

A Bibliometric Mapping Of Green Finance In Msmes: Trends, Structures, And Future Research Directions (2015–2025)

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ABSTRACT

This paper provides a mapping of the intellectual landscape of green finance in Micro, Small and Medium Enterprises (MSMEs) in a detailed bibliometric exercise. As the significance of sustainable finance continues to increase, and MSMEs have become a vital part of the economy, it is necessary to learn more about the development of this area of research. The review is informed by 87 articles found in the Scopus database, published in 2015 and onwards. The Bibliometrix package in R was used to perform bibliometric techniques, such as performance analysis, co-occurrence of keywords, co-citation analysis and thematic mapping. The results indicate that there is a large increase in the number of research publications, especially since 2020, and it indicates growing attention to the topic in academia and policy. The paper determines influential players, journals, and prevalent themes of research, with green finance being the core concept. The findings indicate the combination of sustainability, innovation, and financial limitations, as well as demonstrate the transition between the foundational and more specific and new research fields. This research is valuable to the sustainability in that it offers a systematic insight into the agency of green finance in supporting sustainable MSME development that would allow policymakers and practitioners to devise effective financial policies. It also provides a systematic view of the area, provides key trends, and recommends future research directions

Keywords: Green Finance, MSMEs, Bibliometric Analysis, Sustainable Development, Financial Constraints

INTRODUCTION:

Sustainable financial systems have become an increasingly significant concern around the world due to the increasing urgency to tackle environmental degradation and climate change. In this regard, green finance has become a vital tool in steering financial capital to environmentally friendly initiatives and low-carbon growth strategies. Green finance runs a broad spectrum of financial tools, such as green bonds, green credit, and more sustainable investment approaches, which are designed to encourage environmental sustainability and guarantee economic development (United Nations, 2015; World Bank, 2020). With the growing focus of economies on climate resiliency and sustainability, green finance has emerged as a key element in world policy agendas. Micro, Small, and Medium Enterprises (MSMEs) are important in the economic development of a country as it contributes a significant portion to the generation of employment, innovation, and GDP. Nonetheless, MSMEs tend to have significant financial limitations, especially in their ability to get formal credits and viable financing systems. These limitations restrict their ability to invest in environmentally friendly technologies and adopt sustainable practices (Beck & Demirgüç-Kunt, 2006; OECD, 2017). Green finance needs to be integrated into MSMEs thus, critical in the growth of inclusive and sustainable economic growth particularly in the emerging economies where MSMEs represent the core industrial activity (Ayyagari et al., 2011).

Over the last few years, the academic interest in green

finance has been growing at a very high pace, which can be explained by the significance of this field in solving environmental issues and enhancing sustainable development. The current literature has examined different aspects of green finance such as its effects on the environmental performance, financial markets, and policy frameworks (Zhang et al., 2019; Taghizadeh-Hesary and Yoshino, 2020). A significant part of this research, however, is at the macro-level, that is, national policies, financial institutions and massive investments. In comparison, little focus has been on the role of green finance in the MSME sector especially in comprehending how financial mechanisms affect sustainable business practices at the micro level.

Additionally, the current body of literature addressing green finance in MSMEs is disjointed and is not synthesized in a systematic manner. Since the field is interdisciplinary with its focus extending to finance, environmental economics and entrepreneurship it is necessary to map the intellectual landscape and pinpoint major trends in research. A great methodological approach to achieve this purpose is the bibliometric analysis, which quantitatively examines the pattern of publications, citation networks, and evolution of themes in a field of study (Donthu et al., 2021; Aria & Cuccurullo, 2017). Despite the rising trend in the literature, there is a wide gap in the research that offers a holistic perspective of intellectual framework of green finance in MSMEs using bibliometric techniques. The literature available has been general on the subject of sustainable finance or it has addressed MSMEs without considering environmental

issues. This gap highlights the significance of a methodical and data-based analysis of the research landscape to understand how it has evolved, the factors that have influenced it, and the emergent themes. Thus, the objective of the current research is a bibliometric analysis of articles published in 2015-2025 to map the intellectual organization of the topic of green finance in MSMEs. In particular, the research aims to (i) examine the trends of publications, (ii) determine the most influential authors and sources, (iii) explore conceptual and intellectual networks using network analytics, and (iv) point out the future research directions. This study is a contribution to the literature in that it presents insights, which are useful to the researcher, policy maker and practitioner aiming to have sustainable financial systems and MSME development.

2. LITERATURE REVIEW

2.1 Green Finance and Sustainable Development

Sustainable finance has emerged as an instrumental tool to attain sustainable development by ensuring investments are directed to activities that are environmentally friendly. It includes financial processes that can help in mitigating climate, protecting the environment and conserving resources. The literature emphasizes the idea that green finance will help mitigate carbon emissions, as well as increase the economic stability in the long term through sustainable investments (Falcone, 2020; Soundarrajan & Vivek, 2016). Eco-friendly financial instruments, like climate bonds, sustainability-linked credit facilities, as well as other instruments, have gained significant popularity in recent years as financial institutions and governments seek to fund environmentally friendly initiatives with the help of these instruments.

Researchers have also highlighted how sustainable finance will facilitate the shift toward a low-carbon economy. As an example, the studies show that green financial policies can create a notable impact on the environmental performance of the companies and prompt the firms to become environmentally friendly (Huang et al., 2022). Moreover, the adoption of environmental, social and governance (ESG) factors within financial decisions has strengthened the support of the financial markets with sustainability objectives and hence green finance is an imperative aspect of contemporary financial systems.

2.2 MSMEs and Financial Constraints

MSMEs are critical to the development of the economy, but they usually experience structural difficulties in their access to finance. Financial constraints have been reported to be one of the key obstacles to the growth and sustainability of MSMEs across the literature. Access to formal financial institutions is limited by limited collateral, information asymmetry, and transaction costs among the MSMEs (Berger and Udell, 2006; Beck et al., 2008). Such challenges are more acute when MSMEs are trying to invest in green technologies because they are usually more expensive to invest in and have a longer payback period.

