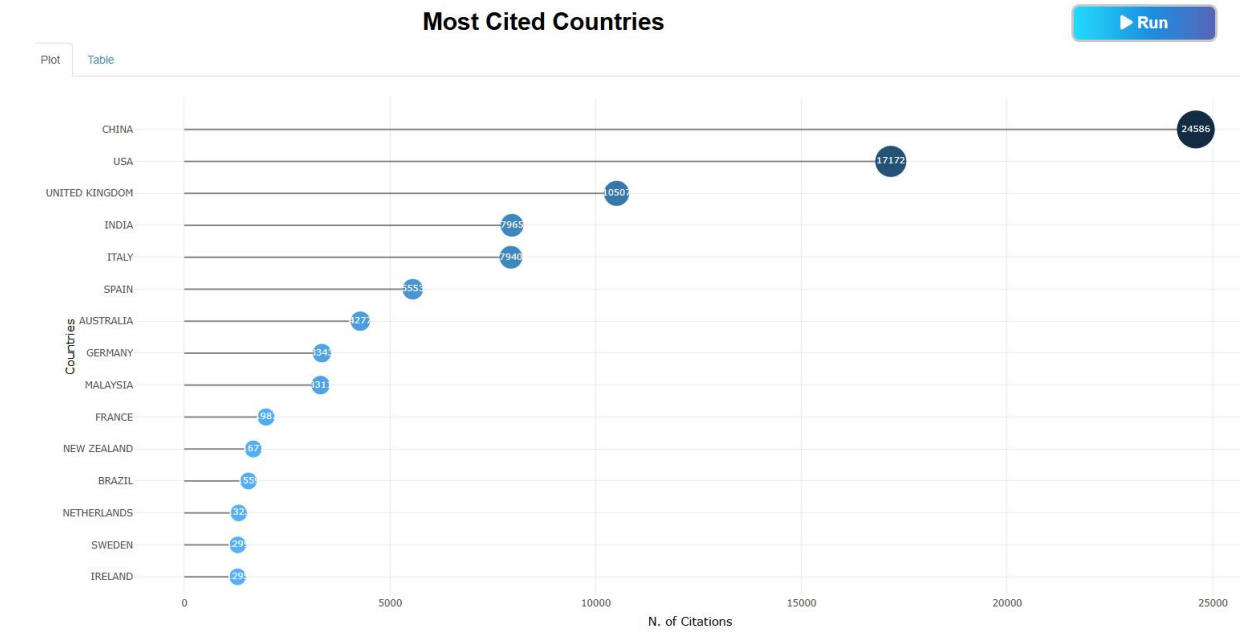


**Figure 13: Most cited countries with citations**

The papers with the greatest intellectual influence in terms of total citations are highlighted in Figure 14, which lists the most frequently cited works in the area. Highly cited articles like El-Kassar (2019), Green et al. (2012), Zhu and Sarkis (2005), and Delmas and Toffel (2008) occupy the top of the list, which explains why these works have been chosen as the foundational reference that has defined sustainability, green supply chain management, environmental strategy, and organisational performance research. Because they provide solid theoretical frameworks, empirically supported findings, and methodological soundness that have been extensively used across other fields, these studies are highly cited. The citation concentration around a few seminal articles is consistent with existing bibliometric theory. According to this view, the spread of knowledge in the sciences is usually driven by a small group of seminal publications that shape the agenda for future research (Price, 1965; Garfield, 1972; Deo & Parsad, 2024; Llach et al., 2025).

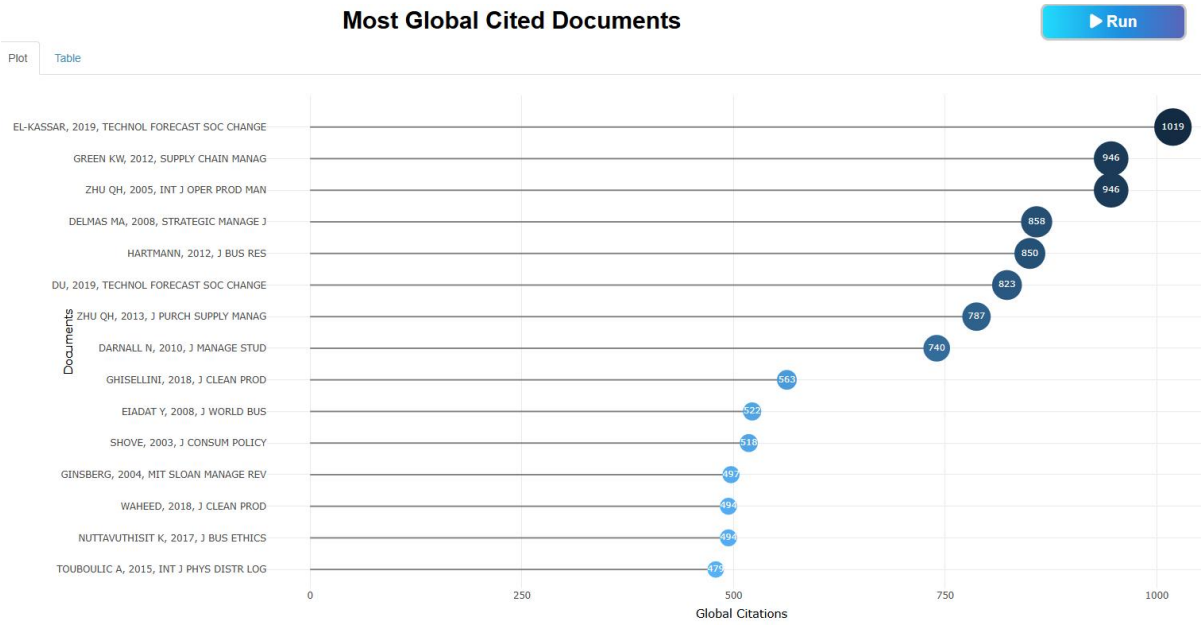

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**Figure 14: Most globally cited documents**

Figure 15 shows a plot of three fields that illustrate the structural interrelationships among the countries of authors (AU_CO), authors (AU), and keywords (DE). It helps clarify how the research's geographic origin relates to leading scholarship and current domains. Among the major centres of knowledge, countries like India, China, the United States of America, Italy, and the United Kingdom possess high connectivity to prolific authors, who, in their turn, act in the area of core themes, such as sustainability, renewable energy, sustainable development, energy efficiency, the circular economy, and climate change. The saturation of such linkages indicates that research on renewable energy and sustainability is both internationally labour-divided and thematically focused, at least in the sense that a small group of powerful authors and nations drives the agendas of high-impact research. The main topic of bibliometric inquiry is these triadic mappings, which help in explaining intellectual structures, collaboration patterns, and topic development in the field. The presence of sustainability-related keywords in the higher ranks also supports the correspondence of the field to the policy requirements of the world, in particular, the SDGs, and the importance of encompassing all three aspects of environmental, economic, and social aspects in the modern energy studies (Callon et al., 1983; United Nations, 2015; Donthu et al., 2021).

