Green economy studies amongst the global climate change challenge between 2016 and 2022: a bibliometric review

Jinsheng Jason Zhu[1], Ruitian Zhang[2], Kesone Kanhalikham[3], Zitao Liu[4] and Xiaoping Shen[5]*

[1]Belt and Road International School, Guilin Tourism University, Guilin, Guangxi, China, [2]Faculty of Arts and Social Sciences, University of Sydney, Sydney, NSW, Australia, [3]Office of Post Graduate Studies, National University of Laos, Vientiane, Laos, [4]Faculty of Tourism Department, Trisakti Institute of Tourism, Jakarta, Indonesia, [5]School of Foreign Studies, Guilin Tourism University, Guilin, Guangxi, China

Practical and theoretical advancements have not caught pace with rising scientific researches in the rapidly emerging economy undertaking a shift to a more sustainable and particularly green model. After the UN adopted the 2030 Agenda for Sustainable Development, there has been a surge in interest in the green economy among academics around the world, and the literature on the issue is proliferating. This paper adopts the methodology of bibliometric review and thematic analysis to summarize the relevant literature from 2016 to 2022 on areas related to the theme of green economy. The literature was obtained from the Web of Science database with a total of 1,022 articles. Furthermore, the literature was analyzed using VOSviewer as well as the R language to couple the literature by keywords, country, affiliation, author, and publication. The findings of the current paper show that the green economy has received more academic attention from scholars since 2016. Asia and Europe are leaders in green economy studies. In the context of climate change, future research is anticipated to concentrate on establishing a green economy for global economic growth. This paper makes a substantial contribution to future research on the green economy.

KEYWORDS

green economy, systematic review, policy, sustainability, recycling economy, bibliometric

Introduction

The twenty-first century is defined by rising environmental degradation and depletion of resources, as well as the need to achieve strategic goals for sustainable development, of which the green economy is a crucial component in advancing global economic growth (Jin et al., 2022). This is a unique opportunity to reset national and corporate agendas in the wake of the Environmental, Social, and Governance (ESG) investment boom and the imperative for economic recovery and sustainable growth (Government of Dubai, 2022). Many sustainable development indicators, such as health (Seshaiyer and McNeely, 2020), inequality (Barbier and Burgess, 2020), and education (Anholon et al., 2020), are influenced by the global COVID-19 pandemic (Naidoo and Fisher, 2020). In recent years, the worldwide environment became more devastating, revealing the volatility of the green economy (Gunay et al., 2022), which will have a significant influence on the achievement of sustainable development objectives. In the post-pandemic era, it will be crucial to determine how to designate appropriate legislation and regulations, modify the government's transformation and upgrading, support economic growth, and energetically develop the green economy in order to accomplish UN sustainable development goals (Campbell, 2017; Kronenberg and Fuchs, 2021). This must be driven by a synthesis of academic researches, technologies, and policies (Lee et al., 2022; Metawa et al., 2022). Governments and organizations,

under the leadership of the United Nations, have taken action and adopted a variety of policies to achieve the Sustainable Development Goals (Rosati and Faria, 2019). Previous literature studies in the topic of economics tended to summarize and discuss particular green economy concerns (Ferguson, 2015). In numerous past research works, it is argued that the current weak articulation of the green economy agenda does not necessarily imply a future transition to a post-growth society, but Ferguson summarizes and proposes a strategy for reformulating the green economy agenda in a post-growth direction (Bina and La Camera, 2011). The green economy has the potential to achieve what sustainable development cannot and can in some way address the limits of traditional economic growth. Although green economy development is now to some extent similar to the past, it has the potential to m move toward a post-growth society. In the face of global climate change challenges now, where economic development is influenced by environmental factors, only the emergence of a green economy community of practice can truly develop the development potential of a green economy. New technologies such as artificial intelligence, big data, the Internet of Things, and blockchain radically alter how industrial companies capture, generate, and distribute corporate value (Hristov Kalin, 2017; Arenal et al., 2020). Currently, nations throughout the globe may energetically advance the application of the fourth industrial revolution's technology group in the sphere of business innovation and green economy (Wang et al., 2022). In reality, many businesses struggle to properly incorporate the green economy into their operational business models (Sjödin et al., 2021). In the era of digital intelligence, when the function of digital technology is rising, the significance and urgency of this issue are intensifying (Linde et al., 2021). Consequently, it is essential to systematically evaluate and research the relationship between the green economy and business innovation in detail, as well as to thoroughly discuss the mechanism and process of the new generation of green technology that impacts the innovation strategy of global enterprises.

Over the course of the past few years, a large number of scholars have authored academic papers (Loiseau et al., 2016; Georgeson et al., 2017; Mikhno et al., 2021), in an attempt to grasp the impacts of green economy on various global industries and the potential of these industries to reflect the emergence of green digitalization. Most of these articles, however, have only summarized previous research in a somewhat categorized manner, without applying bibliometric-related techniques to it and without considering the issue in a worldwide context. In order to fill in this gap, this study, unlike those previous literature review papers, utilizes a bibliometric analysis technique, which is not influenced by the author's subjective considerations, to analyse the present trends and research tendency of the issue of green economy. Consider that the advancement of technology has been a major contributor to green economy model, the current paper hence particularly attempts to assess the significant themes of prior researches on the subjects of green economy and green finance in order to contribute to the debate involving how major corporations are adopting digital resources to redevelop the operational construct concerning the latest digital advancement. In particular, the purpose of this investigation is to grasp an overall bibliometric understanding to the existing research advancement of green economy and to establish a future research agenda. Some of the following are

instances of questions that are pertinent to the bibliometric analysis of green economy: What part has the technology advanced the development of the sustainable and environment-friendly green economy? What does the research agenda for the green economy look like?

In this study, a synthesis of the results of previous research on green economy was first conducted and then the constraints caused by environmental repercussions accordingly. These were the two subjects that generated the greatest conversation in relation to a comprehensive understanding of the green economy and the concerns surrounding environmental preservation. This study drew on the prior work of a combined amount of 1,022 articles about the topic of green economy on environmental issues using a comprehensive selected database. The paper selection procedure as well as the inclusion criteria were further expounded upon throughout the subsequent sections on the research methodology as well as the literature evaluation. Specifically, the organization of this paper is broken down into the following sections. First, the article begins with a summary of the current academic background, which gives an overview of the green economy as well as relevant national policies. In the second part of research methodology, the criteria utilized for selecting the relevant prior literature as well as our full research methodology were explained. The finding section presents the outcomes of this study. Last but not least, the study concludes with a discussion of its theoretical and practical contributions, as well as its limitations and suggestions for further research.

Literature review

According to scholars and a large number of international organizations, the green economy may be characterized as low in carbon emissions, resource-efficient, and socially inclusive (UNEP, 2011). For a significant number of years, one of the primary focal points for economic sustainability has been the application of green economy. A green economy strives to minimize resource depletion and environmental damage, "to generate sustainable, long-term economic growth without causing major environmental damage" (Jacobs, 2012). Meanwhile, the green economy focuses on change, particularly health-improving change. This form of economy prioritizes using renewable energy sources, sustainable transportation, and adequate water, land, and waste management to achieve its goals. Although it is argued such a transition, which emphasizes low-carbon resources, could negatively affect the environment and the local population (Sovacool et al., 2019), businesses everywhere are contemplating changing to adapt to the new paradigm, given the importance attached to the green economy worldwide. The green economy is assumed to have various benefits and therefore vital for creating a sustainable economy and is closely tied to the notion of green growth.

In retrospect, the green economy was originally implemented worldwide in reaction to the global financial crisis and to promote economic recovery (Bina and La Camera, 2011). It has been crucial in attaining the low-carbon transition and sustainable development objectives. As of today, the green economy has had some effect on global policymaking, with Europe and Asia being the most quickly expanding regions (Kaur et al., 2018). For instance, there are a lot

of studies that concentrate upon such geographies, such as China (Zhang et al., 2021) and the United Kingdom (Gainsborough, 2018), as well as other emerging nations like Laos (Luukkanen et al., 2019), India (Reddy, 2016), and Cambodia (Vuola et al., 2020).

As was discussed in the preceding section, the primary goal of a green economy is to gradually shift away from the use of traditional energy that are the sources of devastating pollution. Renewable energy sources, such as solar and wind, can help establish a new standard of energy efficiency if they follow the new guiding principles that they have developed (Chenari et al., 2016). It is a terrible thing when certain markets reject the new green economic model and fail to adhere to environmental protection standards for people, animals, and the planet. A substantial portion of expenses are incurred outside of the local market or nation.

