

## Green Finance and Sustainability: A Systematic Review

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Received Date : 16.06.2023

Revised Date : 07.08.2023

Accepted Date : 14.10.2023

### ABSTRACT

This research aims to explore and analyze the recent focus on green finance and sustainability from 2022 to 2023. It employs a systematic review approach to understand the predominant areas of study during this two-year period. The data search revealed that research focusing on the impact of green finance on decarbonization has gained significant popularity in the past two years. Additionally, other studies have delved into various variables such as Environmental (Management, Economics, Performance, and sustainability), Technology (AI, Blockchain, Smart, and adoption), and Renewable Energy & its Output. This research primarily concentrates on topics that have emerged as trends in the last two years. However, it's noteworthy that among these studies, there are 14 research topics that have been explored less frequently. These include Green Financing, Insurance, Non-Performing Loan Ratio, Ecological Footprints, Climate Mitigation Finance, Solvency, Biofuel, Fuel Cell, Geothermal, Solar, and Wind.

**Keywords : Green Finance; Sustainability; Systematic Review; Economics; Environmental**

### ABSTRAK

*Penelitian ini bertujuan untuk mengetahui kajian dan fokus penelitian dengan tema green finance dan keberlanjutan dalam 2 tahun terakhir 2022-2023. Studi ini menggunakan tinjauan sistematis dari tahun 2022-2023 tentang keuangan hijau dan Keberlanjutan. Dari hasil penelusuran data diketahui bahwa fokus kajian penelitian mengenai pengaruh Green Finance terhadap Dekarbonisasi cukup populer dalam 2 tahun terakhir. Selain itu penelitian lain dilakukan dengan variable Environmental (Management, Economics, Performance & Sustainability), Technology (AI, Blockchain, Smart, & Adoption), and Renewable Energy & its Output. Penelitian ini berfokus pada topik-topik yang menjadi tren dalam dua tahun terakhir, namun dari hasil penelitian terdapat 14 penelitian dengan topik-topik yang jarang dilakukan, antara lain Green Financing, Green Insurance, Non-Performing Loan Ratio, Ecological Footprints, Climate Mitigation Finance, Solvabilitas, Biofuel, Fuel Cell, Geothermal, Solar, dan Wind.*

**Kata Kunci : Keuangan Hijau; Keberlanjutan; Tinjauan Sistematis; Ekonomi; Lingkungan**

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## INTRODUCTION

Sustainability is a strong aspiration and a pragmatic mandate. Sustainability speaks to our lives as citizens and leaders, neighbors and community members, consumers and businesses, students and teachers, workers and professionals. It influences what we buy and sell, consume and dispose of, how we travel and what we eat, whom we vote for and how we interact socially. (Thiele, 2016).

Sustainability is always related to limited natural resources, but the benefits are needed continuously, causing scarcity problems. Irregular use of natural resources will also cause serious problems with global environmental/climate changes. Global or regional climate change concerns an increase in the planet's average temperature, and the resulting changes in the oceans, land surface, and ice sheets (Yousaf & Fazal, 2022). In addition to environmental aspects, sustainability also pays attention to economic and social aspects for future generations (Boelt, 2014).

To anticipate the possible impacts, world leadership responded by formulating Sustainable Development Goals which were carried out by the Open Working Group on Sustainable Development Goals and submitted to the General Assembly of the United Nations (UN) on 19 July 2014 (Boelt, 2014). Scholars, policy makers and governments work together to find solutions to achieve the Sustainable Development goals (Sernaqué et al., 2022). Among the solutions provided is Green Finance.

Green Finance is a series of innovative solutions in the field of economic finance, which are increasingly expanding due to the adoption of the Sustainable Development Goals by the United Nations (UN) in 2015 (Trukhachev & Dzhikiya, 2023). Green Finance aims to promote green activities, such as buying green goods and services or building green infrastructure that will provide economic and environmental benefits for everyone. There are five types of Green Finance, namely; 1) Green Mortgages; 2) Green Loans; 3) Green Credit Card; 4) Green Bank; 5) Green Bonds (Siddhesh Shinde, 2023).

