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A Decade of Green Economic Literature: An Analysis-Based Bibliometric

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ABSTRACT

This research significantly contributes to comprehending the body of work surrounding green economics and sustainable economies by methodically reviewing and categorizing papers from the Web of Science (WoS) core collection. It highlights key authors, subjects, publishing sources, and nations relevant to green economic studies by meticulously analyzing 4157 papers. Additionally, it constructs detailed visual maps based on referenced sources. By conducting a thorough bibliometric analysis, this study underscores the importance of using such tools to gauge research impact and productivity. Leveraging the WoS Core Collection, particularly the Science Citation Index Expanded and the Social Sciences Citation Index, was deliberate to ensure a comprehensive evaluation of green economic research. The data accentuates the changing landscape of this field, indicating its growing significance and the expanding academic discussions around sustainable economic practices. The research delves into emerging research directions that could inform considerations for a sustainable economy. Despite the marked increase in publications in recent years, signaling heightened interest in green economics and sustainable economy studies, this field remains in its infancy, with limited quantitative studies conducted. Consequently, many findings remain inconclusive, and numerous aspects in literature remain unexplored. Finally, this study outlines both practical and theoretical implications gleaned from its findings.

Keywords: Green Economics, Sustainable Economics, Bibliometrics, Literature Review, Web of Science
JEL Classifications: O50; P40; Q20; Q50

1. INTRODUCTION

In the midst of the complex network of contemporary global challenges, an undeniable imperative has emerged: the need to adopt economic models characterized by their dual attributes of sustainability and renewability (Logesh, 2017). These models, meticulously designed to harmonize the aspirations of both present and future generations, serve as guardians of Earth's invaluable natural resources and delicate ecosystems (Bezgodov, 2015). This pressing necessity has given rise to the conceptual innovation known as the green economy, an avant-garde framework strategically positioned to transcend the dichotomy between economic pursuits and environmental preservation (Nhamo and Mjimba, 2017; Horgan and Dimitrijević, 2020).

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The profound significance of the green economy stems from its inherent connection to the mounting urgencies engendered by the accelerating tandem of environmental and economic predicaments (Di Chiro, 2018; Lutfi et al., 2023). These exigencies are accentuated by the looming specters of escalating pollution, the depletion of irreplaceable natural reserves, and the intensifying threat of climate change (Salamé et al., 2021). The current global landscape is ominously scarred by a surge in greenhouse gas emissions, incidents of water contamination, and the unfortunate dissipation of precious food resources – each demanding prompt and effective counteraction (Cox, 2023). Within this crucible of challenges, the green economy emerges as a beacon of hope, ceaselessly striving to achieve a harmonious equilibrium between the imperatives of human society and the stewardship of the environment (Bookchin, 2022). This endeavor is manifested through the proactive redirection of investments and the formulation of policies that chart a trajectory toward environmental resilience (Mehryar et al., 2022).

At its core, the green economy embodies the essence of sustainability, promoting sustainable economic growth while safeguarding the delicate balance of the environment (Bibri, 2021; Lutfi et al., 2022; Liu et al., 2023). This intricate orchestration enables the wise utilization of available resources and opportunities, addressing the needs of the current generation while preserving the legacy for those to come (Nocca, 2017; Morgan, 2018).

Amidst the convergence of intensifying environmental demands and the mounting pressures of sustainable development, the green economy emerges as a dynamic paradigm, poised to redefine the equilibrium between economic progress and responsible environmental stewardship (Allioui and Mourdi, 2023; Porath, 2023; Liu et al., 2023). In a world shaped by unprecedented challenges, the green economy takes center stage as a dynamic, pragmatic, and sustainable response, striving to reshape the contours of economic growth within the encompassing realms of ecological and societal considerations (Pow, 2018). This research firmly establishes itself to underscore the critical importance of the green economy as a powerful tool for achieving sustainable development and fostering environmental resilience.

The unique contribution of this study lies in its ability to not only quantitatively assess research proliferation but also qualitatively analyze the evolution of themes and ideas. The utilization of cluster-based analysis allows us to identify thematic clusters, illuminating the intricate intersections between environmental sustainability, economic theory, and policy implications. By elucidating these interdisciplinary connections, the study bridges the gap between traditional bibliometric analyses and a comprehensive understanding of the intellectual landscape shaping the discourse on green economics, sustainable development, renewable energy, and climate change. It also deepens our comprehension of the evolving discourse and its implications for sustainable economic thought and policy.

The remainder of the paper is organized as follows: The next section provides an overview of the methodology and data used in the study, and Section 3 presents the findings of the bibliometric analysis, identifying the key debates. Finally, in Section 4, the main conclusions are drawn, summarizing the major results, limitations, and implications.

2. DATA AND METHODOLOGY

This study utilizes bibliometric analytic methods, adhering to the frameworks established by Abu Huson et al., (2023), Alqudah et al. (2023), Ge et al. (2022), and Qudah et al., (2023). Initially, the research meticulously examines 4157 papers that cite Brika's (2022) work. Subsequently, visual maps are meticulously crafted based on references, incorporating insights from Zhu et al. (2021), Qudah et al. (2023), and Alqudah et al. (2023). These methodical steps form the cornerstone of the study.

Drawing upon a comprehensive review of prior research (Bhatnagar and Sharma, 2022; Ge and Zhi, 2016; Kozar and Sulich, 2023; Mohanty et al., 2023; Qin et al., 2022; Tan et al., 2021; Wu et al., 2023; Zhang et al., 2018), this study establishes bibliometric analysis as an indispensable tool for evaluating research impact and productivity. Guided by the recommendations of leading experts such as Haq and Bahit (2021), Tepe et al. (2021), and Hendriks et al. (2019), the WoS Core Collection, specifically the Science Citation Index Expanded and the Social Sciences Citation Index, was employed for this study. The deliberate selection of the WoS database was driven by its alignment with the ABS journal guide criteria, ensuring a thorough and comprehensive assessment of Green Economic research.

The WoS database was purposefully chosen to ensure comprehensive coverage of Green Economics, with Scopus being excluded due to content overlap. The systematic review adhered to PRISMA criteria (Pidgeon, et al., 2016). Employing a search query centered on psychological intervention topics, the study meticulously examined English-language literature from 2010 to 2023 in the WoS Core Collection database, yielding 1492 papers. To facilitate bibliographic analysis, the study utilized the Biblioshiny R package, renowned for its time-saving features, BibTeX support, specialized functionalities, and robust visualization capabilities (Hendriks et al., 2019; Ge et al., 2022; Qin et al., 2022; Tan et al., 2021; van Eck and Waltman, 2017). The characteristics of the four literature clusters were identified through an exhaustive examination of the 1492 selected publications (Haq and Bahit, 2021), as depicted in Figure 1.

The software VOSviewer, version 1.6.19, was collaboratively developed in Melbourne, Australia, and Leiden, the Netherlands, by van Eck and Waltman, specifically for the creation of visualizations in bibliometric data analysis (Hendriks et al., 2019; Ge et al., 2022; Qin et al., 2022; Tan et al., 2021; van Eck and Waltman, 2017). VOSviewer significantly enhances bibliometric analysis by automating data processing and offering sophisticated visualization options. Through visual maps, it effectively illustrates co-occurring keywords, international collaborations, prominent affiliations, and thematic maps. This standardized approach not only enhances reproducibility but also aids researchers in identifying trends and evaluating their impact across various

fields (van Eck and Waltman, 2010; 2011; 2013; 2017; Waltman et al., 2010).