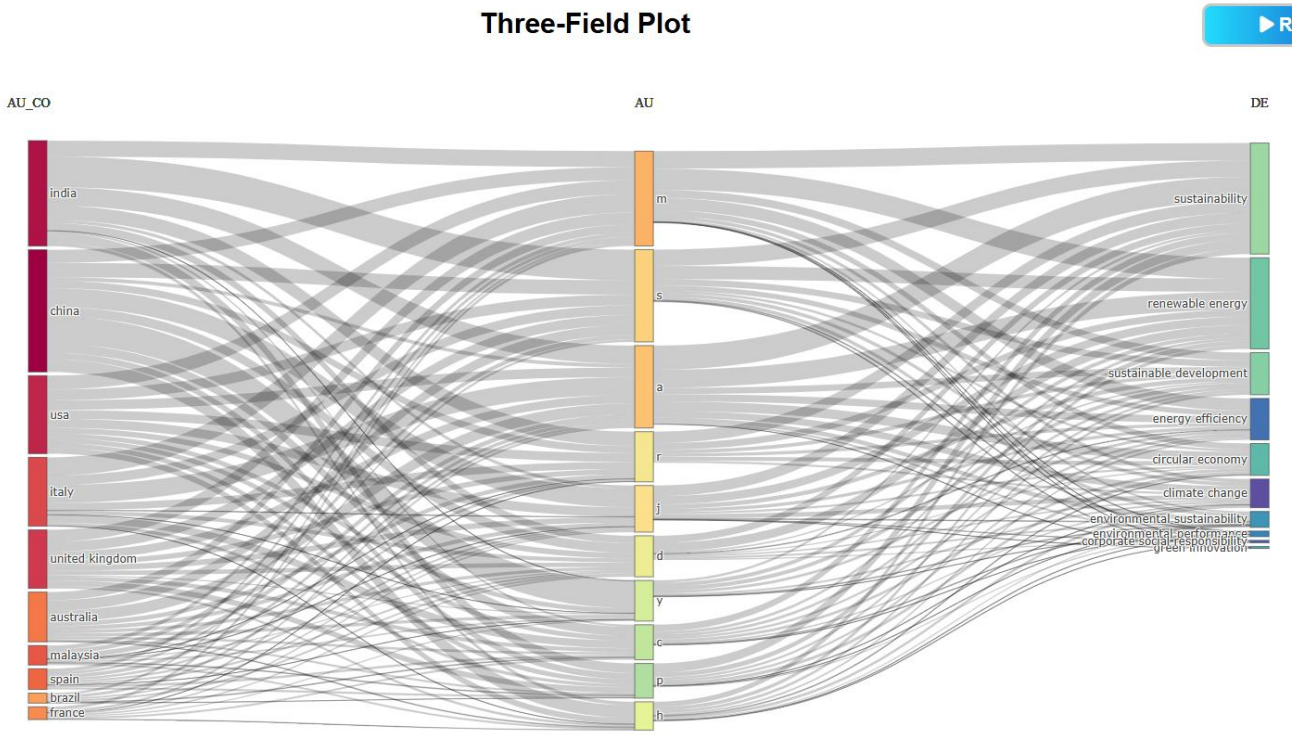


**Figure 15: Three-Field Plot**

Figure 16 illustrates a co-occurrence network showing two thematic clusters that are distinct yet interrelated, thereby reflecting the intellectual architecture of the field. The initial cluster, whose main theme is sustainable development (red), highlights macro-level environmental and energy issues, including renewable energy, energy efficiency, climate change, greenhouse gas emissions, and energy policy, thereby pointing to a strong policy- and systems-focused sustainability discourse. Instead, the more tightly interconnected cluster (blue) centres on performance, impact, adoption, green management, and corporate social responsibility, and adopts a managerial and organisational view that examines innovation, supply chain management, behavioural determinants, and implementation outcomes. The bridges connecting the two clusters, facilitated by keywords such as innovation, sustainability, and adoption, imply a growing integration of environmental sustainability goals into corporate-level performance and decision-making models. On the whole, the network describes a move toward more holistic conceptualisation of sustainable transitions, in addition to management, innovation, and performance measurement, in line with the established bibliometric

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conceptions of thematic evolution and cluster dynamics of sustainability and energy research (Callon et al., 1983; van Eck & Waltman, 2010; Charters et al., 2023).

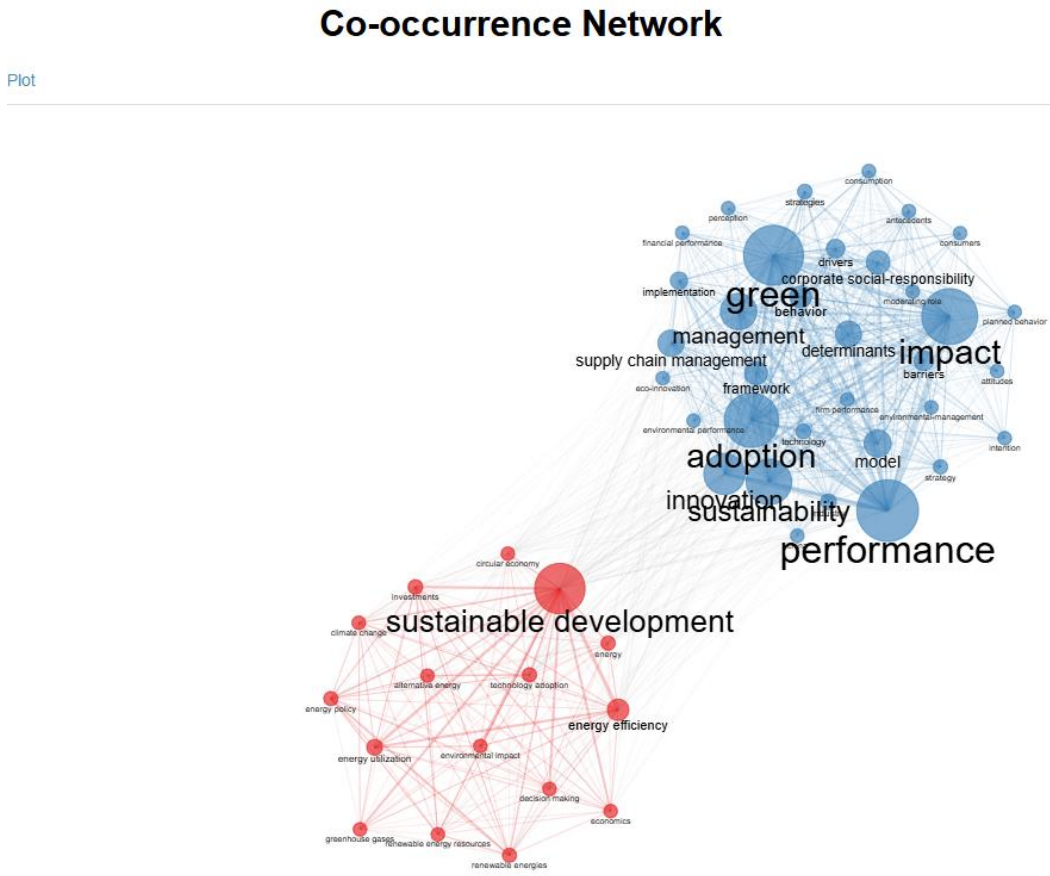


**Figure 16: Co-occurrence Network of two major clusters**

The network of author collaboration shown in Figure 17 represents a fragmented, hub-like system in the literature. There are a few authors, Wang Y and Zhang Y, who occupy central hub positions due to larger node sizes and numerous collaborative links, which demonstrate their roles as key knowledge channels and substantial contributors to the field. These hubs are enclosed by strong subgroups, including groups led by Zhang L, Li Y, and Li J, and another led by Zhang X and Wang Q. Stable co-authorship groups are often associated with institutional or regional research groups. Many of these authors, on the contrary, are small and detached, forming dyads or triads with few external interconnections, implying specialised or context-specific research projects that are less absorbed into the overall collaborative alliance. The lack of sufficient collaboration among groups is evident in the presence of numerous separate entities. As a result, although productivity is increasingly concentrated among a few lead authors, knowledge diffusion remains relatively low across the research community. In general, the network structure corresponds to bibliometric data, indicating that sustainability and renewable energy research uses core authors and clustering of collaborations, which affirms a large potential of the network to increase international and inter-institutional collaboration, making them more interdisciplinary, with methodological diversity, and in exchange of knowledge (Arroyo & Carrete, 2019; Choudhary & Srivastava, 2019; Donastrog et al., 2022).

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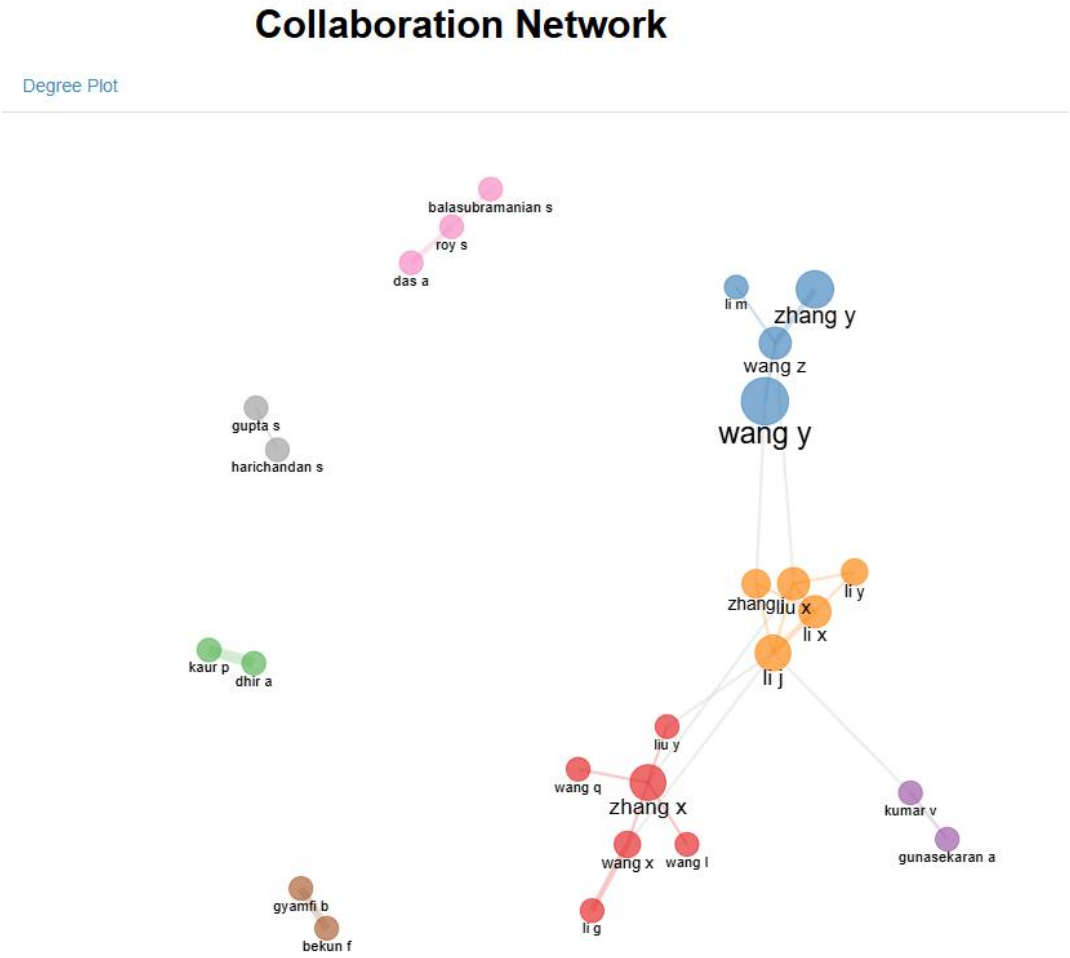


**Figure 17 Collaboration Network among authors**

The network of country-level collaboration, as presented in Figure 18, indicates a highly centralised, clustered structure of research collaboration in renewable energy and sustainability. Strong hubs, that is, the United Kingdom, China, the United States, and India, appear, which is proved by relatively large node sizes and high linkages, indicating the increased productivity of research and the prevalent international co-authorship. These central states form the foundation of the world system of collaboration, having connections with developed and emerging economies. Secondary clusters can be identified; for example, a European group that includes Germany, the Netherlands, Sweden and Switzerland, and an Asia-Middle East cluster that includes Malaysia, Saudi Arabia and Indonesia, indicating regionally based research collaboration. Less integration into global research networks is reflected by relatively few and weak connections in peripheral countries. In general, the observed topology is a core-periphery structure typical of scientific collaboration networks, in which a few nationally scientifically advanced countries drive the production and dissemination of knowledge, and collaboration intensity decreases towards the periphery. This highlights the need for more inclusive and diverse international research collaborations in sustainability and renewable energy research (Wagner & Leydesdorff, 2005; Glanzel & Schubert, 2004; Börner et al., 2010; Shi et al., 2022).