The sustainability of green finance is of utmost importance in addressing pressing environmental challenges and promoting a transition to a more sustainable future (Cuiyun & Chazhong, 2020; Cunha et al., 2021; Zhou et al., 2020). By directing financial resources towards projects and initiatives that have positive environmental impacts, green finance contributes significantly to mitigating climate change, reducing pollution, and preserving ecosystems. It supports the development and deployment of renewable energy sources, energy-efficient technologies, sustainable agriculture practices, and clean transportation systems. These investments not only help in curbing greenhouse gas emissions but also foster innovation and job creation in the green sector. Furthermore, green finance ensures the efficient allocation of resources, promoting the responsible and sustainable use of natural resources. By integrating environmental considerations into financial decision-making, green finance encourages sustainable business practices and fosters long-term economic stability. It also promotes transparency and accountability, as investors and stakeholders demand greater disclosure and reporting on environmental performance. Ultimately, the sustainability of green finance is essential for achieving a harmonious balance between economic growth, environmental protection, and social well-being, creating a more resilient and prosperous future for generations to come.

Sustainability is the common goal of humans to live for a long time based on the three pillars of conception, namely social, economic and environmental. The specific definition of the term sustainability varies according to the literature, context and time, therefore it is difficult to agree on a definition of sustainability (Purvis et al., 2019; Ramsey, 2015). Sustainability tends to be related to the environment so that in its utilization,

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sustainability often focuses on environmental and natural resource issues, including climate change and the destruction of biodiversity (Biermann et al., 2022). Therefore, sustainability refers to the preservation of natural resources and ecosystems that will preserve human life in the future (Berg, 2019; Harrington, 2016; Ramsey, 2015; Scoones, 2016). Following up on the issue of sustainability, world leaders through the United Nations (UN) agreed on 17 sustainable development goals which refer to processes and pathways to achieve long-term goals/a more sustainable world (Assembly, 2015; Wiktor-Mach, 2020). The sustainable development goals set the global agenda for sustainable development, with a deadline of 2030.

Green Finance is a series of innovative solutions/new instruments in the field of economic finance in increasing investment financing that provides environmental benefits adopted by the United Nations (UN) from the 2015 Sustainable Development Goals (Sachs et al., 2019; Trukhachev & Dzhikiya, 2023). Green Finance aims to promote green activities, such as buying green goods and services or building green infrastructure that will provide economic and environmental benefits for everyone. There are five types of Green Finance, namely; 1) Green Mortgages; 2) Green Loans; 3) Green Credit Card; 4) Green Bank; 5) Green Bonds (Sachs et al., 2019; Siddhesh Shinde, 2023). Green finance has an important role including; The advantages of green banks include offering better credit conditions for clean energy projects, the ability to pool small projects to achieve a commercially attractive scale, the creation of innovative financial products, and market expansion through the dissemination of information about the benefits of clean energy. Proponents of green bonds believe they can provide affordable long-term capital to refinance projects once they pass the construction phase and operate successfully. (Henderson, 2016; Sachs et al., 2019). In addition, green finance also has a negative impact on CO<sub>2</sub> emissions in certain countries, so researchers emphasize the importance of green finance as a mitigation measure to minimize economic externalities without sacrificing significant economic growth (Meo & Abd Karim, 2022).

This research stands out from prior studies in several notable ways. Firstly, it places a dedicated emphasis on the intersection of Green Finance and sustainability, a focus that sets it apart from research that has traditionally explored these fields separately (Ning et al., 2022). Moreover, its timeliness is a standout feature, as it concentrates on investigations conducted in the years 2022-2023. This temporal focus is especially pertinent in the rapidly evolving landscape of Green Finance, characterized by the continuous emergence of new financial instruments and practices. Additionally, the research adopts a systematic review approach, a rigorous and comprehensive methodology that systematically collects, analyzes, and synthesizes all relevant research in this domain. This approach distinguishes it from other review techniques, such as bibliometric reviews, which primarily seek to identify trends and research concentrations. Furthermore, the research brings to light specific innovations within Green Finance, such as green bond standards, grant programs, and sovereign green bonds, which have gained increasing prominence, particularly in Asian markets (Al-Qudah et al., 2023). This granular examination adds depth and specificity to its findings. Another notable aspect is its global perspective, acknowledging the widespread adoption of Sustainable Finance—a precursor to Green Finance—and its growing recognition by both the public sector and financial market investors worldwide. This global outlook underscores the international relevance and importance of the research. Moreover, the research underscores the role of Green Finance as a mitigation measure, effectively reducing CO<sub>2</sub> emissions in select countries without compromising economic growth. This dual emphasis on environmental and economic aspects differentiates it from studies that may prioritize one dimension over the

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other. Systematic reviews are distinct from other review techniques like bibliometric reviews, which are designed to spot trends and research concentrations in a specific field (Triansyah, Gunawan, & Ramadhaniyati, 2023; Triansyah, Mitayana, Yanti, et al., 2023; Triansyah, Suwatno, & Machmud, 2023; Triansyah, Suwatno, & Supardi, 2023).

