



# Data-Driven Environment, Society and Governance: Exploring How Green Finance Sparks Sustainability Based on Scientometric Analysis

Wei-Keng Zhou<sup>1</sup>, Yi-Lin Yu<sup>2</sup>(✉), Yu-Mei Peng<sup>2</sup>, Meng-Ting Liu<sup>2</sup>, Ning-Chang Guo<sup>2</sup>,  
Ye-Cheng Xu<sup>2</sup>, Yi-Wen Tang<sup>2</sup>, and Lin-Sheng Huang<sup>2</sup>

<sup>1</sup> Business School, Lingnan University, Tuen Mun, Hongkong, China

<sup>2</sup> Accounting School, Nanfang College Guangzhou, Guangzhou, China

1301058941@qq.com

**Abstract.** The core concept of socialism with Chinese characteristics for a new era is to promote high-quality social development and build a sustainable ecological civilization. In recent years, China and even the rest of the world have begun to focus on the development of green finance, which is also one of the ways to promote sustainable economic development. With the goal of “promoting the reform of green finance and promoting the sustainable development of ecological civilization”, this paper conducts a systematic data science analysis on the existing literature in the field of green finance, so as to provide more scholars with a new vision and method on the theme of how green finance stimulates sustainability. Based on this, this paper selected 145 literatures from the Web of Science (WOS) database, and analyzed their annual number of publications, annual citation times, keywords, main research institutions, countries and so on by using big data analysis technology and visualization software. Reveal the relevant current situation of the development of green finance, so as to provide a more complete picture and produce more insightful cutting-edge academic achievements. To a certain extent, it provides innovative value theory and practical significance for promoting sustainable and high-quality development of research and co-construction environment, data-driven green investment and sustainable financial system, and makes a small contribution to the development of green finance reform and innovation programs in China and the world.

**Keywords:** Green Finance · Green Economic · Sustainable Development

## 1 Introduction

In 1992, the United Nations Environment Programme Finance Initiative (UNEP FI) proposed that financial institutions should integrate Environment, Social and Governance (ESG) factors into their decision-making processes. ESG emphasizes balanced development between economy, environment, society and governance to achieve green finance

and sustainable development. ESG is an enterprise evaluation system that focuses on Environmental, Social and Governance performance rather than financial performance. This will help enterprises implement the concept of shared development and coordinated development, and better handle the relationship between economic development and social harmony; It is conducive to guiding enterprises to implement the concept of green development and innovative development, encouraging enterprises to research and develop, adopt energy-saving and environmental protection technologies, and participate in the construction of a resource-saving and environment-friendly society, so as to better handle the relationship between enterprise development, economic growth and environmental sustainable development.

The China ESG Institute is also making great efforts to promote economic development in the new era, and research has found that data-driven helps to achieve a paradigm shift in urban safety governance, effectively reducing different risk factors, disaster factors, and opportunities for crisis generation, and greatly enhancing social governance [1]. Through studying the green finance project of Huaxia Bank, Zhou Xinyi found that it is currently necessary to build up an ESG system that meets the characteristics of China's economic market, which should not only be close to the current stage of China's economic development, corporate governance characteristics and the level of information disclosure and transparency, but also consider the interpretability to the international market [2]. Yan Huaiyan and Wu Qiufang et al. found that green finance has shown a good trend and a promising future in the development of China, and many financial institutions at home and abroad have strengthened cooperation in green finance [3]. Daniel J. Crichton and Chris A. Mattmann et al. found that NASA could play a natural role in expanding ESG for satellite observation data used for climate research. The use of ESG platforms can observe social data and promote the development of green financial innovation [4]. Paul Brest, Ronald J. Gilson et al. proposed that the focus of ESG rating systems should be on the social aspects of ESG and improve ESG performance to increase the social value generated by companies, in addition, they found that ESG-based proposals are gaining support from investors across financial institutions [5]. Eric Cigu, MB. Petrisor et al. argue that the development of green finance, which enhances the capacity for innovation and the speed of transformation, helps humanity to meet the challenges of natural succession, ecological crises and energy security [6]. Davies, Anna R., Mullin, and Sue J. see that green finance is now emerging as a "win-win" approach to economic and environmental development. While a "win-win" approach to economic and environmental development is being promoted globally, there are concerns that today's economic recovery framework may be marginalizing existing approaches to socially sustainable innovation [7]. From a global perspective, green finance is being promoted as a "win-win" approach to economic and environmental development, but there are also concerns that today's economic recovery framework may marginalize existing sustainable innovation approaches in society [8].

