A Bibliometric Analysis on Sustainable Investment in Financial Markets

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ABSTRACT

With the appearance of potential risks and benefits brought about by environmental, social, and governance factors, various industries are aware of the importance of sustainable investment. Undeniably, sustainable investing has become an important force for change in different industries, especially in financial markets. However, the current state of research in this field remains unexplored, with the specific research focus and the role of countries in economic globalization and sustainable development remaining undocumented. To address this issue, this article presents a bibliometric analysis of sustainable investments in financial markets using data extracted from the Scopus database. The study explores the current state of research on sustainable investing in financial markets and identifies potential directions for future research by analysing a total of 1,794 academic articles published in leading finance and sustainability journals between 1982 and April 2023. This analysis further examines the relationship between national academic collaboration and key research themes. Analysis of the results shows that the United States, China and the United Kingdom rank among the top three in the number of publications in the field of sustainable investment research. Developing countries such as China and India are also gradually increasing their attention in this field and gradually assuming corresponding responsibilities. The keyword co-occurrence analysis further highlights the vital role of the core concepts of "Investment", "Commerce", "Costs" and "Climate Change" and "Energy policy" in sustainable investment research and practice. The findings of this quantitative bibliographic analysis will be of significant value to researchers, policymakers and practitioners interested in sustainable investing and its role in shaping the future of finance.

JEL Classification: G11, G15

Keywords: Bibliometric analysis; Sustainable investment; Financial markets

INTRODUCTION

With the development of financial markets and the improvement of capital theory, traditional financial market companies have begun to invest a lot of resources and production factors in internal organizational management, corporate market investment and sustainable development, in addition to focusing on cost and benefit decision-making (Talan and Sharma, 2019). Sustainable investing, a broader and more integrated approach considering environmental, social, and governance (ESG) factors in investment decisions, has evolved from socially responsible investing (SRI) (Renneboog et al., 2008). Some scholars have emphasized the significant significance of the emergence of sustainable and socially responsible investment, which can provide feasible and effective solutions for enterprises from the perspective of economic, social and ecological issues in the investment and operation process (Ivanisevic-Hernaus, 2019; Richardson, 2013). As sustainability remains a key concern for investors, the development of sustainable investing practices is likely to continue in the coming years.

The traditional approach of maximizing investor interests is arguably not the golden rule for societal development. Many problems require solutions, and it is realised the traditional investment approach or concept does not always work well (Benoit et al., 2020). To cope with the issues, for example, environmental issues, child labour, and gender equality are expected to be alleviated. To elaborate further, the advent of industrialization led to significant changes in the economic structure and people's way of life. For instance, there was a substantial increase in the use of fuel, thereby having a profound impact on the environment, and greenhouse emissions have been a problem in reducing the negative impact of global warming. From the social perspective, firms are expected to take more responsibility in their business activities, for example, firms usually donate to those areas that suffered natural disasters which is not their legal responsibility. Moreover, many governments and organisations have already proposed schemes to promote the development into a new stage highlighting sustainability.

The financial industry's focus on environmental and ESG factors in the decision-making process also reflects the importance and academic research ability of sustainable investing. Against such a trend and the background of the environment, many literatures have emerged. Due to the ongoing development of sustainable investment, there are still many areas not fully investigated or still under debate. For example, issues such as what are the latest research topics on sustainable investing and the differences between different countries and regions in sustainable investing. In this context, bibliometric analysis is particularly important. Through this analysis, the research could systematically evaluate the status and future directions of research on sustainable investing in financial markets, thereby revealing research trends, main contributors, and key research topics. For example, issues such as what are the latest research topics on sustainable investing and the differences between different countries and regions in sustainable investing. In this context, bibliometric analysis is particularly important. Through this analysis, the research could systematically evaluate the current status and future directions of research on sustainable investing in financial markets, thereby revealing research trends, main contributors, and key research topics.

In order to enhance comprehension, analysis, and advocacy of sustainable investing within financial markets, this study attempts to evaluate, illustrate, and conduct a bibliometric analysis. Utilizing a comprehensive dataset encompassing academic articles published up to 2022, the research aims to scrutinize research profiles, discern trends, and illuminate areas of knowledge deficiency in sustainable investing within financial markets. This article employs bibliometric analysis methods to visually analyse sustainable investment in financial markets, identifying leading research countries/regions, active research participants, and promoting international cooperation. In addition, it attempts to address research questions such as the current state and future research directions of academic research on sustainable investment in financial markets, as well as the research interest and degree of cooperation between countries in sustainable investment in financial markets.

