

A Bibliometric Survey on Sustainable Finance: Research Patterns and Trends

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Abstract: The changing socio-economic environment for development, has redefined many aspects of development. It has changed the word “development”, to “sustainable development”, so the source of the finance, has also changed “finance” to “sustainable finance”. The purpose of this study is to investigate trends and literature development of sustainable finance, that is an emergent issue in research. For analysis of trends and literature development of sustainable finance, this is a Bibliometric analysis, and has been conducted from the Scopus database. For analysis VOSviewer Bibliometric tools has been used to measure the different Bibliometric dimensions of sustainable finance. In the analysis, authors have examined the top most cited authors, thematic structures, top publishing journals, country-wise Bibliographic couplings and trends of the publication trends of sustainable finance. In this study, it has been found that there is widespread interdisciplinary research, for sustainable finance, but the specific and confined research of sustainable finance, is limited to the growth in publications trends that infer sustainable finance as an emerging concern of researchers and different stakeholders.

Keywords: Sustainable Finance; Sustainable Development; Green Finance

1 Introduction

Sustainable finance and green finance are transposable terms used in different reports and studies, but the sustainable finance word, is more holistic than green finance, because sustainable finance is an evolution of green finance [1]. Green finance has been defined by International Finance Corporations [2] as “financing of investments that provide environmental benefits” further [3] UNFCC(2018) has given a wider and more conclusive definition as, “*local, national or transnational financing-drawn from public, private and alternative sources of financing-that seeks to support mitigation and adaption actions that will address climate change*” both definitions have some differences, but both of the terms have concern is to provide suitable financing instrument [4] for sustainable environment and climate change [5]. To provide sufficient funds for clean and green environment, financial system of different economy provides climate finance, Green finance and sustainable finance, where climate provide mitigation, as well as adoption funding, green finance promotes better biodiversity and protection [6], but sustainable finance has wider scope to extend of application and implementation of environmental social governance, in nutshell climate finance, green finance are subset of sustainable finance [7].

Sustainable finance is systematic, and an organized management of financial resource, for those economic activities, which are involved in sustainable projects [8]. In spite of environmental issues and strict environmental social governance, Sustainable Finance play pivotal role in economic growth of any society [9]. In era of the sustainable development, sustainable finance has emerged as key factor for inclusive growth and development, as well as mobilization of financial resources [10]. Policy makers and other stakeholders have great concern because sustainable finance helps for inclusive growth and profitable growth in equity return of organization [11]. On the basis of different literature discussion sustainable finance is one of the emerging issues for researcher and new paradigm in area of financing sources of fund [12]. In the existing literature, there is so much on green finance, environment and sustainable development are widely available but organized Bibliometric analysis for exclusive for sustainable finance are not available or they very limited. This limited research penetration of sustainable finance is a crucial research gap, because as global economy moving towards sustainable development, then the role sustainable finance has a dynamic role and is a strong catalyst for sustainable development, so sustainable finance research cannot be avoided. The objective of this study, is to explore the different dimensions of sustainable finance, in the existing literature and find out the variables of sustainable finance and further analyze the developments in the area of sustainable finance. To fulfil the objective of this research, the following are the research questions that need to be answered:

RQ1 What is the literature development status of sustainable finance?

RQ2 What is different themes and subthemes in area of sustainable finance?

RQ3 How much of the sustainable finance literature is diverse?

The study has been organized in six parts. The first part explores the introduction, the second, discusses background of sustainable finance, the third, discuss methodology, the fourth part presents findings and interpretations, the fifth part highlights conclusion and last, sixth part, discuss the works limitations and future scope of studies.

