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Evolution of Green Banking in the 21st Century: A Bibliometric Analysis

(Evolusi Perbankan Hijau pada Abad ke-21: Satu Analisis Bibliometrik)

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ABSTRACT

The rise of green banking represents an obvious reaction of the banking industry to climate-related risks and sustainable finance requirements. Nevertheless, literature reviews available in this context are mostly descriptive or conceptual in nature, concentrate on specific countries, or perceive green banking as a sub-area of the broader concept of green finance. In order to close this gap, this paper provides a bibliometric overview of 436 publications indexed by Scopus within the period from 2000 to 2024 (August 2024 search) and analyzed with PRISMA and VOSviewer software. Unlike previous literature reviews, the present paper offers an analysis of publication trends, citation impact, country and author contributions, keyword co-occurrences, as well as co-authorship network analysis. The number of annual publications increased from 20 publications in 2019 to 93 in 2023. India (81), Malaysia (49), United Kingdom (41), and Bangladesh (34) are the most prolific nations, whereas Africa, Latin America, and the Middle East regions are poorly represented. Sustainability (Switzerland) is the most prolific journal (34 papers), and Aizawa and Yang (2010) is the most cited publication (173 citations). In keyword co-citation analysis, there are six clusters: environmental governance and green finance practices, sustainable and ethical banking, financial performance, sustainable finance and climate change, corporate governance and environmental policy, and regulatory frameworks. The coauthorship network is divided into small and isolated clusters. Such findings indicate research gaps in comparative and collaborative studies across regions. This study covers the Scopus database only, and 2024 data were incomplete.

Keywords: Green banking; bibliometric analysis; sustainable finance; environmental risk management; methodological trends

ABSTRAK

Kebangkitan perbankan hijau merupakan tindak balas yang ketara oleh industri perbankan terhadap risiko berkaitan iklim dan keperluan kewangan mampan. Walau bagaimanapun, sorotan literatur yang sedia ada dalam konteks ini kebanyakannya bersifat deskriptif atau konseptual, tertumpu kepada negara-negara tertentu, atau menganggap perbankan hijau sekadar sub-bidang kepada konsep kewangan hijau yang lebih luas. Bagi merapatkan jurang ini, kajian ini menyediakan gambaran keseluruhan bibliometrik terhadap 436 penerbitan yang diindeks oleh Scopus dalam tempoh dari tahun 2000 hingga 2024 (carian Ogos 2024) dan dianalisis menggunakan perisian PRISMA serta VOSviewer. Tidak seperti sorotan literatur terdahulu, kajian ini menawarkan analisis tentang trend penerbitan, impak sitasi, sumbangan negara dan pengarang, kemunculan bersama kata kunci, serta analisis rangkaian pengarang bersama. Bilangan penerbitan tahunan meningkat daripada 20 penerbitan pada tahun 2019 kepada 93 penerbitan pada tahun 2023. India (81), Malaysia (49), United Kingdom (41), dan Bangladesh (34) merupakan negara yang paling prolifik, manakala rantau Afrika, Amerika Latin, dan Timur Tengah kurang diwakili. Sustainability (Switzerland) ialah jurnal paling prolifik (34 kertas kerja), dan Aizawa dan Yang (2010) merupakan penerbitan yang paling banyak disitasi (173 sitasi). Dalam analisis sitasi bersama kata kunci, terdapat enam kluster utama: tadbir urus alam sekitar dan amalan kewangan hijau, perbankan mampan dan beretika, prestasi kewangan, kewangan mampan dan perubahan iklim, tadbir urus korporat dan dasar alam sekitar, serta rangka kerja kawal selia. Rangkaian pengarang bersama pula terbahagi kepada kluster-kluster yang kecil dan terpencil. Penemuan ini menunjukkan wujudnya jurang penyelidikan dalam kajian perbandingan dan kolaboratif merentas rantau. Kajian ini hanya merangkumi pangkalan data Scopus, dan data bagi tahun 2024 adalah tidak lengkap.