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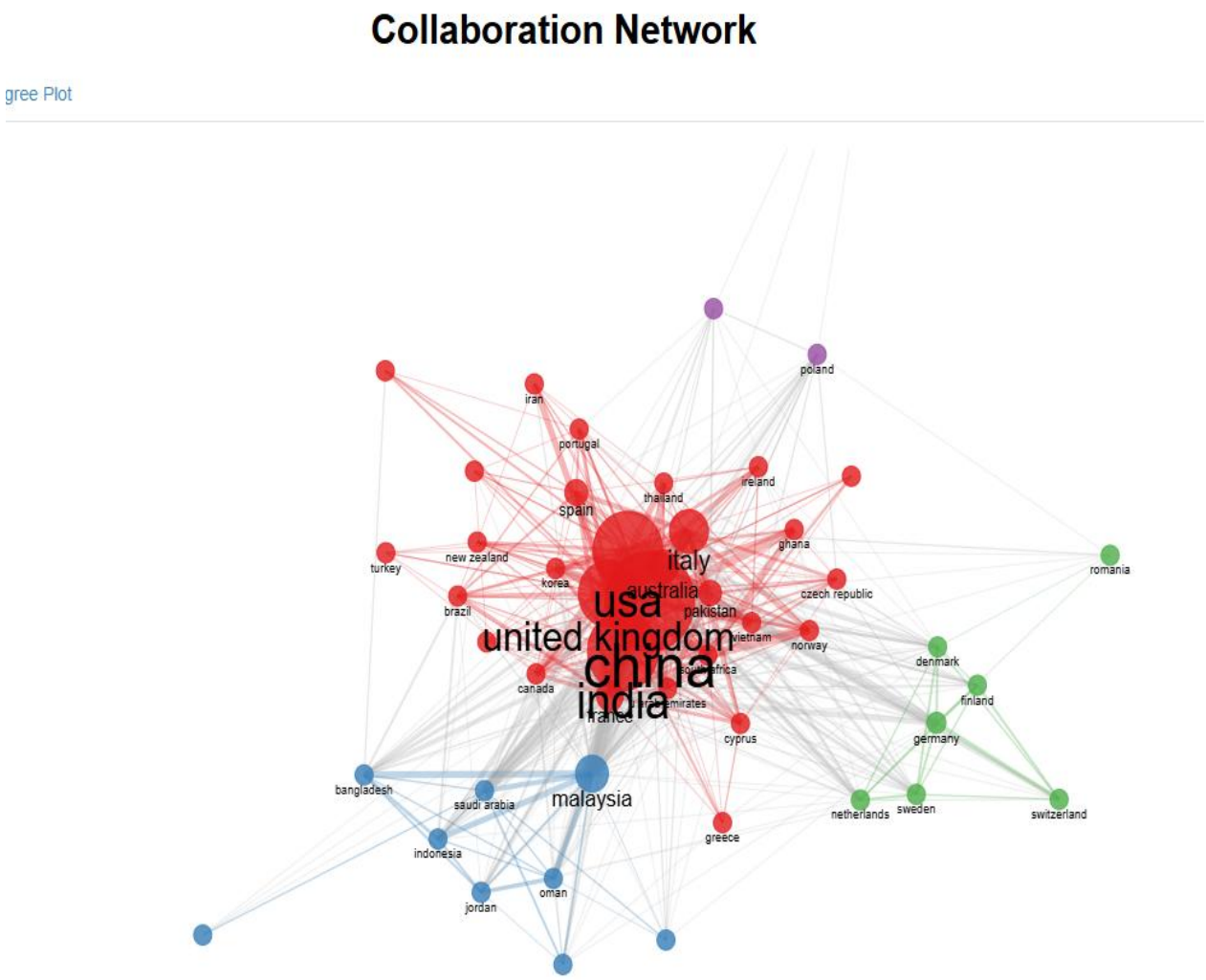


**Figure 18 Collaboration Network within countries**

Figure 19 is a thematic map that shows the intellectual architecture of sustainability research by grouping co-occurring keywords based on centrality and density, using a traditional bibliometric methodology to identify dominant, emergent, and peripheral themes in the discipline. Sustainability and sustainable development have become central, well-elaborated themes, highlighting their fundamental importance in integrating environmental, social, and economic aspects of literature. Environmental sustainability, circular economy, and green innovation are closely connected and part of a family of motor themes that are actively driving the field through innovation, eco-efficiency, and resource circularity. Renewable energy, climate change, and energy transition visibility to the extent of active alignment of the sustainability research with decarbonisation and global climate targets is strong, especially in the SDGs. New and crosscutting topics, such as artificial intelligence, blockchain, electric vehicles, and technology implementation, suggest an increased interest in the digital and technological facilitators of sustainable systems. At the same time, the applied clusters, such as supply chain management, corporate social responsibility, green marketing, and consumer behaviour, indicate how sustainability is operationalised at the firm and market levels. Overall, the map indicates a mature yet evolving research area, in which sustainability is the integrative nexus of policy, technology, innovation, and management perspectives (Callon et al., 1991; Cobo et al., 2011; Donthu et al., 2021).

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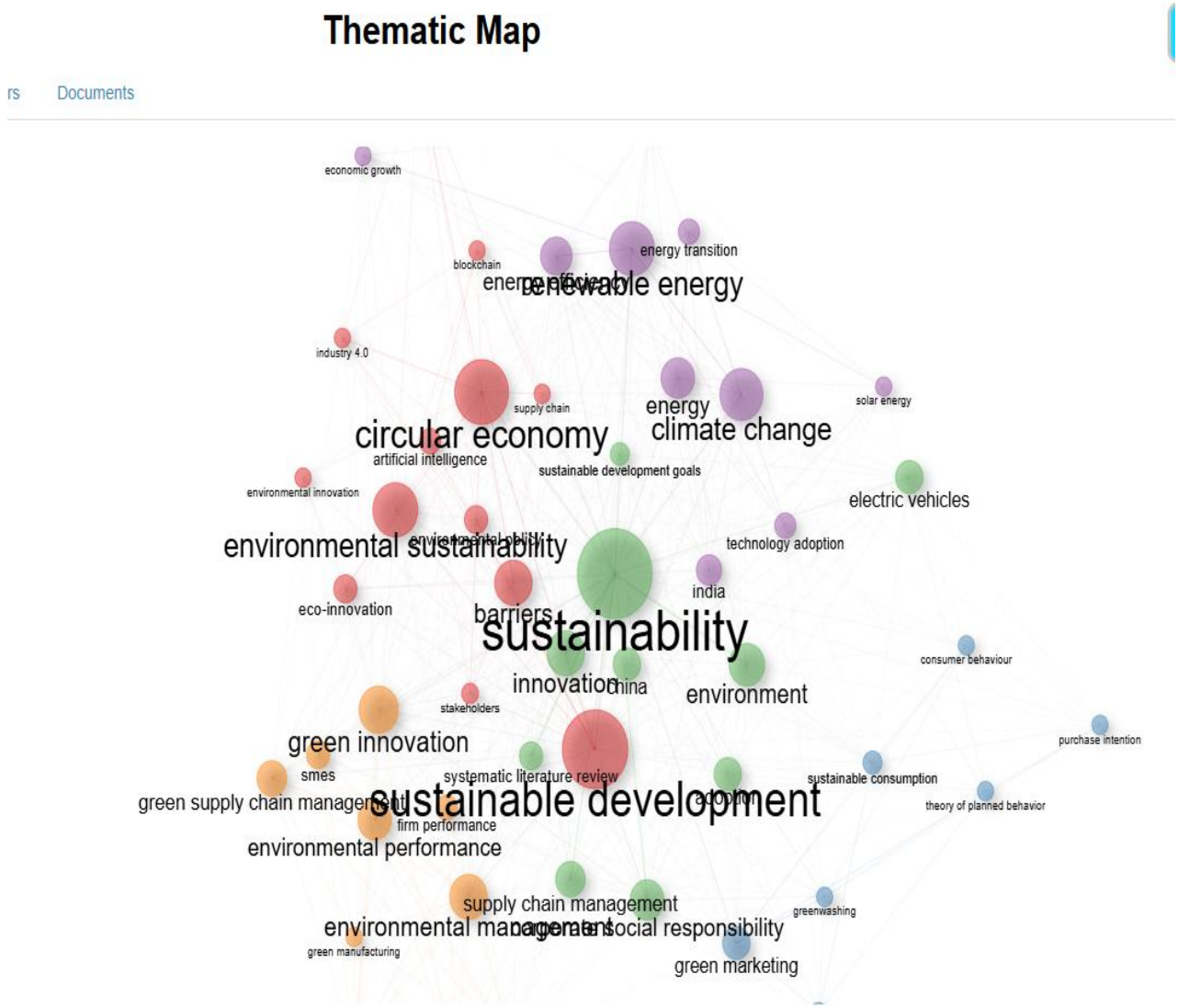


**Figure 19: Thematic Map for themes**

The co-citation network in Figure 20 illustrates the theoretical and methodological foundations of sustainability, management, and behavioural research by showing how major works in the literature are referenced together, indicating a common intellectual force. The most vivid and central node, Fornell and Larcker (1981), holds the network together and highlights the omnipresence of structural equation modelling (SEM) and construct validity in the domain of empirical sustainability and management research. Closely related works, e.g., Podsakoff et al. (2003) and Hair et al. (1998, 2019), also emphasise methodological rigour in the field, particularly regarding common method bias and multivariate analysis. A further major node centres on Ajzen (1991) and Henseler et al. (2015), which represent the integration of behavioural theories (primarily the Theory of Planned Behaviour) with the latest methods for synthesising variance using sophisticated SEM tools. The other, though narrower, cluster of authors includes Porter (1995), Barney (1991), and Russo and Fouts (1997), whose work on the foundations of strategic management and the resource-based view establishes links between environmental performance and competitive advantage. In general, the network reveals a developed, rather methodologically sound research area, in which sustainability research is well established against the background of established theories of behaviour, strategy, and quantitative analysis, thus strengthening theoretical coherence and empirical plausibility (Small, 1973; Zupic & Čater, 2015).