2 Background of Sustainable Finance

The history of sustainable finance is not new, it dates to before to the industrial revolution, in banking sector. In the 15th and 16th centuries, Italian banks started to give loans to those firms and businesses that were not involved directly and indirectly in any war or unethical practices [13]. The concept of that time period was different, but the objective was still the same, like the peaceful existence of society and the environment. In the present era, sustainable finance has emerged from the 1991 Earth Summit in Rio de Janeiro, in this summit the United Nations Environment Program Finance Initiative (UNEP FI) [14] made the alliances with banks and financial institutions to promote sustainable development [15] and further define the dimension of sustainable finance. To help in investor guidance and evaluation of the sustainable instrument, in 1992, the Dow Jones Sustainability World Index was launched [16]. Global level monitoring and reporting of sustainable development activities was challenge, so the Global Reporting Initiative (GRI) was started, as collaborating institute of the UNEP in 2002 [17] and further in 2015, sustainable development and source of sustainable finance added the Millennium development goal [18]. In 2008, the World Bank launched the first green bond and in India, Yes Bank, launched the Green Infrastructure Bond, in 2015. After 2015, many green bonds and various sustainable finance instrument emerged in different development projects [19].

Although numerous components of the system are concerned with sustainability, financial implications are critical to any organization's longevity. Finance, in a larger perspective, encompasses a series of levels, actions and agents, including educators, employers and government agencies [20]. [21] According to Haigh (2012c, pp. 88-90), sustainable finance can signify the environment and society in which the financial system operates, seems to be in excellent shape [22]. Further, this excellent condition of financial systems can yield a more sustainable society.

3 Methodology

The Author has adopted Bibliometric methodology to identify evolution of research progress in area of sustainable finance. Bibliometric is a quantitative tool used to analyze the existing literature development and provide conclusive research patterns [23]. The Bibliometric is an important tool in the identification corpus of literature, in specific areas of research for consolidated out looks [24]. Through Bibliometric analysis, researchers seek patterns of intellectual development of a research area, publication, citation, top authors, top-cited papers and several other trends and patterns [25].

3.1 Selection of Manuscript and Data Analysis

Figure 1 highlights the process of document navigation and provides a short list of documents concerning “sustainable finance”, in Scopus source data base of Elsevier Ltd. The first step search “sustainable finance”, found 356 documents then the second step documents, limited only to social sciences, business management & economics documents, found 301 documents. Steps 3 documents were limited to only research articles, finding 201 documents in the English language, then the analysis of 201 research articles, for this bibliometric analysis, has been conducted by VOSviewer software.