LITERATURE REVIEW

Growing recognition of sustainable investing has spurred research into its relationship with financial performance and the factors influencing investment decisions (Diouf et al., 2016; Eccles et al., 2013;

Ivanisevic-Hernaus, 2019). For example, the adoption of technologies like big data, machine learning, and AI, to analyse and identify sustainable investment opportunities is increasing (Vo et al., 2019; Kumar et al., 2022). The major current research trends in financial markets and the degree of academic cooperation between countries are yet to be visualized. In addition, with the development of green economics and the internet, green bonds, digital inclusive finance, and other products are gradually emerging in the financial market (Bhutta et al., 2022). These investments are used as fixed-income securities for supporting sustainable environmental development. Another theoretical background is that consumers and investors have paid more attention to responsible investment or the concept of social responsibility recently (Barman, 2018). Based on these papers, a clearer visual analysis is needed in financial markets, to better understand the factors that influence sustainable investment decisions and the implications of sustainable investing for business and the wider financial sector. Additionally, a more standardized and visualized bibliometric analysis of sustainable investment is of great research significance, which could promote sustainable investment decision-making to a certain extent (Chalissery et al., 2023; Koenigsmarck and Geissdoerfer, 2021).

From a practical point of view, the traditional approach to maximising the interest of shareholders to drive development is not a way to solve other social issues. For example, inequality of income, child labour, global warming, etc (Bolton and Kacperczyk, 2021; Fiaschi et al., 2020; Hall et al., 2019). This has been valued by governments, business entities, non-profit organizations, and other market involvers (Cubas-Díaz and Martínez Sedano, 2018). Investors embrace sustainable investment for its value proposition, and this is thought of as a strategy for reducing negative impacts from invested projects (Folqué et al., 2021). Because the core concept of sustainable investment is to enlarge the scope of factors to make decisions including traditional financial indicators, and ESG factors particularly (Talan and Sharma, 2019; Avetisyan and Hockerts, 2017). Moreover, factor integration is not only to influence individual investors with preferences in the value but also a trend to change the traditional market (Sahut and Pasquini-Descomps, 2015). From the regulation perspective, considering what they expect is more than economic value, they encourage market participants to act with their responsibilities beyond the legal requirements (Maltais and Nykvist, 2020). Based on this, some countries and areas have already issued guidance to companies to release their responsible reports Besides the guidance from regulations, some organizations have already made and improved standards to help enterprises communicate with one of the most important stakeholders, investors (Townsend, 2020). For instance, the Global Responsible Indicator (GRI) is a welcome standard which has been widely adopted by companies around the world (Dumay et al., 2010; Isaksson and Steimle, 2009; Fernandez-Feijoo et al., 2014). Also, more consulting companies provide services to support firms to better participate in the changing market. Additionally, some countries or markets have already promoted the level of this regulation to a mandatory level.

In recent years, some developed countries have already focused more on sustainability as well. For example, the USA has already proposed a scheme that claims to reduce greenhouse gas emissions to about half the level compared with the emission amount in 2005 (Saidur et al., 2010). The Federal government of the United States issued a plan to encourage sustainable development from nine dimensions with specific goals to ensure the successful transition of its economy. These acceptable dimensions are clean energy, clean vehicles, green buildings, supply chains, carbon emissions, climate-resilient infrastructure, climate and sustainable workforce, justice and equality, as well as good relationships, both domestically and internationally. In addition, the European Union (EU) expects to transform economic development into more green and sustainable conditions. For instance, to boost more and more financial resources to support the firms to participate in sustainability, the green bond is encouraged to be invested and utilised for the effectiveness and efficiency of the market in the EU (Directorate-General for Financial Stability, Financial Services and Capital Markets Union, 2021). Moreover, a sustainable finance strategy should be implemented within the EU Green Deal framework. Under this framework, actions including aspects of climate, environment and oceans, energy, transportation, agriculture, finance and regional development, industry, as well as research and innovation are expected to be involved broadly (Skjærseth, 2021). Furthermore, the tendency for sustainable transition is not only in developed countries but also in the emerging economies involved. As the leading developing country, China has put more effort into developing its economy for a sustainable future. The Chinese government issued the 13th Five-Year National Plan to push economic and social development with 169 targets in sustainability 018). From the claims of The World Bank, the considerations about ESG for long-term investhments are important in sustainable finance, and this is what regulators, investors, and asset

