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# Role of Green Finance for Sustainable Environment So Far: A Bibliometric Analysis and Policy Framework

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**ABSTRACT**

A bibliometric examination of green finance's contribution to environmental sustainability is the intended outcome of this work. The research also offers a policy framework for environmentally friendly financing. To produce the bibliometric analysis, we used proper keywords to sift through the Scopus database for relevant, peer-reviewed research articles published between 2008 and 2022 (Dec 2022). In this study, the titles, abstracts, keywords, frameworks, and headers of 444 relevant papers were screened using bibliographic coupling and text mining. The research used the scientific landscapes visualization tool for the analysis. Our evaluation provides a systematic account of the effectiveness of related works in the field of green finance. Authors, publications, and theoretical and topical contributions to the field are all revealed through bibliometric analysis. This paper provides a theoretical framework for future studies on the effects of green financing on sustainable environments. The interdependencies between different industries and how they might work together to protect the environment are also laid forth. Green finance plays a unique role in protecting the natural world. This work makes a contribution to the literature on green finance and sustainable environments by identifying theoretical clusters for future research on environmental performance. The paper also lays out the goals of the green finance policy framework.



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## 1. Introduction

Positioning the green energy towards energy and sustainable environment and their related sustainable development goals directly and indirectly is becoming vital after 2018 (Rasoulinezhad & Taghizadeh-Hesary, 2022). In order to achieve the SGDs, we need to save the environment and for this purpose, green finance development is enhancing the innovation capacity and transforming the economies into green economies. People may better manage the issues of climate change, the ecological crisis, and energy security with the aid of green finance development, which improves innovative capacity and economic green transformation. For green finance, it's critical to create sustainable and balanced development (Cui, Wang, & Wang, 2020). The key findings indicate that banks continue to have a monopoly on the financial market for granting credits, while businesses listed on the second board exhibit greater levels of financing effectiveness. The effectiveness of business financing as it relates to the relationship between green finance policies and regional economic development initiatives (Zhu, Jin, & He, 2019).

Multiple other industries and the financial sector have close ties. The expansion of the social economy is proportional to the fluctuations of the financial sector (Wang, Tsai, Du, & Bi, 2019). The traditional financial sector adopted internet technology as a result of the Internet's rapid growth, and internet finance has since become much more stable due to the Internet's and mobile technology's secure foundations, according to Yuwen Bai et al. It has expanded swiftly, increasing the funding alternatives accessible to businesses and solving their financial challenges. Given the state of the environment, the financial sector regards environmental protection as a

fundamental policy; any potential environmental impact must be considered when making investment and financing decisions, and the potential return, risk, and cost associated with environmental conditions must be factored into financial transactions. In this new financial pattern that combines environmental protection and economic rewards, the phrases "green" and "finance," which are both tough issues, are highlighted. As a result, online finance, ecological finance, and sustainability are becoming increasingly popular. This special issue focuses on these two issues and has received a number of outstanding papers that merit recognition for their attention to academic inquiry into interrelated disciplines and the advancement of society(Dong & Li, 2015).

Experts acknowledge that while the GF offers a chance to pursue ecologically sustainable innovation routes, it does not genuinely shield biomass producers from institutional and financial challenges when trying to finance their investment initiatives. These concerns include: ambiguity over government regulations, a lack of financial providers' engagement in the biomass industry, the short-term focus of financial instruments, and enterprises' scant awareness of available financing choices and technological know-how (Falcone & Sica, 2019). This study aims to present a bibliometric analysis of green finance efficiency for sustainable environment. Bibliometry is the use of quantitative, statistical techniques to trace the evolution and structures of a scientific area (Zupic & Čater, 2015). This method offers a systematic overview of the domain's research trends, topic clusters, and theoretical frameworks. Our bibliometric analysis is focused on the following research questions (RQ), which serve as the analyses' compass.

- What are the trends in research publications and who are the key writers, organizations, sources and nations?
- What are the most-cited keywords and how have they changed over time?
- How green finance create linkage among the sectors and roadmap towards the sustainable environment?
- How is green finance policy framework important for the sustainable environment?

Our research contributes in a number of important ways. First, our findings offer a comprehensive and organized classification of prominent publications, intellectuals, networks of collaborators, organizations, and nations. Our analysis also offers a logically coherent evolution of ideas on what is meant by the term "green finance efficiency." Scholars wishing to contribute to the field of Green Finance (GF) study are given direction by the field's development. Interdisciplinary study within this important research subject is strengthened by acknowledging ongoing attempts to establish and analyze environmental performance in commercial interactions.

Our findings demonstrate that the quality and quantity of research at micro level like authors and journals and macro level e.g., institutions and nations, are influenced by a greater intellectual grasp of environmental performance. Research maturity may be shown in the use of both existing and novel policy frameworks to analyze GF. Additionally, defining the hypotheses that underlie this research gives future GF investigations focus. Future research may be streamlined by utilizing these theoretical combinations.

The remaining sections of this essay are as follows. In Section 2, we examine the literature and discuss how the concept of environmental performance has evolved. The research concept, analytical techniques, and data gathering procedure are presented in Section 3. The findings of the publishing trend are displayed in Section 4, along with the top journals and organizations, regional distributions, highly cited works, and co-authorships. Emerging research clusters and theoretical clusters are also included in this section. The linkage of sectors for green finance and sustainable environment is explained in section 5 and objectives of policy framework is presented in section 6. The study comes to a close in Section 7 with a discussion of the findings, a list of its drawbacks, and suggestions for further research.

## 2. Literature Review

Green finance has received attention recently as a result of the agreement on environmental protection, steps taken to combat climate and environment change, and the fulfillment of the Sustainable Development Goals (SDGs) by 2030 (Amidjaya & Widagdo, 2020). Green finance is often referred to as sustainable finance, environmental financing, climate finance, and green investment (Dörry and Schulz 2018). The importance of green finance peaked during the eleventh G-20 summit in Hangzhou, China, in 2016 (Süßbauer & Schäfer, 2018), when

it was widely discussed and publicized. Diverse views on green finance represent the aspects of the topic that are significant to the researcher, creating differences in viewpoints and levels of interest.

The definition of "green finance" is investing in products that promote social justice, environmental protection, and economic growth. According to Lindberg, Markard, and Andersen (2019), the concept is exemplified by green economy-supporting financial institution policies. The "finance" component of the concept describes how capital is allocated and invested through financial systems (Berensmann et al., 2017; Weber & ElAlfy, 2019). To promote economic development, banks serve as intermediaries by absorbing and distributing inactive funds throughout society (Fu & Ng, 2020). The "green" term of green finance mandates the division of financial resources across all sectors for corporate governance, renewable energy, green building, climate change, and environmental protection (Urban & Wójcik, 2019; Yuan & Gallagher, 2018).

Many major financial institutions have recently announced shifts in business strategy to prioritize environmentally friendly products. These institutions include Societe Genale, Deutsche Bank and Credit Agricole, among others. Their goal is to cut off financial support for organizations and individuals whose activities have a harmful effect on the natural world (Sanchez et al., 2018). Several central banks, notably the Chinese-Central Bank, have designed and implemented legislation to drive green financing transactions in the banking industry (He, Liu, Zhong, Wang, & Xia, 2019). Despite the gravity of these pacts, many financial institutions throughout the world have not demonstrated a readiness to provide green financing-oriented financial products. Because of this, green financing has not been widely accepted yet. The absence of standardized regulations, the severity of the risks involved, and the narrowness of its uses are all obstacles.

