

# Green Financing an Immediate need for Sustainable Development: A Systematic Literature Review using Bibliometric analysis

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## ABSTRACTS

Green financing has been gaining popularity over the recent years. This term is used for the arrangement of funds or financing of environmental and sustainable development related projects. Green financing is emerging as a public policy instrument, and numerous research articles have been published in the last decade on green financing and sustainable development. The goal of this paper is to examine the evolution of green financing or sustainable finance, as well as the trend of research topics, using a systematic literature review. To achieve the study's objectives, we conducted bibliometric analysis (keyword co-occurrence, co-citation authors, and source analysis), and data were collected from the SCOPUS database and analysed for articles published between 2010 and 2022. We used Vosviewer and R-Biblioshiny software for this purpose and found some key literature and prospective research areas on green financing. At last we concluded our study with some broader areas of green financing related to sustainable development, identifying research gaps and future directions.

*Key words:* Green financing, Sustainable finance, Climate change, Sustainability, Co-citation, Co-occurrence.

## Introduction

Development at the expense of natural destruction may jeopardize humanity's ability to survive on the planet. This makes sustainability, the most integral part of the development process, regardless of its form. According to a recent United Nations research, the planet is on course to warm by more than 3 degrees celsius by the year 2100. Severe weather and rising sea levels may cause harm to some assets, while others may lose value. As world is aiming towards low carbon economy, the concept of sustainable financing comes into scene. To re-

verse biodiversity loss by 2030, humanity will need to invest an additional \$ 600-800 billion each year. Furthermore, achieving all the Sustainable Development Goals will cost an additional USD 2.5 to 3 trillion every year. So, how can sustainable finance assist in filling these huge financing gaps? What is the source of this money? Banks, businesses, institutional investors, central banks, international financial organizations, and green funds are the six primary categories of sustainable financiers. In a research Matolcsy (2020) highlights that competitiveness and sustainability are inseparable concepts as both are long term concepts and by using resources

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in 'greener' manner, global competition can be achieved. Further, the importance of data was highlighted as it is one of the most important resources in current scenario.

Many financial experts predict that when the COVID-19 pandemic shakes up the global economy, sustainable investing becomes the new norm. The Earth is now warmer than it has been in at least 12,000 years. In the last 20 years, almost half a million people have perished as a result of climate-related natural disasters; the globe is also undergoing a mass extinction that might wipe out over a million species in the next decades; and the loss of biodiversity is already proving costly to humanity. Food, clean water, electricity, and carbon sequestration are all provided by functioning ecosystems. According to the European Union, finance, not only promotes economic progress, but also takes into account what is known as ESG, or environmental, social, and governance concerns. Things like greenhouse gas emissions, biodiversity loss, pollution, and water usage are all environmental factors. Human rights, inequality, labor relations, and health and safety are all social factors. Finally, CEO compensation, openness, board independence, and shareholder rights are all aspects in corporate governance. These environmental, social, and governance (ESG) characteristics distinguish sustainable finance from conventional financing. Sustainable finance is a relatively new concept. The concept of green finance was born under the sustainable development. In 2007, the world's first green bond was issued. Since then, though, the industry has grown at a rapid pace. A total of \$554 billion in sustainable bonds were issued globally in 2020, more than double the amount issued in 2019. Versal and Sholoiko, (2022) studied the green projects by the World Bank (WB) and the European Bank for Reconstruction and Development (EBRD) and noticed a positive trend in the issue of green bonds in the volumes which indicates supportive thinking of the WB and EBRD, despite the shift in emphasis caused by COVID-19.

Sustainability is a global concern, Tolliver *et al.*, (2021) states that green innovation and green finance are two key components of sustainable development. They further said that due to risk-alleviating feature and social responsive appeal has made green bond predominant in green finance. Verdolini *et al.* (2018) in their research recommended that the G20 should target innovative green technology

SMEs for financial de-risking which could be achieved by creating signals for private investors through creating a proper reporting system, using public funds and inclusion of SMEs while designing green finance platforms. Bak *et al.* (2017) conducted a descriptive study for proposing a policy package of low-carbon growth stimulation through steep increase in sustainable infrastructure, mobilizing sustainable finance and adoption of carbon pricing to simultaneously achieve the objectives of the Paris Agreement and the SDGs. Saha *et al.* (2022) concluded that in OECD countries gender inequality is a major social issue which impedes full potential of green financing of eco-innovations. Thus a more gender inclusive policy is needed to be reframed. Chen *et al.* (2021) studied about emission trading and emission right-backed lending mechanism under green financing mode and how it enhanced sustainability. The study shows that this financial tool meets the dual objective of profit and sustainability. Quang and Thao (2022) highlights the importance for ASEAN countries to achieve SDGs through green financing. But the main result of their study demonstrates short-term negative impact of green bonds on energy intensity.

