



Review

A systematic review of green finance in the banking industry: perspectives from a developing country

Shahinur Rahman^{1,2,*}, Iqbal Hossain Moral¹, Mehedi Hassan³, Gazi Shakhawat Hossain^{2,4}, Rumana Perveen¹

¹ Department of Business Administration, Northern University of Business and Technology Khulna (NUBTK), Shib Bari Circle, Sonadanga, Khulna, Bangladesh

² Department of Business Administration, School of Management (SoM), Huazhong University of Science and Technology (HUST), Wuhan, Hubei, China

³ Department of Marketing, University of Barishal, Barishal, Bangladesh

⁴ Department of Business Administration, University of Global Village (UGV), Bangladesh

***Corresponding:** Email: srahman.bu367@gmail.com.

Abstract: Globally, scholars and practitioners are becoming increasingly interested in determining the interaction between finance and environmental sustainability. However, a few studies have investigated and organized existing information in the context of the green finance of banks in developing countries. The purpose of our study is to find major dimensions of green finance and research gaps from a thorough evaluation of the literature. As a result, existing research on green finance in the banking industry has been evaluated in this paper with a focus on green finance and sustainable development. This study employs the content analysis method and it analyzes and summarizes a total of 53 relevant previous studies in the field of green finance. The findings of this research reveal 21 crucial dimensions of green finance in Bangladesh. The primary green finance products of Bangladeshi banks include green securities, green investments, climate finance, green insurance, green credit, green bonds and green infrastructure. The other factors include environmental performance and green economic growth, energy efficiency, green finance policy and environmental protection and the risk impact of bank policy formulation. The findings of this study will help policymakers to understand the green finance concept and its associated variables, which need to be considered when adopting and implementing green finance.

Keywords: green finance; sustainable development; environmental protection; developing country

JEL Codes: B26, F30, F37, G17, G19

Abbreviations: SDGs: Sustainable development goals; IFC: International finance corporation; WB: World Bank; HSBC: Hong Kong-Shanghai Banking Corporation; PCBs: Private commercial banks; SCBs: state-owned and foreign-owned commercial banks; ESRM: Environmental and Social Risk Management; SBN: Sustainable banking network; UNEP: United Nations Environment Programme; FINTECH: Financial technology; AI: Artificial intelligence; GCF: Green climate fund; UNFCCC: United Nations Framework Convention on Climate Change

1. Introduction

Globally, environmental protection and climate change action are the keys to achieving the sustainable development goals (SDGs) of the United Nations by the year 2030 (Amidjaya and Widagdo, 2020). The concept “green finance” can play a robust role in successfully attaining the SDGs, specifically the goals 11, 12 and 13. Moreover, green finance has been widely accepted and garnering heightened interest among scholars (Dörry and Schulz, 2018). At the G-20 nations’ eleventh conference in Hangzhou, China in 2016, green finance also received much attention (Schäfer, 2018). Aside from that, the International Finance Corporation ((IFC)) notes green finance as an investment option that safeguards the environment, ensures social equity and promotes a country’s economic success (Liu et al., 2019). Therefore, green finance calls for extensive research across the world.

Green finance is synonymous with “sustainable finance”, “environmental finance”, “climate finance” and “green investment” (Akomea-Frimpong et al., 2021). Lindenberg (2014) defined green finance as the policies and investments of financial institutions that support a green economy. More specifically, capital distribution and investments for green or ecological projects through financial systems are also known as green finance (Weber and ElAlfy, 2019; Berensmann et al., 2020). The green features of green finance suggest that financial resources be allocated to environmental preservation, clean energy, green building, climate change, social inclusion and corporate governance across the economy (Yuan and Gallagher, 2018; Urban and Wójcik, 2019).

Bangladesh, a developing nation in South Asia, is seen as one of the most growing economies in the 21st century due to it having significant investment and development (Nawaz et al., 2021). However, Bangladesh is struggling with climate change and its associated environmental effects, which have been intensifying in recent decades. According to Sanchez-Roger et al. (2018), Bangladesh is one of the most vulnerable countries in the world due to rapid climate change. Consequently, this climate change exacerbates global warming and sea-level rising, which threaten our natural ecosystems and economic progress. As a result, the concerning authorities in Bangladesh have developed and diversified methods to reduce the loss due to climate change and environmental hazards (Zheng et al., 2021a). This involves preventing environmental degradation and promoting long-term growth through structured and coordinated green investment in accordance with global standards. According to Zhang et al. (2022), green finance is a crucial financial tool in any country’s long-term economic progress. Similarly, Haque and Murtaz (2018) have stated that Bangladesh’s long-term economic development would be greatly aided by green banking or green financing. Globally, green finance is considered to play a prominent role in addressing climate change challenges and achieving SDGs (Mohd and Kaushal, 2018).

In recent decades, green finance has emerged in the banking sector as a way to protect banks and society to mitigate unexpected future economic issues (e.g., climate change, financial instability, social unrest and so on) (Ziolo et al., 2019). As a result, the traditional banking paradigm is evolving toward the provision of environmentally friendly products (Dikau and Volz, 2021). At the One Planet Summit in Paris in December 2017, central banks and key banking institutions from around the world promised their support for the development of environmentally friendly financial solutions (Akomea-Frimpong et al., 2021). The World Bank (WB) has also declared that it will no longer allow funds to be received by the companies and countries that do not prioritize environmental protection (Urban and Wójcik, 2019; Zhang et al., 2022). To welcome the policy of the WB, several banks, including Societe Generale, Hong Kong-Shanghai Banking Corporation (HSBC), Deutsche Bank, BNP Paribas and Credit Agricole, have acknowledged that they will work hand-in-hand and shift their corporate strategies to adopt environmentally friendly goods (Sanchez-Roger et al., 2018).

Besides, modern technological advancements have also accelerated the growth of green finance. Financial technology (Fintech) has a profound impact on improving the business world (Giudici et al., 2020). Scholars across the countries have been working on Fintech (Macpherson et al., 2021; Suh and Kim, 2019) and how it can be associated with energy efficiency, green bonds, green investments and other antecedents of green finance (Liu et al., 2022). In order to gear up financial sustainability (Giudici, 2018), Fintech can be utilized by combining artificial intelligence and big data. Liu et al. (2022) note that the inclusion of Fintech with the traditional financial tools reduces the technical complexities and difficulties of green finance in the modern business world. Based on these arguments, it is evident that green finance can reshape financial systems with the inclusion of Fintech. Although, the context still demands a significant number of research studies on Fintech and green finance.