Recent research indicates that it is important to address these financial obstacles in order to allow MSMEs to engage in sustainable development programmes. Creative financing models, including microfinance and fintech

solutions, and government-sponsored green credit have been suggested as potential solutions to the financing gap (Brixiová et al., 2020). Policy interventions to increase financial inclusion and facilitate green entrepreneurship are also needed to increase the ability of MSMEs to pursue environmentally sustainable practices.

2.3 Intersection of Green Finance and MSMEs

Green finance and MSMEs intersection is a new subject area which is a combination of sustainability and development of small businesses. The literature available demonstrates that green finance may be a game changer in ensuring that MSMEs can employ the use of technologies that are environmentally friendly and become more efficient in their work. As an example, the financial barrier can also be reduced through the use of financial incentives (access to the green credit and subsidies), to motivate the MSMEs to invest in renewable energy and energy-efficient processes (Wang & Zhi, 2016). Nonetheless, the implementation of the green finance among MSMEs is still uneven among regions because of disparities in institutional frameworks, regulatory conditions and market conditions. Research also highlights the importance of awareness, capacity building, and technological support in facilitating the adoption of green finance in the MSME sector (Zhang et al., 2021). In spite of these insights, the literature does not provide a thorough insight into how research in this field has developed and the manner in which various themes are interrelated.

2.4 Bibliometric Studies in Green Finance

The bibliometric analysis is gaining popularity to study the formation and organization of research fields. It allows researchers to determine the productive publications, authors and research trends using quantitative methods. Some bibliometric reviews have been conducted on the topic of green finance and sustainability, showcasing such central themes as climate finance, renewable energy investment, and sustainable development (Ding et al., 2022; Liu et al., 2021).

Although these studies offer very useful information on the greater area of green finance, they do not consider the context of MSMEs. Likewise, bibliometric studies on MSMEs are more inclined to address entrepreneurship, innovation, and financing limitations without considering environmental aspects. This lacuna indicates that there is a necessity to conduct an integrated bibliometric analysis to investigate specifically the intellectual framework of green finance in relation to the MSME context.

2.5 Research Gap

According to the analysis of the existing literature, it is clear that the investigation of green finance is mainly focused on the macro level, including national policies, financial systems, and macro-scale sustainability initiatives. Simultaneously, the research on Micro, Small, and Medium Enterprises (MSMEs) is mainly focused on financial limitations and finance accessibility, and less research analyzes the incorporation of sustainability and environmental aspects. Moreover, not many studies have tried to explore the intersection of green finance and MSMEs, which implies that there is no extensive knowledge in this hybrid field. Moreover, the lack of bibliometric studies aimed at systematically mapping intellectual framework, research patterns, and thematic

development of green finance in the MSME setting is also prominent.

Thus, this study fills the gaps by offering a systematic bibliometric analysis to map the intellectual framework, outline the main trends of research, and outline the new tendencies in the sphere of green finance in MSMEs.

3. METHODOLOGY

3.1 Research Design

The research design of the study is a quantitative bibliometric research design to analyze the intellectual framework of the green finance research in the MSME context. Bibliometric analysis allows the systematic analysis of scientific literature, the analysis of the pattern of publications and citation structure, and the relationships of the themes. The method combines performance analysis with science mapping methods to determine the major research trends, contributions, and emerging themes in the field. The basic unit of analysis in this study is single scientific documents accessed in the database.

3.2 Data Source and Search Strategy

The data needed in this work were accessed in the Scopus database that is well-known due to its extensive coverage, good indexing, and the ability to conduct bibliometric research better than any other databases. To identify pertinent studies, a systematic search query was formulated with keywords that are pertinent to the topic of green finance and MSMEs. Searches were done in the Title, Abstract and Keyword (TITLE-ABS-KEY) to make sure that all the related literature could be covered. The search string that was used in the study is as follows:

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TITLE-ABS-KEY (
("green finance" OR "sustainable finance" OR "climate
finance" OR "green credit")
AND
("MSME" OR "SME" OR "small and medium
enterprises" OR "micro enterprises")
)
AND PUBYEAR > 2014 AND PUBYEAR < 2026
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The search was narrowed to publications that were published since 2015 and up to 2025. Peer-reviewed journal articles and conference papers were only taken to maintain consistency and quality as they were in English. To achieve relevance and comprehensiveness of the studies retrieved, the search query was narrowed down in an iterative process. Even though the search query was within the years 2015 to 2025, no publications were found to fit the years 2015 and 2016. Thus, the resulting dataset works as the best representation of research activity since 2017, meaning that the scholarly interest in green finance in MSMEs is comparatively new and has been gaining full steam in the subsequent years.

3.3 PRISMA Framework for Data Selection

This study adheres to PRISMA in order to provide transparency and systematic literature selection. The PRISMA approach is a systematized process of identifying, screening, and choosing the appropriate studies. First, the database was searched to obtain 130 records. Having eliminated duplicates, 120 records were left to screen. 20 records were excluded because of irrelevancy based on the reading of the title and abstract.

Then, 100 full-text articles were evaluated based on their eligibility, and 13 were not used. Lastly, the bibliometric analysis had a total of 87 documents in the bibliometric analysis. Figure 1 demonstrates the detailed process of selecting them.