Environmental and resource conservation are vital to the development of a green economy. Businesses are supposed to ensure that their economic activities are consistent with the concepts of sustainable development by reducing their environmental effect. In other words, the economic growth does not threaten ecological sustainability. The green economy incorporates precautions to prevent environmental harm from normal financial transactions (Kasayanond, 2019). To connect their operations with sustainable development objectives, enterprises must minimize their ecological impact. This may include establishing sustainable resource management and decreasing air and water pollution. Moreover, corporations must ensure that their actions have no negative impact on the environment, which includes refraining from behaviors that could cause pollution or deplete natural resources.

In addition, there are several benefits of the green economy development. Firstly, the green economy promotes the development of new product markets and the more efficient use of natural resources. It can also solve the energy problem to a certain extent (UNEP, 2012). Currently, many developing countries relying on the import of fossil fuel are heavily influenced by the international situation and pollute the environment. The development of a green economy can reduce the impact of these problems by replacing fossil fuels with green energy (Policy Advisor, 2016). What is more, a green economy aims to achieve sustainable development through the rational use of resources and the regulation of policies that will lead to sustainable development (Smith et al., 2007). All these studies demonstrate that the green economy and environmental protection (for dealing with global climate change) concepts are inextricably intertwined. Green economics apply protections to minimize environmental damage from economic processes, and environmental protection is integral to green economies through fostering efficient and sustainable resource management.

Research methodology

The authors began by conducting an exhaustive research for pertinent publications indexed in Web of Science Index, for instance, the Science Citation Index Expanded (SCI-EXPANDED) and Social Sciences Citation Index (SSCI). Consequently, through searching the Web of Science data, the authors searched the database with the terms of green economy, sustainable

development, policy, goal, as well as a review of prior researches. The results included journal articles and proceeding from a variety of conferences. Additionally, we scanned the bibliographies of pertinent review papers. The following criteria were used to screen the papers.

1. Topic = (Green Economy OR Sustainable Development) AND Topic = (Policy) AND Topic = (Goal).
2. Research domains: Sustainability Science; Economics; Environmental Sciences; Environmental Sciences; Ecology; Business Economics.
3. Document Types: Peer-reviewed articles and conference proceedings written in English, which were indexed in Science Citation Index Expanded (SCI-EXPANDED) or Social Sciences Citation Index (SSCI).
4. Web of Science Categories: Environmental Sciences; Green Sustainable Science Technology; Environmental Studies; Economics.

In this article, the research objects utilized to generate the mapping are important indicators linked to the topic of green economy, such as keywords, number of publications, number of citations, nations, and authors of literature. For each article, the authors examined the title, abstract, introduction, or them together to determine that the investigations are pertinent to the current study. Inter-coder dependability was examined throughout such encoding procedure to increase the accuracy and dependability (Clarke and Visser, 2019; Baek et al., 2021). As a result, a total of 1,022 articles were selected after the initial categorization procedure. Specifically, the particular steps can then be broken down into the following phases. First, the target literature was screened from the Web of Science database, with the previously mentioned criteria as the specific research indicator. Second, country analysis was conducted for the published literature. Third, the affiliation of the existing literature was analyzed. Fourth, the journals to which the literature belongs were classified and summarized. Fifth, the number of publications of researchers in the field of green economy was counted. Sixth, using the correlation method of literature coupling, the keyword network mapping was constructed, and the correlation between the countries, authors and references of the literature design was analyzed in detail. Last but not least, the authors used the R language analysis technique to identify the summative analysis to the existing literature. For the acquired literature, this paper adopts a bibliometric-related approach for quantitative research (Farrukh et al., 2020). This method is a combination of three fields: literature, statistics and mathematics, and it analyses the correlation between specific indicators of published scientific results, such as disciplines, journals, regions and countries (Bonilla et al., 2015; Amiguet et al., 2017; Martínez-López et al., 2018).

More specifically, to analyze the existing data, the authors use VOSviewer and R language, two software programs widely used in various fields for their simplicity and efficiency. For literature analysis, coupling analysis is often used, which simply means that the relevance of a research topic is determined by analyzing the citations among published articles (Mora-Valentin et al., 2022). Another alternative to this is to analyze the citations of the existing articles to determine the relevance of the themes' co-relationship (Wang et al., 2013). Both of these two methods are applied in this

study to achieve precision with reliability and credibility in the analysis of the acquired literature.

Bibliometric analysis process

Analysis of the published literature

To locate relevant scholarly materials, this article searched the Web of Science database. This section describes the methods used to obtain data from published sources. These particular strategies contain data obtained by two independent reviewers, and we proceed to further investigation to the obtained data.

In addition, we explained the Web of Science in terms of the automation technologies used in the procedure. Keyword searches to ensure that no relevant literature on green economy-related policy research is excluded. According to the findings of an information retrieval study conducted using Web of Science, there were 1,022 papers on green economy. A framework analysis of the articles indicates that the number of papers has increased exponentially over the past 9 years, especially from 2016 to 2022. This substantial increase suggests that the study of green economy is gaining increasing growth momentum (see Figure 1).

To be specific, as shown in Figure 2, 1,022 papers were published between 2016 and 2022 with a quick annual growth. In 2016, there were only 22 papers while by the end of 2022, 322
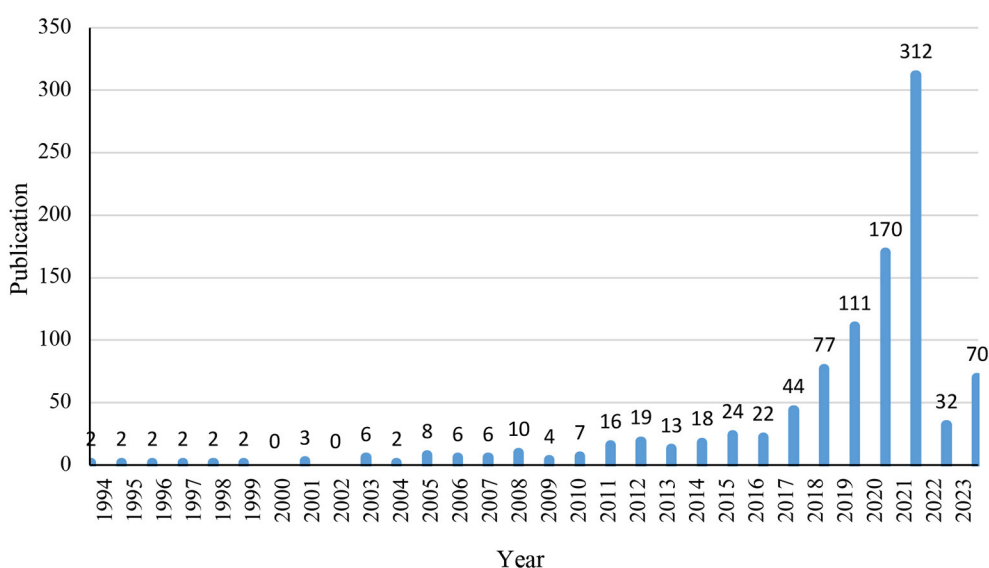

FIGURE 1
The increasing number of articles published on green economy development goals and policies.
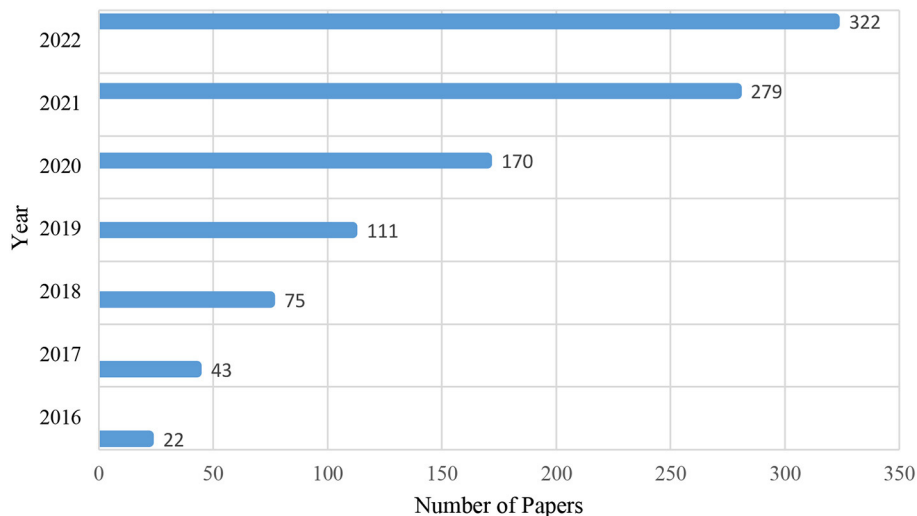

FIGURE 2
Annual publication analysis of green economy issues in published literature.

articles will have been published, a 10-fold increase of 2016. It is assumed that this growth trend will continue.