## RESEARCH METHOD

A comprehensive overview of the steps undertaken in the systematic review process is essential for a complete understanding of the research methodology. In this study, the systematic review spanned from 2022 to 2023 and focused on the theme of "Green Finance and Sustainability." The systematic review process follows a transparent and well-defined approach, which involves several key stages.

Firstly, the research questions were meticulously formulated to guide the systematic review. These questions were designed to pinpoint the specific aspects of green finance and sustainability that needed to be explored.

Next, an extensive search was conducted in the Scopus database using the keywords "Green Finance and Sustainability." This initial search aimed to identify a broad pool of potential research articles that were relevant to the study's focus.

Following the initial search, a rigorous screening process was applied to the retrieved articles to ensure they met the predetermined criteria. Articles that did not align with the research objectives or were of insufficient quality were excluded.

Subsequently, the selected articles underwent a thorough assessment of their quality. This assessment helped in determining the credibility and reliability of the chosen studies, ensuring that the final selection comprised high-quality research.

Once the high-quality articles were identified, findings from these studies were synthesized. This synthesis process involved both qualitative and quantitative analyses, enabling a comprehensive understanding of the relationships and trends within the field of green finance and sustainability.

In conclusion, this systematic review followed a systematic and transparent methodology, beginning with well-defined research questions, followed by extensive literature searches, stringent screening, quality assessment, and comprehensive synthesis of findings. This rigorous approach was essential to maintain the integrity of the systematic review process and provide valuable insights into the topic of green finance and sustainability.

## RESULTS AND DISCUSSION

Table 1. provides an overview of previous research studies that have delved into various aspects of Green Finance and its implications. These studies encompass a wide range of topics, from evaluating the development of green financing in specific regions to exploring the impact of Green Finance policies on non-performing loans. They also investigate the role of Green Finance in promoting sustainability, its relationship with renewable energy, and its effects on environmental performance. Moreover, these studies analyze the contributions of different countries to the advancement of Green Finance, its effects on carbon emissions, and its influence on the ecological footprint. Each study offers unique insights and findings, contributing to our understanding of Green Finance and its multifaceted impact on economic and environmental dynamics.

**Table 1. Previous Research**

No	Author	Focus Study	Results
1	(Wang et al., 2023)	This paper aims to conduct a more objective evaluation of green finance (from the five dimensions of green credit, green securities, green medical, green investment, and carbon finance), to analyze the legal dynamics of the development of green financing in the twin city economic circle. , and find the relationship between overall and partial green financing development.	The empirical results show that Chengdu and Chongqing have the highest contribution to the development of regional green investment, regional green insurance, regional green credit and regional carbon finance. Meanwhile, Chengdu itself has the highest contribution to the development of regional green securities
2	(Al-Qudah et al., 2023)	This study investigates the impact of the United Arab Emirates' Green Credit Policy on non-performing loans. The main objective of this study is to investigate the financial risks associated with green loans and whether an increase in green loans will decrease a bank's non-performing loan ratio.	1) The results show that the green loan ratio has a negative effect on the non-performing loan ratio, the same as the return of equity, 2) credit quality, inefficiency, and bank size have a positive effect on the non-performing loan ratio. 3) In addition, research has found that the solvency ratio has a significant negative effect on the non-performing loans ratio.
3	(Chen et al., 2023)	This study explores the mechanism of the impact of green finance policy implementation on the green transformation of the manufacturing industry from the three aspects of capital formation and incentives, credit catalysis, integration and decentralization, as well as conducting quasi-natural experiments using differences. -in-difference (DID) models.	1) The application of green finance significantly promotes the green transformation of China's manufacturing industry, 2) The effect of promoting green finance on the green transformation of the manufacturing industry is only large in state-owned industries, 3) The effect of green finance on the green transformation efficiency of the manufacturing industry (with a more good) more significant than manufacturing industries with poor information environment, 4) Effect of green finance promotion on green transformation of manufacturing industry is significant in low competition industries but not significant in high competition industries
4	(Feng et al., 2023)	Our research objective is to examine the current state of green finance, its development, challenges, and prospects for sustainable growth in the future.	The study found that China has made significant progress in building green finance, becoming a leader in green financial products such as green bonds and credit. In addition, eco-friendly financial products have an impact on CO <sub>2</sub> reduction. The challenges in building green finance are quite diverse, including promoting green insurance, building an integrated green finance system, and overcoming the lack of green financial information asymmetry.
5	(Trukhachev & Dzhikiya, 2023)	This study aims to explore the importance of green finance (smart green finance as a new type of finance) in the era of AI for the economy (for the whole set of Sustainable Development Goals) and environmental management.	The theoretical significance of this study is that it reveals the peculiarity of green finance in the era of AI, namely that green finance can reach its full development potential only by relying on smart technology. In addition, the increased use of smart technologies will increase the competitiveness of green finance and accelerate