On the other side, Lee, (2020) explored the role of green finance in achieving sustainable development goals based on China, and suggested that it is high time for leveraging rising pressure on companies and investors towards sustainability although the main challenge of increasing private investment remains the same. Green financing is the recent trend in the financial arena. The financing of a green project is known as green financing. So, what is the definition of sustainable finance? Sustainable finance, often known as green finance or ESG finance, refers to investment decisions that consider the long-term environmental impact rather than merely financial gains. Ryszawska (2018) mentioned that transition to green economy means conversion (evolution) from the existing model of economy towards one based on increased social and environmental responsibility.

There are a number of instruments that can aid with climate finance. Djukic and Ilic (2021) state that green investments is new approach to investing money and is a part of green economy they contributes to the sustainable development concept, further they also suggest practices to be adopted by less developed economy. Sustainable investment is divided into seven categories by the European Sus-

tainable and Responsible Investment Association. The most practical and used tool of green financing is Green Bonds. Green bonds are a type of debt bond that is offered by public or private organizations for environmental reasons, such as combating climate change. Then there are Concessional Loans, which are a type of simple loan granted for climate control activities with a longer repayment time and low interest rates. Finally, grants and donations to combat climate emergencies are available. International financial institutions can aid in the scaling up of green investments by issuing green bonds, experimenting with new financial approaches, and persuading policymakers to support green projects more. Climate change, biodiversity loss, and other environmental challenges are addressed by green funds, which are multilateral funds.

There exist plenty of research to highlight the significance of green financing for achieving SDGs. Dmuchowski *et al.*, (2021) highlight that due to high level of environmental problems, there is an increased need for green and/or sustainable investment by local governments in Poland but for this, there are hurdles like private sector low involvement, regulatory and fiscal barriers and inability of local governments to provide effective currency hedging. Recently, Madaleno *et al.* (2022) in the research exhibits that clean energy caused by green finance is less evident, except in specific periods, especially at the start of the pandemic and for this reason, green finance investments are promoted and proportionated by the need for clean energy.

Morningstar recently discovered that over the last ten years, sustainable funds have outperformed typical funds, particularly during the COVID-19 epidemic. Investors are beginning to see the advantages as well. Storebrand, a Norwegian asset manager, for example, divested from major oil and mining businesses in 2020 due to their opposition to climate action. Another campaign that investors started and is still going on is Climate Action 100+, which includes 289 investors and about 33 trillion dollars in assets and is trying to collaborate with firms who are big polluters of GHGs. Banks, on the other hand, continue to lend trillions of dollars to businesses like fossil fuels, mining, and agribusiness, which contribute to climate change and biodiversity loss. However, if banks want to move beyond ESG and look into impact investment or need assistance financing sustainable development, they have two further choices to consider: (1) GIIN (Global Impact

Investing Network), a non-profit organization with 280 members dedicated to advancing the impact investment business. (2) The Global Alliance for Banking on Values is a non-profit organization comprised of 63 financial institutions with the common goal of using finance to achieve sustainable development.

Akomea- Frimpong *et al.*, (2021) advocates that concern for environmental protection and sustainable development has led researchers and policy makers to focus on green finance. According to the World Bank Report, the infrastructure development, construction, power, and transportation sectors account for more than 70% of global Green House Gas emissions. Green finance also does not guarantee full success of projects but also helps to win confidence of general public at large. Soler- Dominguez *et al.* (2021) studied the performance of 3920 mutual funds based on LCD scores and concluded that there exist difference in performances based on investment areas and scores and also mutual funds with high consideration for sustainability were found to be better in financial performance. Investors, fund managers, and financial regulators are becoming more aware of the restrictions and accounting treatment of green projects. Wu *et al.*, (2021) reveals that 1% rise in Green financing index improves the environmental quality by 0.375% in G7 countries and by 0.3920% in E7 countries. Overall, sustainable finance must progress beyond negative screening, with much more money going towards truly green projects such as sustainable land use, biodiversity, and renewable energy.

### Background of the topic

Substantial effort has already been made in the direction of green financing, still much more is needed to be done. Being an emerging financial concept, there is no universally accepted definition of Green Finance. Zhang and Wang (2021) states that green finance development is the system which evolves with the interaction of economic, environmental and financial activities. Many authors have emphasized the need for green financing. Dörry and Schulz (2018) in their explorative research tries to identify linkage between Finance industry and local businesses that are leading towards sustainable economic practices. They also propose a critical review of existing and novel prudential approaches to incentivizing the de-carbonization of Banks' Balance Sheet since there is no "one size- fits- all" approach

to greening the financial system. Cui *et al.*, (2020) illustrated the importance of achieving sustainability and balanced development for green finance. Guild (2020) states that the awareness regarding the sustainable development, is the driving force behind nascent green finance sector. Moreover, in emerging market it is more challenging to structure the green financing rather than raising capital for green projects.