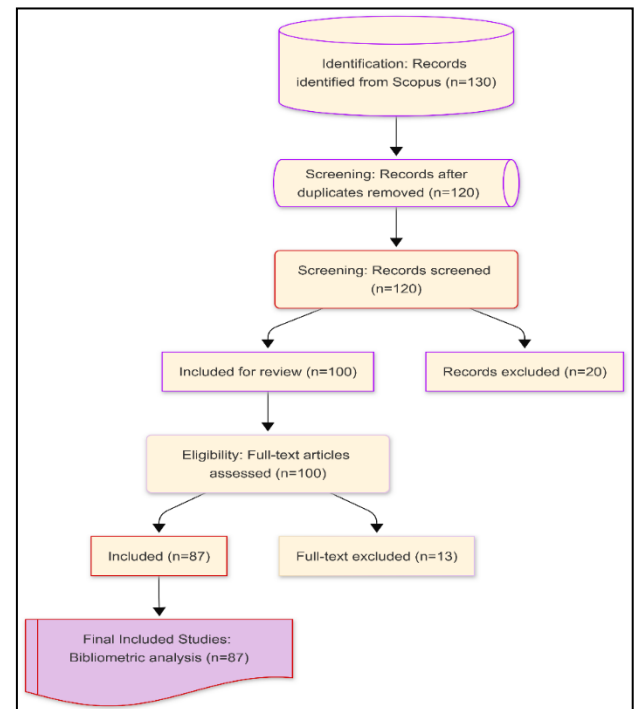


Figure 1: PRISMA Flow Diagram of Literature Selection Process

3.4 Data Extraction and Cleaning

The chosen documents were extracted as CSV files including bibliometric information such as authors, titles, abstracts, keywords, citations, and references. Preprocessing of data included the elimination of any duplicates, the standardization of the names of authorities, the harmonization of keywords (excl. the combination of SME and SMEs). Records that were incomplete and irrelevant were also eliminated to maintain accuracy and consistency of data to be used in the future analysis.

3.5 Analytical Tools and Software

RStudio and bibliometrix package were used to carry out the bibliometric analysis. The software offers both complete science mapping and quantitative analysis, allowing to visualize bibliometric networks and to use more sophisticated methods of analysis, including co-occurrence and co-citation analysis.

3.6 Bibliometric Techniques

The research utilizes a mix of the bibliometric methods to study thoroughly the research environment of green finance in MSMEs. To determine the productivity as well as the contributions of the studies within the domain, annual publication trends, the leading authors in productivity, the leading journals, along with citation patterns were analyzed. Analysis of the conceptual structure was conducted through keyword co-occurrence examination with author keywords, requiring a minimum of three occurrences to establish significant clustering and identification of key research themes and how they relate to each other. Moreover, the intellectual structure analysis

was conducted based on the co-citation analysis, determining influential studies and stream of underlying research by analyzing the joint frequency of appearance of the documents. Alongside, social structure was analyzed to investigate collaboration patterns of countries and this gave information on the spatial distribution of studies and the extent of global collaboration. Lastly, thematic analysis was done through thematic mapping methods, which categorize research themes in terms of centrality and density as motor, basic, emerging and niche ones, thus providing a greater insight into how different research areas evolved and what importance they hold to the sphere.

3.7 Parameter Settings

In order to achieve consistency and reproducibility, there were certain thresholds that were used in the analysis. Analysis of keyword co-occurrence and co-citation was done with a minimum occurrence threshold of three and a minimum citation limit of five respectively. In the case regarding country collaboration examination, a minimum of one document was considered. Normalization for association strength method was used to enhance accuracy of clustering. These thresholds have been chosen to balance the network clarity and analysis strength, especially given the moderate dataset size.

3.8 Reliability and Validity

A well-established database and standardized bibliometric methods are used to ensure the reliability of the study. PRISMA framework helps to increase transparency in the selection process, whereas data cleaning procedures enhance accuracy. The fact that all parameter settings are reproducible also enhances the strength and validity of the results.

4. RESULTS AND DISCUSSION

4.1 Descriptive Analysis of Publication Trends

Annual scientific production analysis offers valuable information on the growth path and changes in research on green finance in MSMEs throughout the study period. Figure 2 shows that between 2015 and 2025, they were able to identify 87 articles, but none were published in 2015 and 2016. As a result, it is possible to note the starting of observable research activity since 2017, which implies the relative novelty of this research area.

During the first phase (2017-2019), the amount of scholarly output was low, and there were one publication in 2017 and 2018, and no publication in 2019. This means that it is a nascent stage where academic involvement is minimal. Nevertheless, since 2020, the area demonstrates an apparent upward trend. The publications grew up to 8 in 2021 and 2022, and then the growing rate is greater with 11 publications in 2023 and 18 publications in 2024. There is a significant increase in 2025, 38 publications, indicating a high rate of growth of research activity. This fast development highlights a major trend of a shift between an emerging and a fast-growing research field. The period after 2020, especially, is a turning point, which implies that green finance in MSMEs has become quite academic and policy-relevant. The growing number of publications shows that scholars are interested in learning more about how financial sustainability and the development of small businesses intersect.

This increase in research output can be attributed to

several developments in the world. The COVID-19 pandemic contributed significantly to unveiling structural weaknesses in the traditional economic and financial frameworks and in the speeding up of the need to find more resilient and sustainable financing models. Simultaneously, the increased popularity of Environment, Social, and Governance (ESG) frameworks have encouraged investors and policymakers to consider sustainability in financial decision-making. In addition, the global policy measures like the United Nations Sustainable Development Goals (SDGs) have contributed even more significantly to the significance of equitable and environmentally sustainable economic growth and consequently influenced the research priorities. All in all, the given trend in publications indicates not only the maturation of the field but also its growing applicability in the context of the modern-day sustainability issues. The steep increase over the last few years indicates that green finance in MSMEs is moving to a mainstream research stream with immense policy, practice, and future scholarly research implications.