Kata kunci: Perbankan hijau; analisis bibliometrik; kewangan mampan; pengurusan risiko alam sekitar; trend metodologi

INTRODUCTION

Green banking started to take shape in the late 1990s and early 2000s when banks began to see the impact of environmental risks and the part that finance plays in sustainable development (Sharma 2024). Financial institutions had a less positive attitude towards the environment; however, international environmental agreements and regulatory requirements have increasingly forced financial institutions to incorporate sustainability in their policies, lending activities, and risk management (Khairunnessa et al. 2021). Green banking then started to become more influential when the environment-related regulations became stricter, and the importance of environmentally related credit risk was put in focus by banks. In addition, the use of environmentally friendly technologies and processes has been linked to the efficiency and competitiveness of banking (Zhang et al. 2022).

Eco-friendly banking, or green banking, is an overall term that includes banking approaches and policies that promote environmental protection and social gains. It includes sustainable finance, sustainable investment, sustainable lending, sustainable financial products and services, sustainable business operations, and institutional policies. Banks can also finance renewable energy and other environmentally positive investments to help reduce negative externalities and achieve environmental goals. The development signals the increasing awareness of the financial industry's contribution to solving ecological problems from an environmental policy and an economic policy perspective (Jeucken 2010; Weber & Feltmate 2016).

Green banking is also relevant to the United Nations Sustainable Development Goals (SDGs). SDG 9 (Industry, Innovation and Infrastructure), SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action) are especially applicable to the field of sustainable banking (United Nations 2020). The Principles for Responsible Banking also include sustainable business financing and the incorporation of environmental risks into financial decision-making as a key element of banks' responsibilities (United Nations Environment Program Finance Initiative, 2018). Banking activities can be affected by the environment, with the possibility of reducing waste and emissions and maintaining the sustainability of the bank (Bouma et al. 2001). In the meantime, green banking can help to achieve long-term financial stability by mitigating climate and regulatory risk and meeting the demands of shareholders and sustainability-conscious consumers (Park & Kim 2020).

Aside from the regulatory compliance and risk management aspects, green banking has grown in relevance to competitiveness in the financial sector. They are more aware of the impact of banking activities on the environment, thus pressuring banks to be more accountable and transparent. Institutions that incorporate sustainability practices could gain significant benefits in terms of customer relations, reputation, innovation, and growth (Bahl 2012; Sharma & Choubey 2022). UNEP (2015) also mentions that green banking can lead to energy savings due to the efficient working of the banks, and it could result in a decrease in some of the compliance costs. Green Banking can therefore be considered a reaction to the environment and as a strategy with the potential of contributing to the performance and stability of institutions (Oyegunle & Weber 2015; Krstić 2013).

It is possible to evaluate the evolution and the organization of a research area through bibliometric analysis of publications, citations, and keywords. It can assist in determining the scope of the topic, important writers and journals, and the overall pattern of scholarly discourse (D'Amato & Roome 2009). Bibliometric methods, in combination with citation and keyword co-occurrence analysis, can also show other characteristics such as interdisciplinarity and thematic development (Zhao et al. 2023). Bibliometric tools are therefore beneficial for tracking the evolution of research areas and/or the scholarly influence, as well as pointing towards new research directions (Muff et al. 2017).

In light of this, the present study aims to follow the evolution of green banking research over the period of the study (2000–2024) by applying bibliometric techniques. The analysis is mainly done on publication trends, countries, authors, journals, keywords, citation patterns, and thematic linkage in the field. It also offers a glimpse into the interrelationships between various aspects of green banking research for future academic and policy debates. For literature screening, the PRISMA-guided methodology is used, and for visualization of intellectual structures, thematic patterns, and research networks, VOSviewer is used (Nti et al. 2023; Baarimah et al. 2024).

The paper is arranged as follows. The Literature Review discusses the key ideas, definitions, issues, and theories pertaining to green banking. The research methodology is based on the description of the database, search strategy, inclusion and exclusion criteria, and bibliography procedures. The Results section provides publication trends, highly cited publications, influential journals, countries, authors, keyword and co-authorship networks. These results are discussed in the discussion section in terms of previous studies. The main findings, implications, limitations, and directions for further research are summarized at the end of the paper.