2.1. Raw Data

Figure 2 presents crucial information about the WoS Core Collection, spanning the period from 2010 to 2023. This diverse dataset encompasses 21 sources, including journals and books, and comprises 50 documents. Remarkably, the annual growth rate stands at an impressive 25.92%, indicating the dynamic nature of the collection. The documents exhibit an average age of 1.42 years, highlighting the freshness and relevance of the content. Each document receives an average of 20.98 citations, demonstrating the scholarly impact and significance of the included materials. This comprehensive network of interconnected knowledge encompasses 2628 references.

Delving into the document contents, the dataset incorporates 155 Keywords Plus (ID) and 162 Author's Keywords (DE), enhancing the comprehension of the subject matter. Reflecting the collaborative nature of scholarly endeavors, 150 authors have contributed to the collection, with 8 participating in single-authored documents. The average of 3.14 co-authors per document and an international co-authorship rate of 32% further underscore the collaborative spirit. The document types within the collection include 41 articles, 8 early access articles, and 1 editorial material or book chapter. This wealth of data highlights the breadth, depth, and collaborative spirit that permeates the WoS Core Collection. The remarkable growth rate, low average document age, and high citation count suggest that the WoS Core Collection is an active and impactful resource for researchers in the field of Green Economics. The international co-authorship rate indicates the global reach of Green Economic research. The diversity of document types reflects the multifaceted nature of the field.

3. FINDINGS AND DISCUSSION

3.1. Evolution of Publications and Citations Analysis

Figure 3 illustrates the chronological evolution of publications and citations in the field of Green Economics from 2010 to 2023. During this period, the number of publications has consistently increased, culminating in its zenith in 2023 (highlighted in red) with 246 publications. Simultaneously, the citation count has also experienced a significant uptick, signifying the growing impact and influence of research in Green Economics. In 2023, the total citations reached 7187, showcasing substantial growth in scholarly acknowledgment and engagement with the field. The preceding years contribute to this upward trajectory, with 2022 registering 243 publications and 7211 citations, 2021 featuring 183 publications and 4620 citations, and so on. This upward trajectory indicates a sustained interest and relevance of Green Economics, as evidenced by both the quantity and impact of academic output. The data emphasizes the evolving landscape of research in Green Economics, reflecting its increasing significance and the expanding scholarly discourse surrounding environmentally sustainable economic practices.

Figure 1: Modified research protocol (Inspired by Za and Braccini, 2017)

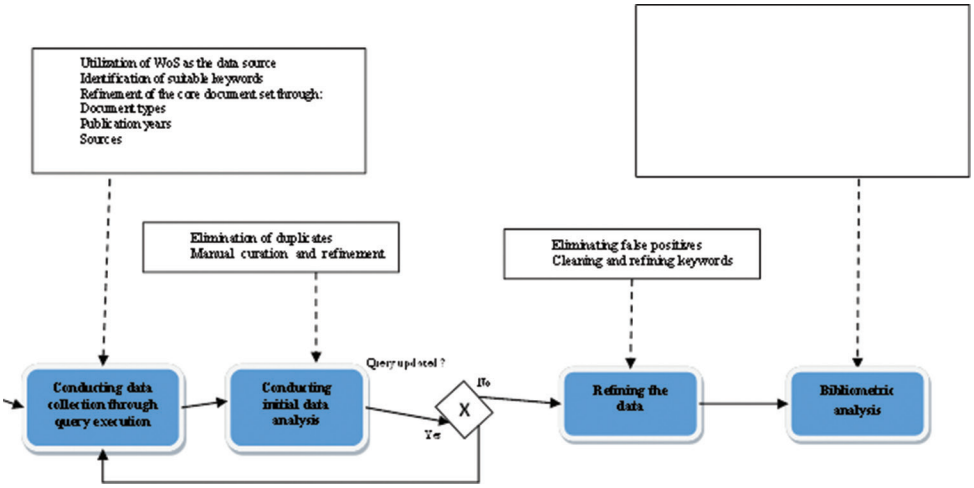


Figure 2: Critical data for the Wos core collection

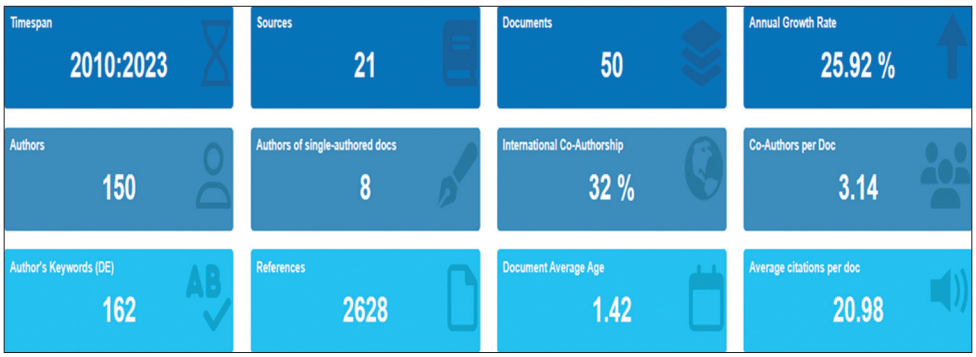


Figure 3: The evolution of publications and citations in the field of green economics

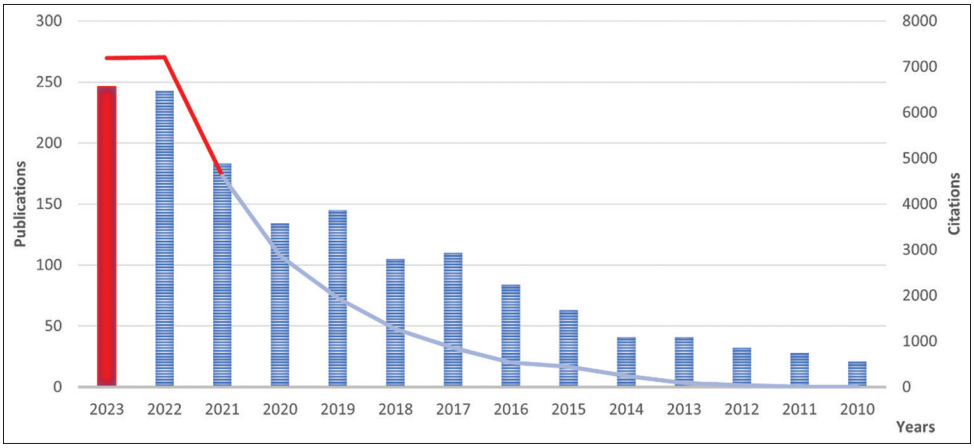
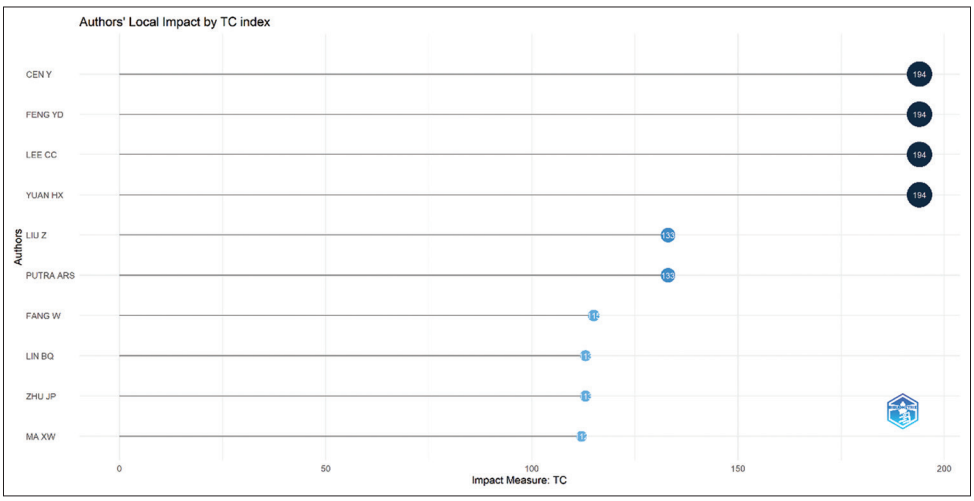