A relatively recent area of finance is green financing. International organizations and economists have been unable to uniformly or precisely define the term. However, a number of academics, organizations, and governments have created useful definitions (Labatt & White, 2002). An intriguing variant on this is that several groups have created the term "a sustainable financial system" rather than "green finance" (Hira, 2012). However, their methods and tools remain the same. According to the United Nations Environment Programme (UNEP), a sustainable financial system is one that takes into consideration the process of value production and makes it easier to manage financial assets.

This makes it possible to make use of actual wealth over the long term in order to fulfill the requirements of an inclusive economy that is environmentally sustainable. According to the findings of the G20 Green Finance Study Group (Berensmann et al., 2017), "green financing" is defined as money that stimulates the adoption of technology that reduce pollution. According to the People's Bank of China, "green finance" is a combination of institutional and legislative initiatives that are meant to attract private capital into green sectors such as environmental preservation and energy conservation through the use of financial services. This definition was provided by the People's Bank of China.

# 3. Methods

## 3.1. The Search Terms

For this study, we build our dataset by searching literature from the Web of Science. This study considered only the research articles published in English. From Scopus database 62280 results were received for term, “Sustainable”, AND “Green” AND “Finance” OR “Growth” = 4795. After excluding “proceeding papers” and “editorial Material”, and all the major categories belonging to the web of core collection were selected and we are left with the following number after including “Economics”, “Applied Economics”, “Environmental Science”, “Environmental Science and Management”, “Studies in Human Society” and “Policy and administration”, our final sample of 444 studies.

# 4. Results

## 4.1. Documents Profiles

Documents profile reveals that the selected data file as per the topic of the study, we get “article” and “Book Chapters” equal to 271 and 83. This shows the article captures the maximum portion of the database. We also included conference papers that were 21, review papers were 33. The table 1 summarize the document types and their percentage. Table 2 presented a

comprehensive picture of subject areas that are included in the study. The main areas are "Economics", "Applied Economics", "Environmental Science", "Environmental Science and Management", "Studies in Human Society" and "Policy and administration" and their respective percentages are also calculated in table 2.

**Table 1: Document Type**

| Document Type | Total Publications (TP) | Percentage (%) |
|---|---|---|
| Article | 271 | 61.04 |
| Book Chapter | 83 | 18.69 |
| Conference Paper | 21 | 4.73 |
| Review Papers | 33 | 7.43 |
| Note | 19 | 4.28 |
| Review | 17 | 3.83 |
| | 444 | 100.00 |

**Table 2: Subject Area**

| Subject Area | Total Publications (TP) | Percentage (%) |
|---|---|---|
| Economics | 117 | 26.35 |
| Applied Economics | 108 | 24.32 |
| Environmental Sciences | 102 | 22.97 |
| Environmental Sciences and Management | 74 | 16.67 |
| Studies in Human Society | 33 | 7.43 |
| Policy and Administration | 10 | 2.25 |

## 4.2. Research Trends

A sustainable environment was one of the millennium development goals by the year 2000, but focus shifted to large investments in energy production and transportation infrastructure that took use of the available deposits of uranium, coal, and oil. The research study highlighted the enormous potential for increasing the supply of renewable energies with rigorous government regulation. The first decade of 21$^{st}$ century witnessed only one publication (Zhang. 2008). Since 2008, there was an increase in the number of studies and this boom is still continued till date.

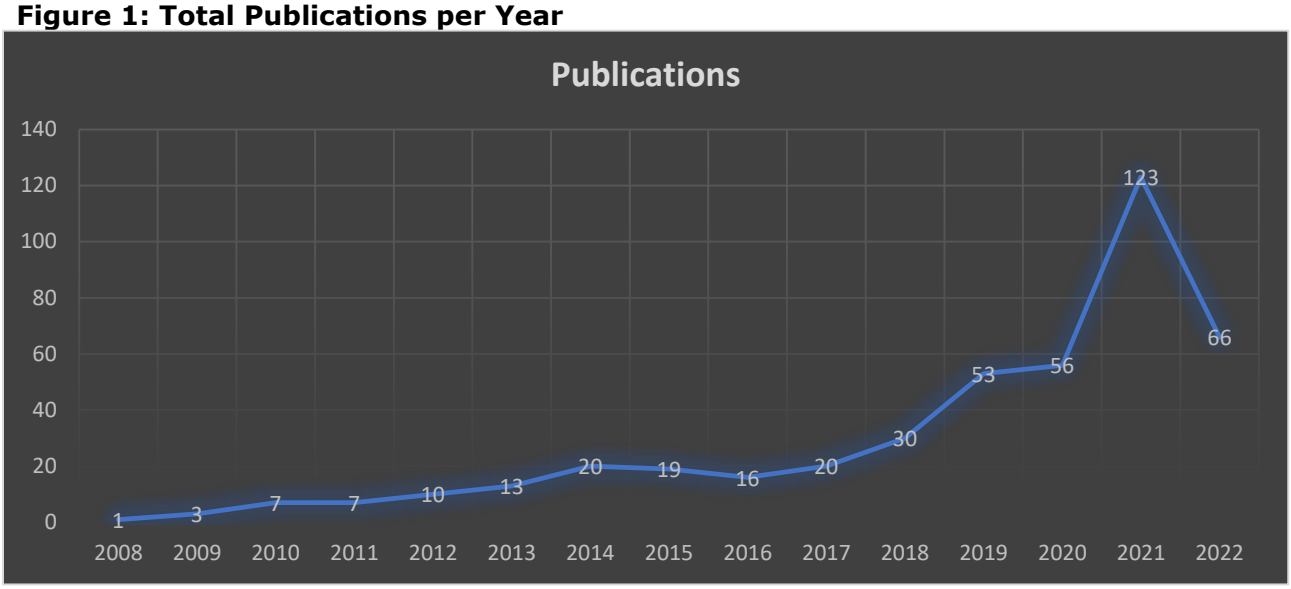
The table 4 is summarizing year wise trend of publication on energy transition and climate change relation in Scopus studies over the time period of 2008-2022. In this table total citation (TC) per year, average citation (C/P) and average citation per citation publication are also reported. Figure 2 is depicting the trend of publication in a graphical way. The vertical bars are representing the number of publication per year and line graph represents number of citation per year.