LITERATURE REVIEW

OVERVIEW OF THE CONCEPT AND DEFINITIONS OF GREEN BANKING

Chitra and Gokilavani (2020) define green banking as a new banking concept that combines innovative financial thinking and environmental goals with the involvement of clean-tech. Studies related to green banking link it with sustainable industrialization and reduction of adverse environmental impacts (Bhardwaj & Malhotra 2013). Green banking can also be viewed as social, environmental, and governance risk management approaches taken by financial institutions under pressure from stakeholders, technological innovations, policy push, and economic factors (Zhelyazkova & Kitanov 2015; Kartika et al. 2023).

Commercial banks are shifting their activities towards the integration of social and environmental goals, which is part of the responsible finance concept (Lalon 2015; Stojanović 2020). In the Indian context, some banks like ICICI and SBI have started their environmental initiatives across various banking operations (Ganesan & Bhuvaneswari 2016). Another aim of green banking is to reduce financing of environmentally harmful activities and to encourage clients to act pro-environmentally (Mikliński 2023; Zioło et al. 2019).

CHALLENGES FACED BY BANKS IN ADOPTING GREEN BANKING

There are several challenges associated with the implementation of green banking practices, such as operational costs, challenges in measuring green projects, credit risks, and transparency and accountability in banking practices (Zheng et al. 2021). Uncertainties in the bankability of green projects, inadequate transparency in monitoring of sustainable capital flows, as well as the lack of same-size mechanisms to link the supply of green investments with market demand, represent some other challenges to sustainable banking (Mendez & Houghton 2020). Some sustainability-related activities were impacted by the COVID-19 pandemic, with focus and resources given to short-term financial and operational issues (Chen et al. 2022). In addition to the regulatory and policy support needed by companies to switch to greener operations, banks will have to face the costs of implementation and the trade-offs that come with it (Șimandan & Păun 2021). In addition, banks in developing economies might need to further enhance their knowledge of environmental issues and embed green banking into their regular business operations to safeguard their reputation and customer confidence (Khan et al. 2023). There are generally three main categories: economic, operational, and regulatory (Zheng et al. 2021; Mendez & Houghton 2020; Șimandan & Păun 2021).

THEORETICAL FOUNDATIONS OF GREEN BANKING

Theories of green banking include environmental issues, pressure from stakeholders, policy requirements, economic considerations, and the need for sustainable value creation (Kartika et al. 2023). The incorporation of environmental and social criteria in lending policies might assist banks to deal with credit and liability risk, enhance the quality of their loan portfolio, and enhance investment results (Biswas 2016). Through green banking, finance can be channeled into environmentally sustainable and socially responsible projects that can provide value to the financial institutions, industries, and the environment, which can contribute to the SDGs (Mir & Bhat 2022; Stojanović 2020).

External institutional factors such as regulatory and policy responses to climate change affect their development. Policy and financial innovation (Omurova et al. 2021) are therefore needed to integrate green finance and social investment with development finance. Previous studies also show strong links between the concept of green banking and other related green finance issues, such as green bonds, green credit, climate investment, and the regulation of climate finance (Debrah et al. 2022; Vanishvili & Katsadze 2022). Three theories, namely resource-based view (RBV), institutional theory, and stakeholder theory, can be used to understand green banking. Stakeholder theory describes banks' reactions to regulators' expectations, investor expectations, customer expectations, and civil society expectations, and institutional theory gives a focus on regulatory requirements, industry norms, and peer influence in the development of bank practices (Freeman et al. 2021; McGahan 2021; Govindan et al. 2021).

The RBV emphasizes the internal capabilities and resources that banks build with green lending, green HR practices, green governance, and environmental competencies that can enhance the outcomes of banks (Paolone et al. 2024; Beamish & Chakravarty 2021; Andersén 2021). These views can be used to gain a better understanding of the interplay between external pressures and internal resources in the implementation of green banking. More studies are needed to explore the differences in these mechanisms in institutional contexts and markets.