How to build green finance and digital transformation with Chinese characteristics not only determines the direction and prospect of China's sustainable development, but also affects the sustainable development of the global economy and ecological environment. Therefore, based on the planning of green finance reform and new construction, in-depth discussion of theoretical and practical issues related to social and environmental

governance is of substantial research significance for the whole country and even the world.

## 2 Scientometric Approach and Data

In this article, through in the related fields of WoS database to collect papers, master the research situation, disciplines and roughly evolution progress, better development of related industries and future trends, to further explore the forefront of green finance related area, further guide the green finance and the environment, social responsibility and corporate governance, economic transformation and sustainable development.

**TS = (“Green finance” OR “Sustainable finance” OR “Green transformation”) AND TS = (“Sustainability” OR “Sustainable development” OR “Corporate social responsibility”) AND SU = (“Business & Economics” OR “Government & Law” OR “SocialSciences” OR “Management” OR “Communication” OR “Technology”).**

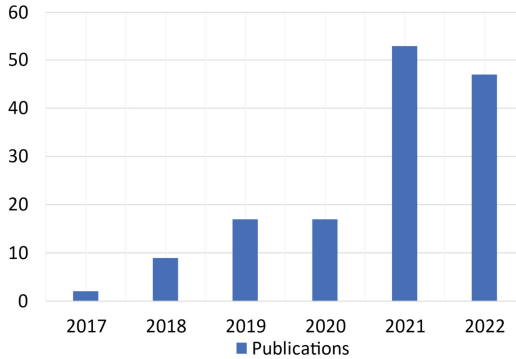
As of August 28, 2022, 145 WoS database papers have been queried and collected (papers range from SCI-Expanded, SSCI, a & HCI and ESCI). Based on the multiple interactions of word clusters, the research content is classified and summarized, and finally analyzed and mapped by the Vosviewer visualization package. The spatial relationships of keywords, disciplines, topics, and sources are tracked to establish dynamic interaction network results and provide more new perspectives for the wide application of green finance.

## 3 Research Findings

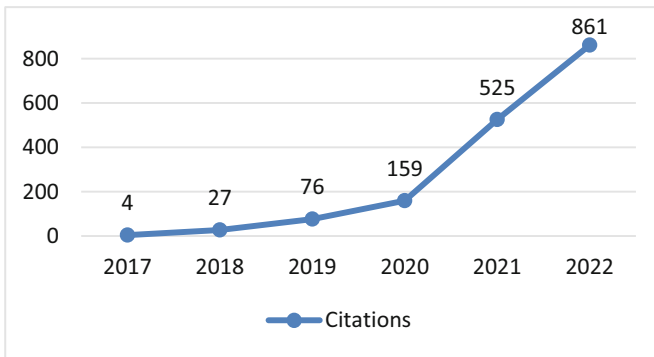
### 3.1 Annual Trends

According to Fig. 1, from the number of publications in the past five years from 2017 to 2022, it can be seen that although the research on this topic fluctuates greatly, it shows an overall upward trend, especially reaching a peak in 2021, indicating that more and more scholars pay attention to the integration of green finance, sustainable development, ESG and other topics in 2021. And its popularity will continue to surge in 2022, so the number of its publications is expected to exceed last year by the end of this year.

According to Fig. 2, since 2017, the number of paper citations every year has shown a surge trend, with a significant increase in 2020 and 2021, and a peak in 2022, indicating that more and more people are studying green finance and ESG-related topics, and their popularity is rising. Among the many published articles, the most cited article is titled “Public Spending and Green Economic Growth in BRI Region: Mediating Role of Green Finance, published in the journal Energy Policy in May 2021, has 146 cumulative citations and 73 annual citations. The paper mainly assesses and highlights the relationship between public expenditure on R&D (Research and Development) and green economic growth and energy efficiency, and its findings show that the impact is heterogeneous for countries with high GDP per capita.