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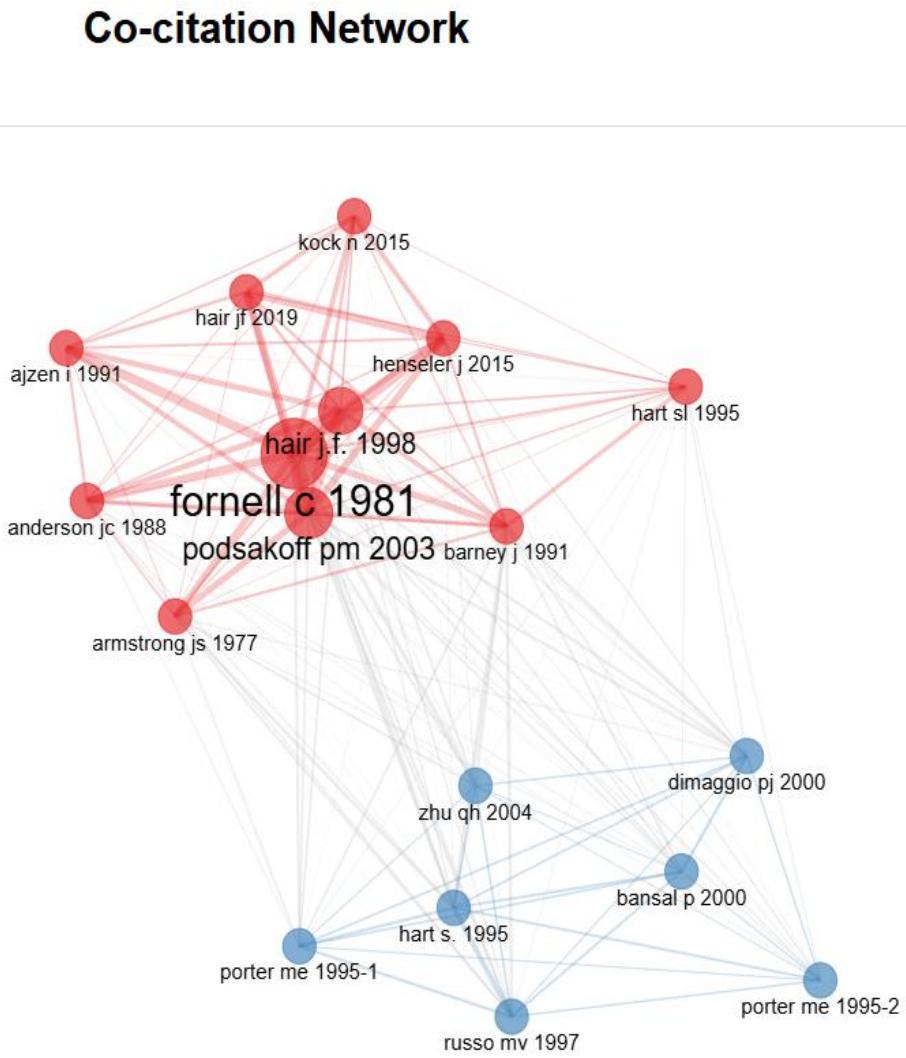


**Figure 20: Co-citation Network within documents**

The collaboration network is presented in Figure 21, which shows the patterns of institutional co-authorship that explain the geographic and organisational organisation of knowledge production in the domain of sustainability research. The magnitude of the node represents the impact of separate publications, whereas the thickness of the link represents the degree of cooperation. A key role in coordinating multinational research across Asia, Africa, and Europe is highlighted by the strong collaborative capacity of major centres such as the Hong Kong Polytechnic University, the University of Johannesburg, the University of Science Malaysia, Shenzhen University, and Xian Jiaotong University. Intensive networking among Asian institutions, especially in China and Malaysia, underscores the region's rapid emergence as a leader in sustainability, renewable energy, and environmental management scholarship. The European universities (e.g., the University of Turin, the University of Bologna, the University of Salerno) are structured as complementary clusters, which implies intercontinental scholarly flows and the spread of methodological behaviour. Smaller peripheral nodes, which represent Middle Eastern, Indian and North American institutions, indicate new collaborations or specialised work groups rather than individual research activity. Taken together, the network heralds a more internationalised and interconnected research ecosystem, where sustainability issues are solved through cross-border collaboration and the creation of diversity in knowledge, research quality, and internationalisation (Newman, 2001; Zupic & Cater, 2015; Wagner & Cater, 2005).

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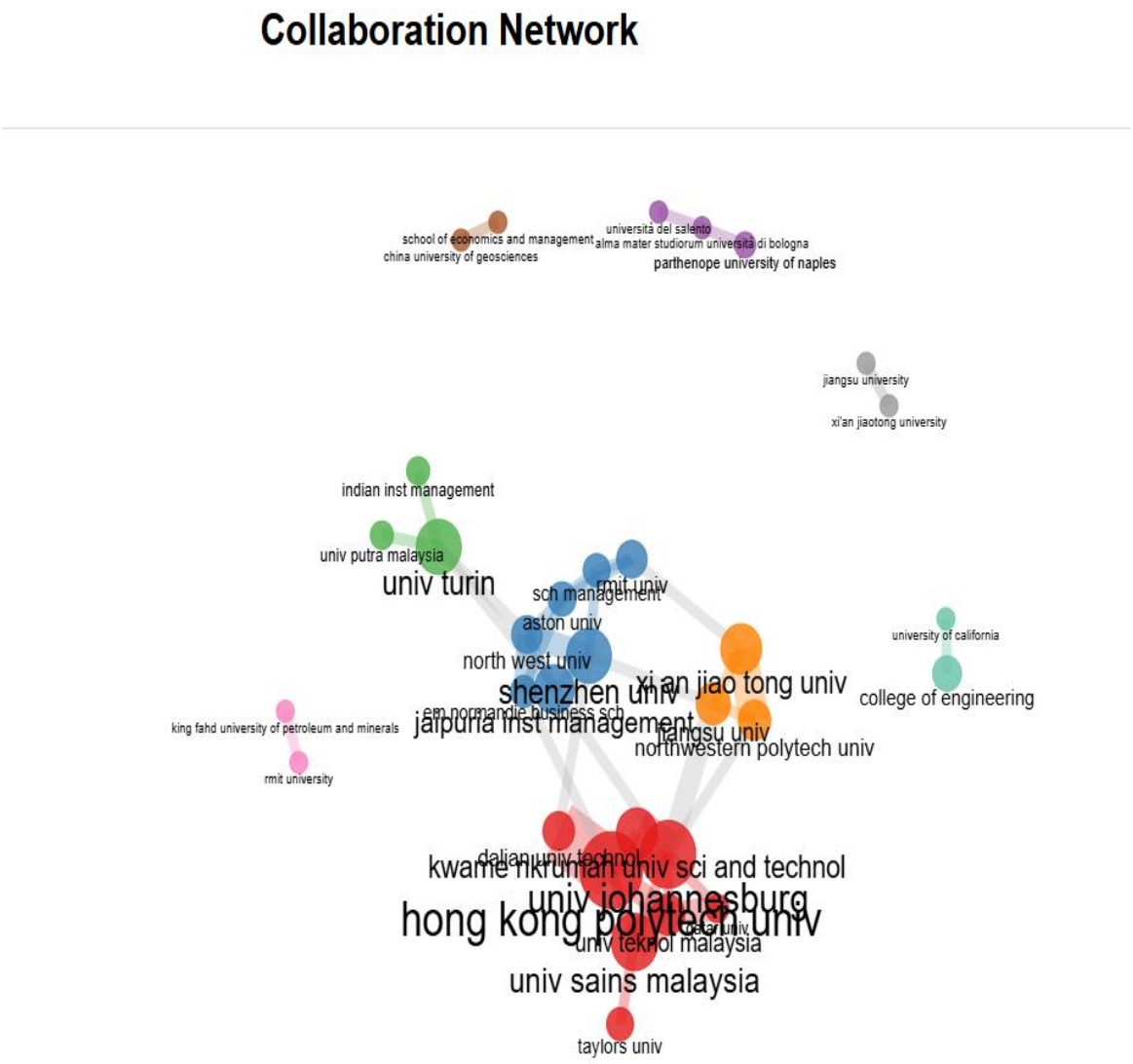


**Figure 21 Collaboration Network within institutions**

On the whole, the bibliometric analysis characterises rapid growth in the research field, which follows an interdisciplinary trend and is gaining momentum. The field has become more broadly inclusive of business strategy, policy structures, and sustainable development goals, rather than being purely technical. The cumulative nature of the quantitative indicators testifies that renewable energy has become a core area of research and therefore has implications for managerial praxis and public policymaking (Yazdi et al., 2024).