However, in order to implement sustainable finance, the role of the Green Climate Fund (GCF) for the developing countries is undoubtedly crucial. GCF is the part of the United Nations Framework Convention on Climate Change (UNFCCC). Basically, this fund is allocated to the developing countries to reduce greenhouse gas emissions and contribute to green finance (Amighini et al., 2022). Amighini et al. (2022) also added that, in formulating green finance policies that allocate climate funds, central banks are also considered as pioneers in financial sectors. Durrani et al. (2020) conducted a study on 18 central banks and concluded that central banks can play a key role in promoting green finance funding by either amending the financial framework or encouraging easy green loans to the other financial institutions. Moreover, the role of central banks in green fundraising has been widely studied across many countries (Dikau and Volz, 2018; Gunningham, 2020). It certainly indicates the significance of central banks in executing and monitoring green finance activities in the respective countries.

While conducting this study, the authors found limited literature on green finance related to the context of bank activities both in developed and developing countries. For example, Sarma and Roy (2021) looked into certain characteristics and phrases related to the bank internal processes for green banking. Liu et al. (2020) looked at green finance in general. Whereas, Sharma et al. (2022) determined the significance of green finance for emerging nations. Most of the scholars have investigated the robustness of green finance in the context of general financial institutions and countries while ignoring the contributions of the banking industry. On the other hand, a few studies have been conducted recently in the field of green finance in Bangladesh. For example, Zhixia et al. (2018) demonstrated the role of central banks in implementing sustainable banking. In another study, Zheng et al. (2021b) illustrated the sole contribution of private commercial banks to green finance in Bangladesh. But, the studies that consolidate, analyze and identify trends in green finance for future

study and policy formation in the banking sector are few (Zheng et al., 2021b), which emphasizes the need for conducting future research in green finance in the banking industry.

To fill these gaps, this paper presents a comprehensive evaluation of significant studies on green finance. Therefore, some specific goals of this research are to be addressed in the following sections. First, we examine yearly publications from 2014 to 2022. Second, we determine which journals, authors, nations and institutions are actively contributing to the publishing of banking research on green finance. Third, we examine the policies initiated by the Bangladeshi banks that promote green finance. Fourth, we identify key issues in the green finance of Bangladeshi banks, such as dominating green finance products and determinants of green finance. Finally, we draw attention to research gaps and pave the way for future research on banks' green finance.

This study is significant and it adds value to the existing literature from multiple dimensions. First, this study is unique in that it reviews the green finance measures of banking institutions, focusing on environmental variables and managerial variables in the context of developing countries, including Bangladesh. Second, this study signifies the importance of green finance in achieving the SDGs for developing countries, which are vulnerable due to climate change and global warming, that can benefit from stressing green finance implementation for their banks and other financial institutions. Third, this study is first in terms of demonstrating the key variables of green finance in Bangladesh. There is the opportunity to investigate these variables comprehensively in future studies. Fourth, the current study provides a synopsis in the realm of green finance that summarizes a wide range of previous studies and scholars' notable contributions which indicate the importance of green finance in the realm of existing research. Finally, this study provides noteworthy support to clarify and make understandable the green finance concept for the policymakers and other stakeholders.

2. Background of the study

Scholars and practitioners around the world are increasingly focusing their studies on sustainable economic growth, green banking and financial sustainability (Liu et al., 2019). The financial sector is regarded as an essential component of the economy, and it acts as a mediator between long-term economic growth and environmental conservation. In addition, the financial sector is directly or indirectly involved in environmental sustainability (Zhixia et al., 2018). According to Bangladesh's financial institutions, green finance is still a relatively new idea, and it is defined as the issuance of "green bonds," "green equity" or "green debentures" (Zheng et al., 2021a; Sadiq et al., 2022). Green financing is, nonetheless, regarded as one of the most important factors in developing countries' sustainable economies (Zheng et al., 2021a; Haque and Murtaz, 2018).

It is a harsh truth that climate change is now one of the world's most pressing issues (Ngwenya and Simatele, 2020). Notably, developing nations are in the most vulnerable position due to this climate change. These developing economics often rely on existing global climate funds for climate protection and environmental hazard mitigation. But, the lack of well-established institutions, project design expertise and planning experience force the non-approval of the application for funds from many least developed countries (Ngwenya and Simatele, 2020). However, the goal of global finance is to balance the enhancement of monetary events, environmental stability, ecological preservation and SDG achievement for all nations (Zhou et al., 2020).

According to Wang and Zhi (2016), green finance is a new monetary event that combines economic benefits with environmental conservation. Similarly, Wang and Zhi (2016) have noted that

the two most recent study subjects are sustainable development and finance, both with emphasis on green finance. Although expanding green finance is crucial to achieving sustainable economic growth and improved environmental quality, it addresses economic-environmental conflict among the stakeholders in the banking sector (Zhou et al., 2020; Saeed Meo and Karim, 2022). Nevertheless, to maintain sustainable development, banking institutions have to come forward and ensure financial sustainability (Hasan Himo et al., 2019).

Recently, the central bank of Bangladesh has initiated a green finance policy to promote green funding and credit allocations for the financial institutions. As a result, banks and non-bank financial institutions in Bangladesh are encouraged to implement a green finance system to support green growth and environmental improvements (Zheng et al., 2021a). Furthermore, green banking operations, particularly green financing, have the potential to minimize both internal and external carbon emissions (Hossain, 2018). However, in Bangladesh, private commercial banks and non-banking financial institutions take the lead over state-owned and foreign-owned commercial banks (SCBs) in executing green finance policies (Haque and Murtaz, 2018).

However, it has been difficult for banks and financial institutions to implement green finance policies because of some regulations required to govern this practice. Besides, high transaction costs overshadow the benefits of green projects (Bhatia et al., 2017). Even though banks and financial institutions are required by law to provide at least 5% of their total loan portfolio to green projects, they are unable to come up with enough green project ideas (Zheng et al., 2021b). In addition, the most up-to-date technologies for green projects are inadequate, which brings about concerns for the undeveloped green product market. For instance, (Nawaz et al., 2021) claimed that the acceptability of green finance has been limited in India due to a lack of interest from stakeholders. Green equity finance is still in the dark because of a lack of an acceptable business climate and legal framework to attract effective investments (Zheng et al., 2021b). Besides, the green initiatives of financial organizations are nipped in the bud due to a lack of the adoption of new technology and the potential for commercialization.

Recent advancements in green finance have been found in previous research publications (Nawaz et al., 2021). As a result, research on green finance has lately made significant progress throughout the world, despite the several obstacles mentioned above. Green finance currently has widespread acceptance because it benefits both the environment and investors. To make the green finance concept popular, law enforcement agencies and policymakers are focusing on modifying difficult methods of green financing and providing training to the associated parties (Zheng et al., 2021b). This is because green finance development calls for innovative skills in finance and environmental economics.

Implementation of green finance poses some difficulties in every country throughout the world, but the difficulties are most acute in emerging countries that depend on the production of oil and natural gas for their economic growth (Fedorova, 2020). Additionally, Fedorova (2020) found that green finance's growth has been examined in light of the concerns surrounding its development, including difficulty in monitoring and analyzing the external impact of green finance. Structural hurdles like uncertainty about creditworthiness and insufficient information to make an accurate credit evaluation necessitate extensive investigation and heightened research to ensure the proper implementation of green finance in any country.