Analysis of the study area of green economy

Besides the growth in numbers shown before, the study on the green economy has also experienced a geographic expansion worldwide in recent years, as indicated in Table 1. The top 10 nations were selected in terms of the number of papers published worldwide by its scholars from 2016 to 2022. With 353 publications and 5,597 citations, China is far ahead of other countries. This signifies that Chinese scholars have gradually shifted their focus to the green economy, an active response to the green transition policy by the Chinese government Second to China is the United Kingdom. The United States ranks third with 107 articles, subsequently followed by Germany, three Asian countries, Turkey, and Pakistan, India, and three European countries, Italy, Spain, and Netherlands.

TABLE 1 Country analysis.

No	Country	NP	Citations	Citations/paper
1	China	353	5,597	15.86
2	The UK	107	2,843	26.57
3	America	107	2,268	21.20
4	Germany	87	2,563	29.46
5	Turkey	77	3,002	38.99
6	Pakistan	74	1,535	20.74
7	India	67	1,851	27.63
8	Italy	66	1,364	20.67
9	Spain	53	1,511	28.51
10	Netherlands	47	1,461	31.08

Figure 3 depicts the outcomes of the subsequent coupling analysis, which was conducted with VOSviewer analysis software. The quantity of publications is proportional to the diameter of the circle. China, the United Kingdom, and the United States are the top three countries. This conclusion is consistent with the results presented in Table 1.

Since many studies are conducted internationally, it was appropriate to consider the collaboration between scholars in each country. The outcomes of this investigation are demonstrated in Figure 4. China continues to lead the list of countries most inclined to collaborate in research on the trending topic of green economy. It is anticipated that Chinese academics would participate significantly in future studies on the green economy.

Authors' affiliation analysis

The attributing affiliations of the authors of the publication are also an essential component of the bibliometric analysis. Table 2 shows the findings of the authors' affiliation via the VOSviewer analysis. With 32 papers, the Chinese Academy of Sciences was the most prolific institution. With 29 and 28 articles, respectively, Istanbul Gelisim University from Turkey and the University of London from the United Kingdom scored second and third in the list. The significance of Asian research institutions in the study of the green economy is accurately depicted.

Analysis of the volume of publications in relevant journals

Journal analysis is also an integral aspect of our investigation. As shown in Table 3, the authors selected a total of 10 journals that publish high-profile in-depth research on topics connected to the green economy between 2016 and 2022. *Sustainability* is one of the most highly ranked journals on the list. *The Journal of Cleaner Production*, and *Environmental Science and Pollution Research* ranked second and third, respectively, with
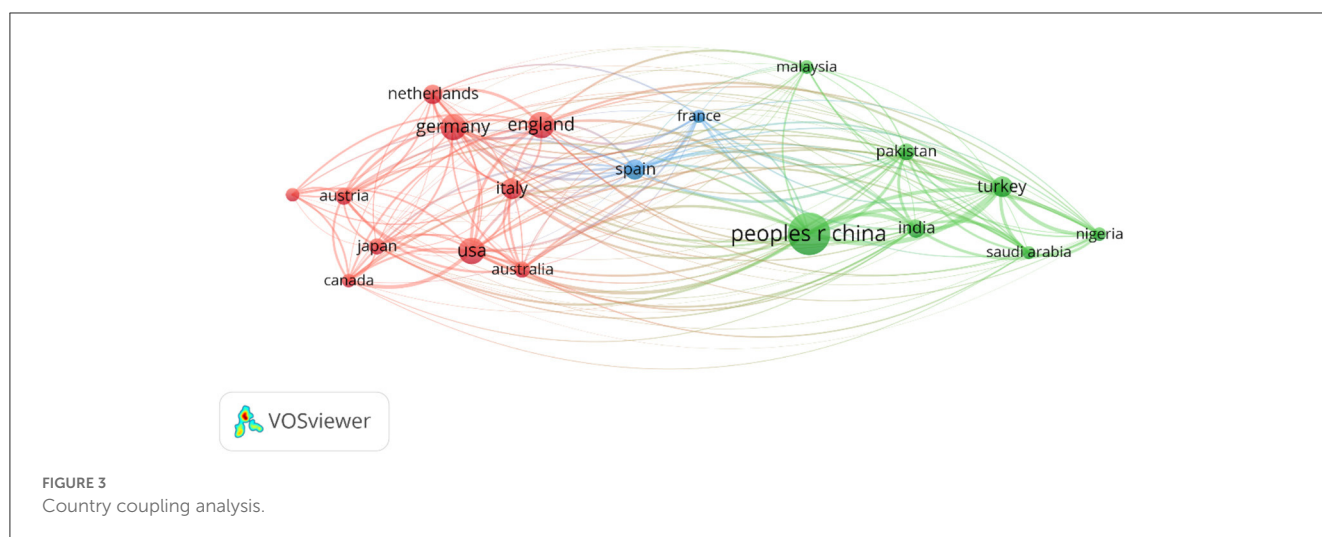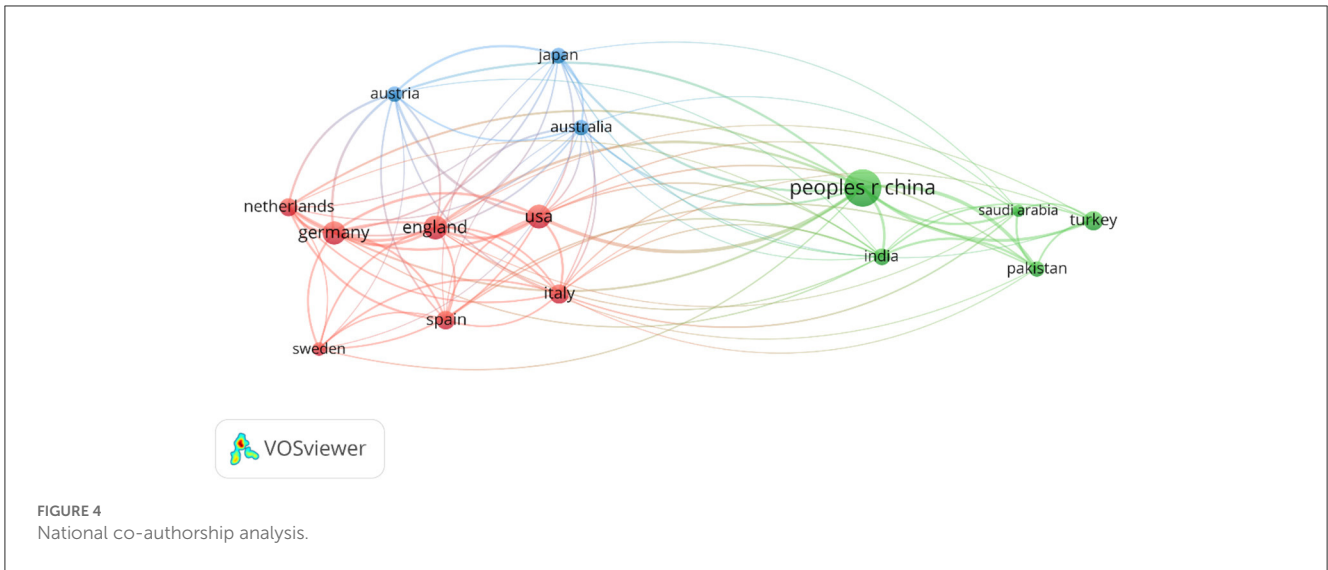
FIGURE 3
Country coupling analysis.

FIGURE 4
National co-authorship analysis.

TABLE 2 Article affiliation analysis.

Universities/institutes	TP	TC
Chinese Academy of Sciences	32	319
Istanbul Gelisim University	29	1,185
University of London	28	653
International Institute for Applied Systems Analysis IIasa	24	580
Goa Institute of Management	20	1,259
Beijing Institute of Technology	19	647
Southern State University	18	634
Tsinghua University	17	752
University College London	17	168
Beijing Normal University	15	246
Potsdam Institut fur klimafolgenforschung (Potsdam Climate Research Center)	15	796
Ulusracht-Kibiris University	15	329
Peking University	14	436
University of Chinese Academy of Sciences CAS	14	117
Utrecht University	14	612

TABLE 3 Journal analysis.