## 4. Results and Discussions

This section will present an explanatory synthesis of the bibliometric results, situated within the current theoretical frameworks of energy transitions, innovation diffusion, and sustainable development. The discussion explains the causal processes that have given rise to bibliometric trends and clarifies their implications for business, management, and policy research.

### 4.1 Renewable Energy Research Evolution towards Sustainable Development.

During the early development phase of the renewable energy investigation, the major focus was on technological advancement, aiming to improve efficiency, assess resource availability, and evaluate ecological benefits (Dincer, 2000). As technologies matured and costs decreased, the research broadened to include institutional, economic, and behavioural aspects. Bibliometric indicators of increased emphasis on policy, governance, and adoption-related issues suggest that changes in renewable energy are beginning to be

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viewed as complex socio-economic, rather than engineering, issues. The extreme growth of literature published after 2015 indicates a structural realignment of the renewable energy research agenda towards a less resource-utilisation-oriented and more broad-based analysis of the dynamic processes of the socio-technical transition. From the perspective of energy transition theory, the period is associated with the acceleration stage of socio-technical transitions, when a niche innovation gains policy legitimacy and begins to challenge established fossil-based regimes (Nakićenović, 1999; Kumar & Majid, 2020; Brent, 2021; Juhola et al., 2023).

**4.2. Centrality of Policy and Institutional Frameworks.**

The concentration of studies on energy policy and on governance lends credibility to the priority of policy stability and credibility as the key areas of focus in the literature. This finding aligns with the theory of innovation diffusion, which argues that uncertainty reduction is critical for adopters and investors. Inadequate incentives or unstable political regimes can erode confidence, limit investment, and slow the pace of transformation. As a result, the bibliometric eminence of policy research reflects the real-world problems governments and markets face as they struggle to scale renewable energy infrastructure. The fact that the majority of policy-related keywords and journals account for most of the bibliometric results also highlights the instrumental role of institutions in influencing renewable energy outcomes. In socio-technical systems, policy instruments, including feed-in tariffs, subsidies, renewable portfolio standards, and carbon prices, serve as regime-level tools to facilitate or limit technological diffusion (Shi & Lai, 2013; Sheikh et al., 2016).

**4.3 Business Models, investment and management perspectives.**

Thematic analysis indicates an increasing incorporation of business and management concepts into renewable energy studies. The keywords related to investment, firm strategy, and market mechanisms indicate a shift towards conceptualising renewable energy as a strategic business area rather than a policy-sensitive sphere. The resource-based view believes that the renewable energy capabilities based on the technological know-how, project-management skills, and stakeholder engagement are strategic assets that create a long-lasting competitive advantage. The literature increasingly recognises firms as agents of energy transitions, with respect to business model innovation, the mobilisation of finance, and the formation of cross-sector partnerships. Such a developmental pattern explains why management-oriented journals rose to the top of the bibliometric outcomes (Guta, 2020; Kaartemo & Gonzalez-Perez, 2020).

**4.4 Behavioural, Social and Adoption Dimensions.**

As indicated by bibliometric evidence, adoption research has yet to become as central as policy and technology subjects. Such an imbalance suggests that behavioural dimensions remain underrepresented compared to their important role in the real world. It is increasingly recognised in the literature that public opposition, misinformation, and perceived unfairness can significantly harm renewable energy projects, especially at the community level. The rise of keywords related to adoption, perception, and acceptance indicates the growing importance of behavioural and social aspects in energy transitions to renewable energy. Diffusion theory of innovation helps to understand that when it comes to adoption, economic incentives are not the only factors that can be taken into consideration, as social norms, perceived risks, and institutional trust also play a role (Claudy et al., 2013; Kapoor et al., 2014; Yun et al., 2015; Kesari et al., 2021).

**4.5 Connections between renewable energy and sustainable development.**

Thematic mapping indicates a strong correlation between research on renewable energy and sustainable development outcomes, particularly climate mitigation and economic growth. This finding indicates an understanding of renewable energy as an integrative facilitator of sustainable development, impacting multiple SDGs simultaneously. However, integrative, multi-SDG frameworks also show a low prevalence in the bibliometric outcomes. Most studies focus on individual outcomes, such as emissions reductions or employment, without systematically examining trade-offs and synergies across economic, social, and environmental dimensions. This disjuncture is indicative of a broader difficulty in sustainability scholarship: complexity is usually beyond the analytical reach of monodisciplinary instruments (Guney, 2019; Brent, 2021; Islam, 2023).

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### 4.6 Energy Justice and Equity: An Emerging yet Peripheral Theme.

One intriguing finding is that the topic of energy justice and equity is positioned at the edge of the thematic map. These subjects are not as well developed as policy and economic themes, even though they have been gaining traction in recent years. The theory of energy justice focuses on fairness in the distribution, procedural, and recognition of energy systems. The relative centrality of these themes suggests that research studies in the field of renewable energy are not yet well engaged with critical issues concerning beneficiaries, cost bearers, and the inclusion of diverse voices in decision-making. Such a gap is especially problematic in developing countries, where renewable energy initiatives can directly affect livelihoods, land use, and social inclusion (Irfan et al., 2021; Gupta et al., 2022).

### 4.7 Geographic Concentration and Knowledge Asymmetries.

The country-level analysis shows that a few developed and emerging economies concentrate research output. Although this pattern indicates differences in research capacity and other investment allocation differences, it also demonstrates knowledge asymmetries that permeate the world literature on renewable energy. The under-representation of low-income and least-developed countries, from a development perspective, calls into question the translatability of research findings. The context-specific aspects (institutional capacity, informal economies, and existing social norms) are usually insufficiently represented in the major literature. This weakness highlights the need to have more inclusive and context-based research designs (Li et al., 2020).

### 4.8 Synthesis and Theoretical Implications.

A combination of the findings suggests that research on renewable energy sources to develop a sustainable society has been gradually, though only partially, undergoing a paradigm shift. The discipline has shifted towards a more extreme technological-economic target, with greater emphasis on institutional and managerial opinion. However, there remains an imbalance in the incorporation of these into the literature, with scant cross-fertilisation among energy-transition theory, innovation diffusion, and energy-justice models. Bibliometric evidence supports the argument that future studies need to be more integrative in their theoretical models, clearly relating technology, policy, business strategy, and social outcomes. It is paramount to such integration that renewable-energy transitions are seen not so much as technical interventions but as holistic development (Sharifi et al., 2019).

## 5. Conclusions and Implications

This study systematically maps and synthesises three decades of scholarly research on renewable energy and sustainable development from business, management, and policy perspectives. The study provides a comprehensive picture of the intellectual structure, thematic evolution, and collaboration patterns that characterise this rapidly developing field by using a rigorous PRISMA-guided bibliometric approach to analyse 3,491 peer-reviewed papers from Scopus and Web of Science. The findings show a significant and ongoing rise in research output, particularly after 2015, which is consistent with the impact of the SDGs and the Paris Agreement on international academic agendas.

The bibliometric findings show a substantial shift in the literature from an early techno-centric viewpoint to a more thorough comprehension of renewable energy as a socio-technical and institutional reality. While environmental performance and technological innovation remain crucial, policy tools, governance frameworks, business models, and adoption procedures are increasingly important in recent studies. The analysis also reveals ongoing disparities, particularly the limited attention to behavioural factors, energy justice, and context-specific knowledge from low-income and least developed countries. These findings collectively demonstrate that renewable energy is now broadly recognised not only as a technological response to climate change, but also as a systemic driver of sustainable development with economic, social, and institutional implications.

### 5.1 Chronological and Geographic Evolution of Research Themes

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Over the last four decades, research themes in renewable energy and sustainable development have progressed in close association with global policy milestones and national research dimensions. Developed economies, primarily the United States, the United Kingdom, and Germany, dominated scholarly output during the formative period (1985–1995), concentrating on energy security, environmental protection, and the theoretical underpinnings of sustainable development in the wake of the Brundtland Report (United Nations, 1987). This research addressed environmental governance and resource conservation agendas and was mostly macro-oriented and prescriptive (Callon et al., 1991; Cobo et al., 2011).

The Kyoto Protocol and the institutionalisation of climate policy inside the European Union were agreed upon during the development period (1996–2010). With China accounting for around one-third of all citations, the United States and the United Kingdom emerged as the most influential nations in terms of citation impact, according to the current study's bibliometric findings. Spain, Italy, and India made up the next group of contributors during the same period. Climate change mitigation, energy efficiency, and renewable energy technology (wind and solar) were major themes throughout this time.

The consolidation and diversification phase (2011–2025) saw a shift in research themes toward SDG-aligned, integrated, and solution-oriented fields. European nations have progressed research on green innovation, decarbonization routes, and the circular economy. In contrast, emerging economies such as India, Malaysia, and Saudi Arabia have gradually focused on adoption dynamics, governance, and policy credibility. Despite thematic expansion, collaboration networks reveal a persistent core-periphery structure in which scientifically advanced nations (China, USA, UK, and EU clusters) dominate agenda-setting. At the same time, low-income countries remain underrepresented, reinforcing knowledge asymmetries in sustainability research.