3. Research methodology

To find and choose relevant research publications, the authors employed search algorithms developed by Akomea-Frimpong et al. (2021) and Sarma and Roy (2021). They used a two-stage search strategy (see Figure 1) to conduct their studies, i.e., an initial search and the selection and acceptance of relevant articles. These two-stage search strategies are elaborated in the following section.

Stage 1: Retrieving and selecting relevant articles

The first stage started with searching research articles which are related to the current study. This step entailed using an appropriate search engine to locate all banking industry journal articles on green finance. Scopus was chosen because (1) it has a high accuracy rating for retrieving journal articles (Falagas et al., 2008), (2) it has a wider coverage of publications in fields relevant to this study, such as finance, risk management, and accounting (Gusenbauer and Haddaway, 2020) and (3) it is commonly used as a search engine for contemporary review studies (Sarma and Roy, 2021).

‘Green finance’, ‘green financing’, ‘green loan’, ‘sustainable finance’, ‘green insurance’ and ‘green investment’ were some of the green finance keywords utilized in this study. Keywords related to the banking industry included ‘bank’, and were used to search for relevant articles. Additionally, the authors of this paper considered Bangladeshi perspectives while searching the articles. The first search yielded 280 results, including books, journals, conference proceedings and reviews. Here, the authors put some further restrictions, such as (a) publication year: 2014–2022; (b) search type: journals; (c) document type: articles; and (d) language: English. Initial search codes of articles are mentioned below.

(TITLE-ABS-KEY (“Green finance”) OR TITLE-ABS-KEY (“Green financing”) OR TITLE-ABS-KEY (“Green Investment”) OR TITLE-ABS-KEY (“Green Loan”) OR TITLE-ABS-KEY (“Sustainable Finance”) OR TITLE-ABS-KEY (“Green Insurance”) AND (TITLE-ABS-KEY (“Bank”))).

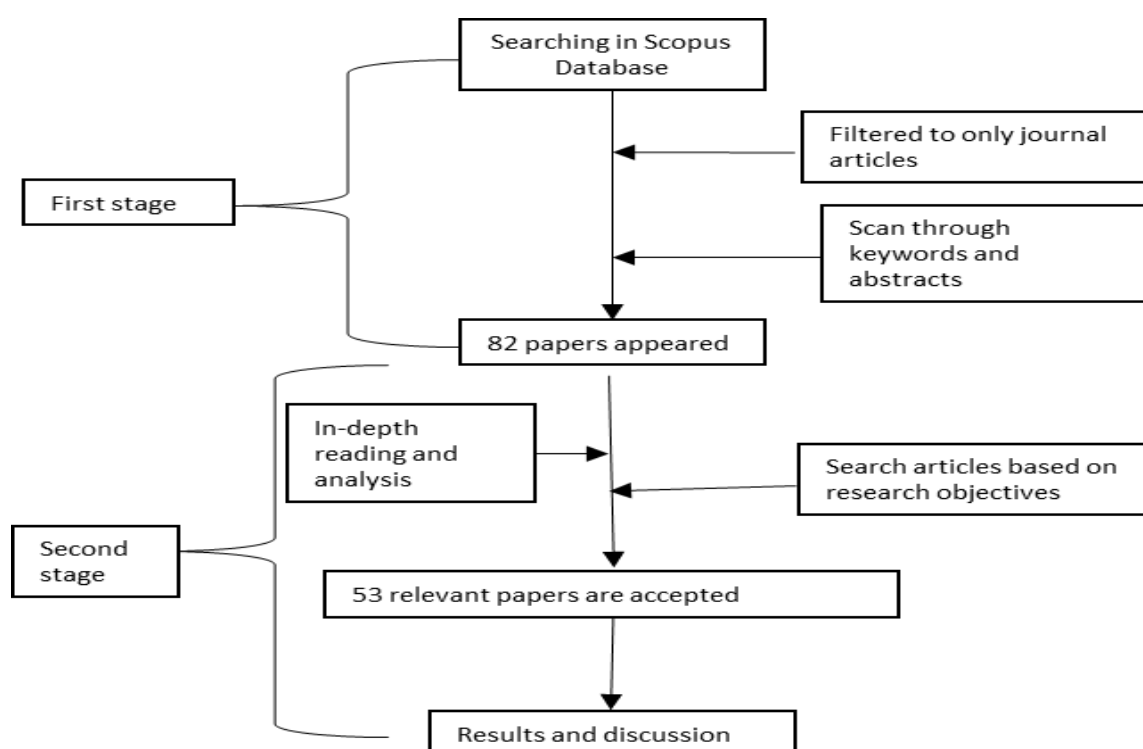


Figure 1. Research framework.

Stage 2: Selection and acceptance of relevant papers

A total of 82 papers related to green finance appeared in the first stage. But, all of these papers were not selected because they did not thoroughly address relevant issues on green finance in the banking sector. After in-depth searching and reading articles based on the research objectives, a total of 53 articles were finally selected for the present study.

The data of all studies employed in the current research were entered into a Microsoft Excel spreadsheet for further graphical analysis. To do so, authors' names, titles of the articles, keywords and abstracts were excluded. Additionally, VOS-viewer software was utilized to process the data.

4. Results and discussion

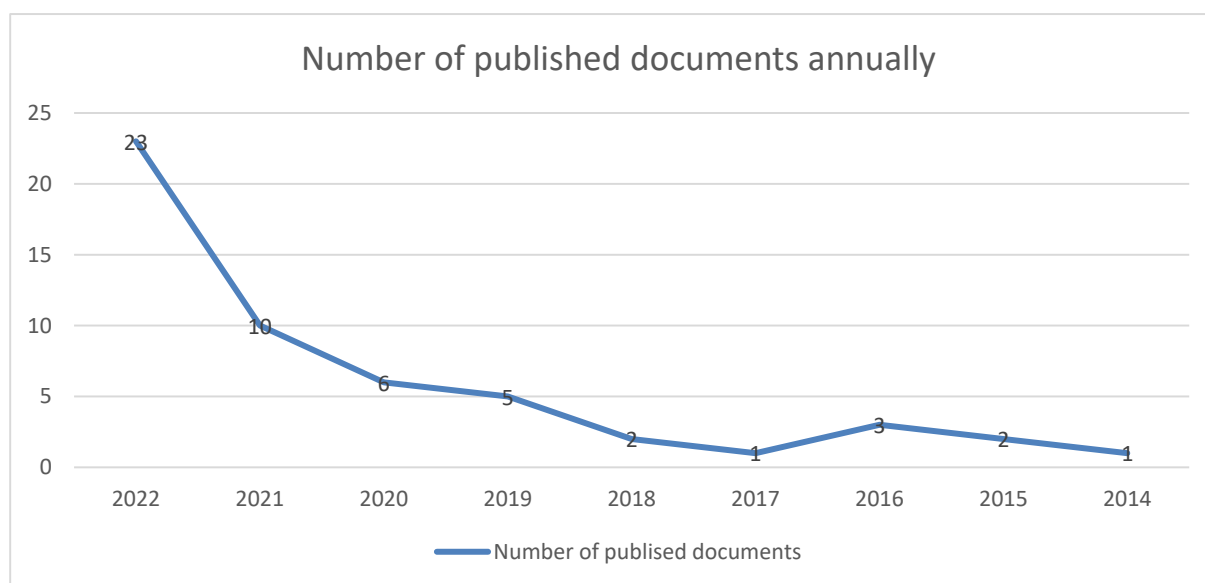


Figure 2. Trends of annually published documents.