RESEARCH METHODOLOGY

RESEARCH QUESTIONS

Existing studies indicate that green banking is shaped by the expectations, requirements, and sustainability aspirations of stakeholders (Zhelyazkova & Kitanov 2015; Kartika et al. 2023). The literature, however, is scattered across conceptual studies, theoretical discussions, and context-specific empirical studies. Existing studies have explored the definitions of green banking and its motivations for various reasons, including green credit and environmental risk management (Bhardwaj & Malhotra 2013; Lalon 2015; Mikliński 2023), and the theoretical explanations have covered the "stakeholder," "institutional," and "resource-based" approaches, which are still not sufficiently synthesized (Freeman et al. 2021; Govindan et al. 2021; Paolone et al. 2024). Other research areas include sustainable finance, governance, and climate policy (Debrah et al. 2022; Vanishvili & Katsadze 2022), but an in-depth bibliometric analysis of the growth of publications, key influential authors, thematic developments, and the citation networks is still required. Based on this, the present study adopts the PRISMA-guided screening and bibliometric mapping with the software VOSviewer to answer the following research questions:

RQ_1 What are the publication trends in green banking research during the 2000–2024 study period?

This question identifies the growth and trajectory of publications during the study period and highlights changes in research output. Publication trends indicate how research activity develops over time and provide an overview of the expansion or contraction of scholarly attention to a field (Borregan-Alvarado et al. 2020).

RQ_2 Which countries and authors have made substantial contributions to green banking research?

This question addresses the geographical distribution of the literature and identifies key contributors based on publication and citation patterns. It helps characterize the distribution of scholarly contributions across countries and authors.

RQ_3 What are the common themes and keywords in green banking research, and how do they co-occur?

This question explores the thematic structure of the research by analyzing keyword co-occurrence, revealing the central topics and their interconnections within the field.

RQ_4 Which publications and journals have the highest citation impact in green banking research?

This question identifies highly cited publications and journals and considers their citation patterns as indicators of scholarly visibility and dissemination within the field.

SEARCH STRATEGIES

This study examined the research on green banking published in Scopus-indexed journals during 2000-2024. The period chosen was to reflect the early development of research on green banking and its rapid growth in a period of increased awareness of sustainability issues, environmental finance, and theses related to the climate. To ensure adequate coverage of the field's early development, the starting year of 2000 was chosen, and 2024 is the latest year of publication for the dataset as of the search time. The database search was done on August 6th, 2024. Scopus was chosen because it offers structured bibliographic information, abstracts, citation details, and extensive coverage of scholarly literature, which are all beneficial for bibliometric analysis (Baas et al. 2020). The period from 2000 to 2024 was used throughout the study to ensure the field emerged, grew, and consolidated during this period (Khairunnessa et al. 2021).

The keywords used were chosen to reflect the key terms used in the field; "Green Banking" to reflect the established term and "Sustainable Bank*" to capture the variations which include sustainable bank, sustainable banks, sustainable banking. The term Sustainab* Bank* extends retrieval to related terms with stems sustainab- and bank-. An asterisk (*) at the end of a word stem is a truncation operator that will match zero or more characters at the end of a word stem and will be used to search for multiple word endings. The TITLE-ABS-KEY field searches the title, abstract, and author-keyword fields. These can be used in concert to give a targeted search, and the common linguistic variations of sustainable and banking terminology can be retrieved.

TABLE 1. Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Publication Type	All document types retrieved by Scopus search	Other types removed during screening
Thematic Areas	All thematic areas relevant to Green Banking and Sustainable Banking	Irrelevant thematic areas (e.g., unrelated fields)
Geographical Scope	All countries/territories	None
Language	English	Non-English languages
Timeframe	2000–2024	Before 2000 or after 2024
Document Type	Records with usable bibliographic metadata	Duplicate or incomplete records

Source: Authors' own elaboration.