**Table 3: Year of Publication**

| Year | TP | TC | NCP | C/P | C/NCP |
|---|---|---|---|---|---|
| 2022 | 66 | 61 | 20 | 0.92 | 3.05 |
| 2021 | 123 | 416 | 66 | 3.38 | 6.30 |
| 2020 | 56 | 546 | 35 | 9.75 | 15.60 |
| 2019 | 53 | 1322 | 35 | 24.94 | 37.77 |
| 2018 | 30 | 467 | 22 | 15.57 | 21.23 |
| 2017 | 20 | 469 | 14 | 23.45 | 33.50 |
| 2016 | 16 | 167 | 9 | 10.44 | 18.56 |
| 2015 | 19 | 143 | 16 | 7.53 | 8.94 |
| 2014 | 20 | 214 | 16 | 10.70 | 13.38 |
| 2013 | 13 | 77 | 11 | 5.92 | 7.00 |
| 2012 | 10 | 170 | 8 | 17.00 | 21.25 |
| 2011 | 7 | 208 | 6 | 29.71 | 34.67 |
| 2010 | 7 | 146 | 5 | 20.86 | 29.20 |
| 2009 | 3 | 104 | 1 | 34.67 | 104.00 |
| 2008 | 1 | 97 | 1 | 97.00 | 97.00 |
| **Total** | **444** | | | | |

Notes: "TP=total number of publications; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; C/NCP=average citations per cited publication;"

**Figure 1: Total Publications per Year**




### 4.3. Geographical Dispersion

Table 4 shows top 15 countries which contributed to the research in the area under research. The Table 4 summarizes the total publications along with total citation, average citation and Total Link Strength. According to the classification done by VOS Viewer, China is leading the list with 1114 citations of 66 publications. (Lei, Wang, Zhao, & Chen, 2021; Su & Gao, 2022; Wang et al., 2019; Zakaria, Ahmi, Ahmad, & Othman, 2021) with many more had presented their work on green finance as an indicator of environmental sustainability. The maximum TLS is also viewed 3322 for China.

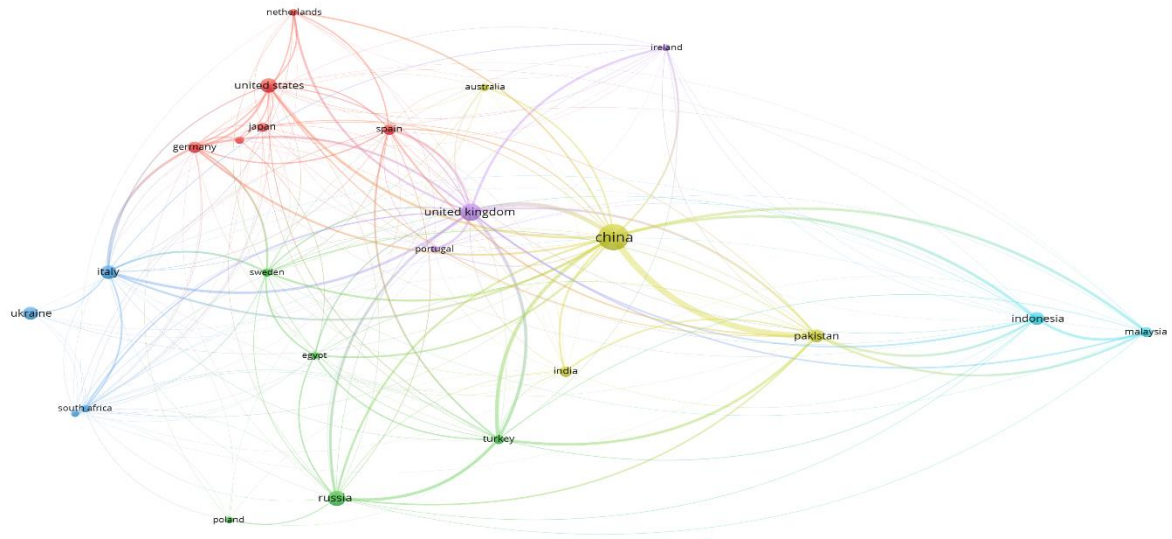
United kingdom (Awosusi et al., 2022; O'Keeffe et al., 2022) stands second in the list with 28 publications and total citations are 974 with 2241 TLS. Russia, United States, Italy, Indonesia, Pakistan, Ukraine, Germany (Kemfert, Claudia; SchÃ¤fer, Dorothea; Semmler, Willi in 2020 and Tien et al. in 2020) and Spain are ranked respectively after USA. Bibliometric coupling method for countries resulted in Figure 3. For each country who is having documents 5 and more was included in the analysis.

**Table 4: Top 20 Countries Contributed to the Publications**

| Country | TP | TC | C/P | TLS |
|---|---|---|---|---|
| China | 66 | 1114 | 16.88 | 3322 |
| United Kingdom | 28 | 974 | 34.79 | 2241 |
| Russia | 22 | 101 | 4.59 | 684 |
| United states | 20 | 915 | 45.75 | 568 |
| Italy | 18 | 316 | 17.56 | 768 |
| Indonesia | 15 | 143 | 9.53 | 697 |
| Pakistan | 15 | 207 | 13.80 | 1946 |
| Ukraine | 15 | 23 | 1.53 | 42 |
| Germany | 13 | 682 | 52.46 | 785 |
| Spain | 11 | 709 | 64.45 | 514 |
| India | 10 | 129 | 12.90 | 192 |
| Malaysia | 9 | 67 | 7.44 | 653 |
| Japan | 8 | 173 | 21.63 | 118 |
| Turkey | 8 | 374 | 46.75 | 1160 |
| Sweden | 7 | 36 | 5.14 | 506 |

Notes: "TP=total number of publications; TC=total citations; C/P=average citations per publication; TLS= Total Link Strength"

**Figure 2: Network Visualization Map of the Publication per Country**




## 4.4. Most Influential Institutions

Table 5 is showing the top fifteen most influential institutions with minimum three publications. The "Istanbul Gelisim University" situated in Turkey is leading the table with maximum 4 publications, 320 Total citations and 356 TLS. "Bournemouth University" secures second position in the ranking with 3 publication and maximum total citations and average citation per publication that are 283 and 94.33 respectively (Adedoyin & Bekun, 2020; Tawiah, Zakari, & Adedoyin, 2021). Five universities of China are a part of the ranking at third, fourth, fifth, seventh and twelfth position.

**Table 5: Most Influential Institutions with Minimum of Five Publications**

| Affiliation | Country | TP | TC | TC/TP | TLS |
|---|---|---|---|---|---|
| Istanbul Gelisim University | Turkey | 4 | 320 | 80.00 | 356 |
| Bournemouth University | England | 3 | 283 | 94.33 | 299 |
| Beijing Institute of Technology | China | 3 | 108 | 36.00 | 228 |
| Jiangsu University | China | 3 | 74 | 24.67 | 159 |
| Nanjing University of Aeronautics and Astronautics | China | 3 | 23 | 7.67 | 118 |
| Binus University | Indonesia | 3 | 52 | 17.33 | 111 |
| Nanjing University of Information Science and Technology | China | 3 | 11 | 3.67 | 109 |
| Universiti Teknologi Malaysia | Malaysia | 3 | 51 | 17.00 | 108 |
| COMSATS University Islamabad | Pakistan | 4 | 79 | 19.75 | 91 |
| Ural Federal University | Russia | 3 | 2 | 0.67 | 27 |
| Swedish University of Agricultural Sciences | Sweden | 3 | 9 | 3.00 | 25 |
| Wuhan University | China | 3 | 21 | 7.00 | 12 |
| University College London | England | 5 | 36 | 7.20 | 8 |
| Financial University | Russia | 3 | 48 | 16.00 | 2 |
| University of Florence | Italy | 3 | 39 | 13.00 | 1 |