Figure 4: Localized author impact on green economics



3.2. Author Impact and Production Trends

Figure 4 illustrates the Localized Author Impact on Green Economics. Table 1 presents the local impact of various authors in the field of Green Economics, as measured by various bibliometric indices. The analyzed authors include Chen X, Liu Z, Phan Tth, Putra Ars, Qin Qd, Wang Y, Ahmad M, Alarifi Ga, Ali S, and Anh Nhv. The h-index, g-index, and m-index are used to assess the authors' productivity and influence within the field. Notably, Wang Y has a high g-index of 3, indicating a significant impact. Furthermore, Alarifi Ga, despite having a modest h-index and g-index of 1, has a remarkable m-index of 1, suggesting a strong influence per publication. Additional details such as total citations (TC), number of publications (NP), and the year of the first publication (PY_start) help to delineate the authors' research profiles. The data highlights a range of diverse contributions, with some authors amassing a substantial number of citations, while others demonstrate a persistent and impactful publication trajectory. The information presented in Table 1 provides a comprehensive overview of the local impact of these authors in Green Economics, shedding light on their unique strengths and contributions to the field.

Figure 5 and Table 2 present a comprehensive overview of authors' productivity over time in the field of Green Economics. The table includes data on publication frequency (Freq), total citations (TC), and citations per year (TCpY) for each author across different years.

In 2021, Ahmad M, Ali S, Chen X, and Qin Qd were active contributors to the field. In 2022, Liu Z, Phan Tth, and Putra Ars joined the list of contributors, with Liu Z and Putra Ars each publishing two papers and accumulating a substantial total citation count of 133 each. Additionally, Anh Nhv's publication in 2022 garnered 18 citations. Alarifi Ga made a notable contribution in 2023. The table provides a detailed snapshot of authors' scholarly output, highlighting variations in productivity and impact over the specified years in the context of Green Economics.

Figure 6 and Table 3 present a comprehensive overview of the most prominent countries in the field of Green Economics, assessed based on total citations (TC) and the average number of citations per article. China stands out as a leading force in Green Economics, accumulating an impressive total of 806 citations with an average of 20.70 citations per article. Indonesia follows closely with 117 total citations and a remarkably high average of 58.50 citations per article, highlighting the impactful and recognized nature of research originating from this country. Vietnam and Turkey also make significant contributions, with 92 and 20 total citations, respectively. In contrast, Japan and Romania exhibit more modest figures, while the USA, Australia, and Malaysia have yet to garner

Table 1: Authors' regional impact in green economic research

Element	h_index	g_index	m_index	TC	NP	PY_start
Chen X	2	2	0.667	31	2	2021
Liu Z	2	2	1	133	2	2022
Phan Tth	2	2	1	91	2	2022
Putra Ars	2	2	1	133	2	2022
Qin Qd	2	2	0.667	12	2	2021
Wang Y	2	3	0.667	44	3	2021
Ahmad M	1	1	0.333	101	1	2021
Alarifi Ga	1	1	1	1	1	2023
Ali S	1	1	0.333	101	1	2021
Anh Nhv	1	1	0.5	18	1	2022

Table 2: Authors' productivity trends over time in green economics

Author	Year	Freq	TC	TCpY
Ahmad M	2021	1	101	33.667
Alarifi Ga	2023	1	1	1
Ali S	2021	1	101	33.667
Anh Nhv	2022	1	18	9
Chen X	2021	2	31	10.333
Liu Z	2022	2	133	66.5
Phan Tth	2022	2	91	45.5
Putra Ars	2022	2	133	66.5
Qin Qd	2021	1	10	3.333
Qin Qd	2023	1	2	2

Table 3: Significant countries in the landscape of green economic studies

Country	TC	Average article citations
China	806	20.70
Indonesia	117	58.50
Vietnam	92	30.70
Turkey	20	20.00
Japan	10	10.00
Romania	3	3.00
USA	1	1.00
Australia	0	0.00
Malaysia	0	0.00
China	806	20.70

Table 4: Primary countries of significance in green economics based on corresponding authors

Country	Articles	SCP	MCP	Freq	MCP_Ratio
China	39	29	10	0.78	0.256
Vietnam	3	0	3	0.06	1
Indonesia	2	0	2	0.04	1
Australia	1	1	0	0.02	0
Japan	1	1	0	0.02	0
Malaysia	1	0	1	0.02	1
Romania	1	1	0	0.02	0
Turkey	1	1	0	0.02	0
USA	1	1	0	0.02	0
China	39	29	10	0.78	0.256

citations in this specific context. This table not only outlines the quantitative impact of each country but also underscores variations in citation patterns, emphasizing the diverse global landscape of Green Economics research and the varying degrees of influence demonstrated by various nations in this critical field.

Figure 7 and Table 4 present a comprehensive overview of countries considered of utmost importance in the field of Green Economics, focusing on corresponding authorship. The table is organized to include critical metrics such as the number of articles (Articles), the cumulative Sustainable Citation Points (SCP), the total Marginal Contribution Points (MCP), the frequency of corresponding authorship (Freq), and the ratio of MCP to the total (MCP_Ratio). China stands out as a pivotal contributor, presenting 39 articles and a remarkable MCP_Ratio of 0.256, indicative of a significant impact. Vietnam, Indonesia, Australia, Japan, Malaysia, Romania, Turkey, and the USA each contribute one article, featuring diverse SCP and MCP values. Notably, Vietnam stands out with a perfect MCP_Ratio of 1, signifying that all their articles carry a distinct marginal contribution. This table provides valuable insights into the distribution of corresponding authorship in Green Economics, shedding light on influential countries and their unique contributions to the scholarly discourse within the field.

Figure 8 presents a comprehensive view of China's evolving connections with other nations from 2020 to 2023, revealing a notable increase in the number and strength of economic, scientific technological, and political ties. The map underscores China's robust global integration, with particularly strong links in Southeast Asia, North America, Europe, and Asia. The economic dimension emerges as the most substantial, reflecting China's expanding role in global markets and resource access. However, the map also highlights the increasing significance of scientific, technological, and political connections. While this integration offers China access to new opportunities, markets, and technologies, it concurrently exposes the nation to potential vulnerabilities, such as external economic shocks and geopolitical tensions. The map thus serves as a valuable tool for comprehending China's multifaceted role in the global system and for discerning the nuanced implications of its growing global integration.

Figure 9 presents a comprehensive overview of the collaborative landscape and production centers in the field of Green Economics. The table accompanying the figure details the frequency of collaborations between various regions, highlighting China as a central hub with a high frequency of connections. Notably, China has 99 frequent collaborations, indicating its pivotal role in international cooperation and production within the realm of Green Economics. Other key contributors to this collaborative network include Vietnam, the USA, Indonesia, Japan, Ukraine, Australia, India, Malaysia, and Pakistan, each with varying frequencies. The "From-To Frequency" section further elucidates specific collaborations between regions, exemplifying the diverse and global nature of partnerships in the Green Economic sector. The data underscores the significance of international cooperation and the emergence of specific production centers, providing valuable insights into the dynamics of collaboration and production in Green Economics on a global scale.