managers should embrace (Schoenmaker and Schramade, 2019). The foundation of the global sustainable program is based on four pillars, which are measurable natural capital, capabilities for decision-making with the natural capital, and research on sustainable finance in terms of risks, return, and income. Because sustainable investment is not mature enough, the related studies are still in the developing stage. Moreover, previous theories and evidence of sustainable investment were from developed economies, do they still work well in developing economies? Therefore, there is a need to look back at what has been done by researchers in sustainable investment to illustrate and summarise the studies. Doing so will help researchers understand changes and trends in the topic and find potential research directions, and bibliometrics research methods can just address this research need.

METHOD

Bibliometrics Analyses

Various research studies have been undertaken in recent times to investigate the link between sustainable investing and financial performance, and the factors that impact decision-making regarding sustainable investments (Campbell and Mínguez-Vera, 2008; Azmat et al., 2021). To gain a deeper understanding of the development of this field, bibliometric analysis has been used to explore the research trends and characteristics of sustainable investing studies (Eccles et al., 2013). Bibliometric analysis could help researchers to identify the most frequently cited articles, the most influential authors, and the most prominent research themes and trends (Tian et al., 2018; Goyal and Kumar, 2021). According to bibliometric analysis, many studies have focused on examining the financial performance of sustainable investments, (Oikonomou et al., 2012). Notably, a significant corpus of this research is dedicated to exploring the financial outcomes of sustainable investment, emphasizing the banking sector, which can be seen as an indicator of wider market trends. Some research has investigated the role of sustainability reporting and corporate social responsibility in sustainable investing (Buys et al., 2011; Buallay, 2019). However, a comprehensive systematic review and visualization of the literature are still lacking.
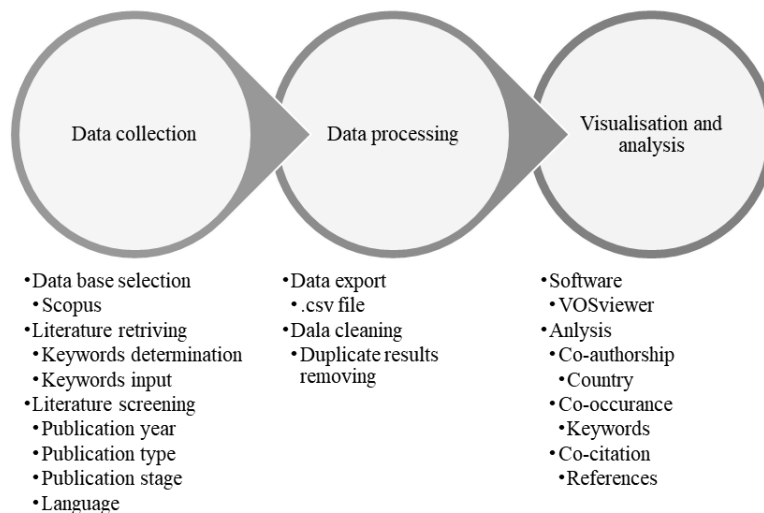
Figure 1 The Research Framework

Building on the established background, this paper aims to conduct a comprehensive and visual analysis of sustainable investment within the entire financial market, with a focus on identifying potential research gaps and opportunities. In addition, the specific research framework is as shown in Figure 1, aiming to identify the leading academic countries and the differences in their direct academic development in the field of sustainable investing by analysing publication patterns, citation networks, and collaboration patterns of articles. It also attempts to reveal the main research themes, gaps, and emerging trends in sustainable investment research in the financial market.

Sampling Procedures and Data Collection

The Scopus database, a leading platform for bibliometric research, serves as the primary source for this study's data. It offers a comprehensive collection of peer-reviewed academic publications, including journals, book series, and business magazines (Supriadi et al., 2022). Not only the coverage of academic publications is large, but also the quality is ensured by screening and selecting the publications that are peer-reviewed (Khudzari et al., 2018). Thus, compared with other literature search databases, Scopus provides more comprehensive journal coverage and frequent updates, as well as unique citation analysis tools, which may be more suitable for the academic research needs of bibliometrics.