Notes: "TP=total number of publications; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; TLS is Total Link Strength"

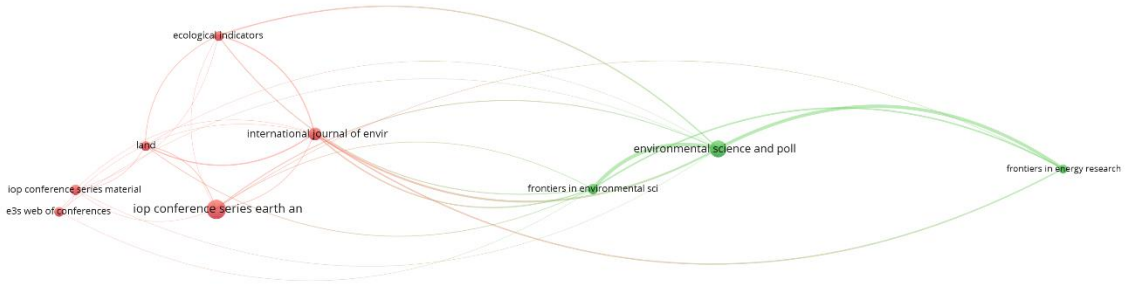
## 4.5. Title of Most Active Sources

Citation analysis algorithm ranked top sources or journals with respect to total publications, citations and TLS and cite score. "Environmental Science and Pollution Research" appears the leader journal of the ranking with maximum 226 TLS, 21 publications and 277 total citations (Adedoyin, Gumede, Bekun, Etokakpan, & Balsalobre-Lorente, 2020). Following Environmental Science and Pollution Research, "Frontiers in Environmental Science" has 142 TLS with 8 publications and 32 citations. These two leading journals are published under Springer and Frontiers Media S.A. "IOP Conference Series: Earth and Environmental Science" has maximum number of publications that are 27 but TLS is 20, "Frontiers in Energy Research" at third with 114 TLS. "International Journal of Environmental Research and Public Health", "Ecological Indicators" and "Land" (Petrova et al., 2022) are also ranked inn top ten sources in the Table 6.

**Table 6: Most Active Source Title**

| Source Title | TP | TC | TLS | Publisher |
|---|---|---|---|---|
| "Environmental Science and Pollution Research" | 21 | 277 | 226 | Springer |
| "Frontiers in Environmental Science" | 8 | 32 | 142 | Frontiers Media S.A |
| "Frontiers in Energy Research" | 6 | 39 | 114 | Frontiers Media S.A. |
| "International Journal of Environmental Research and Public Health" | 13 | 103 | 81 | MDPI |
| "Ecological Indicators" | 7 | 192 | 35 | Elsevier |
| "Land" | 7 | 56 | 27 | MDPI |
| "IOP Conference Series: Earth and Environmental Science" | 27 | 62 | 20 | IOP Publisher |
| "IOP Conference Series: Materials Science and Engineering" | 8 | 25 | 7 | IOP Publisher |
| "E3S Web of Conferences" | 7 | 2 | 4 | EDP Sciences |
| "Journal of Economics" | 6 | 1 | 0 | Springer |

**Figure 3: Network Visualization of Most Productive Sources**




## 5. Citation Analysis

### 5.1. Top Cited Authors

The VOS Viewer allow us to use two algorithms for citation analysis. Bibliometric Coupling is used when studies under analysis are less than 100 and co-citation analysis otherwise. As our sample is having 444 studies therefore, we opted citation analysis for the identification of most productive authors. Total number of authors are 1327 with minimum one document. Top 11 authors are having more than 30 citations are listed in table 7. The ranking of authors by VOS Viewer shows Zhang, Mohsin, Rasheed, Chang, and Taghizadeh-Hesary (2021) as top authors with 183 citations. Le and Ozturk (2020) are second best with 139 citations. (Islam et al., 2014) is at third place, Rauf et al. (2020) are fourth and Miao, Razzaq, Adebayo, and Awosusi (2022) are placed fifth.

**Table 7: Most Productive Authors**

| Author's Name | Title | Year | TC |
|---|---|---|---|
| "Dongyang Zhang, Muhammad Mohsin, Abdul Khaliq Rasheed, Youngho Chang, Farhad Taghizadeh-Hesary" | "Public spending and green economic growth in BRI region: Mediating role of green finance" | 2021 | 183 |
| "Hoang Phong Le & Ilhan Ozturk" | "The impacts of globalization, financial development, government expenditures, and institutional quality on CO2 emissions in the presence of environmental Kuznets curve" | 2020 | 139 |
| "Aminul Islam, Eng-Seng Chan, Yun HinTaufiq-Yapa, Md. Alam Hossain Mondal, M.Moniruzzaman, Moniruzzaman Mridha" | "Energy security in Bangladesh perspective—An assessment and implication" | 2014 | 74 |
| "Abdul Rauf, Xiaoxing Liu, Waqas Amin, Obaid Ur Rehman, Jinkai Li, Fayyaz Ahmad, Festus Victor Bekun" | "Does sustainable growth, energy consumption and environment challenges matter for Belt and Road Initiative feat? A novel empirical investigation" | 2020 | 64 |
| "Yang Miao, Asif Razzaq, Tomiwa Sunday Adebayo, Abraham Ayobamiji Awosusi" | "Do renewable energy consumption and financial globalisation contribute to ecological sustainability in newly industrialized countries?" | 2022 | 59 |

| | | | |
|---|---|---|---|
| "Jeffrey D. Sachs, Wing Thye Woo, Naoyuki Yoshino, Farhad Taghizadeh-Hesary" | "Why Is Green Finance Important?" | 2019 | 49 |
| "Lingui Qin, Dervis Kirikkaleli, Yao Hou, Xu Miao, Muhammad Tufail" | "Carbon neutrality target for G7 economies: Examining the role of environmental policy, green innovation and composite risk index" | 2021 | 47 |
| "Muhammad Kamran Khan, Samreen Fahim Babar, Bahareh Oryani, Vishal Dagar, Abdul Rehman, Abdulrasheed Zakari & Muhammad Owais Khan" | "Role of financial development, environmental-related technologies, research and development, energy intensity, natural resource depletion, and temperature in sustainable environment in Canada" | 2021 | 46 |
| "Sajid Iqbal, Farhad Taghizadeh-Hesary, Muhammad Mohsin, Wasim Iqbal" | "Assessing the Role of the Green Finance Index in Environmental Pollution Reduction" | 2021 | 44 |
| "Fakhr E Alam Afridi, Shahid Jan, Bushra Ayaz, Muhammad Irfan" | "Green finance incentives: An empirical study of the Pakistan banking sector" | 2021 | 35 |
| "Fengsheng Chien, Quang-Thanh Ngo, Ching-Chi Hsu, Ka Yin Chau & Robina Iram" | "Assessing the mechanism of barriers towards green finance and public spending in small and medium enterprises from developed countries" | 2021 | 31 |

Figure 4 represents the Network visualization map of the citation by documents when minimum number of citations of a document is10 and Figure 5 represents when minimum number of citations of a document is 5.