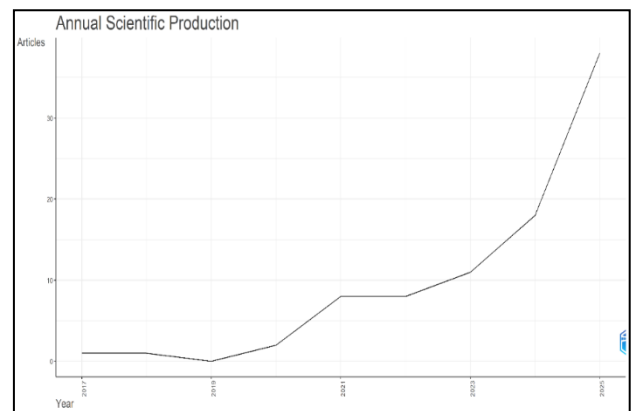


Figure 2: Annual Scientific Production in Green Finance Research on MSMEs (2017–2025)

4.2 Author Productivity Analysis

The productivity analysis of authors gives information about the distribution of scholarly works in the area of green finance in MSMEs. Table 1 illustrates the leading fruitful researchers based on the total count of publications along with their fractional contribution. The findings show that the area of research is not very unified; there is no single author that controls the field. Owen R and Sibindi AB become the most prolific authors, having three publications each. Nevertheless, in terms of fractionalized contributions, Sibindi AB (2.00) has a higher contribution level than Owen R (1.75), which implies that there is a greater individual contribution to the collaborative research outputs.

Two publications each have been made by several authors, such as Kato AI, Li J, Li X, Mirza N, Pham TT, Umar M, Wang Y and Zhang S. The difference between the fractionalized authorship between these contributors indicates that there is a difference in collaboration and individual contribution of studies. In general, the results indicate that the body of research on green finance among MSMEs is still in a nascent phase, with an evenly distributed authorship and lack of a scholarly leadership that is highly concentrated. This trend is characteristic of

emerging areas of research whereby knowledge is produced through a variety of contributions as opposed to

being produced by a handful of influential researchers.

Table 1: Most Productive Authors in Green Finance MSME Research

Author	Articles	Articles Fractionalized
OWEN R	3	1.75
SIBINDI AB	3	2.00
KATO AI	2	1.33
LI J	2	0.42
LI X	2	0.50
MIRZA N	2	0.50
PHAM TT	2	0.53
UMAR M	2	0.50
WANG Y	2	0.45
ZHANG S	2	0.75

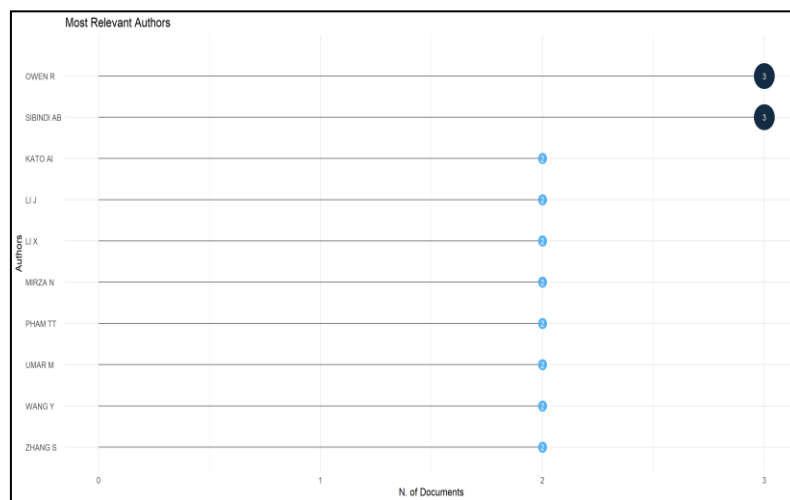


Figure 3: Author Productivity in Green Finance Research on MSMEs

4.3 Source (Journal) Analysis

The source analysis will provide a general picture on the distribution of publications across journals and the most impactful publications on the research topic of green finance in MSMEs. Table 2 presents the leading sources based on the amount of published articles. These findings indicate that the area of study is highly interdisciplinary and the journals are spread across the journals related to environmental science, sustainability, economics and finance. The most prominent sources are the Environmental Science and Pollution Research and Sustainability (Switzerland) that contain four papers apiece. This is indicative of the strong emphasis on environmental as well as sustainability considerations within the study of green finance in MSMEs.

Other interesting sources are Advances in African Economic, Social and Political Development with three publications, then there are journals like Economic Analysis and Policy, Environment, Development and Sustainability, and Singapore Economic Review, all with two articles. The very existence of conference proceedings and specialized publications are merely a way of highlighting how multidisciplinary and dynamic the research area is. Altogether, the spread of the publications in the various sources indicates that green finance in MSMEs does not belong to one academic field but it falls into various areas of research, thus increasing its relevance and its applicability in the policy and practice contexts

Table 2: Leading Journals Publishing Research on Green Finance in MSMEs

Sources	Articles
ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	4
SUSTAINABILITY (SWITZERLAND)	4
ADVANCES IN AFRICAN ECONOMIC, SOCIAL AND POLITICAL DEVELOPMENT	3
ECONOMIC ANALYSIS AND POLICY	2
ENCYCLOPEDIA OF MONETARY POLICY, FINANCIAL MARKETS AND BANKING	2
ENVIRONMENT, DEVELOPMENT AND SUSTAINABILITY	2
SINGAPORE ECONOMIC REVIEW	2
SUSTAINABLE DEVELOPMENT GOALS SERIES	2
2025 IEEE INTERNATIONAL CONFERENCE ON EMERGING TRENDS IN ENGINEERING AND COMPUTING, ETECOM 2025	1
ACADEMY OF ACCOUNTING AND FINANCIAL STUDIES JOURNAL	1

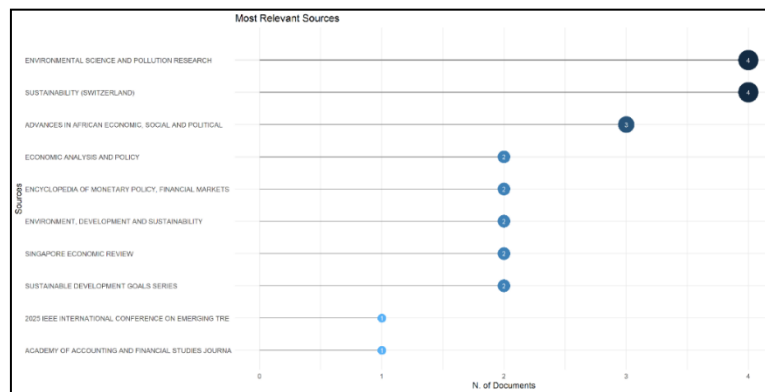


Figure 4: Source-wise Distribution of Publications in Green Finance MSME Research