Following the selection of Scopus as the data source, the study retrieved and exported bibliometric data for subsequent analysis. The search keywords were "sustainable investment" and "financial market". It is worth mentioning that considering the incompleteness of the search result data in 2023 which has not yet been updated and synchronized, the data exported during the preliminary screening of the data will end at the end of 2023 April for further screening and bibliometric analysis. In addition, to better get the analytic results, given the consistency of languages in articles, the bibliometric archives contain only those journal articles written in English. Based on this preliminary screening criteria, 1922 results that meet the criteria are exported as CSV files. Subsequently, the study deleted 47 unpublished articles that were in progress. At the same time, considering the uniformity of the retrieval language, this study only focuses on literature published in English, after excluding other languages, and checking the DOI and title column to delete duplicate articles. Finally, this study obtained data information from 1794 articles that met the data collection criteria, which can be used for bibliometric analysis by Vos viewer software.

RESULTS

The data analysis employs five key techniques, namely co-authorship, co-occurrence, citation analysis, bibliographic coupling and co-citation analysis. The specific units employed for each technique are detailed in Table 1. This study focuses on the countries, where the authors are from or working, to investigate the co-authorship. Co-occurrence analysis, another crucial technique, explores the relationships between keywords. This analysis incorporates all keywords (user-defined, author-assigned, and indexed) to reveal three distinct keyword relationships. In citation analytics, this study explores the linkages among published articles in sustainable investment by citation in units that are respectively the document and countries levels. Besides the other two analyses of co-authorship and citation in countries, this research also conducts bibliographic coupling analysis to explore the relation among published articles with the same research work in countries. Additionally, a cited authors analysis is done to explore the co-citation among authors.

Table 1 Units of Data Analytics

Type of analysis	Analysis Object
co-authorship	countries
co-occurrence	all keywords, author keywords, index keywords
citation	document, countries
bibliographic coupling	countries
co-citation	cited authors

Database Analysis

Over the past four decades, growing interest in sustainable investment is evident in the increasing number of publications in this field (Figure 2). The number of articles has risen steadily since 1982, with a sharp acceleration after 2005. In particular, since 2010, there has been a dramatic surge in publications on sustainable investment, indicating that this field is currently experiencing a rapid growth phase. This reflects the significant increase in public awareness of climate change since 2005 and the milestone in 2010 when many countries began to implement policies to support the Sustainable Development Goals (Sachs, 2012). These changes in social cognition laid the foundation for the development of this field in the financial market.Based on the previous data and tendency, it could be inferred that the publication trend for the year after April 2023 remains positive. This indicates high academic interest and ongoing research activity in the