**Figure 4: "Network visualization Map of the Citation by Documents with Minimum Citations Per Document = 10"**

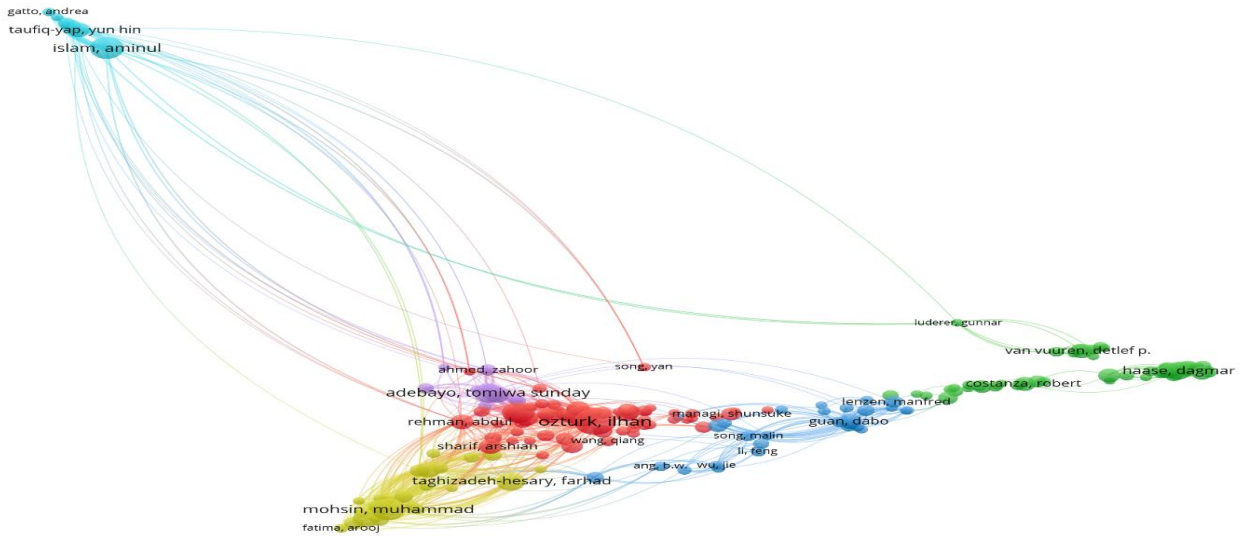
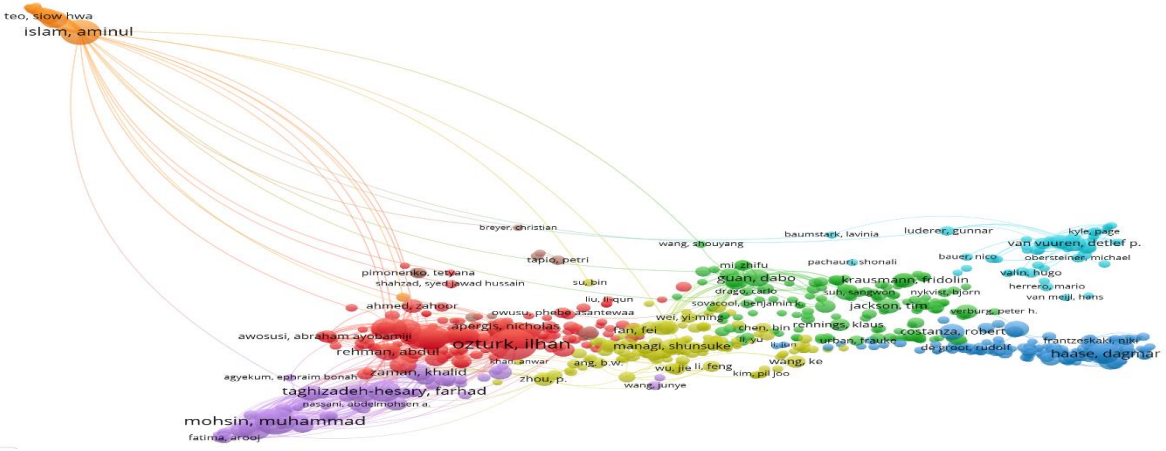



**Figure 5: Network visualization Map of the Citation by Documents with Minimum Citations of Per Document = 05**



## 5.2 Author Keyword Analysis via Text Mining

For analysing the keywords that researchers used in studies on green finance and sustainable environment domain. Using VOS Viewer, Network visualization map of author keywords has drawn by text mining when teach term is appeared in analysis minimum 32 times. The total of 20 Top Keywords are listed in Table 8 and their Visualization mapping is presented by Figure 6. visualization network of keywords based on title and abstract fields (Binary Counting) is represented in figure 7 whereas visualization of authors' keywords based on title and abstract fields (Full Counting) is presented in figure 8. The table 8 reflects that the sustainable development is a leading keyword in all the researches as it appears in 184 publications. Economic Growth places at second position with appearance in 167 publications. Green Energy, Green Growth, and Environment are also in the list of top keywords during investigation of green finance and sustainable environment relationship.

**Figure 6: Network Visualisation Map of the Author Keyword**

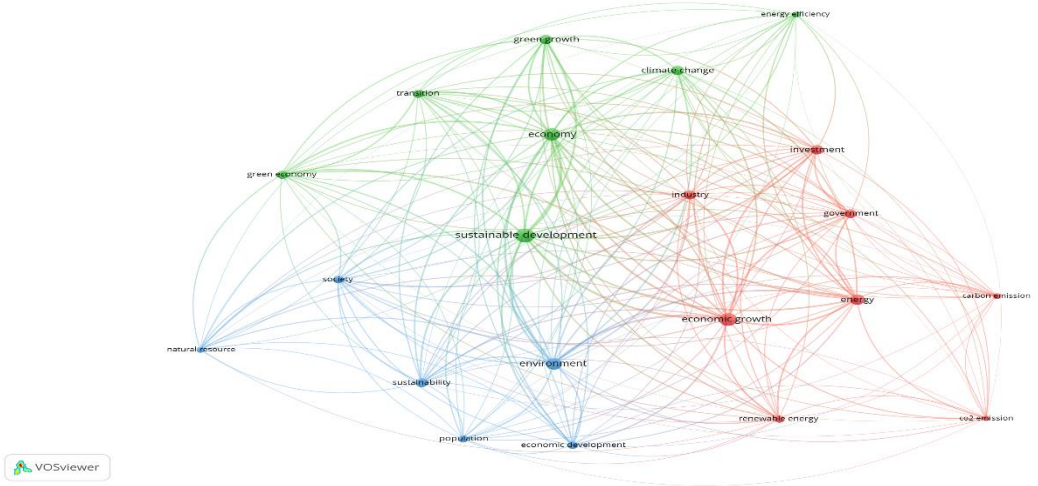



**Figure 7: VOS Viewer Visualization of a Term Co-occurrence Network based on Title and Abstract Fields (Binary Counting)**