No	Source title	Papers	Citations	C/P
1	Sustainability	188	1,673	8.90
2	Journal of Cleaner Production	124	4,283	34.54
3	Environmental Science and Pollution Research	115	1,801	15.66
4	Energy Policy	48	1,172	24.42
5	Science of the Total Environment	34	1,957	57.56
6	Journal of Environmental Management	28	1,038	37.07
7	Environment Development and Sustainability	26	253	9.73
8	International Journal of Environmental Research and Public Health	25	156	6.24
9	Frontiers in Environmental Science	23	76	3.30
10	Environmental Research Letters	22	458	20.82

124 and 115 articles. *Science of the Total Environment* is the most highly-cited journal, with an average of 57.56 citations per article.

For journal citation research, literature co-citation analysis is frequently employed. Figure 5 illustrates the findings of this analysis. *The Journal of Cleaner Production* is the journal with the highest co-citation frequency, followed by *Sustainability and Environmental Science* and *Pollution Research*, where the high co-citation rate is attributable to a large number of related references.

Analysis of the researchers focusing on the field of green economy

This section contains data pertaining to the green economy researchers with the most publications. Sinha A. is in international spotlight with 21 published articles, as shown in Table 4. With 1,737 citations, Alola A.A. ranked first on the list in terms of citations. With an average of 97.77 citations per article, Bekun F.V. topped the list. Each of the remaining academics has authored a minimum of seven articles.
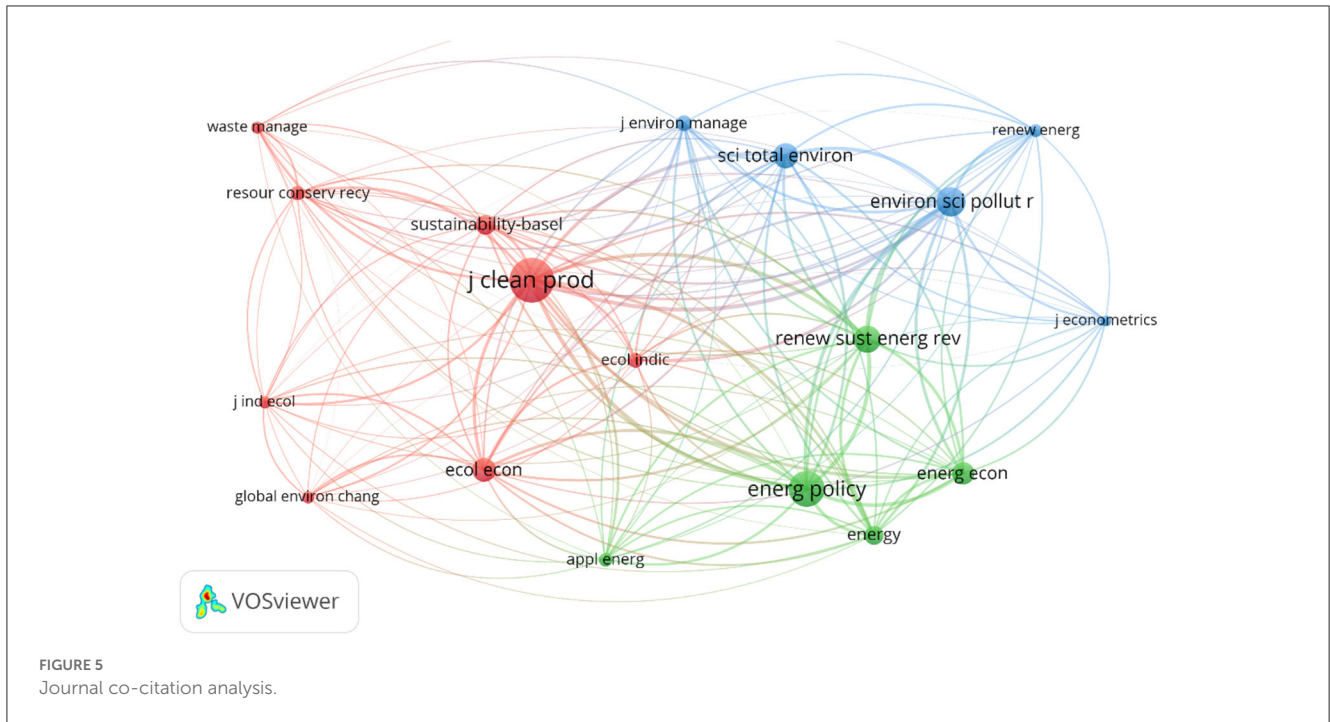
FIGURE 5
Journal co-citation analysis.

TABLE 4 Author analysis.

No	Author	Papers	Citations	C/P
1	Sinha A.	21	1,278	60.86
2	Alola A. A.	19	1,737	91.42
3	Bekun F. V.	13	1,271	97.77
4	Murshed M.	11	417	37.91
5	Schandl H.	10	308	30.8
6	Alvarado R.	9	549	68.63
7	Kirikkaleli D.	8	547	68.38
8	Sharma R.	8	312	39.00
9	Ahmad M.	7	349	49.86
10	Li Y.	7	53	7.57

Literature citation analysis

The number of citations in the selected literature is also a significant indicator when performing a literature review and a crucial criterion for evaluating the quality of a publication. In this part, the top 10 most-cited papers from the Web of Science database were selected based on the search parameters established previously and listed in Table 5. The results suggest that *Toward a sustainable environment: Nexus between CO$_2$ emissions, resource rent, renewable and non-renewable energy in 16-EU countries* is ranked in the first place, which shows its academic significance. The remaining publications have been mentioned at least 156 times, which demonstrates in part their high reference value in the subject of green economy research.

Three-field plot analysis

Among numerous different ways of analysis, the Three-Field Plot Analysis is frequently used to determine the researcher's area of study. This section applies this methodology to the study of the green economy. Figure 6 illustrates the findings of this analysis. On the far left are the names of the researchers, in the center are the most often used terms, and on the right are the countries of the authors. Thus, it is straightforward to associate the researcher with his field of study and nationality. For instance, Liu Y.'s primary research keywords are sustainable development and CO$_2$ emissions, indicating that he is primarily concerned with sustainable development as a result of CO$_2$ emissions.
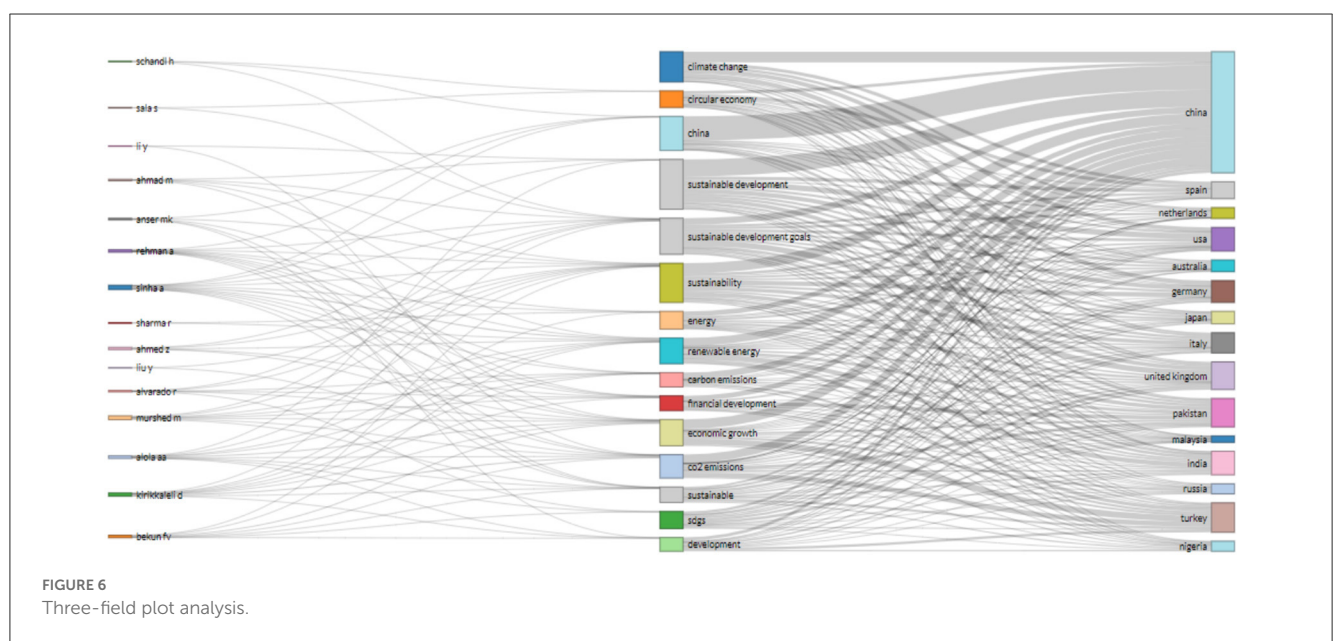
Keyword analysis

This component utilizes the VOSviewer program to perform keyword analysis on the selected documents; the results are displayed in Figure 7. The importance of sustainable development, economic growth, and climate change is evident. This technique is used to map the frequency of keywords in published works. Therefore, future study on the green economy is expected to concentrate on these three terms, which reflect a trend in the field.