Andreeva *et al.*, (2018) bring out leading practices in green funding which includes green projects' funding, funding of green companies, subsidization, credit, tax expenses, Target budget funding and private green project's funding, while financial tools to achieve this includes Green bonds, Green state procurements, green insurance, green mortgage, green funds and green taxes. Later, Torrenova and Gónez (2021) states that sustainability has become one of the hottest discussion subjects now a days also the consideration of ESG factors into economic decisions represent reality rather than just a fashion. Tay (2021) explored a two way relationship between trade and environment and said that new measures are being applied to environmental issues which includes carbon taxes, subsidies, and development of green finance. Earlier, stating the importance of green finance, Cui *et al.* (2020) state that its development helps people to tackle climate change, ecological crisis, and energy security problems and the current research finding are in parity with others which justifies that green finance system has positive impact on sustainable development and there is need to strengthen government regulation.

Recently, after the outbreak of COVID-19 pandemic, an upward trend in green financing has been noticed. Khan *et al.* (2022) state that COVID - 19 Pandemic has accelerated the process of the green energy transition and in bibliometric analysis it was found out that China gained a prominent place in publishing topic related articles. In a prior study, Wu *et al.* (2020) noticed an upwards trend in penetration of Electric Vehicles in Greater Bay area of China which will positively contribute towards energy sustainability and future green finance projects. Li *et al.* (2022) also based their study over China from 2015-2020. The outcome of their study shows that Green Finance (in form of Green Bonds) and Green regulations including environmental taxes play a significant and positive role in promoting investment in renewable energy sources. They recommended that Green Firms in China should be pro-

moted as a long- term strategy.

There are various studies conducted in different time horizons over various countries. Ng, (2018) tries to articulate green financing system in the Hong-Kong, which is the global financial center of China (GFCC), the study suggested that adoption of international standards gradually coerces regulated firms to report on sustainability and a more dynamic green bond issuance system is needed as per international capital market. Lavrikova *et al.*, (2021) researched the Russian economy and it was found that in-spite of green transformation, not all region are ready to embrace sustainable development. Afzal *et al.*, (2021) based their study on data collected from 40 European countries from 1990 to 2021 and concluded that financial development has a negative relationship with environmental degradation. Earlier, Falcone *et al.*, (2018) studied the Italian Green Finance niche for identifying actors which pushes Italian financial sectors towards becoming greener and albeit if no apposite policy interventions are undertaken, such inadequacy could jeopardize the development of green innovation. Semenovva *et al.*, (2020) using regression model, finds out that with increased investment in fixed assets aimed at environmental protection and rational use of natural resources by 1 million rubles, Russian's GDP will increase by 0.1 billion rubles and increasing current environmental expenditure in organization by 1 million rubles will raise Russian GDP by 0.3 billion rubles. While in some other research based on Russia. Afanasiev and Belenchuk (2021) illustrated the importance of green budget in Russia for implementation of Paris Climate Agreements. Altunina and Alieva (2021) highlights the need for National Green Finance Model for ensuring sustainable growth in the Russian Federation.

Yu *et al.* (2019) figured out that increase in public attention has paid towards sustainable development and in Mainland China; government plays a leading role in launching green education and sustainable development. Zhang and Wang (2021) by applying PSR (Pressure-State-response) model, and entropy weight method, a horizontal comparison and vertical trend of green finance development was analyzed in different parts of China from 2004 to 2017 and it was found out that sustainable energy development can be promoted by promoting green finance. Harlan (2021) in a review article argues about "greening" of the China's ambitious Belt and Road Initiative and found out that in high income coun-

tries, low- carbon investments is mainly concentrated while low income countries is currently risk mitigation stage. Wang and Wang (2021) state that Green Finance development is essential for ecological civilization and in industry- wise study over Chinese economy, it was shown that correlation between green finance and output value is highest in tertiary industry followed by primary and secondary industry. Sheng (2020) states that China is at the edge of addressing climate change and sustainable infrastructure. Wang *et al.* (2022) found that there is negative correlation between the overall national green finance and eco- efficiency, but the impact of FDI on China's regional eco- efficiency is generally positive. Sun and Chen, (2022) Green finance is important for adjustment of China's energy consumption structure. Zhou *et al.*, (2022) in their study based over China, analyzed the relationship between ESG performance, financial performance and company's market value using linear regression model and mediating effect model and it was found out that ESG performance can improve market value of listed company.

The role of green bonds as a tool for green financing cannot be underdetermined. The Luxembourg Green Exchange, a subsidiary of the Luxembourg Stock Exchange, is the world's first and foremost platform for green bonds and other sustainable investments. But how do investors know whether potential investments are compatible with their values? Integrating ESG parameters into investment decisions is one of the most common strategies. Jia, (2022) based on example from the People's Republic of China, the Russian Federation and the USA , suggested that today green finance has not yet demonstrated a tangible effect in these countries and the green bonds are most prominent tool of Green Finance. Barua and Chiesa (2019) studies the factors which has influenced over supply - driven green bond market using global database from Bloomberg for 8 years and found that the factors which affect green bond supply are large in number but many of the effects are not long lasting and also no supporting evidence was found for increase in average issue size in the recent years. Bonds with high grade investment rating show a relatively low size of financing compared with others. Sinha *et al.* (2021) states that although green bonds have attracted industrialists and policymakers, still the level of impact it has is difficult to be confirmed. Further, it was empirically find out by them that green financing might