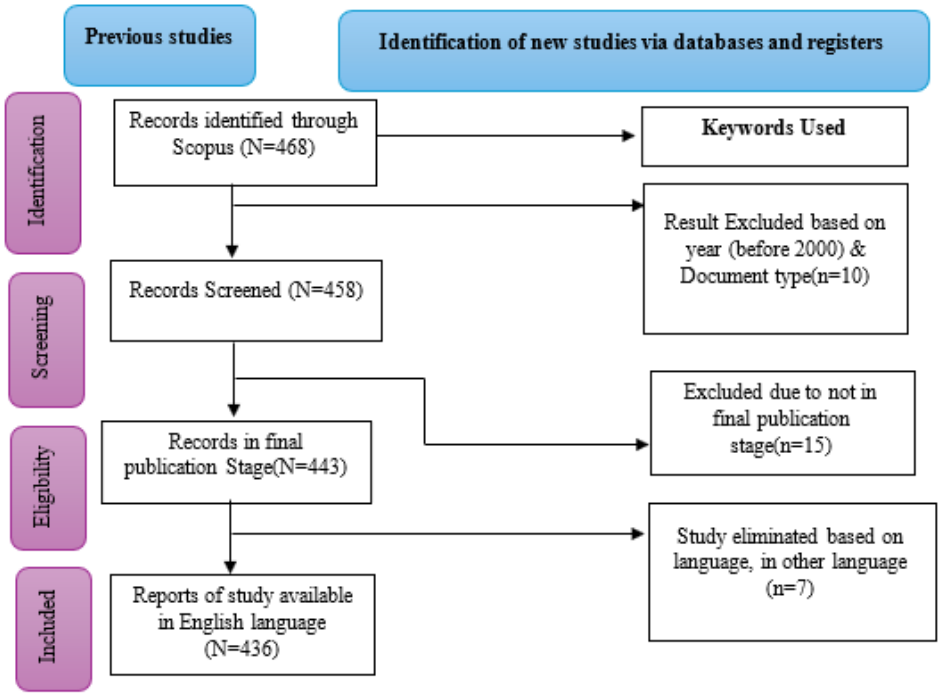


FIGURE 1. PRISMA screening flowchart
Source: Authors' own elaboration.

A preprocessing step was applied to the Scopus metadata to reduce noise, remove duplicate records, and address missing or incomplete values. Following preprocessing, the final dataset comprised 436 publications. The data were exported in CSV format and processed using Microsoft Excel for Microsoft 365. The cleaned dataset was then analyzed using VOSviewer 1.6.20. VOSviewer supports the construction and visualization of bibliometric networks, including relationships among countries, institutions, journals, authors, and keywords (Wong 2018; McAllister et al. 2022).

RESULTS

This section presents the results of the bibliometric analysis for the 2000–2024 study period. The results include publication trends, document types, highly cited publications, influential journals, country and author contributions, keyword co-occurrence, and co-authorship patterns.

TABLE 2. Summary of data

Outcomes	Total Number
final sample (publications)	436
Authors	1042
Sources	276
Keywords	1649
Citations	20912
Countries	86
Affiliations	869

KEYWORD SEARCH

The Scopus search conducted on August 6, 2024, yielded 436 publications within the 2000–2024 study period. The dataset comprised 300 articles, 55 book chapters, 45 conference papers, 16 reviews, 13 books, 3 editorials, 2 conference reviews, 1 note, and 1 erratum. These document types are presented in Figure 2.