3.2 Result Analysis

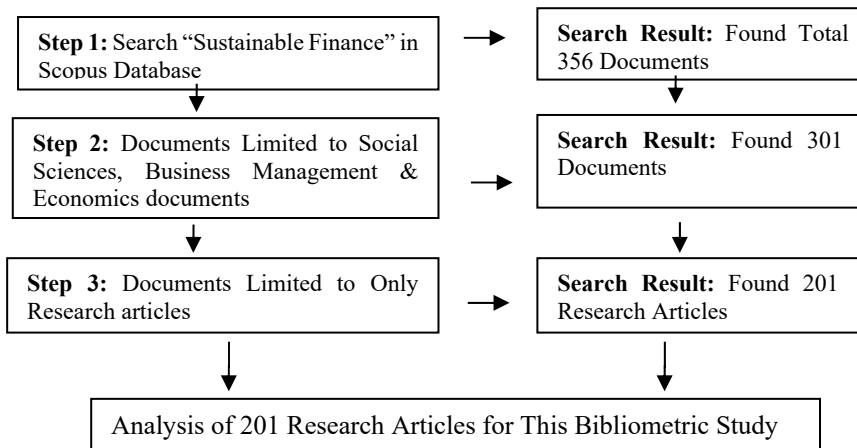


Figure 1

Process of Short-listing process of documents

4 Findings and Interpretation

Table 1

Contains the result of comparing in pairs with the final result

Authors	Title	Source title	Citations
Yip A. W. H., Bocken N. M. P (2018)	Sustainable business model archetypes for the banking industry	Journal of Cleaner Production	104
Fatemi A. M., Fooladi I. J. (2013)	Sustainable finance: A new paradigm	Global Finance Journal	45
Galaz V., Crona B., Dauriach A., Scholtens B., Steffen W. (2018)	Finance and the Earth system – Exploring the links between financial actors and non-linear changes in the climate system	Global Environmental Change	43
Drempetic S., Klein C., Zwergel B. (2020)	The Influence of Firm Size on the ESG Score: Corporate Sustainability Ratings Under Review	Journal of Business Ethics	41
Pueyo A. (2018)	What constrains renewable energy investment in Sub-Saharan Africa? A comparison of Kenya and Ghana	World Development	40
Carolina Rezende de Carvalho Ferreira M., Amorim Sobreiro V., Kimura H., Luiz de Moraes Barboza F. (2016)	A systematic review of literature about finance and sustainability	Journal of Sustainable Finance and Investment	36
Zhan C., de Jong M. (2018)	Financing eco cities and low carbon cities: The case of Shenzhen International Low Carbon City	Journal of Cleaner Production	28
Flammer C. (2021)	Corporate green bonds	Journal of Financial Economics	27
Mengze H., Wei L. (2015)	A comparative study on environment credit risk management of commercial banks in the Asia-Pacific Region	Business Strategy and the Environment	27
Kakabadse N. K., Kakabadse A. P., Summers N. (2007)	Effectiveness of Private Finance Initiatives (PFI): Study of private financing for the provision of capital assets for schools	Public Administration and Development	27
Missbach A. (2011)	The Equator Principles: Drawing the line for socially	Development	26

	responsible banks? An interim review from an NGO perspective		
Pham L., Luu Duc Huynh T. (2020)	How does investor attention influence the green bond market?	Finance Research Letters	25

Source: with help of VOSviewer Compiled by Authors

4.1 Top Cited Articles and Literature Development

Table 1 highlights the top 10 cited articles, related to sustainable finance out of those top 10 articles, Yip & Bocken, 2018 is highest impact article, with total citations of 104. [26] Yip & Bocken, 2018 have adopted wider concept of the sustainable finance and investigated antecedents and consequences of banking industry to provide finance for sustainable development projects .due to wider concept of article got better citation in comparison to other research paper. Despite older article [27] Fatemi & Fooladi (2013) have only 45 citations, because it was confined with only sustainable finance, however, this article is most relevant and impactful for the area of sustainable finance. [28] Galaz, Crona, Dauriach, Scholtens & Steffen (2018) has proposed the importance of the financial actors that play crucial role in sustainable development and climate change and [29] Drempetic, Klein & Zwergel (2020) tried to explore new areas like corporate sustainable and responsible investments for environmental, social and corporate governance (ESG) scores, of the firms. This study has given quantifications, for the sustainable investments of the firms. However, these studies address the problem and concept of sustainable finance and investment but, [30] Pueyo (2018) attracted scholarly attention on different constrains of implementation of the policy related to sustainable finance. [31] Ferreira, Sobreiro, Kimura & Moraes (2016) is a remarkable study, in the area of finance and sustainability, it conducted a systematic review of literature for descriptive analysis, concept of finance and sustainability [32]. Zhan, & Jong (2018) proposed an empirical investigation on financing of sustainable development and the role of the financial vehicles in sustainable urban development, further [33] Flammer (2021) emphasized the corporate green bonds and tried to incorporate the response of investors sentiment towards green bond and the performance of those companies that adopted sustainable finance. [34] Mengze & Wei (2015) has given insights to the environment credit risk and bank performance; moreover, this study was constrained to environment economics. [35] Kakabadse, Kakabadse & Summers (2007) tried to evaluate new dimensions and the impact of private finance initiatives in sustainable finance. Other impactful studies [36] Missbach (2011) examined the role of banks in sustainable finance and further tried to assimilate sustainable finance with social catalysts and investor points of view [37] Pham & Huynh (2020) emphasized how investor attention can impact the returns and volatility. Further, that investor attention can help to develop information in financial market to promote sustainable investment [38]. This section part our work concerned the overall insights of literature development and top cited articles.