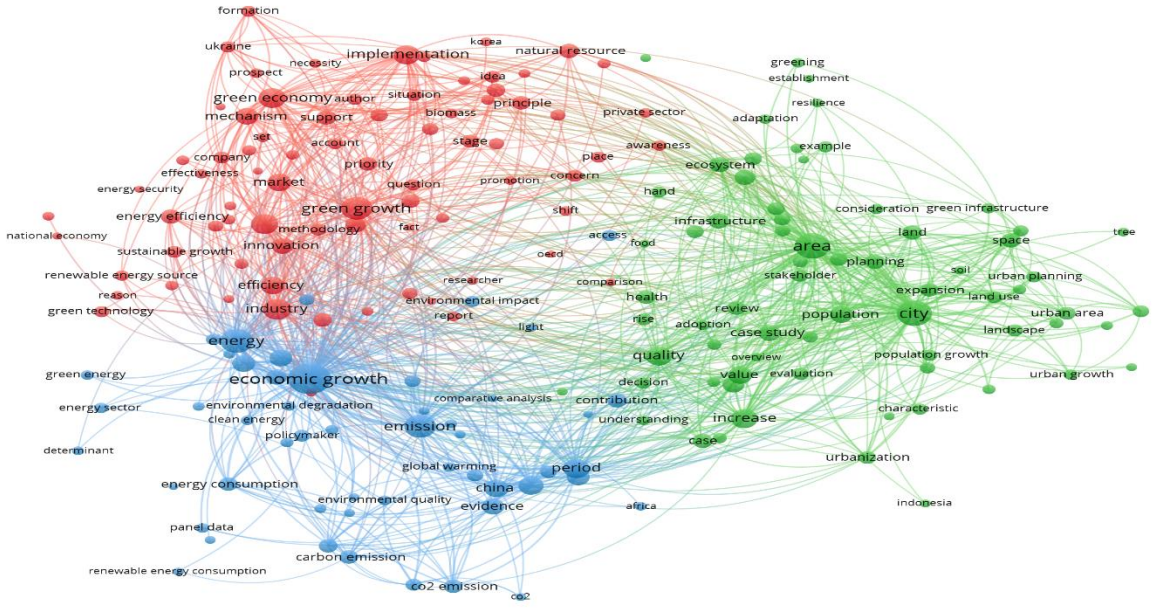



**Table 8: Top Keywords**

| Author Keywords | Total Publications (TP) | Relevance Score |
|---|---|---|
| Sustainable Development | 184 | 1.5278 |
| Economic Growth | 167 | 1.2356 |
| Green Energy | 150 | 1.4947 |
| Environment | 134 | 1.0999 |
| Energy | 111 | 1.3183 |
| Green Growth | 88 | 0.6209 |
| Climate Change | 84 | 0.8689 |

| | | |
|---|---|---|
| Investment | 83 | 0.4553 |
| Sustainability | 78 | 0.4553 |
| Government | 77 | 0.6107 |
| Industry | 72 | 0.461 |
| Transition | 67 | 1.5146 |
| Green Economy | 65 | 1.392 |
| Economic Development | 60 | 0.6541 |
| Society | 57 | 0.5696 |
| Renewable Energy | 49 | 0.8762 |
| Population | 47 | 0.9566 |
| Energy Efficiency | 35 | 0.8037 |
| Natural Resource | 35 | 1.2381 |
| Carbon Emission | 32 | 1.2324 |

**Figure 8: VOS Viewer Visualization of a Term Co-occurrence Network based on Title and Abstract Fields (Full Counting)**

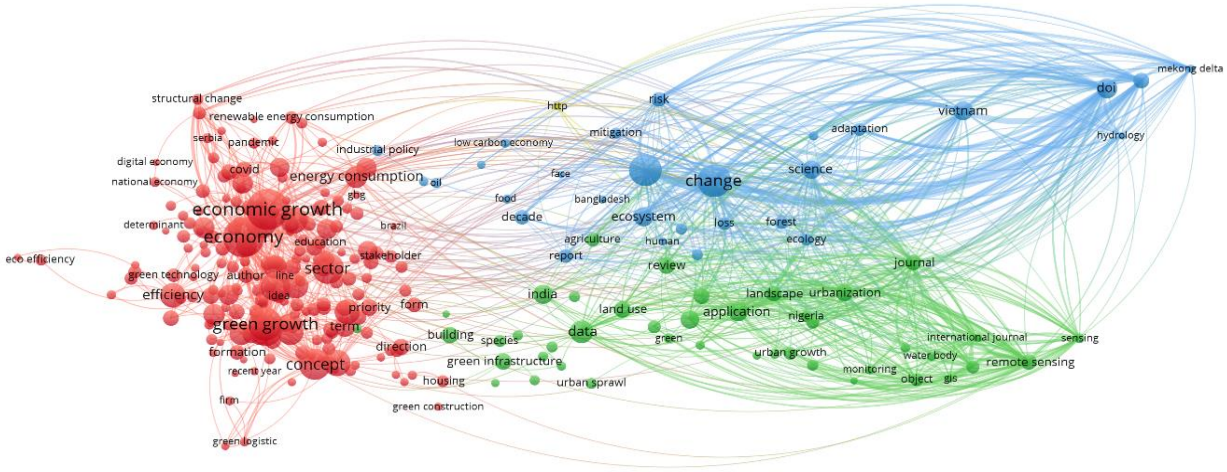
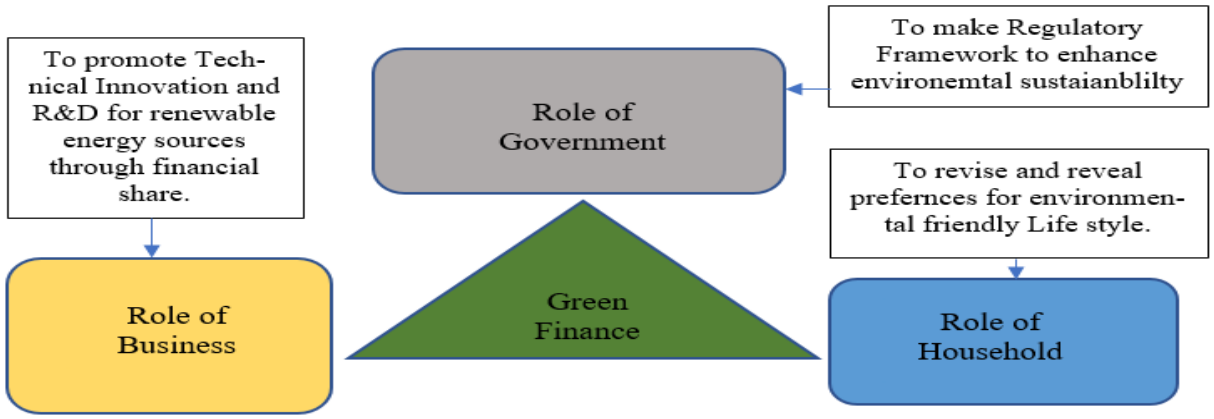



**Figure: 9 Relationship of Green Finance with Three Sectors**




## 5.3 Green Finance and Sustainable Environment

The environmental sustainability can be achieved through the efficient allocation of resources through various projects that can offer any economy the services to review the existing policies and environmental regulations through financial system. A sustainable environment can be observed only if sufficient green finance will be allocating by economies because the environment is a shared commodity by all. Here we need a regulatory framework of financial markets to shape the multi-country policy initiatives. Such initiatives should be from intra-regional to inter-regional and then at global level. Green finance is functioned by mutual collaborations of three sectors i.e. government, business and household. The government has to play its role in making regulatory framework, institutional setup and introduce various subsidies and guarantees that motivate the business sector to adopt the environmental protection policies without any hesitations and risk. The business sector also supports environmental protection policies through the financial shares for renewable energy substitutes, technical innovation,

managerial roles and linkages of local, national and international levels. Then the household sector should be more aware of the eco-friendly foods and services and it should also reflect in their preferences and willingness to pay. This awareness and willingness to pay and affordability can lead to environmental friendly life style and sustainability. The initiative of green technology innovations and its applications on working places and production processes will acquire a decrease in carbon dioxide emissions and natural resources will not be depleted any more (Guo et al., 2021; Shen et al., 2021).