4.4 Conceptual Structure: Keyword Co-occurrence Analysis

Co-occurrence analysis of keywords has been applied to examine the structural framework within the research field and determine the connections between the main research themes in terms of their frequency and co-occurrence. The analysis outcomes are discussed in Figure 5, whereas the most important network measures are presented in Table 3. The results indicate that the most significant and impactful keyword in the network is the green finance with the highest betweenness centrality (73.4) and PageRank value (0.197). Herein lies its central position as the main theme that links different streams of research in the field. The keywords that are close to each other in the same cluster are SMEs, green innovation, sustainable development goals, and financing constraints, which give the impression that the literature is mainly interested in the role of financial mechanisms in sustainable practices among small and medium enterprises.

The analysis also shows that there are several thematic

clusters. The second cluster is around sustainable finance and sustainable, having rather high centrality values, which means that they have a powerful impact and are tightly interconnected into the research field. This group indicates the greater sustainability-focused approach that green finance studies rest on. The third cluster contains the words like SME and policy, emphasizing the significance of regulatory structures along with institutional support in encouraging the adoption of green finance. Meanwhile, the fourth cluster, which includes such keywords as cleantech and early-stage innovation, are new and niche fields of research that are concerned with technological progress and innovation-based sustainability solutions.

On the whole, the key word co-occurrence analysis indicates that the discipline is shifting towards an integrated system that merges finance, sustainability, policy, and innovation. The existence of well-constructed clusters suggests a structured but growing research field, with the concept of green finance being the key connecting factor

Table 3: Key Keywords Based on Network Centrality Measures

Node	Cluster	Betweenness	Closeness	PageRank
green finance	1	73.4	0.048	0.197
smes	1	2.1	0.036	0.062
green innovation	1	0	0.029	0.046
sustainable development goals	1	0	0.029	0.031
financing constraints	1	0	0.029	0.031
climate change	1	0	0.029	0.024
total factor productivity	1	0	0.029	0.024
sustainable finance	2	49.75	0.043	0.149
sustainability	2	7.75	0.037	0.075
sustainable development	2	0	0.029	0.052
bibliometric analysis	2	0	0.027	0.023
entrepreneurship and small business management	2	0	0.029	0.052
microfinance	2	0	0.027	0.023
social equity	2	0	0.027	0.023
sme	3	14	0.03	0.048
policy	3	0	0.021	0.029
cleantech	4	0	1	0.056
early-stage innovation	4	0	1	0.056

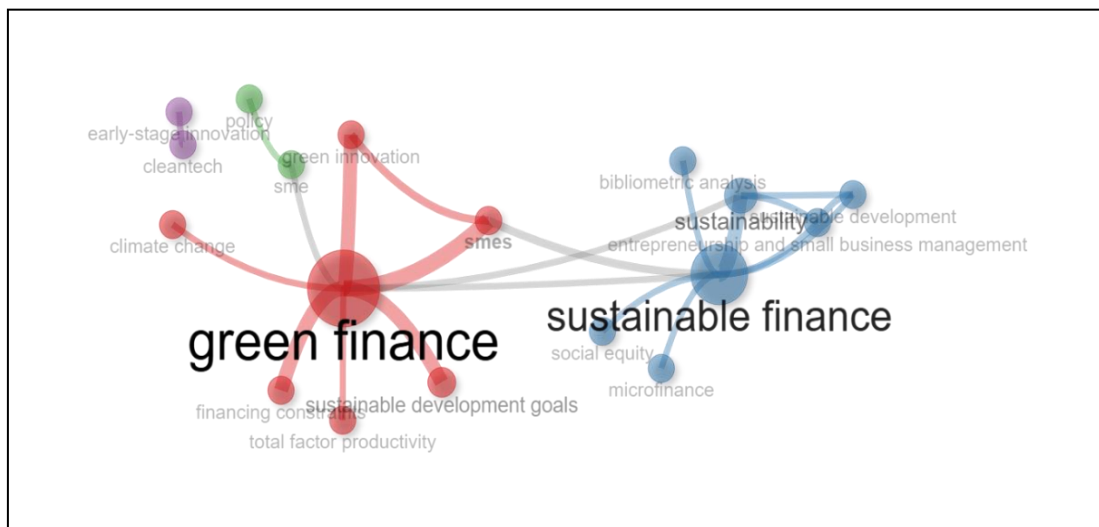


Figure 5: Keyword Co-occurrence Network of Green Finance in MSMEs

4.5 Keyword Importance and Centrality Analysis

In order to gain a clearer insight into the importance of the main research themes a centrality-based analysis of keywords was carried out. Table 4 gives the most significant keywords according to their frequency and centrality measures, in terms of betweenness, closeness, and PageRank. The findings reveal that the keyword of the most prevalent in the network is the green finance, as it has the highest frequency (27 times) and much greater betweenness centrality (4049.099), which proves it to be the most central in linking different research topics. This reiterates the idea that green finance is the central theme on which it organizes the research field.

Other significant keywords are such as innovation and financial constraints that have quite high centrality values

indicating that they have a strong impact in the network. The keywords used (microfinance, green innovations and MSMEs) also highlight the practical and policy-based aspects of the study. Also, new themes like COVID-19, environment, and environmental economics are pointing to the widening of the field with the field absorbing external shocks and environmental impacts on green finance studies.

Although these themes are starting to gain more and more relevance, the predominance of the financial constraints theme sheds light on a very important structural issue in the MSME sector. Access to formal finance, lack of collateral, and high costs of transacting are other issues that MSMEs tend to experience, thus limiting their adoption of green financial instruments. This implies that,

although green finance takes the central conceptual focus, its application is skewed, especially in developing and emerging economies.