Although the keyword analysis references the knowledge content of big data to some extent, it can be utilized to determine future research topics. However, research on the green economy is frequently influenced by a number of uncontrollable circumstances, thus the results of the analysis can serve as a benchmark for particular measurements. Nevertheless, we anticipate that these topics will continue to evolve in the current global situation.

TABLE 5 Literature citation analysis.

Authors	Title	Year	Source title	Number of citations
Bekun F. V., Alola A. A, Sarkodie S. A.	Toward a sustainable environment: Nexus between CO_2 emissions, resource rent, renewable and non-renewable energy in 16-EU countries	2019	Science of the Total Environment	572
D'Amato D., Droste N., Allen B., Kettunen M., Lahtinen K., Korhonen J., Leskinen P., Mathies B. D., Toppinen A.	Green, circular, bio economy: A comparative analysis of sustainability avenues	2017	Journal of Cleaner Production	411
Hickel J., Kallis G.	Is Green Growth Possible?	2020	New Political Economy	408
Alola A. A., Bekun F. V., Sarkodie S. A.	Dynamic impact of trade policy, economic growth, fertility rate, renewable and non-renewable energy consumption on ecological footprint in Europe	2019	Science of the Total Environment	329
van Vuuren D. P., Stehfest E., Gernaat D. E. H. J., Doelman J. C., Van den Berg M., Harmsen M., de Boer H.S., Bouwman L. F., Daioglou V.	Energy, land-use and greenhouse gas emissions trajectories under a green growth paradigm	2017	Global Environmental Change—Human and Policy Dimensions	330
Shahbaz M., Balsalobre-Lorente D., Sinha A.	Foreign direct investment-CO_2 emissions nexus in Middle East and North African countries: Importance of biomass energy consumption	2019	Journal of Cleaner Production	285
Schand H., Geschke A., Hatfield-Dodds S., Wiedmann T., Cai Y. Y., West J., Baynes T., Lenzen M., Newth D., Owen A.	Decoupling global environmental pressure and economic growth: scenarios for energy use, materials use and carbon emissions	2016	Journal of Cleaner Production	175
Ahmad M., Jiang P., Majeed A., Umar, M., Khan Z., Muhammad S.	The dynamic impact of natural resources, technological innovations and economic growth on ecological footprint: An advanced panel data estimation	2020	Resources Policy	181
Shen Y. J., Su Z. W., Malik M. Y., Umar M., Khan Z. S., Khan M.	Does green investment, financial development and natural resources rent limit carbon emissions? A provincial panel analysis of China	2021	Science of the Total Environment	170
Saidi K., Omri A.	The impact of renewable energy on carbon emissions and economic growth in 15 major renewable energy-consuming countries	2020	Environmental Research	156

FIGURE 6
Three-field plot analysis.

FIGURE 7
Keyword analysis.
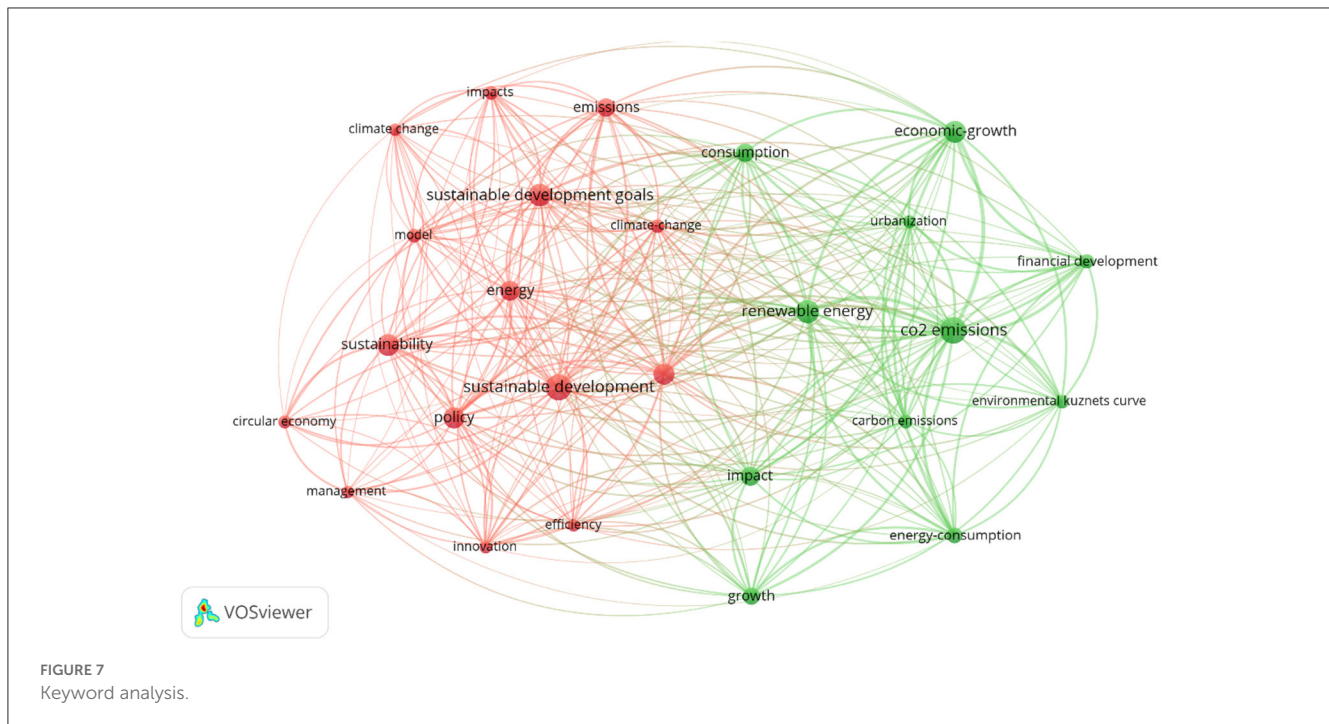
Thematic map analysis

This part presents a structured analysis of the selected keywords in the green economy-related literature, drawing a Thematic Map using the bibliophagy data package in R language. The first quadrant of the four-quadrant diagram indicates research fields that are both significant and well-developed. The second quadrant consists of well-developed but less significant research directions. The third quadrant represents insignificant research content, whereas the fourth quadrant represents significant but underdeveloped study areas (Tennekes, 2018). The fourth quadrant represents research fields that are vital but underdeveloped. Figure 8 demonstrates the outcomes. The first quadrant contains the current topical issues, including renewable energy, economic growth, sustainable development, energy transition and other key words.

Niche Themes focuses on the more contemporary and well-established fields of study, including public policy, food shortages, and sustainability factors. The most crucial are the transitions to sustainable development and the shadow economy. The keywords environmental Kuznets curve, environmental regulation, green innovation, poverty alleviation, energy security, sustainable development, and climate change dominate the third quadrant. As a result of climate change, it is evident that research on sustainable development is becoming more centralized and of a broader study interest. The fourth quadrant represents research directions that are not well-developed at present but have a greater scientific value in the future. Green economy, sustainability, circular economy and other contemporary hot topics are included in this quadrant, reflecting the importance of green economy and sustainable development research in the coming period.

Trends in topic selection

Adopting the bibliophagy data package in the R language to construct time windows with literature keywords reveals future research trends. As depicted in Figure 9, energy security is a leading research topic from 2016 to 2018. From 2018 to 2019, the study field is gradually changing toward the establishment of a low-carbon economy to achieve economic growth. Life cycle assessment have been reintroduced and examined bioeconomic issues by 2020. From 2021 onward, policy research on the formation of a green economy to achieve sustainable development goals became an important topic, paving the path for future studies.

Discussion

The development of a green economy can be distinguished into four different forms: green growth, green transformation, green resilience, and green revolution (Death, 2015). Among them, green growth is the most common green economy model in the global context and belongs to a high-quality development model that focuses on the rational use of resources and the reduction of damage to nature (Li et al., 2022). Green resilience is more technical in nature and places greater emphasis on sustainability (Rizzo, 2020). Green transformation and green revolution Green Transformation and Green Revolution are national government policies to promote economic development (Thenkabail, 2010; Lee and Woo, 2020). The green economy as a whole is a series of policies that are designed to promote economic development. As a whole, the green economy is the sum of a number of concepts that encompass the world economy, energy issues, national policies and more. Du et al. (2019) assert that the output of carbon dioxide into the atmosphere, a contributor to

FIGURE 8
Thematic map.