field. In this regard, the results highlight the importance and potential research gaps related to sustainable investing, suggesting potential areas for further research.
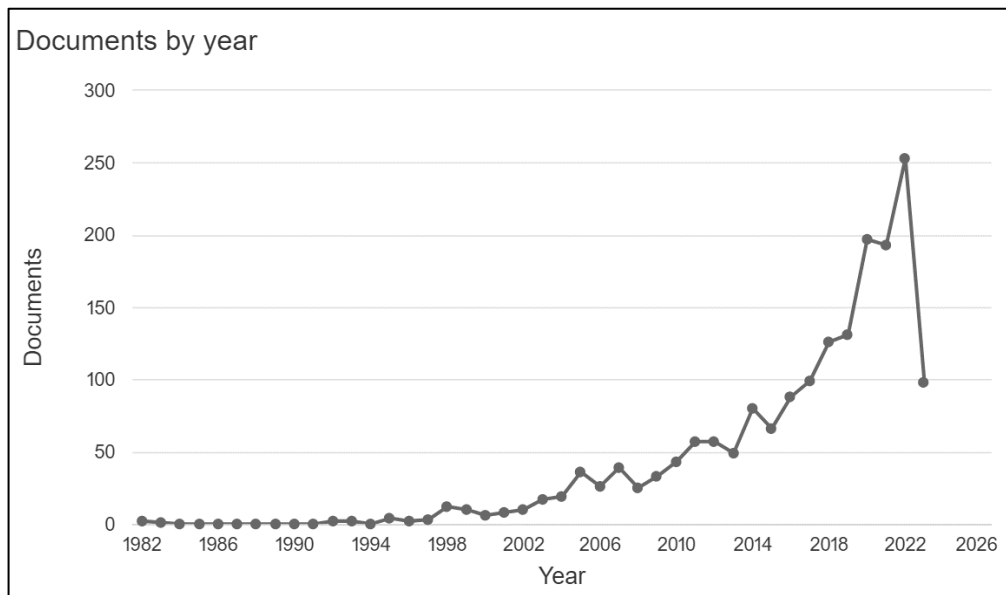
Figure 2 Trend of Publications by year on Sustainable Investment in Financial Markets (1982-2023)
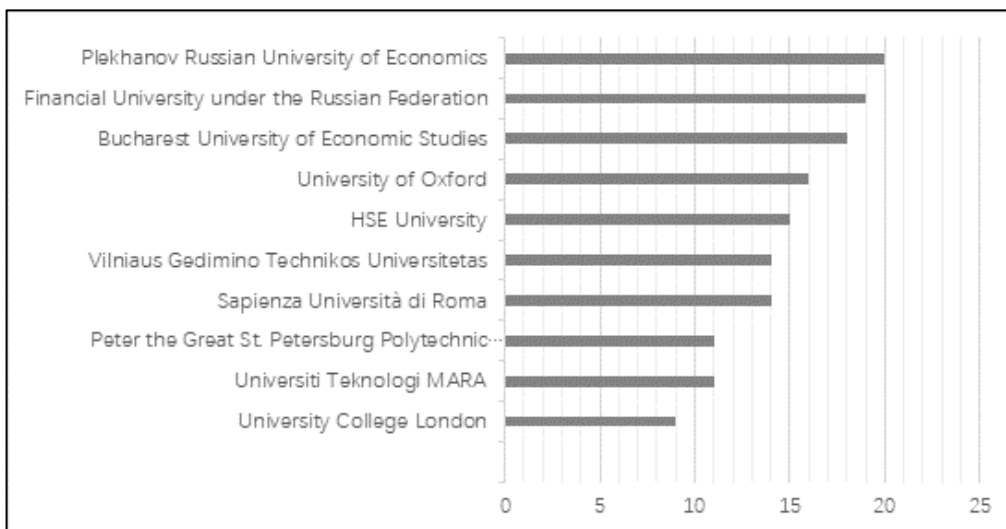
Figure 3 Top Ten Institutions by Number of Publications(1982-2023)

An analysis of sustainable investment research publications from 1980 to April 2023 reveals the top ten most productive institutions (Figure 3). This growth reflects the increasing importance of sustainable investing in financial markets and its rising prominence within academia. Figure 4 shows a pie chart of the distribution of different disciplines within a field. From this chart we can see that sustainable investment research is a multidisciplinary field, including business, management and accounting (16%), economics, econometrics and finance (15%), environmental science (14%)), social sciences (14%), and so on. Multidisciplinary knowledge integration means that this research field involves knowledge and methods from multiple disciplines, and also requires experts from different fields to collaborate to share knowledge and develop new solutions. For example, knowledge from business and management disciplines can help understand how businesses operate economically sustainably, while environmental science can provide a deep understanding of ecological impacts.
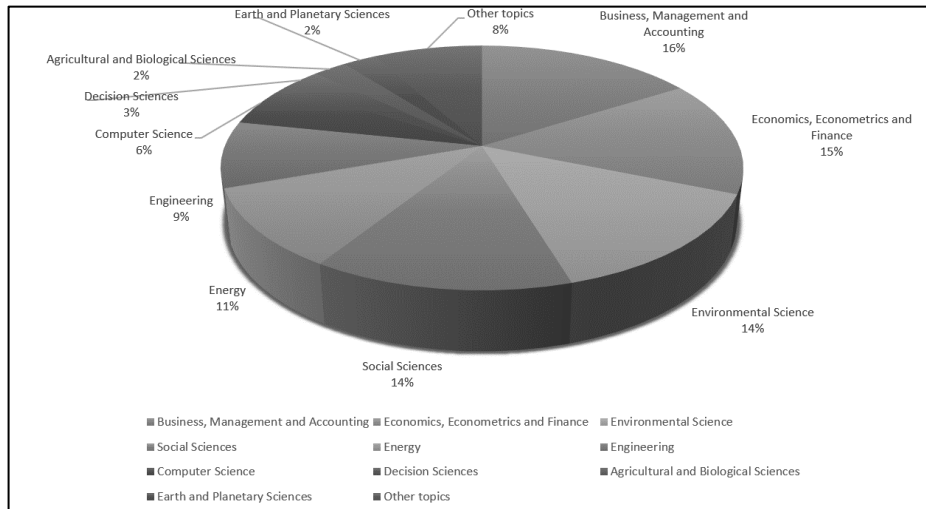
Figure 4 Published Journal Articles by Related Study Fields (1982-2023)