Overall, the chronological evolution demonstrates a transition from environmental awareness to technology-driven and policy-integrated sustainability research, led by a small group of developed and emerging economies. Chronological Evolution of Themes by Countries is presented in the Summary Table 5.1

**Table 5.1 Summary of Evolution of Themes by Countries**

| Period | Dominant Countries | Core Themes | Key Policy Drivers |
|---|---|---|---|
| 1986–1995 | USA, UK, Germany | Environmental protection, sustainable development, energy security | Oil crises; Brundtland Report (1987) |
| 1996–2010 | China, USA, EU countries | Renewable technologies, climate change, energy efficiency | Kyoto Protocol (1997) |
| 2011–2025 | China, USA, UK, India, EU cluster | Energy transition, circular economy, green innovation, governance, SDGs | Paris Agreement (2015); UN SDGs (2015) |

## 5.2 Theoretical Implications

The current research advances theoretical knowledge by explaining the emerging intellectual framework of scholarship on renewable energy and sustainable development. Co-citation and thematic analyses show that the field is highly dependent on the well-known theoretical frameworks based on innovation-diffusion Theory, social-technical transition Research, strategic management and behavioural science, yet these paradigms are commonly applied in a disjointed way. These findings thus highlight the need for a more concerted theoretical synthesis that clearly relates technology to policy, corporate strategy, and societal outcomes within cohesive analytical frameworks.

The growing relevance of policy and governance themes confirms the applicability of the socio-technological transition theory, particularly the role of regime-level institutions in either enhancing or limiting niche innovations. At the same time, there is an emergence of business model innovation, green supply chains, and corporate sustainability, which are consistent with the resource-based view and the dynamic capabilities perspective and therefore portray the firm as an active participant in energy transitions rather than a passive recipient of policy directives. However, the peripheral position of energy justice and equity suggests that normative and distributive theories are insufficiently integrated into the mainstream of renewable-energy research. Further theoretical investigation would be enhanced by integrating energy justice,

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stakeholder theory, and inclusive development frameworks to better capture the distributional and procedural aspects of energy transitions, particularly in developing economies.

### 5.3 Managerial Implications
For business leaders and managers, the findings are that the utilisation of renewable energy is no longer a compliance or cost-saving issue but a strategic move with lasting competitive implications. The increased interconnectedness among renewable energy, company performance, innovation, and corporate social responsibility suggests that clean energy investments can generate strategic value through improved reputation, efficiency, and greater resilience to regulatory and market uncertainty.
The fact that the themes of green innovation, sustainable supply-chain management, and energy efficiency are among the most frequently used and have high bibliometric significance underscores the need to prioritise the use of renewable energy as part of the business strategy, rather than treating it as a separate environmental campaign. These capabilities in project management, stakeholder engagement, and cross-sector collaboration, which the literature identifies as key success factors in implementing renewable energy, should be the central focus for managers. In addition, the scholarly focus on behavioural and adoption-related concerns remains relatively limited, presenting an opportunity for firms seeking first-mover benefits by investing in consumer education, trust-building, and community participation, particularly in decentralised and community-based renewable-energy ventures.

### 5.4 Policy Implications
The current research has several important implications for policymakers at both the national and international levels. The focus of the policy-related topics in the bibliometric analysis demonstrates that stable, credible, and sound policy frameworks are key to scaling renewable energy and integrating it with the goals of sustainable development. The instruments, such as feed-in tariffs, renewable portfolio standards, carbon prices, and long-term investment signals, continue to have an overwhelming impact on the elimination of uncertainty and the mobilisation of private capital.
At the same time, the thematic framework's reference to energy justice and equity reveals a severe disconnect between policy ambitions and academic emphasis. Policymakers should consider placing greater emphasis on inclusive energy transitions to explicitly address affordability, access, land use, and community involvement, particularly in developing and emerging economies. Further evidence of the need for policies is the geographic concentration of research output, which implies the need to promote South-South and North-South research collaboration and, therefore, to contribute to the context-specific learning of policies and the transfer of knowledge. Such alignment of renewable energy policies with several Sustainable Development Goals, in addition to SDG 7, can also help policymakers address trade-offs and synergies among economic growth, social inclusion, and environmental protection.
Overall, the bibliometric study demonstrates how interdisciplinary and policy-focused research on renewable energy as a component of sustainable development has grown. The report also points out that more inclusive, conceptually integrated, and context-sensitive research remains necessary, despite notable progress in integrating technological, economic, and institutional perspectives. The study offers a strong foundation for more scholarly inquiry by outlining the field's evolution and philosophical framework. For managers and legislators seeking to promote renewable energy transitions that are not only efficient but also equitable and sustainable, it offers practical alternatives.

## 6. Future Research Directions
Future research on renewable energy and sustainable development ought to take five interconnected thematic directions, based on the bibliometric gaps, thematic progression, and peripheral research clusters identified in the present study. These guidelines aim to explore unexplored domains identified through keyword co-occurrence, thematic mapping, and co-citation studies, and to resonate with the growing need for integrative, comprehensive, and policy-relevant research models.

### 6.1 Adoption and Behavioural Dynamics Drivers.
Although the growing number of studies in renewable energy applications may be encouraging, the bibliometric analysis shows that the themes of behaviour and adoption remain underdeveloped. In line with

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this, it is recommended that further research be conducted to explore further the socio-economic, psychological, and institutional motivators that determine renewable energy adoption at the household, firm, and community levels. Although economic incentives and technological performance have received considerable attention, other factors, including perceived risk, institutional trust, social norms, cultural values, and behavioural biases, remain inadequately addressed in mainstream models.

Longitudinal and mixed-methods research must be combined with established behavioural research theories, such as the Theory of Planned Behaviour, behavioural reasoning theory, and social practice theory. Over time and across a range of sociocultural contexts, these techniques can elicit dynamic shifts in perceptions and decision-making. To understand why seemingly equivalent policy measures yield varying adoption outcomes, the comparison study's audience by area and socioeconomic category is particularly important. Future research can provide more useful and realistic insights into how to accelerate the spread of renewable energy by taking these behavioural aspects into account.

### 6.2 Energy Justice, Governance and Policy Incentives.

The bibliometric findings support the important role that regulatory frameworks and policy incentives play in promoting change in renewable energy. However, they also show how little attention is paid to fairness and justice issues in policy-based research. To influence deployment outcomes and distributional implications, further research should systematically evaluate the interactions between policy tools (such as feed-in tariffs, carbon pricing, renewable portfolio standards, and subsidies) and governance systems.

Research that clearly incorporates energy justice paradigms and considers the distributive, procedural, and recognition-based aspects of renewable energy transitions is urgently needed. The empirical research on developing and emerging economies should also investigate the beneficiaries of renewable energy projects, the costs borne, and how communities can be involved in decision-making processes, especially for the marginalised and women. The latter would be useful to ensure that renewable energy policies are seen as guiding towards inclusive development rather than deepening the socio-economic inequalities already present. A combination of policy analysis and justice-based views is also key to creating socially viable and politically sustainable energy transitions.

### 6.3 Digitalisation and Technological Innovation.

New digital technologies are a much more recent yet rapidly developing area of research within the body of literature on renewable energy and sustainable development. Artificial intelligence, big data analytics, blockchain, and smart energy platforms, as emerging yet peripheral themes, are identified in the bibliometric analysis, suggesting broad opportunities for future exploration. Research is needed to comprehend how digitalisation affects system integration of renewable energy sources, particularly in complex and decentralised energy systems, as well as efficiency, predictability, and predictive accuracy.

Future studies will focus on how digital tools are used in peer-to-peer energy trading, demand-side management, predictive maintenance, and grid optimisation. Researchers should be able to critically analyse the risks associated with digitalisation, including data governance issues, cybersecurity deficiencies, the uneven distribution of digital infrastructure, and the concentration of technological power. To ensure that digital innovation promotes resilient and sustainable energy transitions rather than creating new systemic risks, interdisciplinary research integrating energy systems, information systems, and governance will be essential.

### 6.4 SDG Connectivity and Systems-Based Perspectives.

The bibliometric study shows that most research remains concentrated on single-goal or single-outcome perspectives, even though renewable energy is directly related to SDG 7 and climate action (SDG 13). Future research should focus on systems-based approaches that view renewable energy as a catalyst for several interrelated SDGs, including decent work and economic growth (SDG 8), industry, innovation, and infrastructure (SDG 9), sustainable cities and communities (SDG 11), and reduced inequality (SDG 10).

Researchers could identify trade-offs and synergies among environmental, economic, and social goals using systems thinking and multi-SDG lenses. These tactics could improve policy coherence and provide a more comprehensive assessment of renewable energy initiatives. This necessitates interdisciplinary collaboration that transcends disciplinary boundaries, scenario modelling, and methodologically integrated modelling. By

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using systems-based techniques, future research can improve a more realistic understanding of the complex issues of sustainable development planning.

### 6.5 Business Models, Inclusivity, and Global South Views.

The bibliometric analysis finds ongoing gaps in research at the firm level, especially in emerging countries and the Global South, even though the concept of renewable energy is increasingly seen in recent literature as a strategic business issue. To enable scalable and equitable investments in renewable energy in resource-constrained settings, future research must focus on innovative business models, value-generating schemes, and financing mechanisms.

To capture institutional differences, informal market forms, and distinctive socioeconomic restrictions prevalent in underrepresented areas, comparative and context-specific research is especially important. Insights into inclusive transition routes may be gained by examining decentralised energy firms, microfinance models, public-private partnerships, and community-owned systems. Increased representation of the Global South in research on renewable energy would improve the generalizability, policy relevance, and developmental character of future scholarship, leading to more robust and equitable global energy transitions.