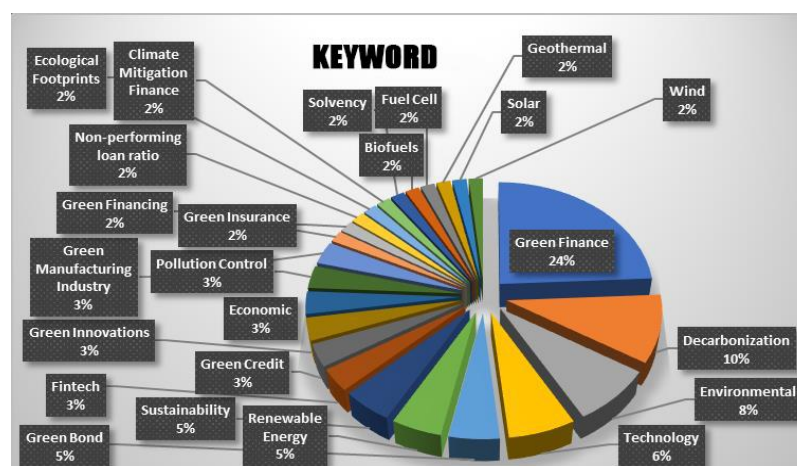


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| 6  | (Jian Afshan, 2023)     | & | This research examines the role of green finance and green technology in addressing carbon neutrality in the G10 countries from 2000 to 2018.   | its application in environmental economics and management.<br>Long-term and short-term estimates confirm that GFIN and technology promote carbon neutrality.  |
| 7  | (Delina, 2023)          |   | This paper explores digital economy innovation through peer-to-peer trading in a blockchain (fintech RE) ecosystem by focusing on the perceptions of experts in Hong Kong.  | potential benefits of fintech RE – especially in terms of new opportunities for citizen participation in the energy transition through decentralized energy markets, new jobs, and contributions to decarbonisation, this innovation also presents challenges to different electricity market arrangements in the region, spatial issues with scaling and accelerating energy transitions in dense environments, and the accompanying emission traps.   |
| 8  | (Meo & Abd Karim, 2022) |   | This study examines the financial relationship between green emissions and carbon dioxide (CO <sub>2</sub> ) in the top ten countries that support green finance (Canada, Denmark, Hong Kong, Japan, New Zealand, Norway, Sweden, Switzerland, United Kingdom and United States). | The overall findings confirm the negative impact of green financing on CO <sub>2</sub> emissions; However, this relationship varies at different quantiles of the two variables. This variation is due to green financial market conditions and country-specific market conditions. Studies prove that green financing is the best financial strategy to reduce CO <sub>2</sub> emissions.  |
| 9  | (Dogan et al., 2022)    |   | This study investigates connectivity and spillover relationships between green finance and five types of renewable energy (biofuels, fuel cells, geothermal, solar, and wind) by applying the new TVP-VAR method from Balcilar et al.   | The results show that dynamic connectedness, both total and paired, is heterogeneous over time and is influenced by economic events. Additionally, wind is recognized as the biggest shock generator for green finance, followed by biofuels, while fuel cells and geothermal receive the least. The findings suggest that green finance is largely the shock recipient of renewable energy sources and that wind has been the shock recipient during the COVID-19 pandemic. The high linkage between the indices highlights safe-haven properties for green financial diversification purposes.      |
| 10 | (Al Mamun et al., 2022) |   | This paper studies the effect of green finance on decarbonization.  | Our results show that green bond financing can significantly reduce global carbon emissions in the short and long term, especially in countries with developed credit markets, countries with higher levels of technological development, and countries that are prone to risk. climate change. This effect is driven by green bonds issued to support waste and pollution control and increase energy efficiency. The impact of green finance on carbon emissions is more pronounced in developed credit markets and economies with higher innovation success and higher exposure to climate change. |
| 11 | (Yan et al., 2022)      |   | This study aims to examine the effect of FinTech adoption on the sustainability performance of banking institutions in developing countries such as Bangladesh. In addition, this study also investigates the role of   | The results show that green finance and green innovation have a significant positive influence on sustainability performance, as well as fully mediating the relationship between FinTech adoption and banking institutions' sustainability performance.  |
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	green finance mediation and green innovation in the relationship between FinTech adoption and sustainability performance.	
12	(Al-Badran, 2022)	This study aims to investigate the trend of green financing from private Iraqi banks listed on the Iraqi Stock Exchange Market.
13	(Yousaf & Fazal, 2022)	The purpose of this study was to examine the role of Renewable Energy (RE), consumption of Renewable Energy (RE), adoption of Green Finance (GF), and Economic Growth (EG) on Environmental Sustainability (ES).
14	(Khan et al., 2022)	This study quantifies green finance as “climate mitigation financing” and examines its impact on the ecological footprints of twenty-six economies in the Asian region.
15	(Bakry et al., 2023)	This paper examines the impact of green finance on environmental performance in developing countries.
		The results show three kinds of green financing trends, namely increasing, decreasing and not changing. Increases in green financing are still slow and less desirable.
		The findings reveal that Renewable Energy output and Renewable Energy consumption, Green Finance adoption, and Economic Growth have positive Environmental Sustainability ES.
		Empirical results and findings show that green finance reduces the ecological footprint, and appears to be environmentally friendly.
		The results show that carbon (CO <sub>2</sub> ) emissions are cointegrated with green finance, real gross domestic product, urbanization, and renewable energy under different specifications, and we therefore estimate the long-run relationship between these variables.