FIGURE 9
Trend topics advancement over the time.
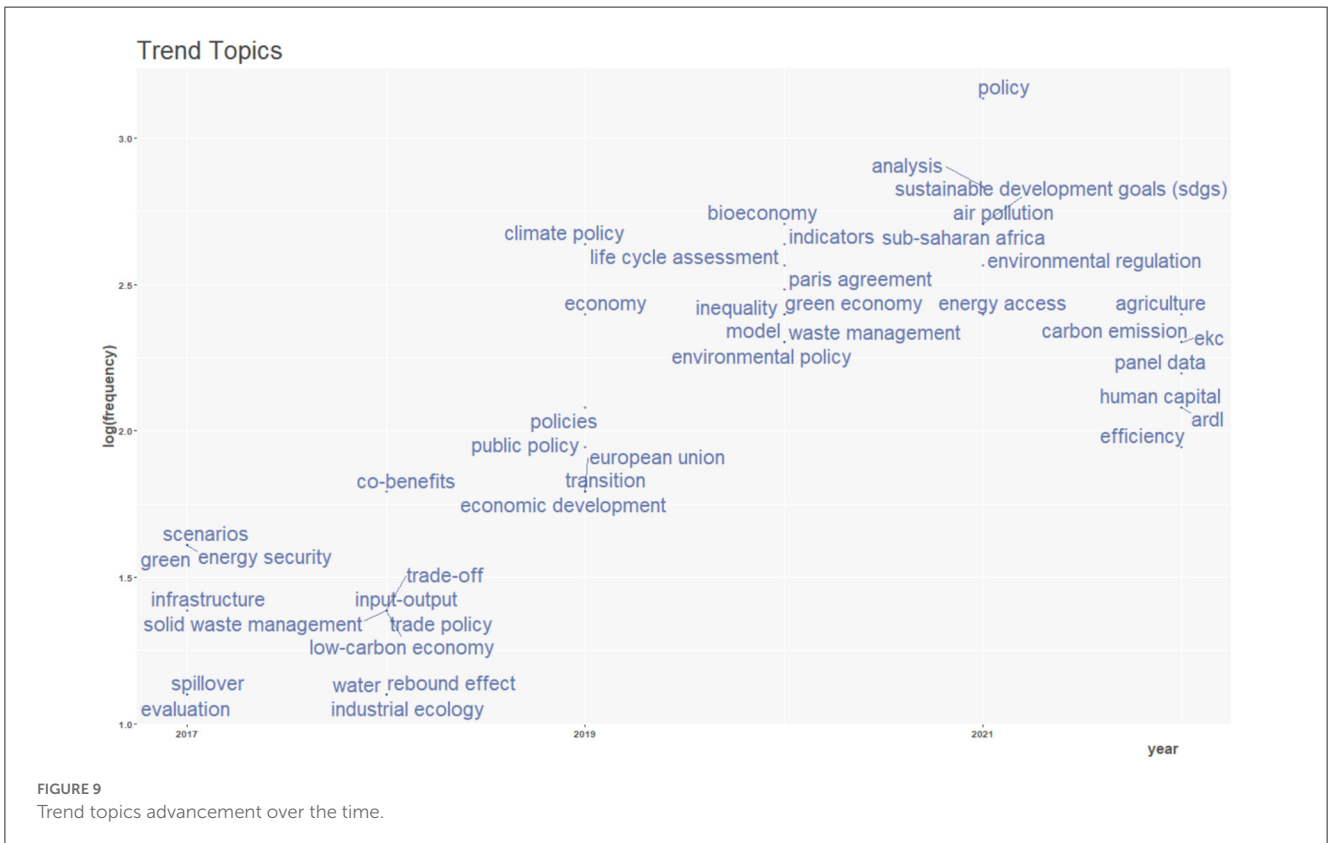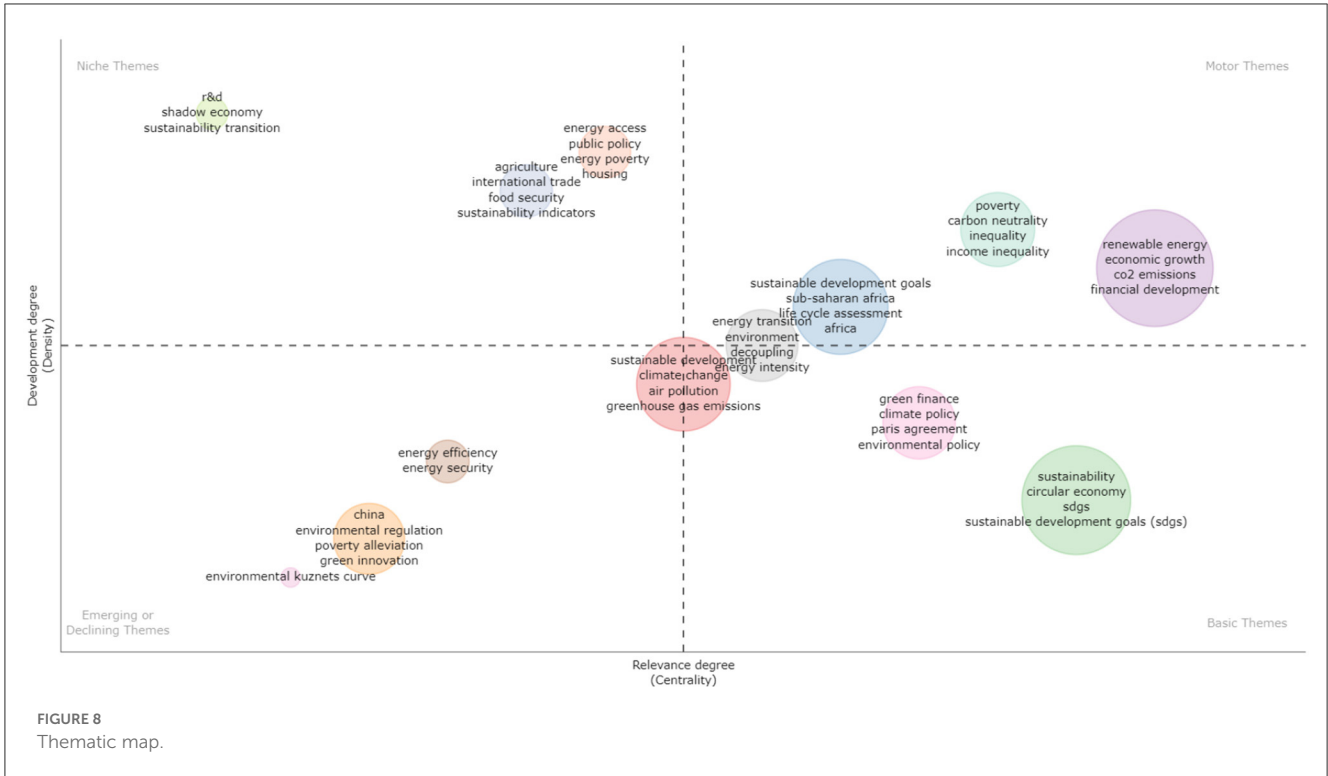
climate change, is reduced by using green technologies such as electric vehicles. In addition, reducing waste and pollution through implementing efficient production and consumption processes adds to environmental protection. Environmental safeguards are also essential for the long-term management of resources. This involves protecting biodiversity, vital to ecosystem health and human quality of life. Moreover, because water is a finite resource, preserving its quality through conservation is essential for maintaining a healthy ecosystem. By protecting the environment, a green economy may ensure that resources are managed

responsibly, which is advantageous for both the environment and the economy.

Promoting environmentally friendly ways of transportation is essential to the green economy. Sustainable is any mode of transportation that considers the needs of society, the environment, and the climate, as well as the effects that transportation has on these factors (Björklund, 2011). Since transportation contributes significantly to carbon dioxide emissions and consumes more than 25 per cent of global energy, its environmental effects cannot be overstated (Barceló, 2010). UN Environment Programme (UNEP) asserts that if persons switched to a better and safer mode of transportation, outdoor air pollution-related premature mortality might be reduced (Mahmood, 2011; Levy and Patz, 2015). Electric vehicles are increasingly popular in countries such as the United States and Germany because they reduce air pollution and improve the environment. Due to the increasing number of incentives offered by nations with advanced economies, it is easier for businesses and municipalities to manage the rise in electric vehicle usage.