4.2 Thematic Structure of Sustainable Finance

After deletion of the duplications of key words, such as, green bonds or green bond, the authors have selected suitable keywords, according for the best fit in the study. In analysis of co-occurrences, we found four clusters that where first in red, second cluster in green, third in blue and fourth in yellow.

4.2.1 First Cluster: Governance Policies for Sustainable Finance

In this section, 11 items have been found and most them are related to governance issues and policy implementation, for the sustainable finance in economy. In Figure 2, the red nodes, co-occurrence of keywords like financial system, corporate governance and government policy economic growth, indicating that for better implementation of the sustainable finance, these key areas of research need to be integrated. For regulatory aspects, [39] Bengo, Boni, & Sancino (2022) in their research, have emphasized that implementation of policies of sustainable development, must have comprehensive and integrated frameworks, with proper checks and balances, further [40] Stawska & Jabłońska (2022) incorporated some these keywords and tried to measure inclusive growth with sustainable finance theory.

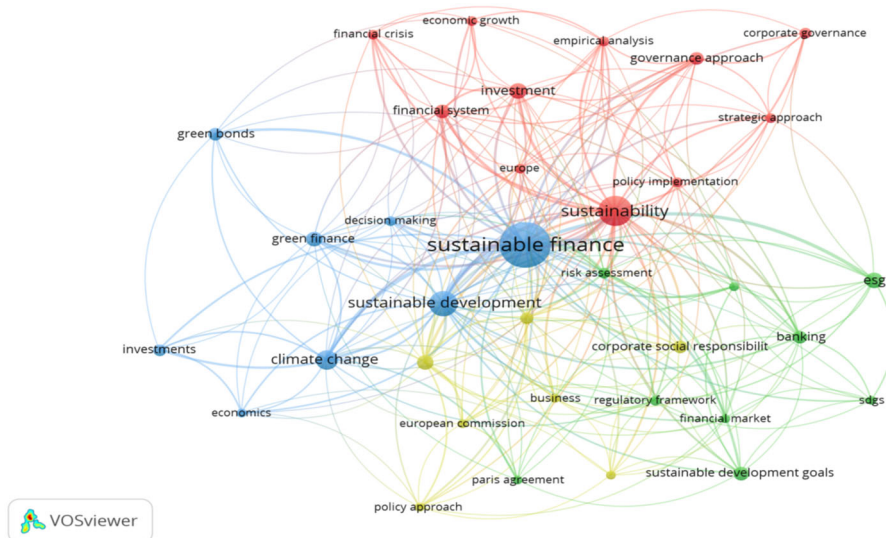


Figure 2

Co- Occurrences

Source: with help of VOSviewer Complied by Authors

4.2.2 Second Cluster: Financial System and Sustainable Development

In Figure 2, the green color nodes, cluster 2, has 9 items and most of the keywords are related to financial system and sustainable development. Banking, sustainable developments (SDGs), environment social governance (ESG) and financial market are intensive penetrated keywords of this segment. In this cluster of keywords, researchers tried to explore and investigate role of financial system in sustainable development in society. [41] Shobande & Enemona (2021) concluded in study that financial system plays crucial role in mobilization of financial resources for sustainable development. In other dimension [42] Straub (2021) has highlighted sustainable finance as lucrative financial avenue for sustainable development as well as their stakeholders.

4.2.3 Third Cluster: Financial Instruments and Sustainable Finance

The third cluster has 8 items of keywords that are highlighted blue. Analysis of this cluster is more important than other clusters, because in this cluster has the existence of keywords, sustainable finance. In this cluster climate change, decision making, economics, green bonds, green finance investments and sustainable finance are major keywords and sustainable finance is most interlinked keyword of the cluster. This cluster highlights those innovative financial instruments that have been emerged over time, in area of sustainable finance. Research area Green bonds, is greatly interlinked with sustainable finance because it has great potential to fulfil the Paris agreement goal for climate change and improve sustainable investment of finance [43] and investment in green bonds has emerged as most preferable for investors and other side researchers', have also taken great interest in this area, with integration of green bonds and sustainable finance [44].