Source: Data processed, 2023

In addition to the objectives and results of the previous research displayed in Table 1., the authors collected data on keywords/research focus that had been carried out by previous studies. The findings are presented in Figure 1.



Source: Data Processing Results, 2023

Figure 1. Keyword Distribution

**Table 2. Keyword**

No	Keyword	Frequency
1	Green Finance & the System	15
2	Decarbonization	6
3	Environmental (Management, Economics, Performance & Sustainability)	5
4	Technology (AI, Blockchain, Smart, & Adoption)	4
5	Green Bond	3
6	Renewable Energy & its Output	3
7	Sustainability Performance & Energy	3
8	Fintech	2
9	Green Credit & policy	2
10	Green Innovations	2
11	Economic Circle & Growth	2
12	Pollution or Waste Control	2
13	Green Manufacturing Industry (Transformation & total Faktor productivity)	2
14	Green Financing	1
15	Green Insurance	1
16	Non-Performing Loan Ratio	1
17	Ecological Footprints	1
18	Climate Mitigation Finance	1
19	Solvency	1
20	Biofuels	1
21	Fuel Cell	1
22	Geothermal	1
23	Solar	1
24	Wind	1
<b>Total</b>		<b>62</b>

Source: Data Processing Results, 2023

From all the keywords in our research based on Figure 1. and Table 2., we divided them into 24 categories. From the results of data tracing it is known that the focus of research studies on the effect of Green Finance on Decarbonization has been quite popular in the last 2 years, but the results of the research conducted show consistent results, namely that the policy of implementing green finance has an influence that can reduce air pollution levels and/or reduce CO<sub>2</sub> levels. (Al Mamun et al., 2022; Bakry et al., 2023; Delina, 2023; Feng et al., 2023; Khan et al., 2022; Meo & Abd Karim, 2022).

The focus of further research is the relationship between green finance and its environment, both from management environment, economic environment, environmental performance and environmental sustainability. This study found that green finance has a positive impact on the economic environment, management environment and environmental performance itself (Trukhachev & Dzhikiya, 2023; Yousaf & Fazal, 2022).

We find that the use of technology such as Artificial Intelligence, Smart Blockchain financial system technology and fintech that is integrated with green finance has a good impact on the environment for sustainability (Delina, 2023; Trukhachev & Dzhikiya, 2023; Yan et al., 2022). Further research trends related to Green Bond, Renewable Energy and Sustainability Performance & Energy and others.