Bibliometric Analysis

This bibliometrics analysis is based on 1794 research papers on sustainable investing in financial markets retrieved and screened from the Scopus dataset. To provide an intuitive visual overview of the literature, the VOSviewer software was used to perform bibliometric analysis and create visualizations. With this approach, the research field of sustainable investing is analysed more systematically and comprehensively and attempts to reveal important patterns and endogenous relationships in the dataset. Distinct colours are utilized to distinguish different keyword categories or clusters, while larger circles mean that the keyword appears more frequently, and the connecting lines reflect the correlation and strength between keywords (Zhu and Hua, 2017). The overlay visualization of sustainable investment in the financial market is shown in the figure below. The specific bibliometrics analysis will be carried out based on Co-authorship (Country) and Co-occurrence (All keywords). Co-authorship analysis is the most effective method to identify patterns of scientific research collaboration, assess the structure of the academic community, and explore potential collaborative relationships (Patel et al., 2019). Keyword co-occurrence analysis intuitively reflects the evolution of knowledge links and research topics in academic fields (Zhao et al., 2022). These methods are the most representative analytical methods and are consistent with the objectives of this study.

Figure 5 Overlay visualization of Sustainable Investment in financial markets

Co-authorship (Country)

To gain a deeper understanding of the current state of sustainable investment in the financial market, assess the extent of scholarly collabor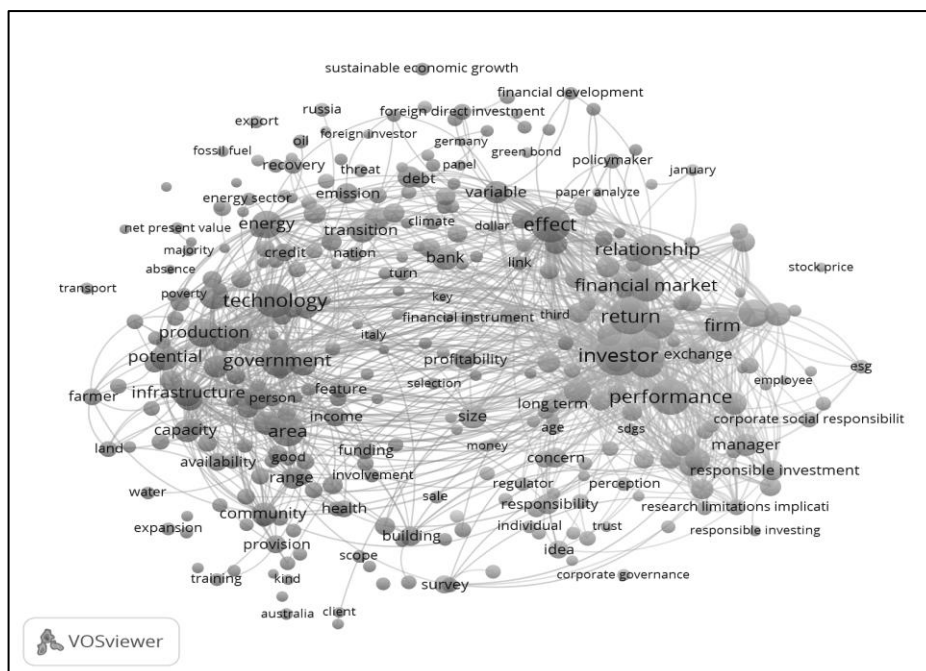ation, and identify influential countries in this field, a co-authorship (country) analysis was conducted. Co-authorship analysis by country, a recognized bibliometric technique Dolhey (2019), is used to investigate research collaborations and identify countries with leading scholars in a particular field (Guleria and Kaur, 2021; Wu et al., 2021). This approach involves analysing co-authorship patterns among scholars from different countries.

As shown in Figure 6, the co-authorship analysis reveals that 63 countries have participated in sustainable investment research within the financial market. The United States (265 papers), China (198 papers), and the United Kingdom (171 papers) are the three most productive countries. Table 2 details the co-authorship networks formed across these countries and highlights significant disparities in interactivity between them. Notably, the bibliometric analysis results show strong connections in sustainable investment research among countries with mature academic development, such as the United Kingdom, the United States, and China. Conversely, academic exchange among co-authors from other countries appears to be relatively limited. This finding suggests potential areas for future collaboration and broader transnational academic exchange in this field.