have gradual negative transformation impact on environmental and social responsibility. Laborda and Sánchez- Guerra, (2021) studied the effects of green bond issues on Companies share's price and finds out that green bonds has positive reaction in the market by increasing the return on shares of green bond issuing. Recently, Wang *et al.* (2022) state that there is limited study in the field of green bond market and especially in forecasting future trends. They concluded that in China Market, CEEMDAN-LSTM is most accurate model in green bond index forecasting. Later, in a research, Jain *et al.* (2022) bring out that with limited source of finance, green bonds provides an alternative and innovative market for green financing. Yuan and Gallagher (2018) bring out the fact that in Latin America and Caribbean region there is a gap in financing of climate change and the development banks are not playing their role in full potency. The outcome of research also shows that increase in supply of green financial funds can result in increase in composition of green financial flows in host country Balance sheet. In a study, Tu and Dung, (2017) it was found out that development of Green Banking is an inevitable trend for the commercial banks in Vietnam and currently, there is need of government supportive role. Khan *et al.* (2022) in their study highlights the importance of Asian Development Bank in adoption of United Nations Sustainable Development Goals and Paris Climate Agreements in the Asia and the Pacific. In their empirical study they found that ecological footprints is reduced with the adoption of Green financing and also advocate the continuous Investment in the field of climate financing Chen *et al.* (2021). It was concluded that bank's employees, daily operations and policy related Green Banking practices have significant positive effect on Green financing contrary to customer- related green banking practices which is not statistically significant. Cihangir and Öztürk (2019) studied the investment offered by Turkish bank to finance green investments and find out that climate change, ecosystem degradation, poverty etc. has increased the importance of green investments. Wang *et al.* (2022) explore the role of green financing for enhancing CSR in banking sector and suggested that additional financial resources should be allocated to promote CSR attributes. Nguyen *et al.* (2022) studies that how six Vietnamese commercial Banks are contributing to advance green business activities.

In-spite of promising future, green financing

practices are impeded by various factors. Li *et al.* (2021) argued that reduction in energy demand caused by COVID-19 pandemic has made green projects less competitive. Wasan *et al.* (2021) finds that in India, policy economic and knowledge barriers are the top 3 barriers for Green Finance adoption. They further state that clear green policies, risk assessment frameworks, credit enhancement mechanism, low - cost refinancing, incentivized finance with direct finance are few of the suggested strategies to promote Green finance. Ibrahiem and Sameh (2021) in their empirical research finds out that there is natural resource curse in Egypt and clean energy sources cause financial development and natural endowment. It was also found out that FDI leads to the deployment of more clean energy resources. Madaleno *et al.* (2022) In their study finds out that clean energy caused by green finance is less evident, except in specific periods, especially at the start of the pandemic. This study also exhibits the need to design a comprehensive policy for strengthening environmental responsibility and green finance.

Various ways are suggested by the researchers to boost green financing practices. Green financing, like traditional investing, can take two forms: debt and equity. IFIs and green funds enter the picture as a result of the high risk of equity financing. So, what green funds and impact investors may do is acquire the lowest-ranked stock and debt to put them at the bottom of the ladder. Zhang *et al.* (2022) constructed an index pertaining to green finance and environmental performance based on 30 Chinese provinces and was found out that industrial structure, economic development level and environmental regulations have positive impact on Green Finance development. Taghizadah- Hesary and Yoshino (2019) provides the way to induce private participation in green finance and investment by establishing green credit guarantee schemes (GCGSs) and suggested returning a portion of revenue collected by tax generated from spill-over effect of green energy supply to investors. They also advocate use of distributed ledger technologies for maintaining transparency in green finance and investments.

Ning *et al.* (2022) applied fuzzy decision making modelling technique figured out that Energy Performance Contracts (EPCs) will replace project based financing and also the benefits from Green bonds are limitless. Zhang *et al.* (2018) highlights the need for digital technologies like block-chains and Internet of Things (IoT) which may act as low- cost

high speed instrument to achieve low- carbon economy, keeping China as a model, where green finance law was enforced through block-chain based innovative. Zhang and Vigne, (2021) by using Green Total Factor Productivity (GTFP) measured jointly the economic and environmental efficiency and raises that innovation efficiency can be applied to solve under and over estimation effect caused by innovation input and output. They concluded that in-spite of continually devoting in innovation input; the firm and policy maker should consider innovation efficiency and green finance development. Cui *et al.* (2020) suggested that along with that green finance production cost is needed to be reduced by financial institutions and compensation for consumer pollution is needed to be increased. Moreover corporation is needed amongst all the participants of Green Finance system. Circular economy will be employed instead of linear economy in the long run. Technological advancements must be linked to long-term development.