Table 1. Citation analysis, with authors, article titles and cited times (top 10 cited articles).

Authors	Article titles	Cited times
Yip and Bocken (2018)	Sustainable business model archetypes for the banking industry	120
Li et al. (2018)	Green loan and subsidy for promoting clean production innovation	112
He et al. (2019)	Can green financial development promote renewable energy investment efficiency? A consideration of bank credit	90
Umar et al. (2021)	Carbon neutrality, bank lending, and credit risk: Evidence from the Eurozone	68
Sadiq et al. (2022)	Does green finance matter for sustainable entrepreneurship and environmental corporate social responsibility during COVID-19?	43
Mengze and Wei (2015)	A comparative study on environment credit risk management of commercial banks in the Asia-Pacific Region	40
Wang et al. (2019)	Does green credit policy work in China? The correlation between green credit and corporate environmental information disclosure quality	32
Jin et al. (2021)	The financing efficiency of listed energy conservation and environmental protection firms: Evidence and implications for green finance in China	25
Julia and Kassim (2020)	Exploring green banking performance of Islamic banks vs conventional banks in Bangladesh based on Maqasid Shariah framework	24
Chen et al. (2021)	The impact of regional banks on environmental pollution: Evidence from China's city commercial banks	18

The current study considers the previous research articles published in the timeline of 2014 to 2022. Figure 2 demonstrates the trends of the annual publication of research papers in the field of green finance. The figure also shows that the trends of annual publication in this field are rising gradually. This is due to increasingly heightened interest among scholars. It is evident from Figure 2 that, in 2014, there was one research paper, and in 2015, there were two research papers. But the trends started to go upward in 2019–2020, when five and six papers were published, respectively. The number of annual publications in 2021 was 10. Surprisingly, the highest number of articles (23) was published in 2022 so far. This means that green finance is garnering more attention by scholars day by day.

Citation analysis is the way of determining the impact of a research work by how many times a research work is cited by other research projects. Besides, this analysis yields which research articles have more importance and impact on a particular research field. Table 1 represents the citation analysis based on author names, article titles and cited times in the realm of green finance. It is shown that the study of Yip and Bocken (2018) has been cited the highest number of times (122), which means that the work has a significant impact on the context of green finance.

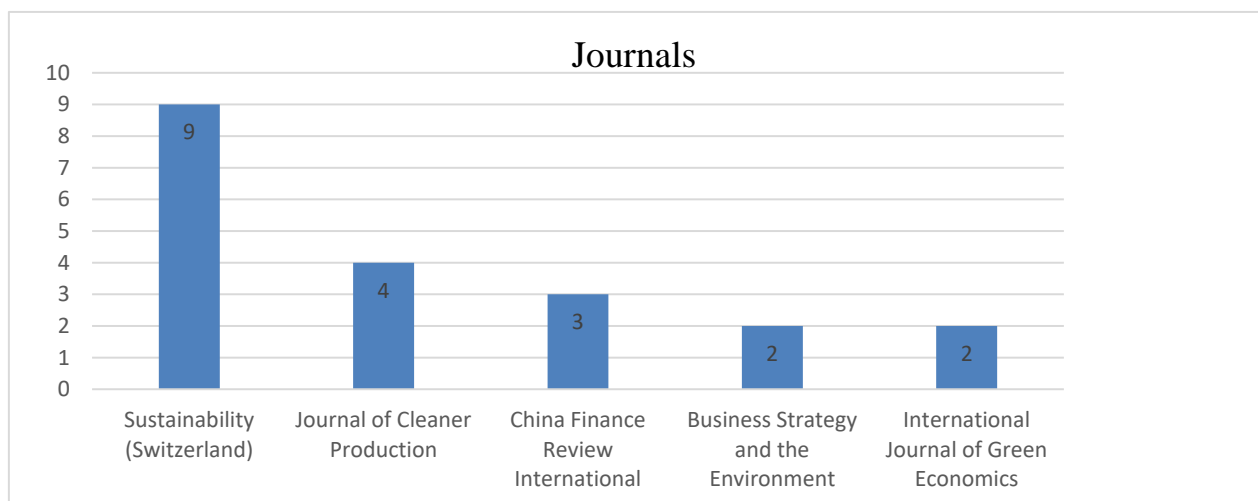


Figure 3. Names of the major journals contributing to green finance.

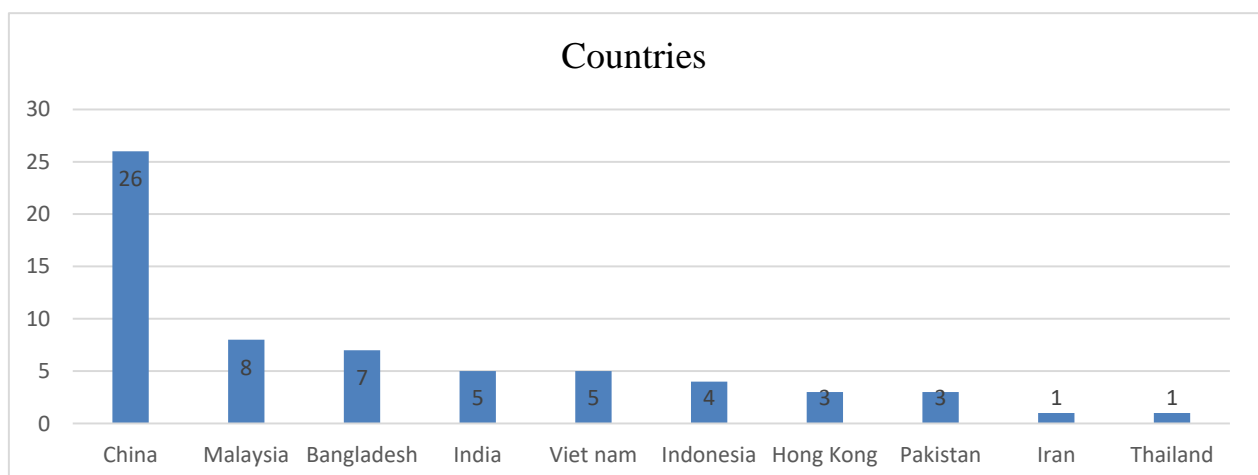


Figure 4. Major developing countries contributing to green finance.