The analysis further shows that developed countries, such as the United Kingdom and the United States, initiated research on this topic, while other countries, such as China, Iran, Pakistan, and Saudi Arabia, have since carried out research and development in this field. Consequently, future research on sustainable investment in financial markets should prioritize enhancing cooperation among scholars and promoting broader academic exchanges in transnational fields.
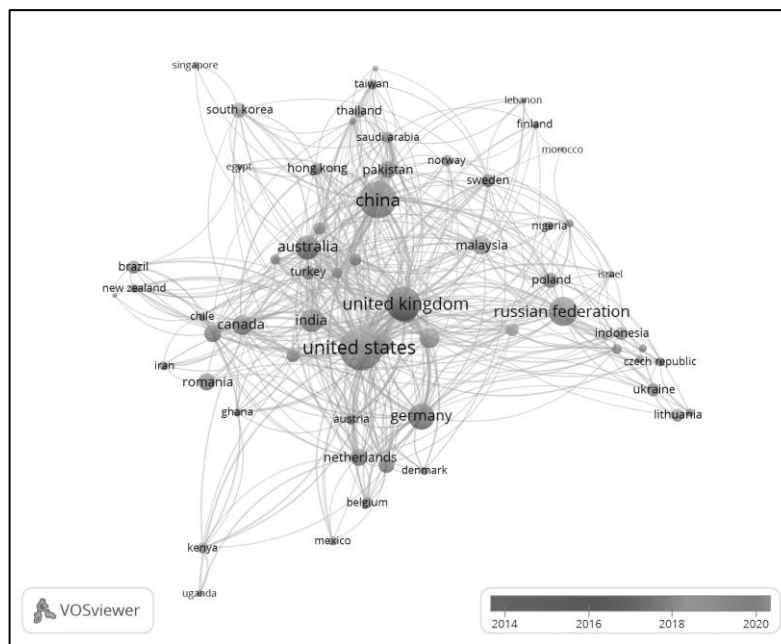
Figure 6 Co-authorship analysis of sustainable investment in financial markets by country

Table 2 Co-authorship analysis results of sustainable investment in financial markets

ITEM	CLUSTER	LINKS	TOTAL LINK STRENGTH	DOCUMENT	AVG.PUB.YEAR
United States	5	50	182	265	2014.05
China	2	43	150	198	2019.82
United Kingdom	7	45	165	171	2015.78
Russian Federation	1	19	29	119	2019.12
Germany	7	27	86	95	2016.08
Australia	2	29	68	81	2015.96
India	3	31	47	79	2019.04
Spain	9	27	56	61	2017.90
Malaysia	1	23	51	52	2018.27
Pakistan	2	23	60	41	2020.37
Poland	1	16	22	34	2019.59
Iran	3	7	10	14	2020.21

Co-occurrence (All keywords)

Co-occurrence keyword analysis refers to the use of keywords obtained from bibliographic data on related research topics to indicate the relationship between these two keyword concepts (Bornmann et al., 2018; Koenigsmarck and Geissdoerfer, 2021). In order to explore the common theme of sustainable investment in the financial market, this study conducted a co-occurrence analysis of all keywords, extracted a total of 9251 keywords, set the minimum co-occurrence number of keywords in VOSviewer to 5, resulting in 672 keywords meeting the threshold that meet the threshold and are put into the 9 clusters accordingly. The most frequently found keywords are sustainable development (644 occurrences), investments (614 occurrences), and commerce (278 occurrences). Details of other keywords are shown in Figure 7 and Table 3.

Table 3 shows that sustainable development, investment, and commerce are the three most frequently used keywords in the literature in this field. This finding is logical. Firstly, sustainable development is the overarching goal of sustainable investing, and thus is a fundamental concept in this field. Secondly, investment is a key aspect of sustainable investing, as the allocation of capital towards sustainable investments is a critical mechanism for promoting sustainable development. Finally, commerce is also an important aspect of sustainable investing, as it involves the integration of sustainability considerations into business practices and decision-making processes. Overall, the frequent use of these keywords in the literature reflects the central role of sustainable development, investment, and commerce in sustainable investing research and practice. The analysis of frequently occurring keywords revealed that sustainable investment in financial markets is not only influenced by social and government policies, but also significantly impacted by internal and industry-specific factors. Additionally, macroeconomic considerations such as costs, environmental and organizational management, innovation, energy (policy and efficiency), financial resources, and economic growth emerged as prominent themes. It is worth mentioning that in the keyword co-occurrence analysis, the frequency of occurrence in China, India and other developing countries is also relatively high, which shows that this field has received a certain degree of attention in the academic circles and practices of developing countries.