## Methodology

The methodologies utilised in this investigation are discussed in this section. In order to determine the connection between green financing and sustainability, this article will undertake a comprehensive evaluation of green financing. The authors used VosViewer software and the biblioshiny platform available on R-Studio to conduct a systematic literature review based on content analysis and bibliometric analysis to accomplish the goal.

To perform an SLR, it is crucial to first define the study area and create a procedure for identify, select, review, and synthesizing pertinent literature; Seuring S. *et al.*, (2008).

This paper consist in five phases for conducting SLR proposed by Denyer *et al.* (2009) followed by Novais *et al.* (2019). (i) Formulation of research questions, (ii) Identification of research articles, (iii) sorting and evaluation of studies manually by reading abstract and methodology, (iv) Analysis of selected studies (v) Results and discussion

### Phase-I Formulation of questions

The basic objective of this paper is to see the developments in green financing for sustainable development through studies that have already been conducted and to find out the research gap and future research directions. To meet the objectives of the

study, following questions have been formulated.

**RQ1:** To see the literature developments in green financing area in totality and which specific areas are mostly focused by the authors.

**RQ2:** How green financing is aligning with sustainable development?

**RQ3:** What are the research gaps and future direction that can be identified based upon existing studies?

Here, it should be highlighted that RQ1 and RQ2 are introductory questions for all forms of systematic literature reviews and are employed to see the studies in sustainable or green finance have already been conducted.

**Phase II: Identification of research articles**

This phase involves looking for relevant research papers, for this paper an SCOPUS database is used to identify relevant studies on the topic of green financing and sustainable finance.

The SCOPUS database, a broad and interdisciplinary bibliographic database was used to retrieve publications on green financing or sustainable finance. The time span is from 2010 to 2022.

In order to create corpus of documents for investigation, a search query is implemented enabling keyword option in Scopus database:

Search query = (“Green Finance”) OR (“Sustainable Finance”)

To retrieve the sufficient publications on given topic, we gave input “Green Finance” OR “Sustainable Finance” in keyword search of Scopus database. Total 1109 publications were retrieved by the first query. There was restriction on these publica-

tions and trend of publications is given in Figure 1.

The publication trend on the subject of “Green Finance and Sustainable Finance” from 1992 to 2022 is depicted in the above graph. The results shown here show a gradual upward trend from 1992 to 2013, but after that a significant improvement in green and sustainable finance can be noted. This subject has gained popularity over the past five years, and the current increase in popularity demonstrates the subject’s significance.

**Phase III: Sorting and Evaluation of Articles**

After the first phase, the abstract, methodologies, outcomes and subject area were closely evaluated. After this, it is found that most of the articles were irrelevant. Further, we limited our search query to (“Green Finance”) OR (“Sustainable Finance”) AND (LIMIT-TO (SUBJAREA, “ECON”) OR LIMIT-TO (SUBJAREA, “BUSI”) AND (EXCLUDE (Pubyear, 2009)).

After applying the second query which is most relevant to the topic and after manual review a total of 162 publications were identified for in-depth investigation purpose.

Documents Types	Frequency	%N=162
Article	130	80.24
Book	1	0.61
Book chapter	14	8.64
Conference paper	6	3.70
Editorial	1	0.61
Note	2	1.23
Review	8	4.93

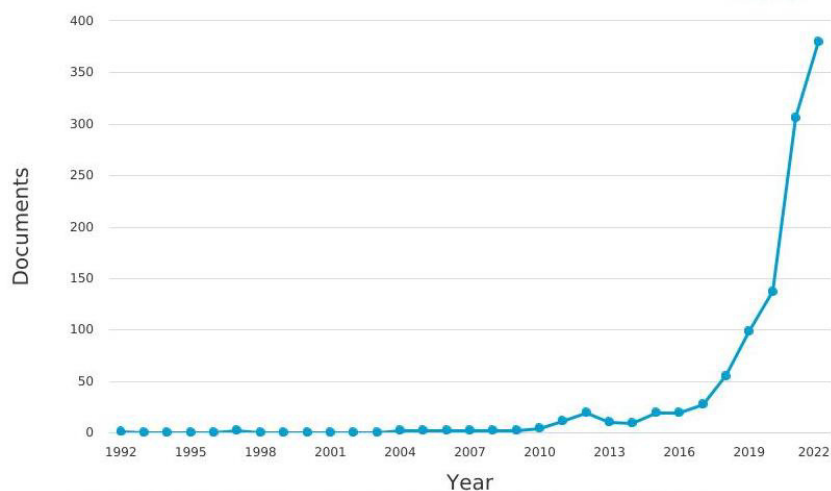


Fig. 1. Published Trend in the area of Green Financing or Sustainable Finance

**Bibliometric Analysis**

Sankey diagrams are typically used to illustrate how energy or materials move across various networks and processes. With quantitative details, they depict flows, linkages, and their transition. Sankey diagrams are representations of weighted, directed graphs with flow preservation properties. The influx weights at each node have the same size as their outgoing effects; Riehmman *et al.* (2005), Kumar *et al.*, (2021). The association between the contributing nations, the author’s keyword, and the sources was visualized in our study using three field plots in Biblioshiny.