## Appendix 1

**Scopus database as of 07 January 2026 for search query:**

( ( "renewable" OR "green" OR "clean" OR "sustainable" energ* ) AND ( "sustainab*" OR "social" OR "economic" OR "environmental" ) AND ( "adoption" OR "perception" ) ): Resulted in 1408 documents

**WOS database as of 07 January 2026 for search query:**

( ( "renewable" OR "green" OR "clean" OR "sustainable" energ* ) AND ( "sustainab*" OR "social" OR "economic" OR "environmental" ) AND ( "adoption" OR "perception" ) ) : Resulted in 2396 documents

After the removal of 313 documents, a total of 3491 documents are used for analysis.

**R Studio pseudo code for analysis**

```
> setwd("D:/##################")
> library(bibliometrix)
> web_data<-convert2df("savedrecs_wos_07012026.txt", dbsource="wos", format="plaintext")
> scopus_data<- convert2df(file = "scopus_db_07012026.csv", dbsource = "scopus", format = "csv")
> combined<-mergeDbSources(scopus_data, web_data, remove.duplicated = TRUE)
> View(combined)
> library(xlsx)
> write.xlsx(combined,"Renewable_Energy.xlsx")
> biblioshiny()
```

### References

1. Adnan, N., Nordin, S. M., Rahman, I., & Rasli, A. M. (2017). A new era of sustainable transport: An experimental examination on forecasting adoption behavior of EVs among Malaysian consumers. Transportation Research Part A: Policy and Practice, 103, 279–295. https://doi.org/10.1016/j.tra.2017.06.005
2. Alhaddi, H. (2015). Triple bottom line and sustainability: A literature review. Business and Management Studies, 1(2), 6–10.
3. Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of Informetrics, 11(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007
4. Arroyo, P., & Carrete, L. (2019). Motivational drivers for the adoption of green energy: The case of purchasing photovoltaic systems. Management Research Review, 42(5), 521–540. https://doi.org/10.1108/MRR-02-2018-0070
5. Bennett, J., Baker, A., Johncox, E., & Nateghi, R. (2020). Characterizing the key predictors of renewable energy penetration for sustainable and resilient communities. Journal of Management in Engineering, 36(5), 04020060. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000767

*Vol. 12 Issue 5s (September, 2026)*

*ISSN: 2208-2190 Pages- 41-71*

*DOI: https://doi.org/10.69980/bh82yf48*

6. Börner, K., Chen, C., & Boyack, K. W. (2010). Visualizing knowledge domains. Annual Review of Information Science and Technology, 41(1), 1–41. https://doi.org/10.1002/aris.2010.1440410102
7. Brent, A. C. (2021). Renewable energy for sustainable development. Sustainability, 13(12), 6920. https://doi.org/10.3390/su13126920
8. Callon, M., Courtial, J. P., & Laville, F. (1991). Co-word analysis as a tool for describing the network of interactions between basic and technological research: The case of polymer chemistry. Scientometrics, 22(1), 155–205. https://doi.org/10.1007/BF02019280
9. Callon, M., Courtial, J. P., Turner, W. A., & Bauin, S. (1983). From translations to problematic networks: An introduction to co-word analysis. Social Science Information, 22(2), 191–235. https://doi.org/10.1177/053901883022002003
10. Charters, B., Heffernan, T., & Daly, M. (2023). When individual action requires collective approval: A roadmap for solar power adoption by strata property owners. Journal of Social Marketing, 13(1), 100–120. https://doi.org/10.1108/JSOCM-04-2022-0076
11. Choudhary, P., & Srivastava, R. K. (2019). Sustainability perspectives – A review for solar photovoltaic trends and growth opportunities. Journal of Cleaner Production, 227, 589–614. https://doi.org/10.1016/j.jclepro.2019.118184
12. Claudy, M. C., Peterson, M., & O'Driscoll, A. (2013). Understanding the attitude-behavior gap for renewable energy systems using behavioral reasoning theory. Journal of Macromarketing, 33(4), 273–287. https://doi.org/10.1177/0276146713481605
13. Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). Science mapping software tools: Review, analysis, and cooperative study among tools. Journal of the American Society for Information Science and Technology, 62(7), 1382–1402. https://doi.org/10.1002/asi.21525
14. Collins, L. (1998). Renewable energy from wood and paper: Technological and cultural implications. Technology in Society, 20(2), 157–177. https://doi.org/10.1016/S0160-791X(98)00001-3
15. Daka, E. (2023). Adopting clean technologies to climate change adaptation strategies in Africa: A systematic literature review. Environmental Management, 71, 87–98. https://doi.org/10.1007/s00267-022-01704-w
16. Deo, K., & Prasad, A. (2024). Factors influencing green energy consumer behaviour in Australia. Journal of Cleaner Production, 460, 142609. https://doi.org/10.1016/j.jclepro.2024.142609
17. Dincer, I. (2000). Renewable energy and sustainable development: A crucial review. Renewable and Sustainable Energy Reviews, 4(2), 157–175. https://doi.org/10.1016/S1364-0321(99)00011-8
18. Doğan, B., Khalfaoui, R., Bergougui, B., & Ghosh, S. (2025). Unveiling the impact of the digital economy on the interplay of energy transition, environmental transformation, and renewable energy adoption. Research in International Business and Finance, 76, 102837. https://doi.org/10.1016/j.ribaf.2025.102837
19. Donastorg, A. D., Renukappa, S., & Suresh, S. (2022). Financing renewable energy projects in the Dominican Republic: An empirical study. International Journal of Energy Sector Management, 16(2), 276–300. https://doi.org/10.1108/IJESM-10-2020-0002
20. Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070
21. Duroha, J. C., & Macht, G. A. (2023). Solar installation occupational risks: A systematic review. Safety Science, 160, 106048. https://doi.org/10.1016/j.ssci.2022.106048
22. Du, K., Li, P., & Yan, Z. (2019). Do green technology innovations contribute to carbon dioxide emission reduction? Empirical evidence from patent data. Technological Forecasting and Social Change, 146, 297–303. https://doi.org/10.1016/j.techfore.2019.06.010
23. Elmustapha, H., Hoppe, T., & Bressers, H. (2018). Consumer renewable energy technology adoption decision-making: Comparing models on perceived attributes and attitudinal constructs in the case of solar water heaters in Lebanon. Journal of Cleaner Production, 172, 347–357. https://doi.org/10.1016/j.jclepro.2017.10.131
24. Foroudi, P., Marvi, R., Cuomo, M. T., Bagozzi, R., Dennis, C., & Jannelli, R. (2023). Consumer perceptions of SDG: Conceptualization, measurement and contingent effects. British Journal of Management, 34(3), 1157–1183. https://doi.org/10.1111/1467-8551.12637

25. Garfield, E. (1972). Citation analysis as a tool in journal evaluation. Science, 178(4060), 471–479. https://doi.org/10.1126/science.178.4060.471
26. Glänzel, W., & Schubert, A. (2004). Analysing scientific networks through co-authorship. In H. F. Moed, W. Glänzel, & U. Schmoch (Eds.), Handbook of quantitative science and technology research (pp. 257–276). Dordrecht, The Netherlands: Springer.
27. Gómez Gandía, J. A., Gavrila, S., de Lucas Ancillo, A., & del Val Núñez, M. T. (2025). Towards sustainable business in the automation era: Exploring its transformative impact from top management and employee perspective. Technological Forecasting and Social Change, 210, 123908. https://doi.org/10.1016/j.techfore.2024.123908
28. Güney, T. (2019). Renewable energy, non-renewable energy and sustainable development. International Journal of Sustainable Development & World Ecology, 26(5), 389–397. https://doi.org/10.1080/13504509.2019.1595214
29. Gupta, S., Kar, S. K., & Harichandan, S. (2022). India's emerging fuel mix for 2050: Actions and strategies to decarbonize the transport sector. International Journal of Energy Sector Management, 16(2), 252–275. https://doi.org/10.1108/IJESM-02-2021-0005
30. Guta, D. D. (2020). Determinants of household use of energy-efficient and renewable energy technologies in rural Ethiopia. Technology in Society, 61, 101249. https://doi.org/10.1016/j.techsoc.2020.101249
31. Irfan, M., Yadav, S., & Shaw, K. (2021). The adoption of solar photovoltaic technology among Indian households: Examining the influence of entrepreneurship. Technological Forecasting and Social Change, 173, 120815. https://doi.org/10.1016/j.techfore.2021.120815
32. Islam, M. T. (2023). Newly developed green technology innovations in business: Paving the way toward sustainability. Technological Sustainability. https://doi.org/10.1108/TECHS-02-2023-0008
33. Juhola, S., Laurila, A.-G., Groundstroem, F., & Klein, J. (2023). Climate risks to the renewable energy sector: Assessment and adaptation within energy companies. Business Strategy and the Environment, 33(3), 1906–1919. https://doi.org/10.1002/bse.3580
34. Kajikawa, Y., & Takeda, Y. (2008). Structure of research on biomass and bio-fuels: A citation-based approach. Technological Forecasting and Social Change, 75(9), 1349–1359. https://doi.org/10.1016/j.techfore.2008.04.007
35. Kapoor, K. K., Dwivedi, Y. K., & Williams, M. D. (2014). Examining consumer acceptance of green innovations using innovation characteristics: A conceptual approach. Technological Forecasting and Social Change, 87, 563–572. https://doi.org/10.1016/j.techfore.2013.12.011
36. Kaartemo, V., & Gonzalez-Perez, M. A. (2020). Renewable energy in international business. Critical Perspectives on International Business, 16(4), 341–355. https://doi.org/10.1108/cpoib-08-2019-0062
37. Kesari, B., Atulkar, S., & Pandey, S. (2021). Consumer purchasing behaviour towards eco-environment residential photovoltaic solar lighting systems. Global Business Review, 22(6), 1514–1532. https://doi.org/10.1177/0972150918795550
38. Kumar, C. R. J., & Majid, M. A. (2020). Renewable energy for sustainable development in India: Current status, prospects, challenges, employment, and investment opportunities. Energy, Sustainability and Society, 10, 2. https://doi.org/10.1186/s13705-019-0232-1
39. Li, H. X., Edwards, D. J., Hosseini, M. R., & Costin, G. P. (2020). A review on renewable energy transition in Australia: An updated depiction. Journal of Cleaner Production, 242, 118475. https://doi.org/10.1016/j.jclepro.2019.118475
40. Llach, J., Palau-Pinyana, E., Lei, L., & Perramon, J. (2025). Key enablers for energy firms in implementing the SDGs: Lessons based on a resource-based view approach. Technological Forecasting and Social Change, 213, 124011. https://doi.org/10.1016/j.techfore.2025.124011
41. Lotka, A. J. (1926). The frequency distribution of scientific productivity. Journal of the Washington Academy of Sciences, 16(12), 317–323.
42. Lucchi, E., Turati, F., Colombo, B., & Schito, E. (2024). Climate-responsive design practices: A transdisciplinary methodology for achieving SDG in cultural and natural heritage. Journal of Cleaner Production, 457, 142431. https://doi.org/10.1016/j.jclepro.2024.142431