3.3. World's Most Cited Documents

Figure 10 presents a citation analysis of documents in the field of Green Economics, utilizing bibliometric data spanning from 2021 to 2023. In this visual representation, nodes symbolize authors, and edges denote co-authorship relationships. The

Figure 5: Authors' output trends over time in the field of green economics

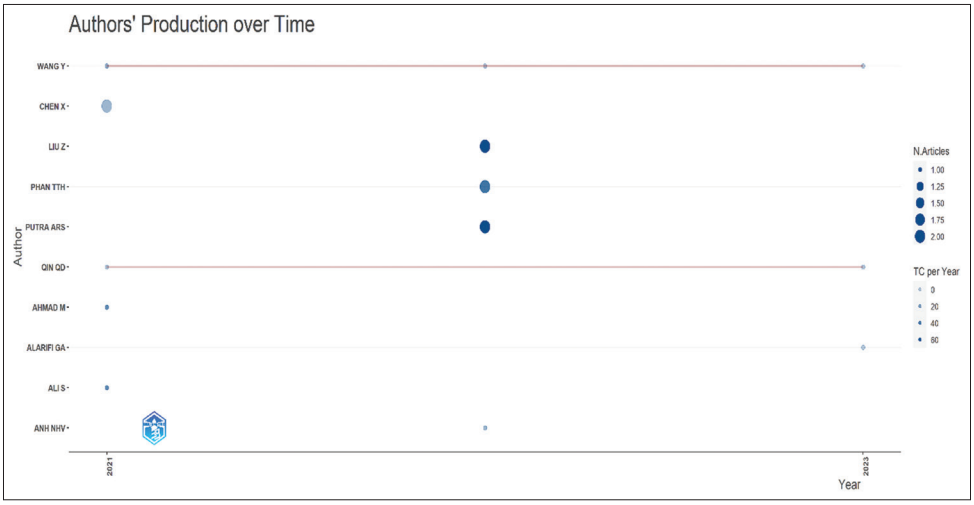


Figure 6: Major players in green economics: A country analysis

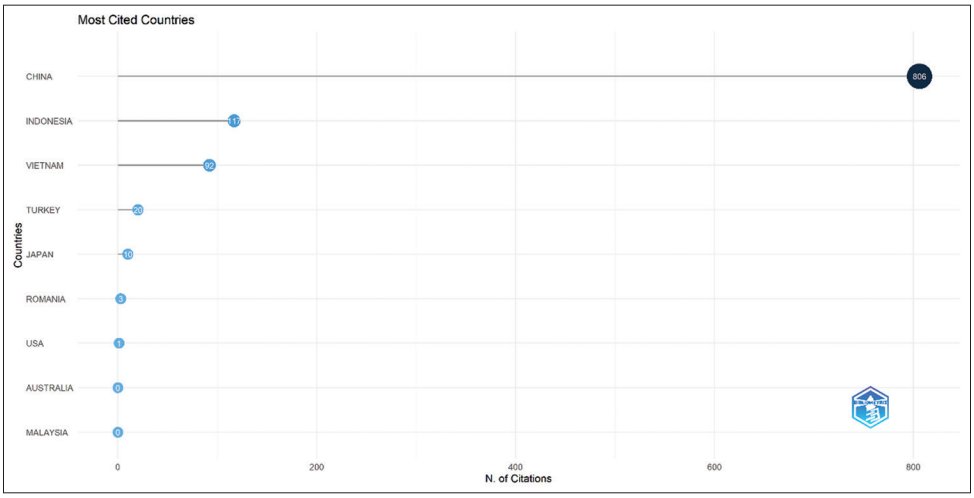
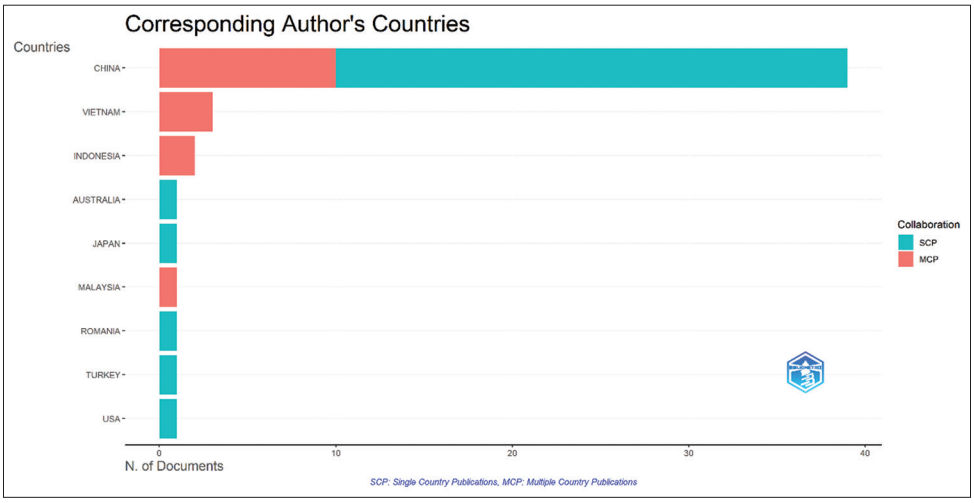


Figure 7: Countries of primary influence in green economic research: Corresponding author perspective



size of each node is proportionate to the respective author's publication count in Green Economics, while the node color corresponds to the author's affiliated country. The graph underscores the highly collaborative nature of Green Economics, revealing numerous instances of authors co-authoring papers. Additionally, the interconnectedness of authors across different countries suggests a global scope for research in Green Economics. Prominent figures in the graph include, (Yuan et al., 2020), notable for their prolific output and significant impact on Green Economics.

In essence, the illustration offers a valuable snapshot of the research landscape in Green Economics. It not only identifies key authors and their affiliations but also underscores the collaborative ethos characterizing research efforts in the field.

Table 5 presents a compilation of the most frequently cited documents on a global scale within the domain of Green Economics. The listed papers include titles such as "How does manufacturing agglomeration affect green economic efficiency?" by Yuan et al., 2020, with a total of 194 citations and an impressive 48.50 citations per year, and "Role of research and development in green economic growth through renewable energy development: empirical evidence from South Asia" by Fang et al., 2022, accumulating 115 citations at a rate of 57.50 per year. The journals in which these papers are published, including Energy Economics, Renewable Energy, and Journal of Cleaner Production, are noted, along with their respective ISSN and impact factor. Notable contributions include investigations into the impact of fiscal spending on green economic growth in China, the effects of environmental regulations on green economic growth, and the prioritization of waste-to-energy technologies for green economic recovery in Pakistan. This comprehensive table offers a snapshot of the impactful research shaping the field of Green Economics, highlighting key papers and their associated metrics.

Figure 8: Mapping bibliographic coupling networks among countries

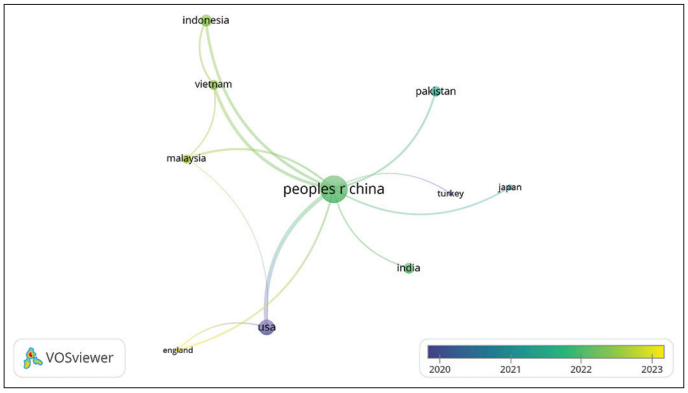
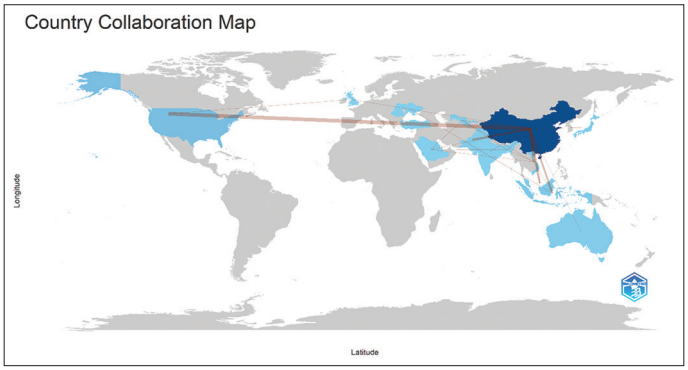