Environmental protection and a green economy are required for sustainable development. A strategy for sustainable development ensures that present and future generations have access to the resources they need to live happy and productive lives. It considers the needs of the economy, environment, and society. The objective of a green economy is to maximize economic output while decreasing environmental hazards and resource shortages, which include reducing pollution and waste; boosting energy efficiency; promoting renewable energy sources and safeguarding natural resources. In addition, it seeks to promote environmentally responsible economic growth. Renewable energy, energy efficiency, sustainable agriculture, and environmentally friendly transportation are green economic projects.

The development of the green economy plays a decisive role in solving the problem of carbon emissions. In the past, governments favored fossil fuels over the green economy, partly because the green economy sector then was relatively underdeveloped, and partly because of the higher risks and lower returns (Tarkhanova et al., 2020). To achieve the goal of sustainable development, a series of policies must be developed to raise funds for the green economy to thrive.

Theoretical implications

Different from the conventional literature reviews, the current research analyzes a broader number of papers, from various aspects, including geographies, publishing organizations, high-profile journals, authorship, citation frequency, and several other variables. Based on this, the future research trend is predicted, which would be conducive for researchers to define the direction of future research and to facilitate research institutions in conducting research and cooperating with their intended academia. In addition, the current research would be beneficial for national governments to precisely identify countries that are in the forefront of green economy research and then to change their policies accordingly. With the acceleration of global digital and intelligent transformation, the corporate environment is in a state of perpetual flux. It is now necessary for the survival and success of businesses to encourage the integration of new technologies and business

to drive business innovation. As green digital technologies are increasingly used in corporate management practices nowadays, green economy, a kind of advanced technology, plays a growing key role in facilitating the business innovation process. The present fast growth of green financing strengthens the prospect of incorporating it into the corporate innovation process. The expansion of sustainable finance has created favorable conditions for an industrial ecosystem that embraces the logic of digital services. Green improvements in product service processes and corporate strategies generate opportunities. Simultaneously, facilitating and supporting enterprise company innovation become more approachable, simple, and collaborative.

Limitations

Despite the fact that this paper has made some contributions, it still has certain limitations. The literature is obtained from the Web of Science database, and there are inevitably important publications that were not counted, which has an influence on the correctness of the analysis. Second, the analytical period for this article is the period between 2016 and 2022, when the green economy is thriving. Therefore, we propose that future research investigate the evolution of the green economy in different eras by comparing the results of studies conducted at different time intervals.

Future research agenda

Future research and analysis on the digital transformation of businesses merits more examination. Topics for research may include the existing and future effects of digital technology, such as artificial intelligence, on digital transformation and business innovation inside enterprises. Based on the theoretical exploration and empirical research conducted, relevant academic achievements can provide practical and effective theoretical guidance and strategies for enterprises to implement digital transformation in the context of the era of digital intelligence enlightenment. In addition, future study subjects may include the role and influence of the COVID-19 pandemic. On the basis of the concepts of digital empowerment and innovation, theoretical debate and empirical study can be conducted on business remodeling, transformation, and upgrading. The relevant academic accomplishments may give useful theoretical advice for conventional firms to implement green innovation using new technologies in the context of the digital economy.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

JZ, XS, and RZ: conceptualization and validation. JZ and XS: data curation, investigation, and writing—review and editing. JZ and RZ: formal analysis, methodology, resources, software,

visualization, and writing—original draft. JZ: funding acquisition, project administration, and supervision. All authors contributed to the article and approved the submitted version.

Funding

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fevo.2023.1168437/full#supplementary-material

References

Amiguet, L., Gil Lafuente, A. M., Kydland, F. E., and Merigó Lindahl, J. M. (2017). One hundred twenty-five years of the journal of political economy: a bibliometric overview. *J. Pol. Econ.* 125. Available online at: https://recercat.cat//handle/2072/330181

Anholon, R., Rampasso, I. S., Silva, D. A. L., Filho, W. L., and Goncalves Quelhas, O. L. (2020). The COVID-19 pandemic and the growing need to train engineers aligned to the sustainable development goals. *Int. J. Sustainabil. High. Educ.* 21, 1269–1275. doi: 10.1108/IJSHE-06-2020-0217

Arenal, A., ArmuÃa, C., Feijoo, C., Ramos, S., Xu, Z., and Moreno, A. (2020). Innovation ecosystems theory revisited: The case of artificial intelligence in China. *Artif. Intell. Econ. Soc.* 44, 101960. doi: 10.1016/j.telpol.2020.101960

Baek, S., Jung, W., and Han, S. H. (2021). A critical review of text-based research in construction: Data source, analysis method, and implications. *Automat. Constr.* 132, 103915. doi: 10.1016/j.autcon.2021.103915

Barbier, E. B., and Burgess, J. C. (2020). Sustainability and development after COVID-19. *World Dev.* 135, 105082. doi: 10.1016/j.worlddev.2020.105082

Barceló, J. (2010). *Fundamentals of Traffic Simulation (? 145).* Berlin: Springer.

Bina, O., and La Camera, F. (2011). Promise and shortcomings of a green turn in recent policy responses to the "double crisis." *Ecol. Econ.* 70, 2308–2316. doi: 10.1016/j.ecolecon.2011.06.021

Björklund, M. (2011). Influence from the business environment on environmental purchasing—Drivers and hinders of purchasing green transportation services. *J. Purchasing Supply Manag.* 17, 11–22. doi: 10.1016/j.pursup.2010.04.002

Bonilla, C. A., Merigó, J. M., and Torres-Abad, C. (2015). Economics in Latin America: A bibliometric analysis. *Scientometrics* 105, 1239–1252. doi: 10.1007/s11192-015-1747-7

Campbell, D. A. (2017). An update on the United Nations millennium development goals. *J. Obstetr. Gynecol. Neonatal Nurs.* 46, e48–e55. doi: 10.1016/j.jogn.2016.11.010

Chenari, B., Dias Carrilho, J., and Gameiro da Silva, M. (2016). Towards sustainable, energy-efficient and healthy ventilation strategies in buildings: A review. *Renew. Sustain. Energy Rev.* 59, 1426–1447. doi: 10.1016/j.rser.2016.01.074

Clarke, E., and Visser, J. (2019). Pragmatic research methodology in education: Possibilities and pitfalls. *Int. J. Res. Method Educ.* 42, 455–469. doi: 10.1080/1743727X.2018.1524866

Death, C. (2015). Four discourses of the green economy in the global South. *Third World Quart.* 36, 2207–2224. doi: 10.1080/01436597.2015.1068110

Du, K., Li, P., and Yan, Z. (2019). Do green technology innovations contribute to carbon dioxide emission reduction? Empirical evidence from patent data. *Technol. Forecast. Soc. Change* 146, 297–303. doi: 10.1016/j.techfore.2019.06.010

Farrukh, M., Meng, F., Raza, A., and Tahir, M. S. (2020). Twenty-seven years of Sustainable Development Journal: A bibliometric analysis. *Sustain. Dev.* 28, 1725–1737. doi: 10.1002/sd.2120

Ferguson, P. (2015). The green economy agenda: Business as usual or transformational discourse? *Environ. Polit.* 24, 17–37. doi: 10.1080/09644016.2014.919748

Gainsborough, M. (2018). Transitioning to a green economy? Conflicting visions, critical opportunities and new ways forward: review essay: Transitioning to a green economy? *Dev. Change* 49, 223–237. doi: 10.1111/dech.12364

Georgeson, L., Maslin, M., and Poessinouw, M. (2017). The global green economy: A review of concepts, definitions, measurement methodologies and their interactions. *Geo Geogr. Environ.* 4, e00036. doi: 10.1002/geo2.36

Government of Dubai (2022). *8th World Green Economy Summit starts Wednesday With the Participation of Prominent Climate Action Leaders, Officials and Experts From Around the World.* Available online at: https://mediaoffice.ae/en/news/2022/September/27-09/World-Green-Economy-Summit (accessed January 18, 2022).

Gunay, S., Muhammed, S., and Elkanj, N. (2022). Risk transmissions between regional green economy indices: Evidence from the US, Europe and Asia. *J. Clean. Product.* 379, 134752. doi: 10.1016/j.jclepro.2022.134752

Hristov Kalin. (2017). Internet plus policy: A study on how China can achieve economic growth through the internet of things. *J. Sci. Technol. Pol. Manag.* 8, 375–386. doi: 10.1108/JSTPM-03-2017-0007

Jacobs, M. (2012). *Green Growth: Economic Theory and Political Discourse (? 108).* London: Grantham Research Institute on Climate Change and the Environment London.