4.2.4 Fourth Cluster: Social Economy for Sustainable Finance

Initially, the policy of sustainable development has emerged in European countries and they are the torch bearers for the creating organized legal framework in financial system, because European countries have focused on 'social economy' [45]. In Figure 2, the light yellow color, highlights cluster 4, with seven items and most of them are keywords that are related to policy provisions and policymaker's entities, those have significant contribution in social economy. This cluster is narrower than other clusters, which indicates the significant gap related to the evaluation of sustainable finance polices and policy makers [46].

4.3 Top Leading Journals in Publishing Sustainable Finance

In the research area of 'sustainable finance', many journals are publishing articles, through the analysis of the top publishing journals, as presented in Table 2. It has been found 'Journal of Cleaner Production' is a top publishing journal with 70

documents, with the highest citation. ‘Journal of Cleaner Production’ is top leading journal is area of sustainable finance and it has a great margin lead, with the second most publishing journal ‘Business strategy and the Environment’, however, the journal ‘Business strategy and the Environment’ is an emerging journal in the area of sustainable development.

Table 2
Top Leading Journals of Sustainable Finance

Sources	Documents	Citations	Total Link Strength
Journal of Cleaner Production	70	2230	755
Business strategy and the Environment	18	759	486
International Journal of Production Economics	10	245	266
Technological forecasting and social change	16	484	251
Journal of Sustainable Finance and Investment	20	150	112
Ecological Economics	7	309	100
Energy Economics	6	558	56
Resources Policy	6	34	34
Resources, Conservation And Recycling		5	230
Marine Policy	6	136	3

“International Journal of Production Economics” and Technological Forecasting and Social Change” are also leading journals in the area of sustainable finance further, if one does analysis of the top 5th journal ‘Journal of Sustainable Finance and Investment’ it is one of the journals which decided to publish papers in the more specific area of Sustainable Finance. Other journals publish interdisciplinary papers with integration of the sustainable finance, so that is the basic reason that ‘Journal of Sustainable Finance and Investment’ is lagging behind the other journals At the same time the ‘Journal of cleaner Production’ is leading journal because in the manuscript of the this journal, there is great diversity and integration of the differences in research areas with sustainable finance, like environment engineering with sustainable finance, bio-circular economies with sustainable finance, etc. The remaining 5 journals are also of quality and high reputation journals, but their influence in area of sustainable finance is limited.

4.4 Analysis of Top Cited Authors

To discover the impact, author and researcher citation analysis is one of the better techniques when checking influence in a specific area of research [47]. Top cited authors of sustainable finance, are presented in Figure 2. In the analysis process, research has ignored documents with author more than 25 and further imposed, 2

more filter 1st minimum 3 documents and 10 citations... as result, found only 5 authors in two clusters. Cluster 1 is highlighted in red node and 2 cluster is represented in green. In cluster 1 there are 3 authors Agyabeng, Baach and Di Vaio. And in 2 cluster, only 2 authors, Lim and Tseng, for a total of 5 authors in both clusters, Tseng is highest influential author with 5 documents and 111 citations, Di Vaio is 2nd highest cited author, with 3 documents and 99 citations, the 3rd most cited author is Baah, with 3 documents and 49 citations, the 4th most cited author is Agyabeng Mensah, having 3 citations and 47 citations and the 5th most cited author is Lim, having 3 documents and 42 citations. Overall, the top author citations indicate that research of sustainable finance, is still very limited.