Figure 9: International cooperation and production centers: Green economics perspective



3.4. Three Fields Plot

Figure 11 provides a comprehensive overview of the collaborative landscape and production centers in the field of Green Economics. The visualization, using node size to represent frequency and line width to indicate connection strength, highlights China's prominent role in international collaboration and production in this field. The interconnectedness of China with countries like Vietnam and Indonesia suggests the formation of a regional production center for Green Economics in East Asia. The affiliations and keywords further highlight key contributors and thematic priorities, revealing strong connections between Green Economics research and practical applications. The prevalence of terms like "sustainable development" and "renewable energy" among the top keywords signals a concerted effort within the field to address contemporary environmental challenges. Overall, Figure 11 offers valuable insights into the collaborative landscape, production centers, and thematic focus within Green Economics, emphasizing the integration of research and practical implementation for sustainable economic development.

3.5. Keywords Clusters

Employing the VOSviewer tool, this study streamlined the bibliometric analysis and mapping of bibliographic data extracted from the WoS Core Collection database. Co-occurrence analysis revealed four distinct clusters of keywords, with "green economic growth" emerging as the most prominent and influential term, appearing 15 times. This term demonstrated strong correlations with nearly all other keywords. Noteworthy clusters also encompassed keywords related to green economic recovery, renewable energy, green economic efficiency, and green economic development. Each cluster showcased interconnected keywords arranged in descending order of relative importance.

Figure 10: Citation analysis of documents in green economics

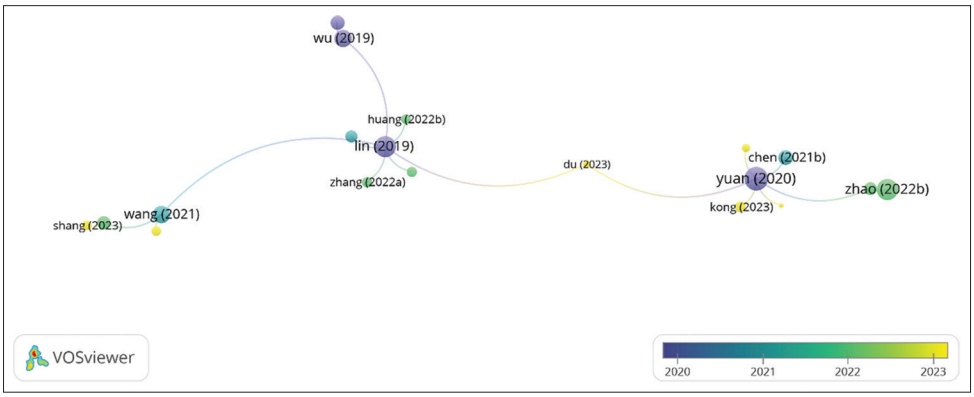


Table 5: The documents most frequently cited on a global scale within the domain of green economics

Paper	Documents title	Total citations	TC per Year	Normalized TC	Journal	ISSN	Impact factor
Yuan et al., 2020, Energ Econ	How does manufacturing agglomeration affect green economic efficiency?	194	48.50	2.60	Energy Economics	0140-9883	12.8
Fang et al., 2022, Renew Energ	Role of research and development in green economic growth through renewable energy development: empirical evidence from South Asia	115	57.50	4.42	Renewable Energy	0960-1481	8.7
Lin and Zhu et al., 2019, Energ Econ	Fiscal spending and green economic growth: Evidence from China	113	22.60	2.02	Energy Economics	0140-9883	12.8
Zhao et al., 2022, Renew Energ	Impacts of environmental regulations on green economic growth in China: New guidelines regarding renewable energy and energy efficiency	112	56.00	4.31	Renewable Energy	0960-1481	8.7
Shah et al., 2021, J Clean Prod	Energy trilemma based prioritization of waste-to-energy technologies: implications for post-COVID-19 green economic recovery in Pakistan	101	33.67	3.06	Journal of Cleaner Production	0959-6526	11.1
Zhao et al., 2022, Econ Anal Policy	Enhancing green economic recovery through green bonds financing and energy efficiency investments	73	36.50	2.81	Economic Analysis and Policy	0313-5926	6.5
Wang and Yi, 2021, Energ Policy	New energy demonstration program and China's urban green economic growth: Do regional characteristics make a difference?	47	15.67	1.42	Energy Policy	0301-4215	9
Wu et al., 2019, Energ Policy	How does the implementation of the policy of electricity substitution influence green economic growth in China?	44	8.80	0.79	Energy Policy	0301-4215	9
Jiang et al., 2021, Energ Econ	How does the one belt one road initiative affect the green economic growth?	40	13.33	1.21	Energy Economics	0140-9883	12.8
Huang, 2022, Econ Anal Policy	Do green financing and industrial structure matter for green economic recovery? Fresh empirical insights from Vietnam.	21	10.50	0.81	Economic Analysis and Policy	0313-5926	6.5

Table 6: Leading network metrics reflecting the importance of keywords in green economics

Keywords clusters	Links	Total links strength	Occurrences	Cluster color	Unique theme
Green economic growth	28	50	15	Blue	Sustainable economic growth that minimizes environmental impact
Efficiency	31	52	11	Red	Optimal use of resources and reduction of waste
Green economic recovery	18	32	10	Blue	Economic recovery that is environmentally sustainable
Growth	26	38	9	Blue	Economic expansion
Performance	21	29	8	Red	Measurement and evaluation of economic and environmental outcomes
Renewable energy	19	31	8	Blue	Energy from renewable sources such as solar, wind, and hydroelectric power
CO_2 emissions	20	34	7	Green	Greenhouse gas emissions
Green economic efficiency	16	18	7	Green	Economic growth that is achieved with minimal environmental impact
Energy efficiency	17	26	7	Yellow	Reduction of energy consumption and waste
Investment	18	25	6	Green	Financial resources allocated to green economic activities

The circles and text within each cluster reflected their recurrence frequency alongside other keywords, signifying the intensity of their co-occurrence. Additionally, the spatial proximity of items and lines on the map indicated the degree of interconnectedness and relationships between various keywords. Figure 12 visually presents the resultant keyword co-occurrence map.