Jin, Y., Tang, Y. M., Chau, K. Y., and Abbas, M. (2022). How government expenditure Mitigates emissions: A step towards sustainable green economy in belt and road initiatives project. *J. Environ. Manag.* 303, 113967. doi: 10.1016/j.jenvman.2021.113967

Kasayanond, A. (2019). Environmental sustainability and its growth in Malaysia by elaborating the green economy and environmental efficiency. *Int. J. Energy Econ. Pol.* 9, 465–473. doi: 10.32479/ijeep.8310

Kaur, G., Uisan, K., Ong, K. L., and Lin, C. S. K. (2018). Recent trends in green and sustainable chemistry & waste valorisation: Rethinking plastics in a circular economy. *Curr. Opin. Green Sustain. Chem.* 9, 30–39. doi: 10.1016/j.cogsc.2017.11.003

Kronenberg, K., and Fuchs, M. (2021). Aligning tourism's socio-economic impact with the United Nations' sustainable development goals. *Tour. Manag. Perspect.* 39, 100831. doi: 10.1016/j.tmp.2021.100831

Lee, C.-C., Wang, C.-W., and Ho, S.-J. (2022). The dimension of green economy: Culture viewpoint. *Econ. Anal. Pol.* 74, 122–138. doi: 10.1016/j.eap.2022.01.015

Lee, J.-H., and Woo, J. (2020). Green new deal policy of South Korea: Policy innovation for a sustainability transition. *Sustainability* 12, 10191. doi: 10.3390/su122310191

Levy, B. S., and Patz, J. A. (2015). Climate change, human rights, and social justice. *Ann. Glob. Health* 81, 310–322. doi: 10.1016/j.aogh.2015.08.008

Li, J., Dong, K., and Dong, X. (2022). Green energy as a new determinant of green growth in China: The role of green technological innovation. *Energy Econ.* 114, 106260. doi: 10.1016/j.eneco.2022.106260

Linde, L., SjÃdin, D., Parida, V., and Gebauer, H. (2021). Evaluation of digital business model opportunities. *Res. Technol. Manag.* 64, 43–53. doi: 10.1080/08956308.2021.1842664

Loiseau, E., Saikku, L., Antikainen, R., Droste, N., Hansjürgens, B., Pitkänen, K., et al. (2016). Green economy and related concepts: An overview. *J. Clean. Prod.* 139, 361–371. doi: 10.1016/j.jclepro.2016.08.024

Luukkanen, J., Kaivo-oja, J., Vahakari, N., O'Mahony, T., Korkeakoski, M., Panula-Ontto, J., et al. (2019). Green economic development in Lao PDR: A sustainability window analysis of Green Growth Productivity and the Efficiency Gap. *J. Clean. Prod.* 211, 818–829. doi: 10.1016/j.jclepro.2018.11.149

Mahmood, S. A. I. (2011). Air pollution kills 15,000 Bangladeshis each year: The role of public administration and government's integrity. *J. Public Admin. Pol. Res.* 3, 129.

Martínez-López, F. J., Merigó, J. M., Valenzuela-Fernández, L., and Nicolás, C. (2018). Fifty years of the European Journal of Marketing: A bibliometric analysis. *Eur. J. Market.* 52, 439–468. doi: 10.1108/EJM-11-2017-0853

Metawa, N., Dogan, E., and Taskin, D. (2022). Analyzing the nexus of green economy, clean and financial technology. *Econ. Anal. Pol.* 76, 385–396. doi: 10.1016/j.eap.2022.08.023

Mikhno, I., Koval, V., Shvets, G., Garmatiuk, O., and Tamošiuniené, R. (2021). Green economy in sustainable development and improvement of resource efficiency. *Central Eur. Bus. Rev.* 10, 99–113. doi: 10.18267/j.cebr.252

Mora-Valentin, E.-M., Najera-Sanchez, J.-J., and Ortiz-de-Urbina-Criado, M. (2022). Assessment of success in university-industry cooperation literature: A bibliographic coupling analysis. *Sci. Publ. Pol.* 49, 686–698. doi: 10.1093/scipol/scac019

Naidoo, R., and Fisher, B. (2020). Reset sustainable development goals for a pandemic world. *Nature* 583, 198–201. doi: 10.1038/d41586-020-01999-x

Policy Advisor (2016). *Benefits of a Green Economy Transformation in Sub-Saharan Africa. Green Growth Knowledge Partnership.* Available online at: https://www.greengrowthknowledge.org/blog/benefits-green-economy-transformation-sub-saharan-africa (accessed January 18, 2022).

Reddy, B. S. (2016). India's energy system transition-Survival of the greenest. *Renew. Energy* 92, 293–302. doi: 10.1016/j.renene.2016.02.027

Rizzo, A. (2020). Megaprojects and the limits of "green resilience" in the global South: Two cases from Malaysia and Qatar. *Urban Stud.* 57, 1520–1535. doi: 10.1177/0042098018812009

Rosati, F., and Faria, L. G. D. (2019). Addressing the SDGs in sustainability reports: The relationship with institutional factors. *J. Clean. Prod.* 215, 1312–1326. doi: 10.1016/j.jclepro.2018.12.107

Seshaiyer, P., and McNeely, C. L. (2020). Challenges and opportunities from COVID-19 for global sustainable development. *World Med. Health Pol.* 12, 443–453. doi: 10.1002/wmh3.380

Sjödin, D., Parida, V., Palmié, M., and Wincent, J. (2021). How AI capabilities enable business model innovation: Scaling AI through co-evolutionary processes and feedback loops. *J. Bus. Res.* 134, 574–587. doi: 10.1016/j.jbusres.2021.05.009

Smith, K. R., Dutta, K., Chengappa, C., Gusain, P. P. S., Berrueta, O. M., and, V., et al. (2007). Monitoring and evaluation of improved biomass cookstove programs for indoor air quality and stove performance: Conclusions from the Household Energy and Health Project. *Energy Sustain. Dev.* 11, 5–18. doi: 10.1016/S0973-0826(08)60396-8

Sovacool, B. K., Martiskainen, M., Hook, A., and Baker, L. (2019). Decarbonization and its discontents: A critical energy justice perspective on four low-carbon transitions. *Climat. Change* 155, 581–619. doi: 10.1007/s10584-019-02521-7

Tarkhanova, E. A., Chizhevskaya, E. L., Fricler, A., Baburina, N. A., and Firtseva, S. (2020). Green economy in Russia: The investments' review, indicators of growth and development prospects. *Entrepreneur. Sustainabil. Iss.* 8, 649–661. doi: 10.9770/jesi.2020.8.2(39)

Tennekes, M. (2018). tmap: Thematic Maps in R. *J. Stat. Softw.* 84, 1–39. doi: 10.18637/jss.v084.i06

Thenkabail, P. S. (2010). Global croplands and their importance for water and food security in the twenty-first century: Towards an ever green revolution that combines a second green revolution with a blue revolution. *Remote Sensing* 2, 2305–2312. doi: 10.3390/rs2092305

UNEP (2011). *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication.* Department of Economic and Social Affairs. Available online at: https://sdgs.un.org/publications/towards-green-economy-pathways-sustainable-development-and-poverty-eradication-17007 (accessed January 18, 2022).

UNEP (2012). *Green Economy Sectoral Study: A Catalyst for Transitioning to a Green Economy in Namibia.* African Wildlife Economy Institute. Available online at: https://www0.sun.ac.za/awei/publications/green-economy-sectoral-study-catalyst-transitioning-green-economy-namibia (accessed January 18, 2022).

Vuola, M., Korkeakoski, M., Vähäkari, N., Dwyer, M. B., Hogarth, N. J., Kaivo-oja, J., et al. (2020). What is a green economy? Review of national-level green economy policies in Cambodia and Lao PDR. *Sustainability* 12, 6664. doi: 10.3390/su12166664

Wang, X., Xu, Z., Qin, Y., and Skare, M. (2022). Innovation, the knowledge economy, and green growth: Is knowledge-intensive growth really environmentally friendly? *Energy Econ.* 115, 106331. doi: 10.1016/j.eneco.2022.106331

Wang, X., Zhao, Y., Liu, R., and Zhang, J. (2013). Knowledge-transfer analysis based on co-citation clustering. *Scientometrics* 97, 859–869. doi: 10.1007/s11192-013-1077-6

Zhang, J., Lu, G., Skitmore, M., and Ballesteros-Perez, P. (2021). A critical review of the current research mainstreams and the influencing factors of green total factor productivity. *Environ. Sci. Pollut. Res.* 28, 35392–35405. doi: 10.1007/s11356-021-14467-4