### 5.4 Objectives of Green Finance Policy Framework for Sustainable Environment

The green finance leads to sustainable environment only if it has clear and specific objectives. Green finance contributes in betterment of environment in such a way that it should not cause to decrease the production level and quality of businesses. As the population is growing very rapidly therefore the regulation framework must have to focus two aspects. One aspect is the population needs are growing and the level of production should also grow accordingly. Other aspect is that the environmental quality should not deteriorate further. So green finance also has these two aspects as two challenges. New technological innovations must focus on high production rate along with low depletion of environment. The objectives of the any policy and regulatory measures on green finance should focus on the following objectives in order to achieve the sustainable environment.

- Reallocation and addition the Capital. This objective has a clear idea about the reallocation of existing capital into green projects and more addition of capital in such eco-friendly projects.
- Measurement of risk. Any policy of green finance should measure the climate risk involve in such practices in all relating institutions.
- Reporting the Information. Policy should have a strong strength flow of information about the environmental factors and climate related risk to green financial projects and portfolios.
- Responsibilities of Financial Institutions. Policy framework must have a clear statement of roles and responsibilities of financial institutions. Financial institutions are the source of provision of capital for green technology projects either public or private.
- These objectives should be clear when a government or regulatory authority is making any policy for sustainable environment. This green finance policy is showing a direction to the businesses of the economy to evolve accordingly and also help the household sector to revise their choices for foe the consumable items.

## 6. Conclusion

This paper applied bibliometric analysis to review the relationship of green finance and environmental sustainability. The bibliometric coupling and text mining are used to identify leading sources, countries and authors. Furthermore, text mining identifies the top keywords. China is leading the list with 1114 citations of 66 publications. “Istanbul Gelisim University” situated in Turkey is leading the table with maximum 4 publications, 320 Total citations and 356 TLS. The ranking of authors by VOS Viewer shows Zhang et al. (2021) as top authors with 183 citations. Sustainable development, Economic Growth, Green Energy, Green Growth, and Environment are leading keywords.

In conclusion, "funding of investments that bring environmental advantages" is the definition of "green finance." The idea of green finance is distinct from conventional banking strategies. By considering environmental risk management techniques and the viability of programs, it represents the benefits of environmental protection (Jeucken, 2001). Additionally, green finance aims to advance a green economy in which the funded companies are predicted to dramatically reduce carbon emissions. The European Banking Federation has a more comprehensive stance when it comes to adaptation to climate change issues, claiming that green financing is not limited to just environmental or climate change-related considerations, opening up prospects for green insurance plans and green bonds (European Banking Federation, 2017).

The green economy also offers three advantages that can be achieve by investing more in green finance. First, as green finance grows, corporate governance concerns become more important. Second, by switching to a green industry, businesses may achieve the Pareto improvement of the natural ecological environment. The second benefit of the green economy is that it raises consumer and producer knowledge of environmental issues and guarantees that both groups safeguard the environment by switching to renewable energy sources and

purchasing low-carbon, biodegradable goods. Third, green financial development may minimize overcapacity in conventional sectors, optimize the supply structure of production inputs, and foster economic transformation and upgrading (Bergset, 2015).

**References**


Adedoyin, F. F., & Bekun, F. V. (2020). Modelling the interaction between tourism, energy consumption, pollutant emissions and urbanization: renewed evidence from panel VAR. *Environmental Science and Pollution Research, 27*, 38881-38900. doi:https://doi.org/10.1007/s11356-020-09869-9

Adedoyin, F. F., Gumede, M. I., Bekun, F. V., Etokakpan, M. U., & Balsalobre-Lorente, D. (2020). Modelling coal rent, economic growth and CO2 emissions: does regulatory quality matter in BRICS economies? *Science of the Total Environment, 710*, 136284. doi:https://doi.org/10.1016/j.scitotenv.2019.136284

Amidjaya, P. G., & Widagdo, A. K. (2020). Sustainability reporting in Indonesian listed banks: Do corporate governance, ownership structure and digital banking matter? *Journal of Applied Accounting Research, 21*(2), 231-247. doi:https://doi.org/10.1108/JAAR-09-2018-0149

Awosusi, A. A., Kutlay, K., Altuntaş, M., Khodjiev, B., Agyekum, E. B., Shouran, M., . . . Kamel, S. (2022). A roadmap toward achieving sustainable environment: evaluating the impact of technological innovation and globalization on load capacity factor. *International Journal of Environmental Research and Public Health, 19*(6), 3288. doi:https://doi.org/10.3390/ijerph19063288

Berensmann, K., Volz, U., Alloisio, I., Bak, C., Bhattacharya, A., Leipold, G., . . . Yang, Q. (2017). Fostering sustainable global growth through green finance–what role for the G20. *T20 Task Force on Climate Policy and Finance, 20*.

Bergset, L. (2015). The rationality and irrationality of financing green start-ups. *Administrative Sciences, 5*(4), 260-285. doi:https://doi.org/10.3390/admsci5040260

Cui, H., Wang, R., & Wang, H. (2020). An evolutionary analysis of green finance sustainability based on multi-agent game. *Journal of Cleaner Production, 269*, 121799. doi:https://doi.org/10.1016/j.jclepro.2020.121799

Dong, Z., & Li, Y. (2015). *Social Responsibility, Green Finance, and the New Urbanization Construction.* Paper presented at the Low-carbon City and New-type Urbanization: Proceedings of Chinese Low-carbon City Development International Conference.

European Banking Federation, e. (2017). TOWARDS A GREEN FINANCE FRAMEWORK.