Figure 11: Triangulating three field countries, affiliations, and keywords

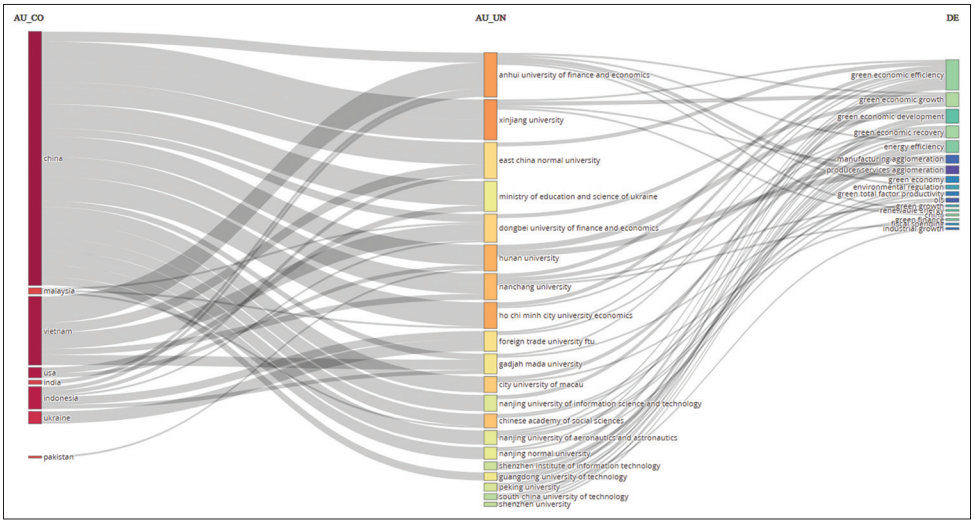


Figure 12: Co-occurrence keyword in green economics

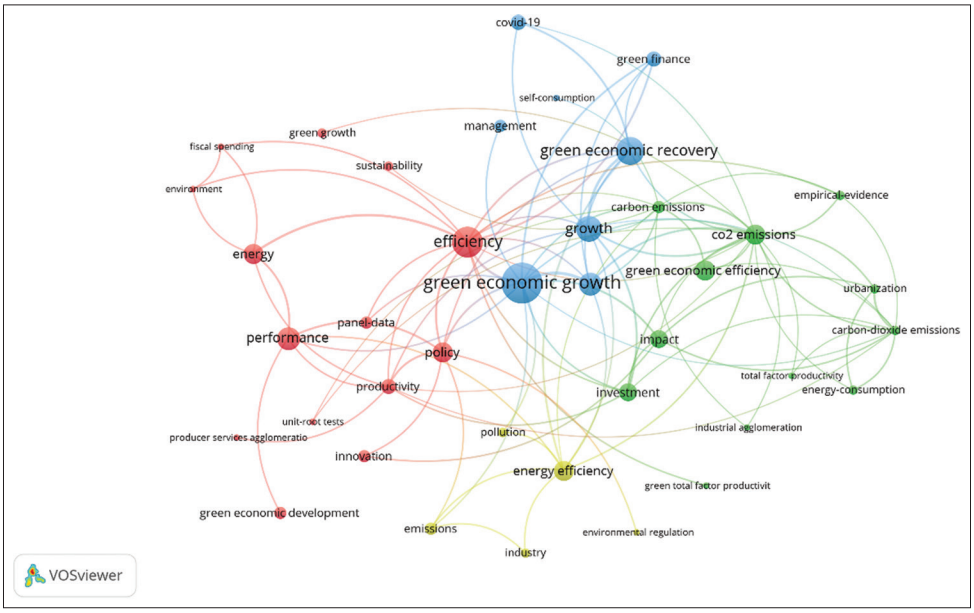


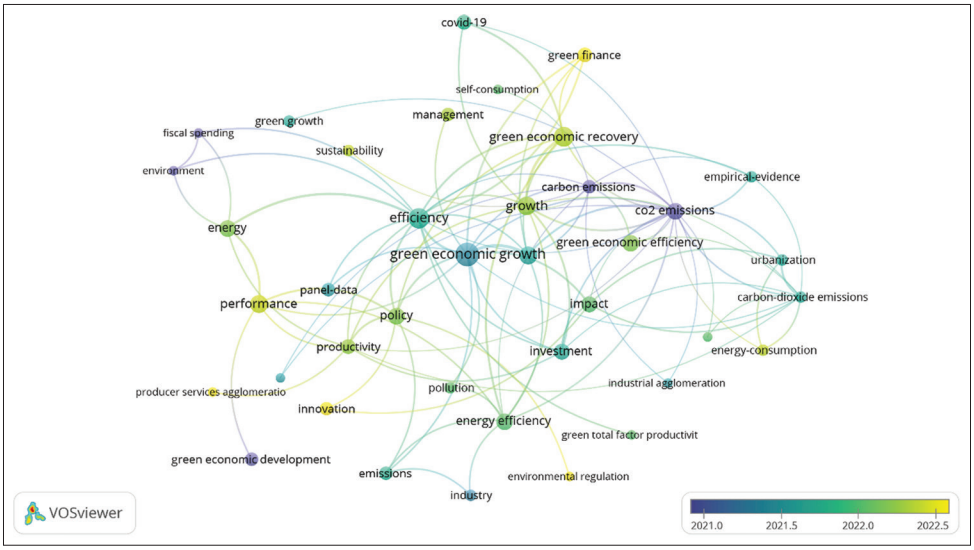
Figure 13 illustrates the growth of co-occurring keywords in Green Economics from 2020 to 2023. The node sizes in the figure correspond to the frequency with which each keyword co-occurred with others in the Green Economics literature, while the lines between nodes depict the relationships of co-occurrence among the keywords. Prominent keywords in the figure, such as "green economic growth," "renewable energy," "green economic efficiency," and "green economic development," are interconnected, signifying strong associations between these various facets of Green Economics. Additional noteworthy keywords include "green finance," "green total factor productivity," "environmental regulation," and "carbon emissions," emphasizing the growing interest in these specific areas within Green Economics research.

Table 6 also captures the temporal growth of certain keywords. For instance, "green economic recovery" and "carbon-dioxide emissions" have experienced significant expansion in recent years, indicating an increasing awareness of the necessity for a green recovery from the COVID-19 pandemic and the pressing importance of addressing climate change.

To more accurately identify the unique theme within each cluster, the study conducted a thorough analysis of the keywords within each grouping. This examination involved a detailed examination of the specific subject matter covered by the keywords in each cluster.

Cluster 1, depicted in red, stands out as particularly intriguing and warrants further investigation. Occupying a prominent position on the left side and bottom of the map, it extends from the central point and forms direct connections with neighboring clusters, particularly the blue and yellow ones. These observations highlight the importance of delving into this specific theory to gain a deeper understanding of its ramifications and implications.

Figure 13: Co-occurrence keyword growth in green economics



The transition to a green economy is a global endeavor, and the interconnectedness of economies plays a crucial role in its success. Abu Huson et al. (2023) and Alghadi et al., (2023) highlight the influence of information technology, artificial intelligence, and blockchain on auditing practices, showcasing the global integration of advanced technologies in support of sustainable development. Al-Qudah et al. (2022) and Lutfi et al. (2022) offer insights into the global economic challenges and responses by examining the effects of the COVID-19 pandemic on conditional accounting conservatism in developing countries.

Technology is fundamental to shaping the future of green economics and achieving sustainable economic growth (Almaiah et al., 2022; Lutfi and Alqudah, 2023). Zhang et al. (2018) emphasize the potential economic benefits of environmentally friendly practices by providing a comprehensive review of the economics of green buildings. Ge and Zhi (2016) showcase the importance of technology in fostering green employment opportunities by exploring the relationship between the green economy, clean energy policy, and employment.

Understanding the determinants of green energy adoption (Qin et al., 2022), the evolution of green finance (Bhatnagar and Sharma, 2022), and the trends in green jobs (Alshebami et al., 2023; Kozar and Sulich, 2023) is crucial for anticipating future trends in sustainable economic recovery and growth (Alqudah et al., 2019). Tan et al. (2021) provide insights into future research directions by conducting a global bibliometric study on research related to green energy and environmental technologies.

Cluster 2, designated as the "green" cluster, stands out as a critical area meriting in-depth investigation in the future. Despite its relatively limited associations with the red clusters, it demonstrates strong connections with both the blue and yellow clusters. This highlights the need for rigorous research within the green cluster, as it holds the potential to yield valuable insights and implications. The pressing demand for comprehensive exploration underscores its significance within the broader framework of sustainable development.

The global dimension of green economics is increasingly recognized as a critical factor in achieving sustainable development. Studies like that of Yuan et al. (2020) demonstrate the intricate connections between global economic activities and environmental outcomes, particularly in the context of manufacturing agglomeration and green economic efficiency. Similarly, Tan et al. (2021) provide a comprehensive overview of research trends shaping the field of green energy and environmental technologies, highlighting the global evolution of research efforts in this domain.