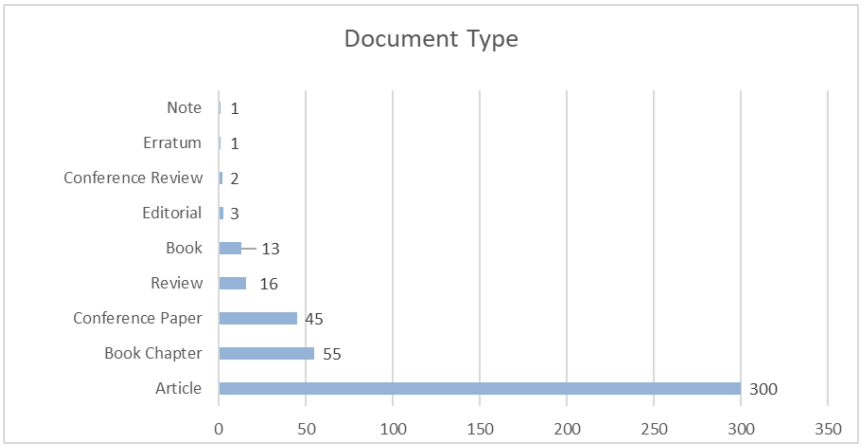


FIGURE 2. Document Type

TRENDS IN PUBLISHING NUMBERS THROUGHOUT RESEARCH TENURE

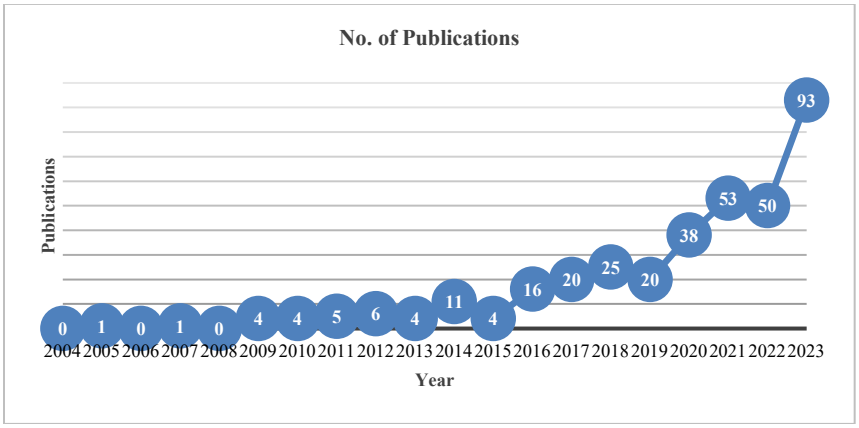


FIGURE 3. Number of publications, 2000–2023

The trend of publications over the years for 2000–2023 is shown in Figure 3. While the study period is through 2024, the annual series presented here will terminate in 2023 due to the search being completed on August 6, 2024, in the Scopus database. There were no publications in the early years, and the number started to increase from 2008 onwards. In 2014, the number of publications was 11, and after 2017, there was a more consistent number of publications. Research activity continued to grow, with the number of publications rising from 20 in 2019 to 38 in 2020 and 53 in 2021. In 2023, the number of publications was at its highest level, 93 per year, as indicated in the figure. The rise since 2019 suggests the scholars' growing interest in green banking, especially in the final years of the study period. The 2024 publication year was not yet complete when the database search was done on August 6, 2024; thus, the annual trend in Figure 3 is limited to available completed-year series through 2023. In summary, it can be seen that there is a significant increase in the volume of green banking research in 2000-2024.

MOST CITED PUBLICATIONS

According to Scopus citation counts, the most-cited publications in green banking are presented in Table 3.