**Fig. 1.** Annual number of papers published



**Fig. 2.** Number of citations for the annual paper

### 3.2 Main Research Fronts: Key Words

Figure 3 shows the keyword co-citation graph produced by the VOSviewer visualization software, with 36 keywords divided into four clusters. The size of the node is the number of times the keyword has been cited, and the thickness of the line indicates its closeness. As shown in the figure, the nodes of “sustainable finance, green finance, sustainable development, corporate social responsibility” are larger, indicating that the keywords are closely related and have a greater impact. In addition, keywords such as “governance, economic growth, climate change, and environmental protection” have also been explored by researchers in the areas of “sustainability” and “green finance”. The following is an analysis of the class clustering coupling network diagram for the keywords handled by WoS.

The left part of the figure is the blue cluster represented by “green finance”, which includes “performance, policy, impact, economic-growth, perspective, CO2 emissions, emissions, economy,” and so on. This part is closely related to the green and yellow clusters, indicating that sustainability, environmental reform, green finance, corporate social responsibility and management are the basis and driving force to support the development of green finance. In addition, the key nodes of the blue cluster also indicate that

the development of green finance needs government support as well as the promotion of reform and transformation. The right part of the figure shows the red clusters with “sustainable development” as the main focus, including “renewable energy, policies, green bonds, finance, challenges, sustainable development goals, climate finance, governance, and investment. Challenges, sustainable development goals, climate finance, governance, investment”. The red cluster is closely related to the green, yellow and blue clusters, and is one of the largest parts of the group, indicating its strong influence and key linkage to the outside world.

The clusters in the middle and bottom of the figure are the green clusters with “sustainable finance” as the main focus, which include the keywords “innovation, corporate social-responsibility financial performance, climate-change, management, risk, social-responsibility, market, ESG”, indicating that CSR, financial reform, climate change and ESG play an important role in the field of sustainable finance. In the field of sustainable finance, CSR, financial reform, climate change and ESG play an important role, and the promotion of sustainable finance requires attention to climate change and ESG, raising awareness of corporate social responsibility and management, and continuous reform and innovation. In addition to this, the green cluster interacts with other clusters, indicating that sustainable finance cannot be separated from green finance and sustainable development, and that the continuous promotion of sustainable development, green finance and climate finance contributes to the development of ESG and corporate social responsibility.

In the middle part and running through the blue cluster is the yellow cluster which contains “sustainability, model, impacts, efficiency, indicators, energy, environmental performance”. It is an important bridge between the blue cluster and the red cluster, which indicates that the common denominator between green finance and sustainable development is “sustainability”. At the same time, the yellow cluster connects the green cluster, and key nodes on sustainability, energy and environmental reform are highly connected to nodes on green finance, corporate social responsibility and climate change.

### 3.3 Main Research Fronts: Countries

Figure 4 shows a network visualization diagram about countries, involving a total of 15 countries. The size and relative distance of the points in this figure indicate the degree of research and contribution of different countries to the topic or field, and the larger the nodes and thicker the lines, the more research, academic contribution and influence of the country. Meanwhile, the connection and trend of each node also feedback the cooperation and connection between countries.

According to the figure, there are four clusters, namely the red cluster represented by “People’s Republic of China”, the blue cluster represented by “Spain”, and the blue clusters represented by “India” and “Malaysia”. The green cluster is represented by “India” and “Malaysia”, and the yellow cluster is only represented by “Japan”.

In the middle of the graph, the most influential cluster is “People’s Republic of China”, indicating that the majority of researchers in this field are cited from the People’s Republic of China. The next most influential countries in the red cluster are the Netherlands, Italy and the United States. In addition, a relatively small percentage of countries are France, the United Kingdom and Sweden. As a whole, most of the other clusters that



**Fig. 3.** Map based on keywords plus co-occurrence network: visualization of clustering results

are more closely associated with the “People’s Republic of China”-based Red Cluster are from Southeast Asian countries.

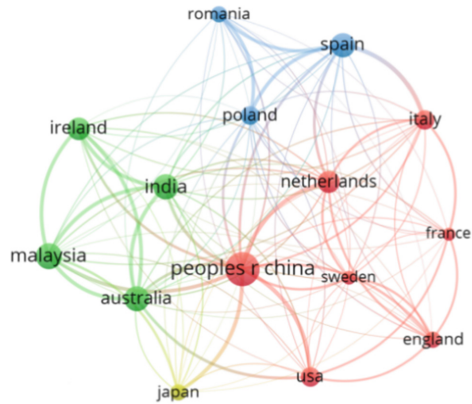
On the left side of the figure is the green cluster, which includes Ireland, India, Malaysia and Australia, as shown in the figure, where more scholars have conducted and contributed to research on topics and areas related to green finance and environment, social responsibility, corporate governance and sustainable development.