Figure 7 Co-occurrence analysis of sustainable investment in financial markets

Table 3 Part of frequently co-occurring keywords

ITEM	CLUSTER	LINKS	TOTAL LINK STRENGTH	Occurrence
Sustainable development	4	653	5659	644
Investment	4	622	5885	614
Commerce	4	530	2757	278
Financial markets	4	390	1710	185
Costs	2	361	1141	107
Climate Change	2	353	902	96
China	1	299	739	76
Energy policy	2	287	820	65
Energy efficiency	6	254	646	61
Stock market	1	246	621	60
Environmental management	7	228	488	44
Risk management	4	194	408	45
Organization and management	3	106	220	18
Gas emissions	2	125	270	22

DISCUSSION

This study conducts a bibliometric analysis of sustainable investing in financial markets by extracting textual and bibliographic data from the Scopus database. With the industry and academic development in this field, the number of relevant research literature is also increasing accordingly, and bibliometric analysis intuitively and systematically presents the research status in a visual form. In addition, this study also clarifies the current research status of sustainable investment in financial markets through many documents provided by the Scopus citation website, providing strong academic support for guiding the current academic development path and identifying potential future areas. For example, the United States and the United Kingdom were the first to start research in this field, and relevant academic analysis is in a leading position. In recent years, China has also increased its attention and research in this field. Co-authorship analysis of countries also reflects the academic status and differences of countries. According to Li et al. (2023), transnational cooperation between scholars can promote and accelerate research progress and achievements to a certain extent, reduce research costs, and improve research. the academic efficiency of researchers. Therefore, it is necessary to strengthen cooperation and exchanges between countries to provide strong academic support for promoting the development of sustainable investment in financial markets, and to contribute to constructing a theoretical framework in this field.

Considering the academic differences between countries and the degree of academic exchanges between countries, the analysis in this paper also clarifies the direction and importance of academic exchanges. This provides a corresponding reference value for whether to strengthen cooperation and exchanges in this field in the future. Meanwhile, after keyword analysis, this study clarifies high-frequency keywords, and proposes specific directions for consideration of internal and industrial policies and macroeconomic conditions, which further promotes specific future research directions under this study and has specific practical reference significance. Apart from these, the results of this analysis have important implications for policymakers, investors, and researchers. Policymakers can use this information to develop policies that support sustainable investment practices and encourage collaboration between countries and institutions. Investors can use this information to make more informed investment decisions and identify emerging trends in the field. Finally, based on these bibliometrics results, researchers can be used to identify gaps in the literature and provide guidance for potential directions of future research to address key challenges of sustainable investing in financial markets.

CONCLUSIONS

A bibliometric analysis of sustainable investment in financial markets was conducted in this study. The results offer valuable insights into the current state of research within this field. Co-authorship analysis reveals that the United States, China, and the United Kingdom are leading producers of research publications, reflecting their prominent academic standing and research contributions in this domain. Furthermore, developing countries such as China and India are demonstrating a growing attention to sustainable investment, highlighting its increasing significance in both academic and practical spheres within developing economies. The keyword co-occurrence analysis further underscores the critical role of core concepts such as "Investment," "Commerce," "Costs," and "Climate Change" in sustainable investment research and practice.

It is important to acknowledge the limitations of this study. First, reliance on the Scopus database may have resulted in the exclusion of relevant literature, particularly regional research not indexed by Scopus. Second, co-authorship analysis may not fully capture informal academic exchanges and collaborations, such as unpublished results of cross-border research projects. Additionally, this study employed descriptive statistics, co-authorship analysis, and keyword co-occurrence analysis. Future research can benefit from incorporating additional methodologies for a more in-depth exploration of this field.

Despite these limitations, the results of this study hold significant value for policymakers, investors, and researchers. Policymakers can leverage this information to formulate policies that support and adapt sustainable investment practices, while encouraging collaboration between countries and institutions. Investors can utilize these findings to make more informed investment decisions and identify emerging trends within the field. Finally, researchers can build on these results to identify gaps in the literature and inform

potential directions for future research endeavours, ultimately addressing key challenges in sustainable investing within financial markets.

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