Falcone, P. M., & Sica, E. (2019). Assessing the opportunities and challenges of green finance in Italy: An analysis of the biomass production sector. *Sustainability, 11*(2), 517. doi:https://doi.org/10.3390/su11020517

Fu, J., & Ng, A. W. (2020). Green finance reform and innovation for sustainable development of the Greater Bay Area: Towards an ecosystem for sustainability. *Sustainable Energy and Green Finance for a Low-carbon Economy: Perspectives from the Greater Bay Area of China*, 3-23. doi:https://doi.org/10.1007/978-3-030-35411-4_1

Guo, D., Zhang, X., Shi, Y., Cui, B., Fan, J., Ji, B., & Yuan, J. (2021). Microalgal-bacterial granular sludge process outperformed aerobic granular sludge process in municipal wastewater treatment with less carbon dioxide emissions. *Environmental Science and Pollution Research, 28*, 13616-13623. doi:https://doi.org/10.1007/s11356-020-11565-7

He, L., Liu, R., Zhong, Z., Wang, D., & Xia, Y. (2019). Can green financial development promote renewable energy investment efficiency? A consideration of bank credit. *Renewable Energy, 143*, 974-984. doi:https://doi.org/10.1016/j.renene.2019.05.059

Hira, T. K. (2012). Promoting sustainable financial behaviour: Implications for education and research. *International Journal of Consumer Studies, 36*(5), 502-507. doi:https://doi.org/10.1111/j.1470-6431.2012.01115.x

Islam, A., Chan, E.-S., Taufiq-Yap, Y. H., Mondal, M. A. H., Moniruzzaman, M., & Mridha, M. (2014). Energy security in Bangladesh perspective—An assessment and implication. *Renewable and Sustainable Energy Reviews, 32*, 154-171. doi:https://doi.org/10.1016/j.rser.2014.01.021

Jeucken, M. (2001). *Sustainable finance and banking: The financial sector and the future of the planet*: Earthscan.

Labatt, S., & White, R. R. (2002). *Environmental finance: a guide to environmental risk assessment and financial products* (Vol. 98): John Wiley & Sons.

Le, H. P., & Ozturk, I. (2020). The impacts of globalization, financial development, government expenditures, and institutional quality on CO 2 emissions in the presence of environmental

Kuznets curve. *Environmental Science and Pollution Research, 27*, 22680-22697. doi:https://doi.org/10.1007/s11356-020-08812-2
Lei, X., Wang, Y., Zhao, D., & Chen, Q. (2021). The local-neighborhood effect of green credit on green economy: a spatial econometric investigation. *Environmental Science and Pollution Research, 28*, 65776-65790. doi:https://doi.org/10.1007/s11356-021-15419-8
Lindberg, M. B., Markard, J., & Andersen, A. D. (2019). Policies, actors and sustainability transition pathways: A study of the EU's energy policy mix. *Research policy, 48*(10), 103668. doi:https://doi.org/10.1016/j.respol.2018.09.003
Miao, Y., Razzaq, A., Adebayo, T. S., & Awosusi, A. A. (2022). Do renewable energy consumption and financial globalisation contribute to ecological sustainability in newly industrialized countries? *Renewable Energy, 187*, 688-697. doi:https://doi.org/10.1016/j.renene.2022.01.073
O'Keeffe, J., Pluchinotta, I., De Stercke, S., Hinson, C., Puchol-Salort, P., Mijic, A., . . . Collins, A. M. (2022). Evaluating natural capital performance of urban development through system dynamics: A case study from London. *Science of the Total Environment, 824*, 153673. doi:https://doi.org/10.1016/j.scitotenv.2022.153673
Petrova, S., Nikolov, B., Velcheva, I., Angelov, N., Valcheva, E., Katova, A., . . . Marinov-Serafimov, P. (2022). Buffer Green Patches around Urban Road Network as a Tool for Sustainable Soil Management. *Land, 11*(3), 343. doi:https://doi.org/10.3390/land11030343
Rasoulinezhad, E., & Taghizadeh-Hesary, F. (2022). Role of green finance in improving energy efficiency and renewable energy development. *Energy Efficiency, 15*(2), 14. doi:https://doi.org/10.1007/s12053-022-10021-4
Rauf, A., Liu, X., Amin, W., Rehman, O. U., Li, J., Ahmad, F., & Bekun, F. V. (2020). Does sustainable growth, energy consumption and environment challenges matter for Belt and Road Initiative feat? A novel empirical investigation. *Journal of Cleaner Production, 262*, 121344. doi:https://doi.org/10.1016/j.jclepro.2020.121344
Sanchez, C. A., Becker, D. J., Teitelbaum, C. S., Barriga, P., Brown, L. M., Majewska, A. A., . . . Altizer, S. (2018). On the relationship between body condition and parasite infection in wildlife: a review and meta-analysis. *Ecology letters, 21*(12), 1869-1884. doi:https://doi.org/10.1111/ele.13160
Shen, Y., Su, Z.-W., Malik, M. Y., Umar, M., Khan, Z., & Khan, M. (2021). Does green investment, financial development and natural resources rent limit carbon emissions? A provincial panel analysis of China. *Science of the Total Environment, 755*, 142538. doi:https://doi.org/10.1016/j.scitotenv.2020.142538
Su, Y., & Gao, X. (2022). Revealing the effectiveness of green technological progress and financial innovation on green economic growth: The role of environmental regulation. *Environmental Science and Pollution Research, 29*(48), 72991-73000. doi:https://doi.org/10.1007/s11356-022-20978-5
Süßbauer, E., & Schäfer, M. (2018). Greening the workplace: conceptualising workplaces as settings for enabling sustainable consumption. *International Journal of Innovation and Sustainable Development, 12*(3), 327-349. doi:https://doi.org/10.1504/IJISD.2018.091521
Tawiah, V., Zakari, A., & Adedoyin, F. F. (2021). Determinants of green growth in developed and developing countries. *Environmental Science and Pollution Research, 28*, 39227-39242. doi:https://doi.org/10.1007/s11356-021-13429-0
Urban, M. A., & Wójcik, D. (2019). Dirty banking: Probing the gap in sustainable finance. *Sustainability, 11*(6), 1745. doi:https://doi.org/10.3390/su11061745
Wang, K., Tsai, S.-B., Du, X., & Bi, D. (2019). Internet finance, green finance, and sustainability. In (Vol. 11, pp. 3856): MDPI.
Weber, O., & ElAlfy, A. (2019). The development of green finance by sector. *The rise of green finance in europe: opportunities and challenges for issuers, investors and marketplaces*, 53-78. doi:https://doi.org/10.1007/978-3-030-22510-0_3
Yuan, F., & Gallagher, K. P. (2018). Greening development lending in the Americas: trends and determinants. *Ecological Economics, 154*, 189-200. doi:https://doi.org/10.1016/j.ecolecon.2018.07.009
Zakaria, R., Ahmi, A., Ahmad, A. H., & Othman, Z. (2021). Worldwide melatonin research: a bibliometric analysis of the published literature between 2015 and 2019. *Chronobiology International, 38*(1), 27-37. doi:https://doi.org/10.1080/07420528.2020.1838534

Zhang, D., Mohsin, M., Rasheed, A. K., Chang, Y., & Taghizadeh-Hesary, F. (2021). Public spending and green economic growth in BRI region: mediating role of green finance. *Energy Policy, 153*, 112256. doi:https://doi.org/10.1016/j.enpol.2021.112256

Zhu, S., Jin, W., & He, C. (2019). On evolutionary economic geography: A literature review using bibliometric analysis. *European Planning Studies, 27*(4), 639-660. doi:https://doi.org/10.1080/09654313.2019.1568395

Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational research methods, 18*(3), 429-472. doi:https://doi.org/10.1177/1094428114562629