The above Figure 2. shows a three field plot with three elements. The author’s nation listed first, followed by keywords of specific theme, i.e. “Green Financing” OR “Sustainable Finance”, and the source, which is journal name, in third place. All three components are linked together by a grey plot, which also depicts the relationship between the contributing nations and journals for the given theme or

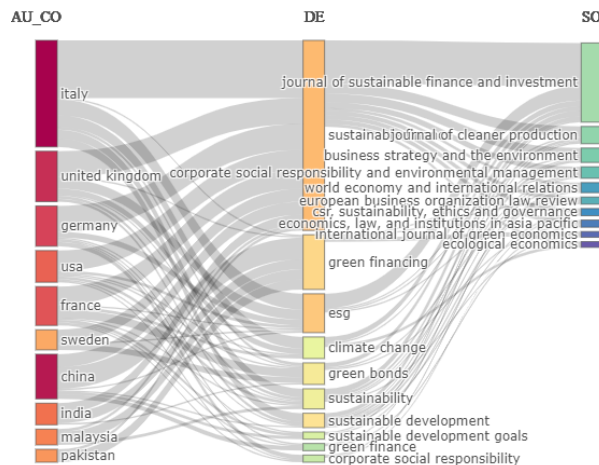


Fig. 2. Sankey Diagram

topic. The country that made the biggest contribution out of the samples was Italy. The most articles have been published in the Journal of Sustainable Finance and Investment. The terms “sustainable finance,” “green finance,” “ESG,” “climate change,” “green bonds,” etc. are frequently used as keywords in publications. These terms demonstrate the relevancy and validity of the selected literatures with topic.

**Influential Journal**

The Biblioshiny platform was used to identify the top ten most influential journals in (Table 1). The number of articles published on the subject and the amount of citations are used to determine which journals are the most influential. Along with the journals impact factor, we also looked at the total number of citations from the Scopus database. These journals were given rank on the basis of number of publications related to the topic. The Journal of Sustainable Finance and Investment has the most publications (19.75%) on the topic of green financing or sustainable finance followed by journal of cleaner production (8, 4.94%), business strategy and the environment (6, 3.70%), journal of financial stability, world economy and international relation (4, 2.47%) each, journal of business economics, global finance review, international journal of green economics (3, 1.85%) each and ecological economics (2, 1.23%). Out of the top 10 relevant journals listed in order of the number of citations received, Journal of Cleaner Production, with 274 citations, and Journal of Sustainable Finance and Investment, with 221 citations, are the two most significant journals (Table 1). It implies that having the most publications in a journal does not necessarily translate into having the most citations or most influential journal.

Table 1. Top ten influential journals

Sources	Articles	R (%)	TC	AC	IF
Journal of sustainable finance and investment	32	19.75	221	6.9	3.65
Journal of cleaner production	8	4.94	274	34.25	9.30
Business strategy and the environment	6	3.70	77	12.83	10.80
Journal of financial stability	4	2.47	24	6	3.73
European business organization law review	4	2.47	10	2.5	1.54
World economy and international relations	4	2.47	12	3	0.59
Journal of business economics	3	1.85	36	12	3.32
Global finance review	3	1.85	64	21.33	0.48
International journal of green economics	3	1.85	17	5.67	0.42
Ecological economics	2	1.23	21	10.5	5.39



**Keyword Co-occurrence**

A keyword co-occurrence network aims to comprehend the knowledge components and knowledge structure of a scientific/technological topic and research trend related to topic Radhakrishnan *et al.*, (2017). Keyword co-occurrence analysis creates a network of topics and their relationship Gao *et al.*, (2021). To identify the research direction of green finance, we analyzed the keyword co-occurrence of keywords and the trend of topics. Keywords play an important role in identifying the research direction in the academic field. A keyword map was created using Biblioshiny, available on R-Studio. In Figure 3. After we established some criteria and examined the literature, only 25 keywords satisfied the requirement. These 25 keywords illustrate the research

emphasis of the literatures we chose for this study. Sustainable finance is the most popular keyword.

**Conclusion**

The present study, reviewed the literature on green financing to see the trend of research and identifying the gaps or areas where past or current research can be employed for further research. In this study, we found most of the authors conducted investigation related to *sustainable business model for banking industry and role of banks and other institutions in enhancing green digital finance, green bond for financing renewable energy, crowdfunding for sustainable ventures, Green financing and ESG, corporate governance and sustainable finance, barriers and enablers to sustainable finance,*



Fig. 3. Keyword Co-occurrence map

Table 3. Top 10 cited Source and authors in publications

Rank	Source	TC	Author	TC
1	Journal of business ethics	167	Mohsin, M	53
2	Business strategy and the environment	100	Serafeim, G	50
3	Journal of cleaner production	100	Taghizadeh-hesary, F.	44
4	Sustainability	98	Schoenmaker, D.	35
5	Journal of cleaner production	90	Busch,T.	33
6	Energy policy	79	Battiston, S.	30
7	Journal of sustainable finance and investment	75	Renneboog, I.	24
8	The journal of finance	53	Zhang, C.	23
9	Strategic management journal	49	Flammer, C.	22