Moreover, the close association between innovation and green finance shows that technology development is a key factor that promotes sustainable transitions. However, the relatively low number of innovation-related keywords in comparison to the frequency of the keyword green finance means that the process of combining financial processes and utilizing technology is still in its infancy. This shows that there is a gap that can be bridged in future research on the capacity of innovation ecosystems, fintech solutions, and digital financial services to expand access of MSMEs to green finance.

These structural obstacles imply that governments and financial institutions ought to alleviate them by promoting inclusive financial systems, incentives, and raising awareness about green financial instruments, as policy. This will also require institutional support and skill development activities to support in closing the divide between the theoretical importance of green finance along with its applied implementation amongst MSMEs. In general, the centrality analysis confirms the conclusions of the co-occurrence network; however, it also shows that the research field has its issues and opportunities, showing that although the field is focused on green finance, it is gradually turning towards the integration of innovation, policy support, and sustainable economic development

Table 4: Top Keywords Based on Frequency and Centrality Measures In Green Finance MSME Research

Occurrences	Words	Cluster	Cluster_Label	btw centrality	clos centrality	pagerank centrality
27	green finance	1	green finance	4,049.099	0.002	0.032
11	innovation	1	green finance	771.536	0.002	0.017
3	financial constraints	1	green finance	125.169	0.002	0.003
3	green innovations	1	green finance	105.747	0.002	0.005
3	microfinance	1	green finance	84.15	0.002	0.003
3	msmes	1	green finance	247.117	0.002	0.002
2	bibliometric analysis	1	green finance	7.882	0.002	0.002
2	covid-19	1	green finance	122.894	0.002	0.003
2	environment	1	green finance	10.512	0.002	0.002
2	environmental economics	1	green finance	69.366	0.002	0.003

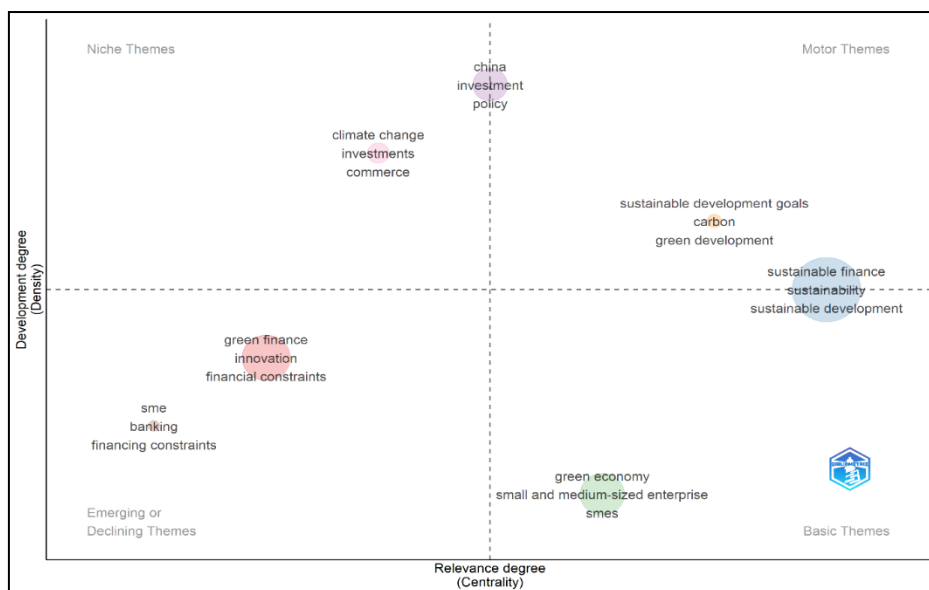


Figure 6: Keyword Centrality Network Highlighting Core Themes in Green Finance Research on MSMEs

4.6 Intellectual Structure: Co-citation Analysis

Co-citation analysis was used for examining the intellectual structure within the research domain as well as determine influential authors and foundational studies by the frequency with which they are co-cited. The approach helps to unveil the theoretical foundation and the major knowledge sets in the area. The results are visualized in Figure 7 and some of the important co-citation metrics can be found in Table 5. The results

indicate that several of the authors have a significant role in the establishment of intellectual basis of the study of green finance in MSMEs. One of them is Porter M.E. with the highest influence with a relatively high betweenness centrality (10) and PageRank (0.142) indicating that there is a high relationship between the different clusters of research. In the same vein, the authors like Henseler J. and Jabbour C.J.C. also have large centrality values indicating their significance in the linkage of different research

streams in the field.

The co-citation network also emphasizes the existence of separate clusters of different theoretical and methodological views. The initial group consists of such influential authors as Acemoglu D., Taghizadeh-Hesary F., and Scholtens B, that are mostly based on the research work that is focused on the field of environmental economics and financial systems. The second group includes such authors like Sarstedt M., Ringle C.M., and Henseler J., which suggests the combination of sophisticated methodological tools, especially in structural equation modeling and techniques of empirical research. Other clusters reflect some new more narrow research fields. To give an example, the works by Corrocher N., Mazzanti M., and Ghisetti C. help to fill in

the streams of the research about innovation and the environmental policy, and the other works point to the increased focus on the sustainability transition and development of green technologies.

On the whole, the co-citation analysis shows that the intellectual organization of the green finance research in MSMEs is not only varied but also in flux. The fact that the clusters are numerous and interconnected shows that it has a multidisciplinary basis which incorporates the knowledge of finance, environmental economics, sustainability studies, and quantitative approaches. This evolving shape is a sign of dynamism of the field and the increasing relevance of the field to global sustainability challenges