Technological advancements are at the forefront of driving green economic growth. Zhang et al. (2018) showcase how technology can transform environmental considerations into economic opportunities, specifically in the realm of green buildings. The work of Abu Huson et al. (2023) and Alqudah et al. (2023) further emphasizes the transformative potential of technological innovation by exploring the intersection of information technology, artificial intelligence, and blockchain in auditing practices, paving the way for enhanced environmental accountability.

Comprehending and anticipating future trends is essential for sustainable economic development. Bhatnagar and Sharma (2022) delve into the trajectory of financial mechanisms supporting environmental initiatives by tracing the evolution of green finance and its enablers. Kozar and Sulich (2023) offer insights into the future landscape of employment opportunities in environmentally conscious sectors through their bibliometric review on green jobs.

The network map highlights Cluster 3 (represented in blue) as a pivotal area meriting thorough exploration. Compared to the other clusters, Cluster 3 exhibits a higher density of connections and interactions, particularly with the remaining clusters. This underscores the need for a meticulous examination of the links and relationships between Cluster 3 and the others to uncover valuable insights into its intricate interplay and overall significance within the broader context.

The discourse on green economics has gained significant traction worldwide. Studies by Tan et al. (2021) and Kozar and Sulich (2023) employ bibliometric analyses to map the global evolution of research on green energy, environmental technologies, and green jobs. Their findings reveal a growing international interest in these areas, indicative of a collective effort to address environmental challenges through sustainable economic practices. In the context of green economic efficiency, Yuan et al. (2020) explore the impact of manufacturing agglomeration on green economic outcomes. Their study contributes to understanding how regional factors influence the effectiveness of green economic initiatives on a global scale.

Technological advancements play a pivotal role in driving green economic growth. Zhang et al. (2018) highlight the economic aspects of green buildings, showcasing how technological innovations can transform environmental considerations into economic opportunities. Similarly, Wu et al. (2023) conduct a bibliometric analysis on green mining, shedding light on the research and development trends in sustainable mining practices. The role of research and development in green economic growth is further explored by Fang et al. (2022), specifically focusing on the empirical evidence from South Asia. Their study underlines the importance of technological interventions, particularly in the renewable energy sector, as a catalyst for green economic development.

As the world moves towards a future shaped by environmental considerations, examining the trajectories of green economic growth becomes imperative. Bhatnagar and Sharma (2022) provide a bibliometric analysis of the evolution of green finance and its enablers, offering insights into the future of financial mechanisms supporting sustainability. In the realm of policy implementation, Wu et al. (2019) investigate the impact of the policy of electricity substitution on green economic growth in China. Meanwhile, Huang (2022) provides fresh empirical insights from Vietnam, examining the influence of green financing and industrial structure on green economic recovery.

Cluster 4, represented in yellow on the provided map, comprises a complex network of ideas that merit in-depth exploration. The relatively weak connections observed between this cluster and the broader conceptual frameworks depicted by the other clusters suggest a potential need for improved integration. Consequently, a thorough examination and analysis of the intricacies and potential linkages between the yellow cluster and the other clusters become indispensable. Such an investigation holds the potential to yield valuable insights into the overarching framework of the study.

The global perspective on green finance is multifaceted, encompassing diverse perspectives and approaches. Zhao et al. (2022) investigate the interplay between environmental regulations and green economic growth in China, providing valuable insights into the intersection of policy and sustainable economic development. In the context of post-COVID-19 green economic recovery in Pakistan, Shah et al. (2021) prioritize waste-to-energy technologies as a potential solution within the framework of the energy trilemma. Huang (2022) offers fresh empirical insights from Vietnam, examining the significance of green financing and industrial structure in the context of green economic recovery.

Technological advancements and research and development are crucial drivers of green economic growth. Fang et al. (2022) empirically explore the role of research and development in green economic growth, focusing specifically on renewable energy development in South Asia. Wu et al. (2019) investigate the implementation of the policy of electricity substitution in China, shedding light on the technological transitions influencing green economic growth.

Green finance also delves into future trajectories, examining evolving trends and programs. Wang and Yi (2021) analyze the impact of the new energy demonstration program on China's urban green economic growth, considering regional characteristics. Jiang et al. (2021) explore the influence of the One Belt One Road initiative on green economic growth, providing insights into the future of sustainable development on a global scale.

3.6. Primary Contributions Unveiled by the Literature Clusters

Cluster 1 emerges as a focal point for exploring the global transition to a green economy. Its prominent position on the map and direct connections with neighboring clusters, particularly the blue and yellow ones, highlight its pivotal role. Studies within this cluster showcase the integration of advanced technologies, such as information technology, artificial intelligence, and blockchain, to support sustainable development practices (Abu Huson et al., 2023; Alrfai et al., 2023; Lutfi et al., 2022). Additionally, research has examined the effects of the COVID-19 pandemic on accounting practices in developing countries, providing insights into global economic challenges and responses (Almaiah et al., 2022; Alshebami et al., 2023). Moreover, the role of technology in achieving sustainable economic growth has been emphasized through a comprehensive review of green building economics (Alshirah et al., 2022; Zhang et al., 2018), underscoring the importance of technology in fostering green employment opportunities (Almaiah et al., 2022; Ge and Zhi, 2016).

Cluster 2 stands out as a critical area for further investigation. Despite its relatively limited associations with the red clusters, it exhibits strong connections with both the blue and yellow clusters. Research in this cluster has demonstrated the intricate connections between global economic activities and environmental outcomes, particularly in the context of manufacturing agglomeration and green economic efficiency (Yuan et al., 2020). Technological advancements remain at the forefront of driving green economic growth, as highlighted by Alsyouf et al., (2023) Zhang et al. (2018) and Abu Huson et al. (2023). Furthermore, studies have explored the trajectory of financial mechanisms supporting environmental initiatives (Bhatnagar and Sharma, 2022) and offered insights into the future landscape of employment opportunities in environmentally conscious sectors (Kozar and Sulich, 2023).

Cluster 3 is a pivotal area characterized by a higher density of connections and interactions compared to other clusters. Bibliometric analyses conducted by Tan et al. (2021) and Kozar

and Sulich (2023) have mapped the global evolution of research on green energy, environmental technologies, and green jobs. Yuan et al. (2020) have explored the impact of manufacturing agglomeration on green economic outcomes, contributing to an understanding of how regional factors influence the effectiveness of green economic initiatives on a global scale. Technological advancements, as highlighted by Zhang et al. (2018), Wu et al. (2023), and Fang et al. (2022), play a pivotal role in driving green economic growth. Bhatnagar and Sharma (2022) have provided a bibliometric analysis of the evolution of green finance and its enablers, and Wu et al. (2019) have investigated the impact of the policy of electricity substitution on green economic growth in China.

Cluster 4 comprises a complex network of ideas that warrant in-depth exploration. Weak connections with other clusters suggest a need for improved integration. Huang (2022) has investigated the interplay between environmental regulations and green economic growth in China, providing insights into the intersection of policy and sustainable economic development. In the context of post-COVID-19 green economic recovery in Pakistan, Shah et al. (2021) have prioritized waste-to-energy technologies within the framework of the energy trilemma. Fang et al. (2022) have empirically explored the role of research and development in green economic growth, focusing on renewable energy development in South Asia. Wang and Yi (2021) have analyzed the impact of the new energy demonstration program on China's urban green economic growth, considering regional characteristics, while Jiang et al. (2021) have explored the influence of the One Belt One Road initiative on green economic growth, providing insights into the future of sustainable development on a global scale.

3.7. Prospects and Emerging Trends in Green Economics Research

The current landscape of green economics research reveals several promising prospects and emerging trends.