Figure 3 and 4 illustrate the top five journals and top 10 developing countries that are contributing to green finance. According to Figure 3, *Sustainability* (Switzerland) has the highest contribution, publishing nine research documents in the field of green finance. Whereas, the *Journal of Cleaner Production* has the second highest number of documents (4). *Business Strategy and the Environment* and the *International Journal of Green Economics* both have two research documents. On the other hand, based on Figure 4, China has the highest contribution to the field of green finance, as the majority of authors are from this country. Malaysia and Bangladesh are the next top two countries that also have a notable number of authors who contribute to the field of green finance.

Table A1 (see in the Appendix section) represents the number of studies employed to demonstrate the context of green finance. All of these articles have been published and made available between the period of 2014 to 2022. Notably, this time frame has been chosen because green finance has been widely studied and gained prominent acceptance during this period. According to Table A1, a substantial number of studies have been conducted in the field of green finance, which indicates the rising attention of scholars. Among a total of 37 papers, 21 papers suggest that green finance has been receiving heightened interest among the stakeholders and academicians who are related to this field. Specifically, 12 papers demonstrate the green finance of banking institutions, which suggests that academicians have been paying close attention to banks' sustainable finance. Surprisingly, scholars have provided a noteworthy contribution to the green finance of banking institutions in Bangladesh as well, which is evident from seven papers. Overall, it is important to highlight that the growing trend of research in the context of green finance for banking institutions will continue, as this is also evident by the recent citations of 10 research papers out of 53 research papers (see Table 1).

Based on the study conducted by Zheng, et al. (2021b), private commercial banks in Bangladesh play a major role in the promotion of green finance. Zhixia et al. (2018) note that the central bank directly plays a significant role in motivating other banks and financial institutions to practice green finance activities. Notably, the majority of Bangladeshi banks are performing well in terms of practicing green finance operations according to the guidelines of the Bangladesh Bank. To maintain green banking activities, the dimensions of green finance, including social, economic and environmental, have to be taken into consideration, as they have a significant impact on the green finance of banking organizations (Zheng et al., 2021a). It has been found that green finance activities contribute to achieve sustainable economic growth (Zhang et al., 2022); as a result, practitioners of green finance in Bangladesh need to consider the sources of green financing, technical obstacles, investment costs and the lack of capable and competent staff carefully to achieve sustainable economic growth.

According to Table A1, it is clear that Bangladesh has achieved great progress in the field of green finance of the banking institutions. In a study, Khairunnessa et al. (2021) found that policy and regulatory actions have a significant and positive influence on the green performance of banks and non-banking financial institutions in Bangladesh. The Bangladesh Bank's three-phase implementation of Policy Guidelines for Green Banking ended in 2015, and the introduction of Guidelines on Environmental and Social Risk Management (ESRM) for banks and financial institutions have generated a positive change in green financial performance in Bangladesh since 2017 (Khairunnessa et al., 2021). It is noteworthy that green banking has progressed both in terms of green finance and in-house environmental risk management initiatives in Bangladesh (Khatun et al., 2021). Every scheduled bank has established a sustainable finance unit and a green banking policy. Every financial institution has also developed its own green banking policy. Currently, 58 out of 59 banks have at least one online

branch, and 45 banks have begun offering internet banking services since September 30, 2020 (Khairunnessa et al., 2021) to ensure the implementation of the green finance measures.

Table 2. Identified factors of green finance in Bangladesh.

No	Factors or dimensions	Authors
1	Conservation of energy, waste management, renewable energy, alternative energy, recyclable product production, green brick manufacturing and green establishments	(Zheng, et al., 2021b)
2	Environmental dimension and sustainability performance	(Zheng, et al., 2021a)
3	Environmental performance and sources of green financing	(Zhanget al., 2022; Islam, 2013; Khairunnessa et al., 2021)
4	Sustainable banking and investment	(Zhixia et al., 2018; Zhang et al., 2022; Islam, 2013)
5	Environmental practice and environmental infrastructure	(Khairunnessa et al., 2021)
6	Sustainable development goals	(Khatun et al., 2021; Haque and Murtaz, 2018)
7	Green finance policies and challenges	(Hossain, 2018)
8	Green economic growth	(Sadiq et al., 2022; Khairunnessa et al., 2021)
9	Corporate social responsibility	(Islam, 2013)

Sarma and Roy (2021) have illustrated that most of the countries in Asia have engaged in green banking research. To promote green banking in Bangladesh, Bangladesh Bank has formed partnerships with several worldwide strategic alliances and joined international organizations (Khairunnessa et al., 2021; Khatun et al., 2021). The central bank is a member of the Sustainable Banking Network (SBN) and has been one of the most helpful SBN country regulators in terms of developing its own national sustainable banking framework. Bangladesh has also collaborated with the United Nations Environment Programme (UNEP) probe since its inception in 2014 (Khairunnessa et al., 2021). Few other banks and financial institutions are also collaborating with various international groups to promote long-term financing.

Notably, Bangladesh was revealed to have some international green finance; however, it was insufficient. During the period of 2014–2019, investments in green initiatives were made by the banking industry and non-bank financial institutions. The Bangladesh Bank has promoted green project finance through the establishment of green banking principles, donor-aided industrial development projects, on-lending systems, credit quotas for banking institutions and tax concession refinancing methods (Zheng et al., 2021a). Chen et al. (2022) found that green financing has been largely influenced by green banking practices. However, banks and financial institutions have been strengthening their ability to deal with green initiatives, especially since green banking policy guidelines were put into place (Haque and Murtaz, 2018).

The research identified the primary roadblocks to the growth of green finance in Bangladesh. The findings illustrate that high transaction costs connected with green projects are the main barriers to green finance growth in Bangladesh. According to Hossain(2018), green initiatives take a different approach than standard projects, posing unusual and specific issues that are unique to these projects. Small local firms have a hard time getting financed because banks do not offer them credit until they have shown their creditworthiness toward green projects. Small-scale firms typically demand loans from banks and financial organizations, but there is a lack of necessary paperwork. Besides, unsolicited

applications with inaccurate information from owners or directors with poor credit ratings are common. Hence, all of these drawbacks should be handled properly to implement green finance in any country (Zheng et al., 2021a).