*Vol. 12 Issue 5s (September, 2026)*

*ISSN: 2208-2190 Pages- 41-71*

*DOI: https://doi.org/10.69980/bh82yf48*

43. Marco-Lajara, B., Martínez-Falcó, J., Sánchez-García, E., & Millan-Tudela, L. A. (2023). Analyzing the role of renewable energy in meeting the SDG: A bibliometric analysis. Energies, 16(7), 3137. https://doi.org/10.3390/en16073137
44. Mishra, R., Naik, B. K. R., & Raut, R. D. (2024). Empowering sustainability: Understanding the users' perceptions on the adoption of renewable energy technologies (RETs) through a systematic literature review. Journal of Indian Business Research, 16(4), 434–451. https://doi.org/10.1108/JIBR-05-2023-0164
45. Naicker, P., & Thopil, G. A. (2019). A framework for sustainable utility scale renewable energy selection in South Africa. Journal of Cleaner Production, 231, 854–865. https://doi.org/10.1016/j.jclepro.2019.03.257
46. Nakićenović, N. (1999). Energy perspectives into the next millennium: From resource scarcity to decarbonization. Technological Forecasting and Social Change, 62(2–3), 101–106. https://doi.org/10.1016/S0040-1625(99)00043-8
47. Newman, M. E. J. (2001). The structure of scientific collaboration networks. Proceedings of the National Academy of Sciences, 98(2), 404–409. https://doi.org/10.1073/pnas.98.2.404
48. Owusu, P. A., & Asumadu-Sarkodie, S. (2016). A review of RES, sustainability issues and climate change mitigation. Cogent Engineering, 3(1), 1167990. https://doi.org/10.1080/23311916.2016.1167990
49. Paananen, A., & Mäkinen, S. J. (2013). Bibliometrics-based foresight on renewable energy production. Foresight, 15(6), 465–476. https://doi.org/10.1108/FS-10-2012-0080
50. Prete, M. I., Piper, L., De Guido, M., & Cerqua, A. (2017). Determinants of Southern Italian households' intention to adopt energy efficiency measures in residential buildings. Journal of Cleaner Production, 153, 83–91. https://doi.org/10.1016/j.jclepro.2017.03.142
51. Price, D. J. de Solla. (1963). Little science, big science. New York, NY: Columbia University Press.
52. Price, D. J. de Solla. (1965). Networks of scientific papers. Science, 149(3683), 510–515. https://doi.org/10.1126/science.149.3683.510
53. Radomes, A. A., Jr., & Arango, S. (2015). Renewable energy technology diffusion: An analysis of photovoltaic-system support schemes in Medellín, Colombia. Journal of Cleaner Production, 92, 152–161. https://doi.org/10.1016/j.jclepro.2014.12.062
54. Rezk, H., Olabi, A. G., Mahmoud, M., Wilberforce, T., & Sayed, E. T. (2024). Metaheuristics and multi-criteria decision-making for renewable energy systems: Review, progress, bibliometric analysis, and contribution to the sustainable development pillars. Ain Shams Engineering Journal, 15, 102883. https://doi.org/10.1016/j.asej.2024.102883
55. Reyes-Mercado, P., & Rajagopal. (2017). Adoption of renewable energy technologies in Mexico: The role of cognitive factors and innovation attributes. International Journal of Energy Sector Management, 11(4), 626–645. https://doi.org/10.1108/IJESM-09-2016-0003
56. Sharifi, M., Khazaei Pool, J., Jalilvand, M. R., Tabaeeian, R. A., & Jooybari, M. G. (2019). Forecasting of advertising effectiveness for renewable energy technologies: A neural network analysis. Technological Forecasting and Social Change, 142, 40–53. https://doi.org/10.1016/j.techfore.2019.04.009
57. Shi, Q., & Lai, X. (2013). Identifying the underpin of green and low carbon technology innovation research: A literature review from 1994 to 2010. Technological Forecasting and Social Change, 80(5), 839–864. https://doi.org/10.1016/j.techfore.2012.09.006
58. Shi, Y., Ding, L., He, C., Zhang, F., Zhang, Z., & Dai, Q. (2022). Do village leaders' engagement, social interaction and financial incentive affect residents' solar PV adoption? An empirical study in rural China. International Journal of Energy Sector Management, 16(2), 383–404. https://doi.org/10.1108/IJESM-02-2021-0027
59. Sotnyk, I., Kurbatova, T., Kubatko, O., Prokopenko, O., & Järvis, M. (2023). Managing energy efficiency and renewable energy in the residential sector: A bibliometric study. Problems and Perspectives in Management, 21(3), 511–527. https://doi.org/10.21511/ppm.21(3).2023.41
60. Small, H. (1973). Co-citation in the scientific literature: A new measure of the relationship between two documents. Journal of the American Society for Information Science, 24(4), 265–269. https://doi.org/10.1002/asi.4630240406

*Vol. 12 Issue 5s (September, 2026)*

*ISSN: 2208-2190 Pages- 41-71*

*DOI: https://doi.org/10.69980/bh82yf48*

61. Smith, C. (1998). The science of energy – a cultural history of energy physics in Victorian Britain. The University of Chicago Press. ISBN 978-0-226-76420-7
62. Stern, D. I., & Kander, A. (2012). The role of energy in the Industrial Revolution and modern economic growth. The Energy Journal, 33(3), 125–152. https://doi.org/10.5547/01956574.33.3.5
63. Sharma, N. (2021). Public perceptions towards adoption of residential Solar Water Heaters in USA: A case study of Phoenicians in Arizona. Journal of Cleaner Production, 316, 128891. https://doi.org/10.1016/j.jclepro.2021.128891
64. Sheikh, N. J., Kocaoglu, D. F., & Lutzenhiser, L. (2016). Social and political impacts of renewable energy: Literature review. Technological Forecasting and Social Change, 108, 102–110. https://doi.org/10.1016/j.techfore.2016.04.018
65. Tahamtan, I., Safipour Afshar, A., & Ahamdzadeh, K. (2016). Factors affecting number of citations: A comprehensive review of the literature. Scientometrics, 107(3), 1195–1225. https://doi.org/10.1007/s11192-016-1889-2
66. United Nations. (1987). Our Common Future (Brundtland Report). Oxford University Press.
67. United Nations. (2015). Transforming our world: The 2030 Agenda for Sustainable Development. New York, NY: United Nations.
68. Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics, 84(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3
69. Wang, Z., Zhang, B., & Li, S. (2013). Renewable energy consumption, economic growth and $CO_2$ emissions: A dynamic panel data analysis for China. Energy Policy, 60, 28–37. https://doi.org/10.1016/j.enpol.2013.05.063
70. Waris, I., Hameed, I., & Ali, R. (2023). Predicting household sign-up for solar energy: An empirical study based on the extended theory of planned behavior. International Journal of Energy Sector Management, 17(2), 336–355. https://doi.org/10.1108/IJESM-06-2021-0010
71. Wagner, C. S., & Leydesdorff, L. (2005). Network structure, self-organization, and the growth of international collaboration in science. Research Policy, 34(10), 1608–1618. https://doi.org/10.1016/j.respol.2005.08.002
72. Wagner, M., Schaltegger, S., & Wehrmeyer, W. (2011). The sustainability balanced scorecard as a framework for eco-efficiency analysis. Journal of Cleaner Production, 19(10), 1046–1057. https://doi.org/10.1016/j.jclepro.2011.02.020
73. Yazdi, A. K., Tan, Y. A., Birau, R., Frank, D., & Pamučar, D. (2024). Sustainable solutions: Using MCDM to choose the best location for green energy projects. International Journal of Energy Sector Management. https://doi.org/10.1108/IJESM-01-2024-0005
74. Yun, S., & Lee, J. (2015). Advancing societal readiness toward renewable energy system adoption with a socio-technical perspective. Technological Forecasting and Social Change, 95, 170–181. https://doi.org/10.1016/j.techfore.2015.01.016
75. Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. Organizational Research Methods, 18(3), 429–472. https://doi.org/10.1177/1094428114562629