The top part of the figure shows the blue cluster containing the countries “Romania”, “Spain” and “Poland”, where the three nodes are similar in size, indicating that the articles from Romania, Spain and Poland have a similar number of article citations. In addition, these three nodes are interlinked with the red and green clusters, reflecting some commonality in the scope of the study.

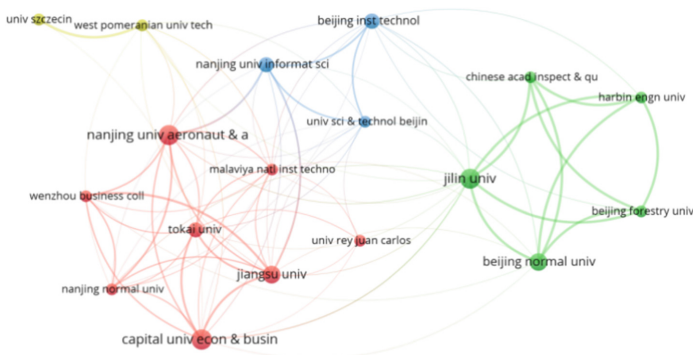
The yellow cluster in the bottom left of the figure contains only one country, Japan, which is also one of the smaller proportion and relatively less influential countries. This cluster is interconnected with the green and red clusters, and serves as an important bridge between “Australia” and “Malaysia” and “USA” and “UK”. It is an important bridge between “Australia”, “Malaysia” and “USA” and “UK”.

### 3.4 Main Research Fronts: Institutions

Figure 5 shows the visual analysis of the bibliographic coupling network regarding the core citation institutions. There are four clusters and 18 nodes in this visualization. Among them, the red clusters of “Nanjing univ aeronaut” and “Capital univ econ and busin” have the largest number of nodes, with 8 nodes. The next largest number of nodes are the green groups, mainly “Beijing normal univ” and “Jilin univ”, and also include “Chinese acad inspect and qu”, “Harbin engn univ”, and “Beijing forestry univ”. The smaller proportion of citations is the yellow cluster containing “univ szczecin” and “west pomeranian univ teach” and “Nanjing univ informat SCI”, “Beijing inst technol”,



**Fig. 4.** Former 15 countries. Bibliographic coupling network visualization

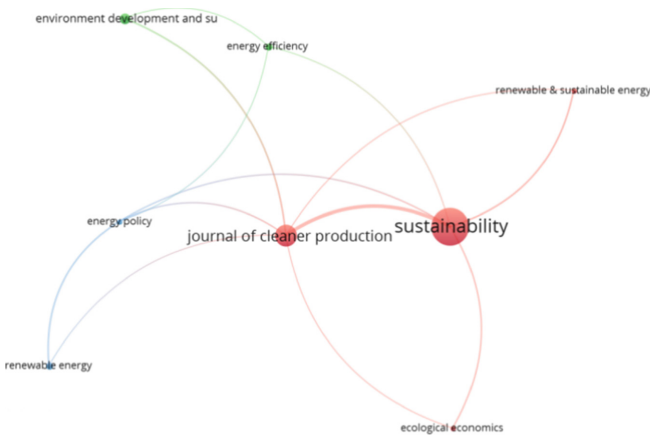


**Fig. 5.** Former Core citation organization. Bibliographic coupling network visualization

and “univ SCI & technol Beijing” in the blue cluster. From the above, it can be seen that most of the research institutions in this topic or field are from universities, and most of them are from developing countries, which indicates that scholars in developing countries are gradually paying attention to and focusing on research related to green finance, sustainable development and CSR, and also indicates that research in this field is promising and practicable.