The research findings have some beneficial implications for financial institutions, bankers, government authorities, clients, investors and research scholars in Bangladesh in regards to promoting green finance to achieve the country's SDGs. Private commercial banks are the major donors for direct green financing in Bangladesh as compared to other banks and non-bank financial institutions. As a result, the findings of this research may help to encourage private commercial banks to boost green investment in different eco-friendly projects. On the other hand, state-owned commercial banks and specialized banks should also be motivated to engage in green investments, green bonds and other green finance products. Ironically, the findings may help to clarify the degree of knowledge, beliefs and understanding of the primary elements of green financing and sources of green finance in Bangladesh, which are helpful for implementing green finance in Bangladesh. Finally, the analysis of this research may help regulators and management develop policies considering the requirements of stakeholders in such a competitive edge of the banking industry.

4.1 Research gaps and future research direction

Still, the green finance to the banking institutions in Bangladesh is in an emerging stage. It is unclear which difficulties regarding green finance products are being faced by the banking industry, and this gap can be bridged by initiating future research. However, green finance is accompanied by the possibility of losses by the stakeholders (Chen et al., 2022), and these losses are difficult to predict from the initial stage. Green finance solutions come with considerable risks, which banks should take into account when making a decision. Steps to decrease risks and boost the green finance debate should be included in the green finance sector and internal bank credit risk policies (Akomea-Frimpong et al., 2021). The present study mainly focuses on the green finance operations of Bangladeshi banks while ignoring the robustness of risk mitigation models. Future studies may be carried out to find how risk mitigation models embrace more responsible financial behavior from a societal and environmental standpoint. Additionally, the current study employed a limited number of factors (i.e., environmental, social, managerial, legal and others) for the discussion part. More relevant and concurrent factors related to green financing can be added in future studies. On the other hand, it is difficult to obtain data on banks' green financing due to the absence of a consolidated database on green finance. Thus, green finance researchers should develop realistic models and institutionalize accurate data. Considering the above gaps and issues, future studies are encouraged to clarify and comprehensively analyze green finance to achieve sustainable economic growth in both developed and developing countries.

5. Conclusions

The goal of this study was to review the existing literature on green finance and reveal some crucial dimensions affecting the green finance operations of Bangladeshi banks. This meta-analysis study illustrates that environmental protection, climate change, social inclusion and sustainability have drawn global attention and interest, which are also seen in the banking business in recent years. The approach of this study was a systematic evaluation of 53 important articles on green finance. The results of this study reveal a total of 21 determinants of green finance in Bangladesh. Environmental

performance, green economic growth, energy efficiency, green finance policy, sustainable development, environmental protection, green investment, green bonds and environmental risks are some of the common variables used in different studies conducted in the context of the banking sector in Bangladesh. Besides, the current study illustrates a substantial number of dimensions of green financing that are practiced in other countries, including China, Malaysia, India and so on. The current study also presents the year-wise number of research documents, which show the rising trend of research publications among scholars in the field of green finance. It is evident from the research findings that a significant number of research contributions to green finance are from developing countries. In the context of green finance, Bangladesh is also providing remarkable contributions to green finance among other South Asian countries.

The current study has noteworthy implications for the practitioners, policymakers, academicians and service providers, especially in banking and financial industries. First, this is the first study that attempts to review the green finance context from developing country perspectives. To be more specific, no review studies have previously been initiated in the banking sector in Bangladesh. This demonstrates the current study's uniqueness. Second, this study identifies a set of crucial green finance dimensions which have a significant impact on implementing sustainable finance. Besides, these identified dimensions of green finance may help research scholars to conduct further in-depth investigations. Third, and finally, the findings of this study will help policymakers to design contemporary and effective green finance policies to achieve their SDGs.

Although this study reveals substantial and valuable findings regarding green finance, it has some limitations as well. First, conference papers, abstracts, reviews and preprints were not considered for this study. This is because all of these research studies are not published in peer-reviewed journals. Second, this review study includes only the articles which have been published in the English language, which generates sampling bias. Third, this study only considers the papers published during the period of 2014 to 2022 although green finance has been studied for a hundred years. This may also pose a bias. Fourth, the study did employ several extensive reviews analyzing tools like Leximancer, Covidence, Zotero, etc. Finally, this study is a meta-analysis of previous studies on green finance, focusing on banking sectors in Bangladesh; as a result, in-depth empirical analysis can be conducted on some specific constructs to clarify the context more comprehensively in other sectors in different nations.

Acknowledgments

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

- Akomea-Frimpong I, Adeabah D, Ofosu D, et al. (2021) A review of studies on green finance of banks, research gaps and future directions. *J Sust Financ Investment*, 1–24. <https://doi.org/10.1080/20430795.2020.1870202>

- Al-Qudah AA, Hamdan A, Al-Okaily M, et al. (2022) The impact of green lending on credit risk: evidence from UAE's banks. *Environ Sci Pollut Res*, 1–24. <https://doi.org/10.1007/s11356-021-18224-5>
- Amidjaya PG, Widagdo AK (2020) Sustainability reporting in Indonesian listed banks: Do corporate governance, ownership structure and digital banking matter? *J Appl Account Res* 21: 231–247. <https://doi.org/10.1108/JAAR-09-2018-0149>
- Amighini A, Giudici P, Ruet J (2022) Green finance: An empirical analysis of the Green Climate Fund portfolio structure. *J Clean Prod* 350: 131383. <https://doi.org/10.1016/J.JCLEPRO.2022.131383>
- Barua S, Aziz S (2022) Making green finance work for the sustainable energy transition in emerging economies. *Energy-Growth Nexus in an Era of Globalization*, Elsevier, 353–382. <https://doi.org/10.1016/b978-0-12-824440-1.00014-x>
- Berensmann K, Volz U, Bak C, et al. (2020) Fostering Sustainable Global Growth Through Green Finance – What Role for The G20? *G20-Insights. Org* 1–8. Available from: https://collaboration.worldbank.org/content/usergenerated/asi/cloud/attachments/sites/collaboration-for-development/en/groups/green-finance-community-of-practice/documents/jcr:content/content/primary/blog/green_finance_education/LVNC/Climate_Green-Finance_V2
- Bhatia A, Ey YLLP, Technology C, et al. (2017) Governance for Green Growth in Bangladesh: Policies, Institutions, and Political Economy. *Econ Dialogue Green Growth (EDGG)* 1: 1–65. [https://www.greengrowthknowledge.org/sites/default/files/downloads/resource/Governance for Green Growth in Bangladesh_Policies, Institutions, and Political Economy_0.pdf](https://www.greengrowthknowledge.org/sites/default/files/downloads/resource/Governance%20for%20Green%20Growth%20in%20Bangladesh_Policies,%20Institutions,%20and%20Political%20Economy_0.pdf)
- Chen J, Siddik AB, Zheng GW, et al. (2022) The Effect of Green Banking Practices on Banks' Environmental Performance and Green Financing: An Empirical Study. *Energies* 15: 1292. <https://doi.org/10.3390/en15041292>
- Chen Y, Cheng L, Lee CC, et al. (2021) The impact of regional banks on environmental pollution: Evidence from China's city commercial banks. *Energy Econ* 102: 105492. <https://doi.org/10.1016/j.eneco.2021.105492>
- Debrah C, Chan APC, Darko A (2022) Green finance gap in green buildings: A scoping review and future research needs. *Build Environ* 207: 108443. <https://doi.org/10.1016/j.buildenv.2021.108443>
- Díaz-García C, González-Moreno Á, Sáez-Martínez FJ (2015) Eco-innovation: Insights from a literature review. *Innovation Manage Policy Pract* 17: 6–23. <https://doi.org/10.1080/14479338.2015.1011060>
- Dikau S, Volz U (2018) *Central Banking, Climate Change and Green Finance*.
- Dikau S, Volz U (2021) Central bank mandates, sustainability objectives and the promotion of green finance. *Ecol Econ* 184: 107022. <https://doi.org/10.1016/j.ecolecon.2021.107022>
- Dörry S, Schulz C (2018) Green financing, interrupted. Potential directions for sustainable finance in Luxembourg. *Local Environ* 23: 717–733. <https://doi.org/10.1080/13549839.2018.1428792>
- Durrani A, Rosmin M, Volz U (2020) The role of central banks in scaling up sustainable finance—what do monetary authorities in the Asia-Pacific region think? *J Sust Financ Investment* 10: 92–112. <https://doi.org/10.1080/20430795.2020.1715095>
- Falagas ME, Pitsouni EI, Malietzis GA, et al. (2008) Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. *FASEB J* 22: 338–342. <https://doi.org/10.1096/fj.07-9492lsf>