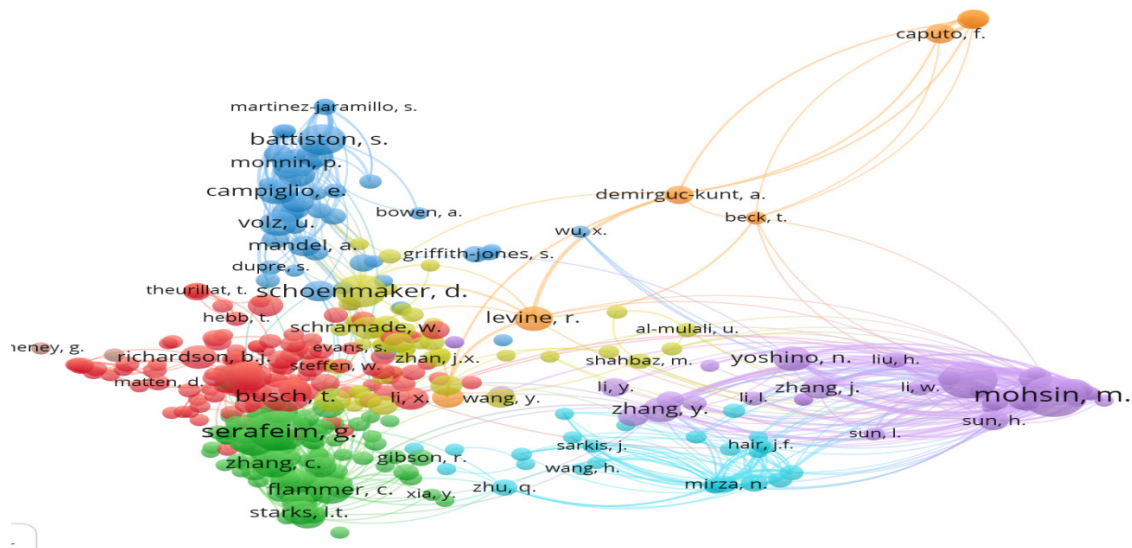


Fig. 4. Co-citation network of authors

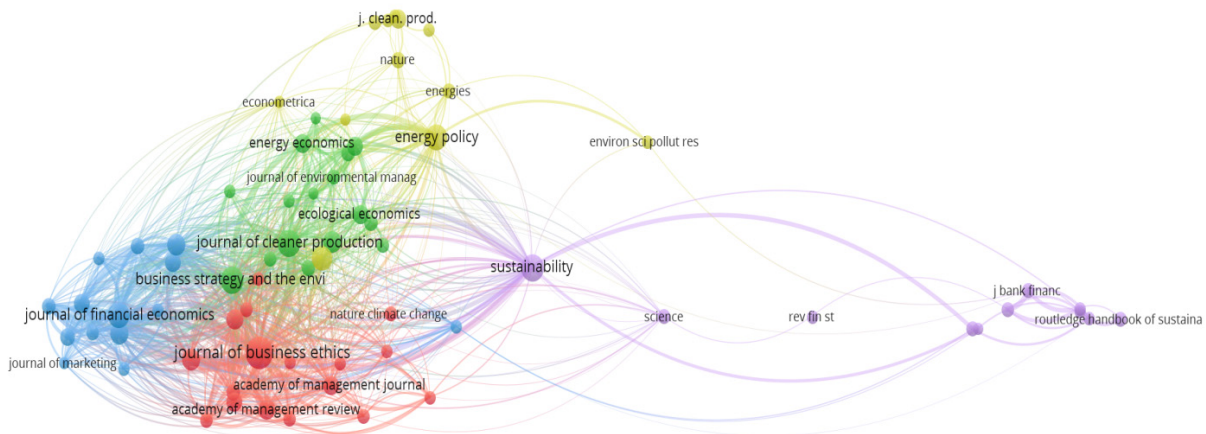


Fig. 5. Co-citation network of sources

Phase IV: Analysis of selected studies

Green Bond and sustainability

Everybody is impacted by climate change. But the developing countries are anticipated to be the most impacted. Its potential impacts on sea levels, precipitation patterns, temperatures, and the frequency of weather-related disasters present dangers to agriculture, food production, and water supply. Recent advances in the battle against poverty, hunger, and illness, as well as the lives and livelihoods of people in developing nations, are now at risk.

To face this challenge world bank in 2008 launched "Strategic Framework for development and climate change" to help public and private activity to fight with climate change challenge. The world bank green bond is an example which raises funds from fixed income investors and lends them to eligible project which helps in mitigation of challenges for climate change. Following are the authors those considered green bond helpful for sustainability.