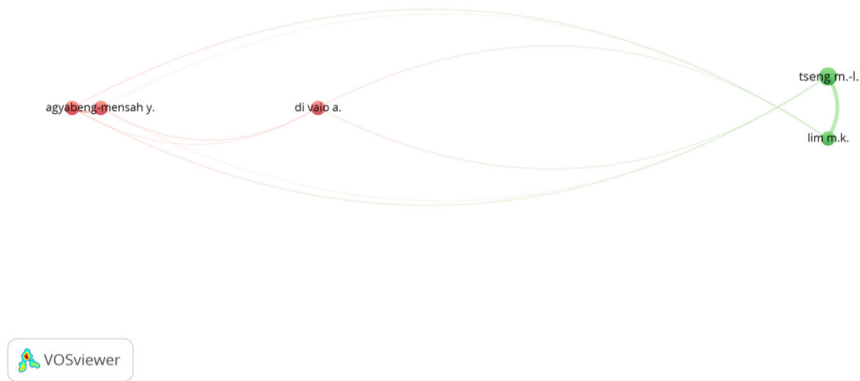


Figure 2

Top cited author

Source: with help of VOSviewer Compiled by Authors

4.4.1 Country Wise Bibliographic Coupling of Sustainable Finance

To analyze the penetration for the country related research of sustainable finance, there has been a bibliographic coupling of sustainable finance conducted.

Figure 3 represents the bibliographic coupling of sustainable finance; here one basis of documents and citation total top 17 countries have been used for analysis. A filter was used to find out some influential countries. In scrutiny process, those documents have more than 25 co-authors were ignored and secondly those countries have minimum 10 documents and 100 citations were included and 17 countries. In the results, there are 3 clusters with cluster 1 in red color, cluster 2 in green and cluster 3 in blue.

According to Table 3, the United States has highest intellectual contributions, with numbers of documents and citations and China has second highest documents and Citations. On the lower side, Malaysia is lowest among 17 countries. In the dimension of the research influence, Spain has highest, because with only 16 documents, it has 876 citations.

4.4.2 Trends of Sustainable Finance in Publication

Figure 4, depicts the chronological development of the literature of sustainable finance, according to Figure 4, the first articles was published in 2004 and in 2006 there were 0 papers, but from 2004 to 2017, growth in publications was not consistent however, after 2017 to 2021 publication of sustainable finance has steadily grown, because in 2017 there was 4 papers and 2021 total published articles are 88. The reason behind the dramatic growth of publications, is due to the different regulatory changes and adoptions of the sustainable finance mechanisms by different stakeholders. This has increased the research interest among researcher around the world. Over the entire period, growth in publications is an indicator for better future prospects for research in the area of sustainable finance however there is still much to do in the area of sustainable finance.



Figure 4
Country wise Bibliographic coupling of Sustainable finance

Source: With help of MS Office EXCEL, Compiled by Authors

Conclusions

Societal concerns for sustainability and sustainable development, has raised issues in sustainable finance [48]. Over the last couple decades, growth in the publication of manuscripts for sustainable finance, depicts an emerging area of research. Bibliometric analysis and discussion of the sustainability of finance, indicates many research possibilities for regulatory institutions and researchers. In the area of sustainable finance, there is still a large research gap and this gap, is an opportunity for research in the area of sustainability and finance. In this bibliometric analysis, it was found that the literature of sustainable finance is not limited to the area of finance, because it is diverse and there is assimilation of other interdisciplinary areas, such as, environmental engineering, sustainable development and economic growth, however, the exclusive research concerning sustainable finance, has limited intellectual contributions.

Limitations and Future Scope of Research

In this work, the authors have taken data from the Scopus database, so for better and more intensive analysis, other databases like web of sciences, Lens, Pubmed, etc., can be integrate for a more holistic coverage of the research area. In the process of searches using only the ‘sustainable finance’ keyword, the authors have found a limited number of papers, so for a comprehensive study with ‘sustainable finance’ and some other included keywords, may give some new dimensions for the future researcher. This study has included only the “articles” category of documents, but in future research, inclusion of chapters in edited books and conference proceedings, could yield new research insights, for the area of Sustainable Finance.

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