The analysis of the research discussions presented reveals several significant trends and findings in the domain of Green Finance. Firstly, the prominence of research focusing on the effect of Green Finance on decarbonization underscores the critical importance of this topic in recent years. Notably, the consistent results across multiple studies affirm that the implementation of Green Finance policies indeed contributes to the reduction of air pollution levels and the mitigation of CO<sub>2</sub> emissions, aligning with the



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global imperative to combat climate change. Furthermore, the shift in research focus towards examining the multifaceted relationship between Green Finance and its environment, encompassing aspects like management, economics, environmental performance, and sustainability, reflects a more holistic approach to understanding its impact. Encouragingly, this shift has unveiled positive influences of Green Finance in these areas, reinforcing its potential as a catalyst for environmental and economic well-being. Additionally, the integration of cutting-edge technologies, such as Artificial Intelligence, Smart Blockchain financial systems, and fintech, into the Green Finance landscape is highlighted as a promising avenue for enhancing sustainability. These findings collectively demonstrate the evolving landscape of Green Finance research, with emerging trends encompassing Green Bonds, Renewable Energy, Sustainability Performance, and Energy-related inquiries, indicative of the field's continued growth and relevance in addressing complex global challenges.

## CONCLUSION

The research findings underscore the paramount significance of Green Finance in addressing the intricate and pressing challenges surrounding sustainability. These challenges are inextricably linked to the finite availability of natural resources, which must be harnessed judiciously to ensure continuous benefits for current and future generations. The repercussions of the unsustainable and erratic utilization of these resources are becoming increasingly apparent through global environmental and climate change issues. To tackle these formidable challenges and to establish a coherent and unified approach to sustainability, world leaders, and stakeholders embarked on a momentous journey.

They conceptualized and formulated the Sustainable Development Goals (SDGs), a comprehensive and ambitious set of objectives designed to address a broad spectrum of global challenges while ensuring a sustainable and equitable future for all. This momentous effort culminated in the submission of the SDGs to the United Nations General Assembly on July 19, 2014, signaling a global commitment to collective action. One of the most pivotal solutions offered in the pursuit of these goals is Green Finance, a set of innovative financial instruments and practices that have gained traction and prominence following the adoption of the SDGs by the United Nations in 2015.

Green Finance represents a beacon of hope and a pragmatic approach to steer economies toward sustainable trajectories. Its core mission is to channel financial resources towards endeavors that promote sustainability, aligning economic growth with environmental stewardship. To comprehensively assess the state of Green Finance and its evolving role in the context of sustainability, a systematic review spanning from 2022 to 2023 was undertaken. The outcomes of this review reveal a multifaceted landscape of research focus areas. These encompass Green Finance's impact on various facets of the environment, including environmental management, economics, performance, and sustainability.

Furthermore, the integration of cutting-edge technologies such as Artificial Intelligence (AI), Blockchain, Smart systems, and Fintech with Green Finance is emerging as a critical avenue for enhancing sustainability efforts. Moreover, the research review brings to light other vital areas of investigation, including the influence of Green Finance on decarbonization, the dynamics of Green Bond markets, the role of Renewable Energy and its contributions to sustainability, and the examination of Sustainability Performance and Energy-related factors. These diverse research directions collectively reflect the dynamism and versatility of Green Finance in addressing complex global challenges.

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In conclusion, Green Finance stands as an indispensable driver of sustainability, offering pragmatic solutions to reconcile economic growth with environmental preservation. As the world grapples with the urgency of sustainability issues, the systematic review presented here underscores the comprehensive and evolving nature of research in the realm of Green Finance. It is clear that this financial innovation holds the potential to lead humanity towards a more sustainable and harmonious future, aligning seamlessly with the overarching objectives of the Sustainable Development Goals and contributing to the global pursuit of a balanced and equitable world.

## RECOMMENDATIONS

The research focuses on topics that have become a trend in the last two years, from the results there are 14 studies with topics that are rarely done, including Green Financing, Green Insurance, Non-Performing Loan Ratio, Ecological Footprints, Climate Mitigation Finance, Solvency, Biofuels, Fuel Cell, Geothermal, Solar and Wind.

It is expected that future research will discuss many variables that are still rarely done. Especially on natural caps such as Biofuels, Fuel Cell, Geothermal, Solar and Wind.

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