Table 5: Influential Authors Based on Co-citation Analysis

Node	Cluster	Betweenness	Closeness	PageRank
porter m.e..	1	10	0.093	0.142
acemoglu d..	1	0	0.052	0.035
taghizadeh-hesary f..	1	0	0.052	0.035
hadlock c.j..	1	0	0.052	0.026
garcia-quevedo j..	1	0	0.052	0.035
scholtens b..	1	0	0.052	0.026
sarstedt m..	2	5.143	0.037	0.076
ringle c.m..	2	0	0.032	0.051
henseler j..	2	12.857	0.04	0.085
samadhiya a..	2	0	0.026	0.046
jabbour c.j.c..	2	18	0.04	0.039
jain v. 2024	2	0	0.026	0.046
schaltegger s..	2	0	0.024	0.017
kamran h.w..	3	0	0.465	0.05
alharthi m..	3	0	0.465	0.05
corrocher n..	4	14	0.037	0.043
mazzanti m..	4	0	0.024	0.049
ghisetti c..	4	0	0.024	0.049
agyemang m. 2018	5	0	0.465	0.05
antarciuc e..	5	0	0.465	0.05

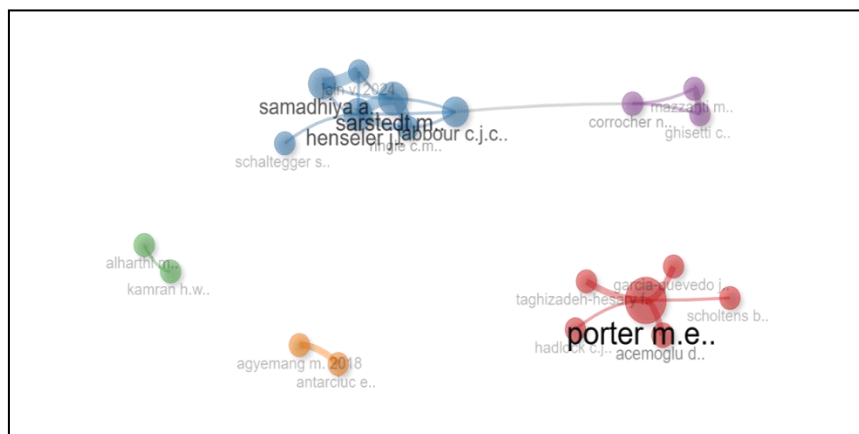


Figure 7: Co-citation Network of Influential Authors in Green Finance Research

4.7 Social Structure: Country Collaboration Analysis

The country-level collaboration analysis of the social organization of the studied field reveals the regional spread of researches and the extent of global collaboration in the field related to green finance within MSMEs. The findings are indicated as shown in Figure 8. The research in this area is distributed globally in the country collaboration network and the developed and developing economies contribute significantly. The nations including China, India, as well as the United States become significant contributors, and it is a testimony to their greater concern with sustainable finance and the development of MSMEs. Besides, many European nations demonstrate positive attendance and this is the indication of the importance of the environmental policies and sustainability in the area.

Another important aspect of the network is that it is evidenced that there is an increasing international collaboration among countries, which means that green

finance is a research subject of international interest, and which must be tackled at the national level. The interconnection of the network is an indication of knowledge dynamism and collaboration which aids in progressing the study within the discipline. Moreover, the participation from the developing countries also supports the significance of green finance in offering a solution to the sustainability problem in those developing economies in which MSMEs are at the core of economic development. Such collaborations will play a significant role in the sharing of the best practices, enhancement of policy frameworks and sustainable financial processes across the globe. On the whole, the analysis of country collaboration shows that there is not only an interdisciplinary study of green finance in MSMEs, but also the study is global. The rising cooperation between nations can be seen as the growing importance of sustainability as a worldwide priority and the necessity to coordinate research and policy work

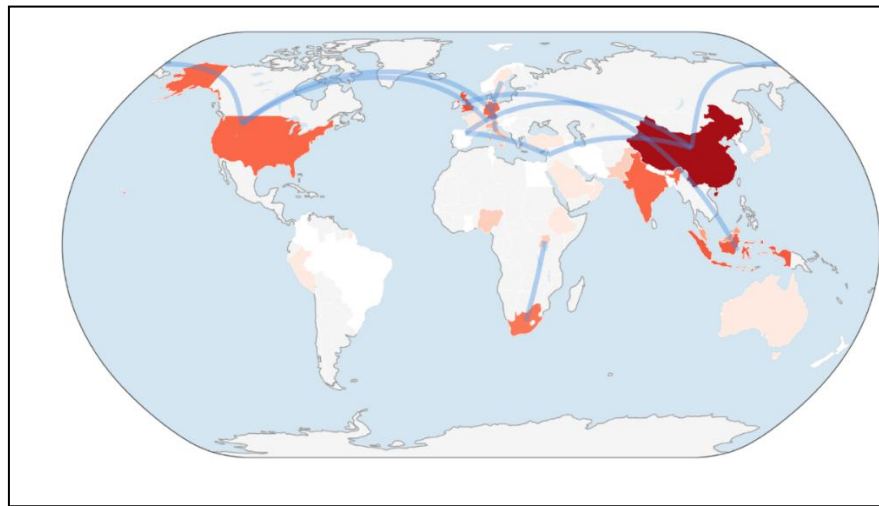


Figure 8: Country Collaboration Network in Green Finance Research on MSMEs (2017–2025)

4.8 Thematic Analysis

The thematic analysis will give a more detailed insight into how the research themes are developed, what holds relevance, and how they are evolving in the sphere of green finance in MSMEs. It is analyzed on the basis of thematic map which categorizes the topics according to their significance (importance) as well as concentration (level of advancement). Figure 9 shows the results. The thematic framework identifies four types of themes: motor themes, basic themes, emerging or declining themes, and niche themes. Motor categories are highly centralized and dense, and they are developed and significant research areas. The theme of sustainability and sustainable development can also be identified as the motor themes in the given research, which means that these two concepts are the central ones in the domain of research.

The cornerstone concepts of the field are basic themes, which are of high centrality but low density. The keywords used in this category include MSMEs, green economy and environmental sustainability which are important research subjects that need to be developed further. Themes with low centrality and low density

(emerging or declining themes) are green finance and innovation. These themes are placed in a way that implies that they are in their early stages and can make a rise in future studies. This is in line with the dynamic nature of the discipline whereby emerging lines of inquiry are still being generated in relation to the global sustainability issues.