### 3.5 Main Research Fronts: Publications

Figure 6 is a visualization of the bibliographic coupling network of core journal sources, and its analysis is beneficial to understand the relevant topics and directions. As shown in the figure, the main source journals are “Sustainability”, “Journal of Cleaner Production”, “Environment Development and Su”, “Energy Efficiency”, Energy Policy, Renewable and Sustainable Energy, Renewable Energy, Ecological Economics. Interethnic sources Most of the journals related to sustainability and new energy. Among them, “sustainability” and “Journal of Cleaner Production” have relatively greater influence and importance,



**Fig. 6.** Former Core citation sources. Bibliographic coupling network visualization

which also reflect their high referential value. The proportion of other green and blue groups is relatively small, but they are also key links that cannot be ignored in the scope of relevant topics.

#### 4 Conclusion

Through the above literature review, data processing and visual charts, it is intuitively shown that there is a diversified structure of intersection and penetration between green economy and sustainable development. Based on different research methods, this paper draws the following conclusions: (1) In the past five years, the scale of research related to green finance and ESG has been expanding globally, and both the number of publications and citations of related topics have shown signs of increasing year by year, especially reaching the peak in 2021. (2) The “sustainable development” as one of the most important of all nodes, has led to more green direction, in the financial sector, there has been a “sustainable finance”, “green finance”, “green economy”, “sustainability” and “sustainable development goals” and “ESG” environmental science and related discussion, proved in the global trend of sustainable development, Green finance and ESG are indispensable in the global trend, and have been paid more and more attention by countries in the financial field. (3) At present, developed countries such as the United States, Spain, Australia and the United Kingdom have relatively more research on this topic. Among developing countries, Malaysia and India also have a good performance. However, China has the largest number of research and the largest contribution, and most of them are concentrated in universities. This is mainly due to the advantages of China’s socialist system, leadership advantages at the national level and policy support at the social level. Although China’s study population accounted for the biggest, represented by the Chinese Academy of Sciences research institutions, according to China’s less developed countries research exchange with other continents, it affected the sustainable development of China as a global issue of research quality, Europe and other developed countries in the field of research is relatively close, show the group effect and relative



high quality research. (4) The development of green finance and sustainability is a long-term and arduous task. Countries around the world should strengthen cooperation to overcome the difficulties in the process of green finance development, so as to achieve mutual benefit and win-win, and realize the realm of “interdependent, with you in me” community of shared future for mankind.

In summary, sustainable development is the premise and goal of China’s economic and social development, and enterprise ESG and green financial management and decision-making are important driving forces to promote sustainable economic development. We on the basis of social science and financial data technology to explore green financial innovation such as the new infrastructure projects, build the environment for the nation and the world research, data driven green investment and sustainable financial system provides the value of innovative theory, will help future researchers better handle and explore related area, produce higher quality and more convincing results, Therefore, it has certain social practical significance.

**Acknowledgments.** This research was supported by the 2021 Guangdong Provincial Science and Technology Innovation Strategy Special Fund (“Climbing Plan” Special fund) (Project No.PDJH2021B0665).

## References

1. Transforming perceptions: ESG credit risk and rating [R]. Principles for Responsible Investment, 2019
2. Zhou Xinyi. A study on ESG index to contribute to sustainable economic development under green finance model [J]. China Business Journal, 2020(18):62-63.
3. Yan Huaiyan; Wu Qiufang; Wan Jia; Research on the current situation and prospects of green finance development in China [J]; Financial Economics; 2018(10)
4. Daniel J. Crichton, Chris A. Mattmann Alexander Bassen. ESG and financial performance: aggregated evidence from more than 2000 empirical studies[J]. Journal of Sustainable Finance & Investment, 2015, 5(4): 210-233
5. Ali Fatemi, Martin Glaum, Stefanie Kaiser. ESG performance and firm value: The moderating role of disclosure[J]. Global Finance Journal, 2017(38): 45-64
6. Eric. Cigu, MB. Petrisor, AC. Nuta, and Cigu. Elena “The Nexus between Financial Regulation and Green Sustainable Economy” Int.J.NAT RESOUR FORUM, 2012 (36): 233–236
7. Davies, Anna R., Mullin, and Sue J. “Greening the economy: interrogating sustainability innovations beyond the mainstream”, 2010 (11):793
8. Davies, Anna R., Mullin, and Sue J. “Greening the economy: interrogating sustainability innovations beyond the mainstream”, vol. 11, no.5, pp.793, Dec 2010, doi: <https://doi.org/10.1093/jeg/lbq050>

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