- Fedorova EP (2020) Role of the State in the Resolution of Green Finance Development Issues. *Financ J* 12: 37–51. <https://doi.org/10.31107/2075-1990-2020-4-37-51>
- Giudici P (2018) Fintech Risk Management: A Research Challenge for Artificial Intelligence in Finance. *Frontiers in Artif Intell* 1: 1. <https://doi.org/10.3389/frai.2018.00001>
- Giudici P, Hadji-Misheva B, Spelta A (2020) Network based credit risk models. *Qual Eng* 32: 199–211. <https://doi.org/10.1080/08982112.2019.1655159>
- Gunningham N (2020) A Quiet Revolution: Central Banks, Financial Regulators, and Climate Finance. *Sustainability* 12: 9596. <https://doi.org/10.3390/SU12229596>
- Gusenbauer M, Haddaway NR (2020) Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources. *Res Synth Methods* 11: 181–217. <https://doi.org/10.1002/JRSM.1378>
- Haque MS, Murtaz M (2018) Green Financing in Bangladesh. *International Conference on Finance for Sustainable Growth and Development*, 82–89. Available from: https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=+Haque%2C+M.S.%3B+Murtaz%2C+M.+Green+Financing+in+Bangladesh.+In+Proceedings+of+the+International+Conferenc+e+on+Finance+for+Sustainable+Growth+and+Development%2C+Chittagong%2C+Bangladesh&btnG=
- Hasan HR, Bakkar SA, Akter A (2019) Corporate Bond Market: The Case of Bangladesh. *World Rev Bus Res* 9: 20–38. <https://zantworldpress.com/wp-content/uploads/2019/04/9.-Afia.pdf>
- He L, Liu R, Zhong Z, et al. (2019) Can green financial development promote renewable energy investment efficiency? A consideration of bank credit. *Renewable Energy* 143: 974–984. <https://doi.org/10.1016/j.renene.2019.05.059>
- Hossain, M (2018) Green Finance in Bangladesh: Policies, Institutions, and Challenges. *ADB Working Paper Series* 892: 1–24. <https://www.econstor.eu/handle/10419/190313>
- Islam MS, Das PC (2013). Green Banking practices in Bangladesh. *IOSR J Bus Manage* 8: 39–44. <https://doi.org/10.9790/487x-0833944>
- Jin Y, Gao X, Wang M (2021) The financing efficiency of listed energy conservation and environmental protection firms: Evidence and implications for green finance in China. *Energy Policy*, 153: 112254. <https://doi.org/10.1016/j.enpol.2021.112254>
- Julia T, Kassim S (2020) Exploring green banking performance of Islamic banks vs conventional banks in Bangladesh based on Maqasid Shariah framework. *J Islamic Mark* 11: 729–744. <https://doi.org/10.1108/JIMA-10-2017-0105>
- Khairunnessa F, Vazquez-Brust DA, Yakovleva N (2021) A review of the recent developments of green banking in bangladesh. *Sustainability (Switzerland)* 13: 1–21. <https://doi.org/10.3390/su13041904>
- Khatun MN, Sarker MNI, Mitra S (2021) Green Banking and Sustainable Development in Bangladesh. *Sust Clim Change* 14: 262–271. Mary Ann Liebert Inc. <https://doi.org/10.1089/scc.2020.0065>
- Lee CC, Lee CC (2022) How does green finance affect green total factor productivity? Evidence from China. *Energy Econ* 107: 105863. <https://doi.org/10.1016/j.eneco.2022.105863>
- Li Z, Kuo TH, Siao-Yun W, et al. (2022) Role of green finance, volatility and risk in promoting the investments in Renewable Energy Resources in the post-covid-19. *Resour Policy* 76: 102563. <https://doi.org/10.1016/j.resourpol.2022.102563>
- Li Z, Liao G, Wang Z, et al. (2018) Green loan and subsidy for promoting clean production innovation. *J Clean Prod* 187: 421–431. <https://doi.org/10.1016/j.jclepro.2018.03.066>