High density, low centrality niche themes are specialties of research that have limited wider impact. These themes tend to revolve around certain elements like clean technology, early-stage innovation and policy mechanisms, meaning that there is some targeted research within the field. On the whole, the thematic analysis shows that the area of green finance in MSMEs is shifting towards the research at a more advanced stage and with a more specialized focus. The presence of the motor, basic, and emerging themes indicate the dynamic nature of the research environment and imply the existence of great opportunities in the future research, especially when it comes to the combination of financial innovation, policy frameworks, and sustainability practices

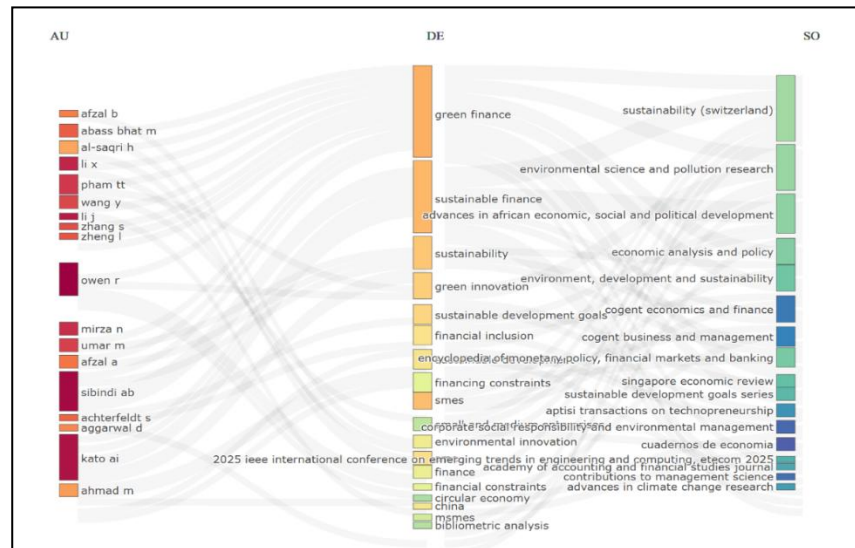


Figure 9: Thematic Map of Green Finance Research in MSMEs

4.9 Sustainability Implications

The results of this research provide valuable suggestions to enhance sustainability in the MSME sector. The bibliometric outcomes show that green finance is at the centre of ensuring that MSMEs embrace green practices that are environmentally sustainable through enhancing access to green financial instruments like green credit, sustainable loans, and climate-oriented investments. Green finance reduces financial barriers, thereby fostering the uptake of energy efficient technologies and cleaner production practices and low-carbon forms business models. The paper also notes the growing incorporation of sustainability, innovation and financial inclusion in the research domain. This implies that policy makers should lay emphasis on formulating specific financial policies such as subsidies, tax incentives, credit guarantee schemes, among others, to help MSMEs engage in sustainable activities. The adoption of green financial instruments can also be improved by strengthening institutional structures and increasing awareness of them. Practically, financial institutions can play a role by coming up with accessible and genderized green financial products that will meet the special needs of MSMEs. Also, the digital financial solutions and fintech innovations can be promoted to assist in bridging the gap between MSMEs and sustainable financing opportunities. In general, this paper is relevant to sustainability as it offers a systematic insight into how green finance can be used to promote sustainable MSME development in accordance with larger objectives like a sustainable environment, inclusive economic growth, and the attainment of Sustainable Development Goals (SDGs).

CONCLUSION

The research presents an extensive bibliometric evaluation of the intellectual framework of the green finance studies in MSMEs in the past five years, 2015–2025. The results indicate that the sphere has been evolving quickly, especially since 2020, as the world pays more and more attention to sustainability, mitigating

climate change, and financial systems that are not discriminatory. Although this increase has occurred, the research field is still rather fragmented, and the contributions are spread among various fields, such as finance, environmental economics, and management studies. Theoretically, the research makes contributions to the literature through a systematic mapping of the intellectual, conceptual and social framework of green finance in the MSME environment. It emphasizes the fact that green finance serves as the core integrative idea that connects the major themes that are innovation, sustainability and financial constraints. The results confirm the fact that the field is multi-disciplinary in nature and that it is shifting to more basic research to more specialized and application-based fields. Moreover, the research area of MSMEs further expands the current body of bibliometrics research by specifically considering the specific level of the enterprise sustainability research that is contrasted with other critical gaps of the macro-level of Green finance research and studies. Policymakers, the findings highlight the importance of specific measures to increase the use of green finance among MSMEs, especially in developing economies, like India or some African countries. Improvement of inclusive green financial frameworks by introducing subsidies, tax breaks, credit guarantee schemes targeting MSMEs should be a priority of the policymakers. The institutional support, the establishment of a more favorable regulatory environment, and the promotion of a government-business world partnership can also contribute to the improved use of green finance. The financial institutions also have the significant role in creating innovative and accessible financial products such as green credit lines and sustainability-based loans to meet the needs and limitations of MSMEs in particular.

Moreover, the study focuses on capacity-building and creation of awareness. Most MSMEs are not aware of the green financial instruments and green practices and this restricts their involvement in green financial programs. In this way, training programs, online services and advisory services should be promoted to enhance increase

economic awareness and technological readiness among micro businesses. Further integration of digital financial services and access to sustainable financing are further lowered as more costs associated with fintech are reduced. Despite the contributions that this study has had, it has limitations. It is founded on one database (Scopus) and a set time frame, which can restrict the thoroughness of the study. These constraints may be addressed in subsequent studies through incorporating multiple databases, longitudinal and comparative research, and use empirical techniques to examine the direct impact of green finance on MSME performance and sustainability results.

To sum up, the current paper has a strong basis to learn about the development and framework of the green finance research in MSMEs. It does not only highlight the opportunities but it also highlights the challenges of integrating sustainability in the background of small business financing, but also offers practical advice of the path forward in the future research, policy formulation and its implementation in practice to achieve sustainable, inclusive economic growth.

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