Flammer (2021) and Ng, (2018)

Green finance and sustainable

The framework for achieving a better, more sustainable future for everybody is found in the Sustainable Development Goals. They deal with issues like poverty, inequality, climate change, environmental degradation, peace, and justice, as well as other worldwide problems we confront, (www.un.org). Lee, J.W. (2020), Busi-

development goals CSR and sustainability	nesses should concentrate on sustainable production to attain a zero-carbon goal due to limited natural resources.
Sustainable Finance and Climate Change	The Sustainable Development Goals (SDGs) and Corporate Social Responsibility (CSR) are well-known ideas in the business sector. A company's reputation and employee happiness may greatly benefit from effective CSR implementation, which also advances the SDGs, (www.socialgoodconnect.org). Following are the authors that considered CSR is helpful for sustainability. Awawdeh <i>et al.</i> , (2021) According to the findings, technological innovation has a favorable effect on business success as well as the environment. Green finance has a substantial and advantageous function in environmental performance. Additionally, in the framework of the study, corporate social responsibility (CSR) plays a little effect on the environmental performance of the energy businesses. Focke M. (2022), examine about whether sustainable institutional investors promote CSR. Birindelli <i>et al.</i> , (2022), tried to investigate relationship between bank's CSR policies at governance level for pursuing green product strategies. Chenet <i>et al.</i> , (2021), Central banks and supervisors now acknowledge that climate-related financial risks (CRFR) are important to their mandates for financial stability.
Green Digital Finance	Coskun <i>et al.</i> , (2022) argued that digital financial system can be can be channelized into green digital finance in a well-designed ecosystem. Rasoulinezhad <i>et al.</i> , (2022) As a combination of FinTech and green finance, green digital finance may be seen as a potential mechanism to absorb foreign money and accelerate the development of green projects in various nations, which may help us reach the Sustainable Development Goals. Adequate investment is required in green energy infrastructure projects to achieve the sustainable development goals.

*green digital finance, green logistic and climate risk management etc.*

Due to the growing significance of global sustainable development, financial institutions are required to support international economies through green financing. L. Khudyakova (2018) have focused on three actors basically institutions which are helpful in achieving the sustainable development goal. These are national governments and financial regulators, international institutions and private financial institutions and their focus should be on 'go green'. Wang *et al.* (2016). The new financial tool known as "green finance" can be used to manage or protect the environment and use resources in a sustainable manner Soundarrajan *et al.*, (2016) in their investigation, authors concluded that by reducing environmental risk and enhancing ecological integrity, green financing aims to increase social fairness and raise the standard of living for all people. In this study, we found green financing is becoming important to ensure a better environmental outcome. The US, China, and France are the top three green bond issuers, but now other nations are also more focused on green financing. By 2023, the market for green bonds may be worth \$2.36 trillion. In this study, some literature related to SBMs also reviewed and find out that some old practices like Eco-innovation and

CSR are insufficient to mitigate the environmental challenges and authors suggested to adopt SBMs which incorporates wide range of benefits to stakeholders, society and environment.

#### **Direction for future research**

The literature on green financing or sustainable finance is rapidly growing in recent three years. Climate change is one of the biggest issues of all countries and now, corporations, governments and policymakers are more focused on environmental challenges. To further research on this important research topic, the following areas can be included;

In this study we didn't cover any specific area but researchers may do research on the topic like, Green banking and sustainability, green technology and innovation, green logistic and sustainability,

*Sustainable Development Goals (SDGs) and Green Financing:* Green finance (or sustainable finance) tools like Green Bonds and bonds with various thematic focuses like Social Bonds, Sustainability Bonds, or Sustainable Development Goal Bonds can serve as a solid link to the SDGs. These programs enable the flow of cash for the execution and fulfilment of business sustainability objectives. Institutional investors are drawn to them as well because they view financial investments in sustainability as

a reliable sign of how well a company is doing in terms of ESG ([www.thesustainability.io](http://www.thesustainability.io)). Researcher can further investigate, to what extent green financing is helpful for achieving SDGs.

*Green Banking*: green banking is the system or banking practices in which society gets environmental benefits. Researchers can do investigations about 'Framework and strategies of green banks for sustainable development'.

*CSR fund utilization for sustainable development*: CEOs mindset towards spending of CSR funds on climate-change or sustainable development can be investigated or new topic for young researchers.

*Embedded sustainability in supply chain or logistic to meet the environmental targets*: Supply chains have gained attention for many firms due to their high resource and financial costs as well as their frequent role as a source of waste. So, maintaining a sustainable supply chain has become a major business objective. From the beginning to the conclusion of their life cycles, businesses have started to assess the societal and environmental effect of the goods and services they offer. Young researchers may have the topic on green supply chain.

In addition to the aforementioned research, numerous researchers have looked into green logistics, green technology and innovation, the green bond market, and sustainable finance for sustainable development, among other topics. As a result, the term "green financing" (or "sustainable finance") is very broad and can be used in a variety of contexts.

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