- Nuanced Aspects of Sustainable Development: The identification of distinct clusters, such as Cluster 1 and Cluster 2, indicates a growing focus on nuanced aspects of sustainable development. Cluster 1, marked by its interconnectedness and strategic position, beckons further investigation, suggesting potential breakthroughs in understanding the complex dynamics shaping green economies. Similarly, Cluster 2 presents an area of critical importance with strong connections to other clusters, emphasizing the need for comprehensive exploration to unlock valuable insights.
- Global Dimension of Green Economics: The global dimension of green economics is increasingly recognized, as highlighted by studies examining the intricate connections between global economic activities and environmental outcomes. This trend underscores a shift towards a holistic understanding of sustainable development that transcends national borders.
- Transformative Potential of Innovation: The integration of advanced technologies, such as information technology, artificial intelligence, and blockchain, in auditing practices and other domains, showcases the transformative potential of innovation in driving environmental accountability and green economic growth.
- Technological Advancements for Green Economic Development: Technological advancements emerge as a pivotal force driving green economic development, with studies emphasizing their role in areas like green buildings, mining, and renewable energy. The intersection of technology and environmental considerations presents economic opportunities, reshaping traditional practices for a more sustainable future.
- Growing Emphasis on Green Finance: The evolution of green finance and its enablers, as explored through bibliometric analyses, signifies a growing emphasis on financial mechanisms that support environmental initiatives, indicating a shift towards more robust and sustainable financial systems.
- Understanding and Anticipating Future Trends: Understanding and anticipating future trends are essential components of sustainable economic development. Research on the determinants of green energy adoption, the evolution of green finance, and trends in green jobs provide valuable insights into the trajectories of sustainable economic recovery and growth.

These trends collectively reflect a global effort to address environmental challenges and shape the future of green economics, pointing towards a comprehensive and interconnected approach to achieving sustainability on a worldwide scale.

3.8. Practical and Theoretical Implications

Analyzing the practical and theoretical ramifications of the identified clusters and emerging trends in green economics research reveals multifaceted implications for sustainable development. These insights inform the formulation of effective strategies, shaping policies to promote green economic growth and environmental accountability.

- Policy Implications: The research findings provide valuable insights for policymakers, highlighting the need for comprehensive and interconnected approaches to green economic development. The transformative potential of technological advancements necessitates a nuanced integration into theoretical frameworks and policy formulations. The global interconnectedness emphasized by the research findings prompts considerations for fostering international collaboration and cross-sectoral partnerships to address environmental challenges effectively.
- Educational Implications: The research highlights the importance of education in fostering a workforce equipped for sustainability challenges. Informed curricula should incorporate knowledge of green economics, sustainability principles, and technological advancements to prepare future generations to contribute to a sustainable future.
- Entrepreneurial Opportunities: The exploration of innovation ecosystems and green entrepreneurship opportunities underscores the role of theoretical foundations in driving practical applications. Research should focus on identifying and nurturing green entrepreneurship ventures, fostering collaboration between academia, industry, and government to accelerate the transition to a green economy.
- Ethical Considerations: Ethical considerations emerge as a critical aspect of green economics research, guiding discussions on the ethical dimensions of sustainable practices, technological interventions, and policy decisions. Research should address ethical concerns related to environmental

justice, social equity, and responsible innovation to ensure that the transition to a green economy is equitable and sustainable.

Ultimately, these insights contribute to building resilience in the face of global challenges and advancing ethical, collaborative, and innovative approaches to green economics. By addressing environmental concerns while promoting economic growth, green economics research holds the potential to shape a more sustainable and equitable future for all.

4. CONCLUSION

This article offered a comprehensive examination of the body of green economic literature. Despite numerous papers released in this field, particularly in recent years, there's been a lack of in-depth analyses that objectively pinpoint influential works, authors, and emerging research trends. This study is a first step in filling that gap, revealing how influential articles have evolved and contributing by clarifying connections between high-impact works in the field.

Our findings indicate a concentration of influential works among a small group of scholars. However, as the field of green and sustainable economics matures, numerous additional authors have joined, broadening the scope across various areas. The more influential papers appeared to peak in the middle of this decade, aligning with a noticeable rise in research rigor during that time. It's not surprising since this period marked an increase in research quality. Recently published works, within the last 3-4 years, might have potential for traction, although citations, especially in management and business research, usually take longer to accumulate.

The distribution of these works revealed that China had the highest quantity with 39 articles. There's also an emerging spread of these works into Asia. Through an unbiased clustering method, we noted that both theoretical and practical studies have laid the groundwork and hold significant influence. Our categorization of the literature by topic indicates that the emphasis is shifting towards prescriptive, normative, and quantitative modelling, suggesting a growing significance. We believe that delving deeper into practical application and modelling using real-world data will be the most promising research direction in the coming years.

For those embarking on research in this field or for educational use, the highlighted "core" articles can serve as an excellent starting point. We've pinpointed recent publications that might signify influential contributions. Understanding the influential scholars in this domain is crucial as they often pave the way for future advancements. Keeping a close eye on their works, as well as collaborations with others, can offer valuable insights for further research. For instance, recent publications by prominent scholars have centered on topics like Growth, Efficiency, and Recovery within the realm of Sustainable Green Economics, along with evaluating obstacles and catalysts for its implementation.

There are certain shortcomings evident in these findings and within the broader field. Firstly, the limited number of scholars and repetitive studies, while impactful, might present a stagnant perspective of sustainable green economics. It's our hope that this isn't the case; we anticipate and trust that a wider array of researchers from diverse backgrounds will contribute innovative and compelling directions to shape this field. The absence of researchers from the Middle East and Africa is concerning. Given the inherently global nature of sustainable and green economics, it's imperative to expand the representation of countries involved in exploring this area. Without the voices of underrepresented regions, the research demonstrates a significant weakness and lacks a multicultural, globally pertinent standpoint.

The lack of diversity in authorship and geographical representation isn't the only concern; there's also a noticeable absence of collaborative efforts across different sectors, hindering the "transdisciplinary" nature of this field. Academic scholars predominantly dominate the field, with minimal involvement from practitioners, be they industry professionals or policymakers. This absence could be why much of the research so far remains conceptual and theoretical. It raises doubts about the applicability of such studies in practical contexts and policymaking. Future research should pivot towards utilizing real industry data instead of solely relying on subjective opinions. By integrating actual industry practices and involving practitioner groups in academic investigations, there's potential for mutual benefit in both practical application and theoretical advancement. This shift might become more common as practical and normative modelling further evolves in the realm of green economics.

On the whole, the field of sustainable and green economics is experiencing growth and maturation. There's considerable potential for further advancement, especially considering the limited number of influential articles and the relatively modest connection between the 243 papers. This figure is expected to rise, given the strong groundwork laid by existing research—an establishment that wasn't present a decade ago. Particularly, ample opportunities exist for additional exploration in formally modelling green economics for practical implementation. Some of the more recent publications (Shah et al., 2021; Wang and Yi, 2021; Liu, 2019; Yuan et al., 2020; Fang, 2022; Lin and Zhu, 2019; Zhao et al., 2022; Zhao et al., 2022; Jiang et al., 2021; Huang, 2022) have highlighted this research focus, signaling a growing interest in this direction.

Expanding on our current study is essential for further research. It's evident that our study has limitations in how we organized and presented the results. Future research in this direction could uncover numerous other contributions and potentially redefine the primary research areas. However, including additional keywords will enlarge the pool of papers, necessitating innovative bibliometric analysis tools and approaches. Many existing tools struggle to handle very large datasets. Moreover, there's room for further content analysis of specific influential manuscripts to pinpoint gaps and guide future research directions. Longitudinal analysis of the field will also be valuable in determining whether the projected shift toward more prescriptive and normative models persists.

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