- Lindenberg N (2014) Definition of Green Finance. *German Development Institute*, 3. Available from: https://scholar.archive.org/work/tgtjvkykqrkpek5wcyvtlauue/access/wayback/https://www.die-gdi.de/uploads/media/Lindenberg_Definition_green_finance.pdf
- Liu H, Yao P, Latif S, et al. (2022) Impact of Green financing, FinTech, and financial inclusion on energy efficiency. *Environ Sci Pollut Res* 29: 18955–18966. <https://doi.org/10.1007/s11356-021-16949-x>
- Liu N, Liu C, Xia Y, et al. (2020) Examining the coordination between green finance and green economy aiming for sustainable development: A case study of China. *Sustainability (Switzerland)*, 12. <https://doi.org/10.3390/su12093717>
- Liu R, Wang D, Zhang L, et al. (2019) Can green financial development promote regional ecological efficiency? A case study of China. *Nat Hazards* 95: 325–341. <https://doi.org/10.1007/s11069-018-3502-x>
- Macpherson M, Gasperini A, Bosco M (2021) Artificial Intelligence and FinTech Technologies for ESG Data and Analysis. *SSRN Electronic J*. <https://doi.org/10.2139/ssrn.3790774>
- Mengze H, Wei L (2015) A comparative study on environment credit risk management of commercial banks in the Asia-Pacific Region. *Bus Strategy Environ* 24: 159–174. <https://doi.org/10.1002/bse.1810>
- Mohd S, Kaushal VK (2018) Green Finance: A Step towards Sustainable Development. *MUDRA: J Financ Account* 5: 59–74. <https://doi.org/10.17492/mudra.v5i01.13036>
- Nawaz MA, Seshadri U, Kumar P, et al. (2021) Nexus between green finance and climate change mitigation in N-11 and BRICS countries: empirical estimation through difference in differences (DID) approach. *Environ Sci Pollut Res* 28: 6504–6519. <https://doi.org/10.1007/s11356-020-10920-y>
- Ngwenya N, Simatele MD (2020) The emergence of green bonds as an integral component of climate finance in South Africa. *S Afr J Sci* 116: 1–3. <https://doi.org/10.17159/sajs.2020/6522>
- Sadiq M, Amayri MA, Paramaiah C, et al. (2022) How green finance and financial development promote green economic growth: deployment of clean energy sources in South Asia. *Environ Sci Pollut Res* 29: 65521–65534. <https://doi.org/10.1007/S11356-022-19947-9>
- Sadiq M, Nonthapot S, Mohamad S, et al. (2022) Does green finance matter for sustainable entrepreneurship and environmental corporate social responsibility during COVID-19? *China Financ Rev Int* 12: 317–333. <https://doi.org/10.1108/CFRI-02-2021-0038>
- Saeed MM, Karim MZA (2022) The role of green finance in reducing CO₂ emissions: An empirical analysis. *Borsa Istanbul Rev* 22: 169–178. <https://doi.org/10.1016/j.bir.2021.03.002>
- Sanchez-Roger M, Oliver-Alfonso MD, Sanchís-Pedregosa C (2018) Bail-In: A sustainable mechanism for rescuing banks. *Sustainability (Switzerland)* 10: 3789. <https://doi.org/10.3390/su10103789>
- Sarma P, Roy A (2021) A Scientometric analysis of literature on Green Banking (1995-March 2019). *J Sust Financ Investment* 11: 143–162. <https://doi.org/10.1080/20430795.2020.1711500>
- Schäfer H (2018) Germany: The ‘greenhorn’ in the green finance revolution. *Environment* 60: 19–27. <https://doi.org/10.1080/00139157.2018.1397472>
- Sharma GD, Sarker T, Rao A, et al. (2022) Revisiting conventional and green finance spillover in post-COVID world: Evidence from robust econometric models. *Global Financ J* 51: 100691. <https://doi.org/10.1016/j.gfj.2021.100691>

- Suh W, Kim K (2019) Artificial Intelligence and Financial Law. *Gachon Law Rev* 12: 179–214. <https://doi.org/10.15335/glr.2019.12.4.006>
- Umar M, Ji X, Mirza N, et al. (2021) Carbon neutrality, bank lending, and credit risk: Evidence from the Eurozone. *J Environ Manage* 296: 113156. <https://doi.org/10.1016/j.jenvman.2021.113156>
- Urban MA, Wójcik D (2019) Dirty banking: Probing the gap in sustainable finance. *Sustainability (Switzerland)* 11: 1745. <https://doi.org/10.3390/su11061745>
- Wang F, Yang S, Reisner A, et al. (2019) Does green credit policy work in China? The correlation between green credit and corporate environmental information disclosure quality. *Sustainability (Switzerland)* 11: 737. <https://doi.org/10.3390/su11030733>
- Wang R, Zhao X, Zhang L (2022) Research on the impact of green finance and abundance of natural resources on China's regional eco-efficiency. *Resour Policy* 76: 102579. <https://doi.org/10.1016/j.resourpol.2022.102579>
- Wang Y, Zhi Q (2016) The Role of Green Finance in Environmental Protection: Two Aspects of Market Mechanism and Policies. *Energy Procedia* 104: 311–316. <https://doi.org/10.1016/j.egypro.2016.12.053>
- Wang Z, Shahid MS, Binh AN, et al. (2022) Does green finance facilitate firms in achieving corporate social responsibility goals? *Econ Res-Ekon Istrazivanja*, 1–20. <https://doi.org/10.1080/1331677X.2022.2027259>
- Weber O, ElAlfy A (2019) *The Development of Green Finance by Sector*, 53–78. https://doi.org/10.1007/978-3-030-22510-0_3
- Yin X, Xu Z (2022) An empirical analysis of the coupling and coordinative development of China's green finance and economic growth. *Resour Policy* 75: 102476. <https://doi.org/10.1016/j.resourpol.2021.102476>
- Yip AWH, Bocken NMP (2018) Sustainable business model archetypes for the banking industry. *J Clean Prod* 174: 150–169. <https://doi.org/10.1016/j.jclepro.2017.10.190>
- Yuan F, Gallagher KP (2018) Greening Development Lending in the Americas: Trends and Determinants. *Ecol Econ* 154: 189–200. <https://doi.org/10.1016/j.ecolecon.2018.07.009>
- Zhang H, Geng C, Wei J (2022) Coordinated development between green finance and environmental performance in China: The spatial-temporal difference and driving factors. *J Clean Prod* 346: 131150. <https://doi.org/10.1016/j.jclepro.2022.131150>
- Zhang X, Wang Z, Zhong X, et al. (2022) Do Green Banking Activities Improve the Banks' Environmental Performance? The Mediating Effect of Green Financing. *Sustainability (Switzerland)* 14: 989. <https://doi.org/10.3390/su14020989>
- Zheng GW, Siddik AB, Masukujjaman M, et al. (2021a) Factors affecting the sustainability performance of financial institutions in Bangladesh: The role of green finance. *Sustainability (Switzerland)* 13: 10165. <https://doi.org/10.3390/su131810165>
- Zheng GW, Siddik AB, Masukujjaman M, et al. (2021b) Green finance development in Bangladesh: The role of private commercial banks (PCBs). *Sustainability (Switzerland)* 13: 1–17. <https://doi.org/10.3390/su13020795>
- Zhixia C, Hossen MM, Muzafary SS, et al. (2018) Green banking for environmental sustainability-present status and future agenda: Experience from Bangladesh. *Asian Econ Financ Rev* 8: 571–585. <https://doi.org/10.18488/journal.aefr.2018.85.571.585>

- Zhou X, Tang X, Zhang R (2020) Impact of green finance on economic development and environmental quality: a study based on provincial panel data from China. *Environ Sci Pollut Res* 27: 19915–19932. <https://doi.org/10.1007/s11356-020-08383-2>
- Ziolo M, Filipiak BZ, Bak I, et al. (2019) How to design more sustainable financial systems: The roles of environmental, social, and governance factors in the decision-making process. *Sustainability (Switzerland)* 11: 5604. <https://doi.org/10.3390/su11205604>



AIMS Press

© 2022 the Author(s), licensee AIMS Press. This is an open access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>)