TABLE 3. 10 Most-cited publications

Title	Authors	Year	Source title (Journal)	No. of citations
"Green credit, green stimulus, green revolution? china's mobilization of banks for environmental cleanup"	Aizawa M.; Yang C.	2010	Journal of Environment and Development	173
"What drives green banking disclosure? An institutional and corporate governance perspective"	Bose S.; Khan H.Z.; Rashid A.; Islam S.	2018	Asia Pacific Journal of Management	122
"The influence of green HRM practices on green service behaviors: the mediating effect of green knowledge sharing"	Rubel M.R.B.; Kee D.M.H.; Rimi N.N.	2020	Employee Relations	112
"Csr, co-creation and green consumer loyalty: Are green banking initiatives important? A moderated mediation approach from an emerging economy"	Sun H.; Rabbani M.R.; Ahmad N.; Sial M.S.; Guping C.; Zia-Ud-din M.; Fu Q.	2020	Sustainability (Switzerland)	104
"Developing an Islamic Corporate Governance framework to examine sustainability performance in Islamic Banks and Financial Institutions"	Jan A.A.; Lai F.-W.; Tahir M.	2021	Journal of Cleaner Production	98
"Sustainability in The Banking Industry: A Strategic Multi-Criterion Analysis"	Raut R.; Cheikhrouhou N.; Kharat M.	2017	Business Strategy and the Environment	97
"Global banks as global sustainability regulators? The equator principles"	Conley J.M.; Williams C.A.	2011	Law and Policy	87
"Green washing or authentic effort? An empirical investigation of the quality of sustainability reporting by banks"	Khan H.Z.; Bose S.; Mollik A.T.; Harun H.	2021	Accounting, Auditing and Accountability Journal	84
"Green banking initiatives: a qualitative study on Indian banking sector"	Sharma M.; Choubey A.	2022	Environment, Development and Sustainability	78
"Developing a framework for assessing sustainable banking performance of the Indian banking sector"	Kumar K.; Prakash A.	2019	Social Responsibility Journal	75

The top 10 publications cited in the dataset are listed in Table 3. Aizawa and Yang (2010), "Green credit, green stimulus, green revolution? The highest number of citations was for "China's mobilization of banks for environmental cleanup," with 173. The study explores how banks can help with environmental cleanup in China and is a pioneering effort that connects banking activities with environmental goals. Bose et al. (2018) examined the motives behind green banking disclosure. Bose et al. (2018) investigated the factors behind green banking disclosure. An institutional and corporate governance perspective, ranked next in citation count, with 122 citations, focuses on the institutional and corporate governance factors associated with green banking disclosure. The article that Rubel et al. (2020) published, "The influence of green HRM practices on green service behaviors: The mediating effect of green knowledge sharing," garnered 112 citations and linked green HRM to service behavior through the lens of knowledge sharing. Sun et al. (2020), "CSR, co-creation and green consumer loyalty: Are green banking initiatives important? A moderated mediation model of an emerging economy," gained 104 citations and discusses CSR, green banking initiatives, and consumer loyalty in an emerging economy setting. Other highly cited publications were Jan et al. (2021), which created an Islamic corporate governance framework for evaluating the sustainability performance of Islamic banks and financial institutions, with 98 citations, and Dutta (2021), which had 82 citations for its publication on Islamic banking and social media marketing. Raut et al. (2017), published in Business Strategy and the Environment, were cited 97 times, and their work focused on sustainability in the banking sector from a strategic multi-criterion perspective. From the citation patterns in Table 3, one can see that the studies that have been cited by a large number of studies cover the following dimensions of green banking: Environmental clean-up, Disclosure, Green human resource management, Consumer loyalty, Corporate governance, and Sustainability performance. These themes reflect that the study of green banking is based upon a range of related fields of sustainability and finance.

MOST INFLUENTIAL JOURNALS

During 2000–2024, 436 articles were published in 276 journals. Table 4 shows the top 10 journals by total publications (TP) and their citation and journal-impact indicators such as total publications (TP), total citations (TC), citations per publication (CPP), CiteScore, SNIP, and SJR.

TABLE 4. Top 10 publication sources by number of publications

Journal Name	TP	TC	CPP	Cite Score	SNIP	SJR
"Sustainability Switzerland"	34	833	24.5	6.8	1.086	0.672
"Environment Development and Sustainability"	10	318	31.8	10.2	1.297	0.889
"International Journal of Green Economics"	8	68	8.5	3.4	0.360	0.426
"Business Strategy and the Environment"	6	175	29.16	22.5	3.043	3.666
"E3s Web of Conferences"	6	13	2.16	0.9	0.400	0.182
"Qualitative Research in Financial Markets"	6	63	10.5	4.6	1.262	0.492
"Environmental Science and Pollution Research"	5	18	3.6	8.7	1.141	1.006
"Finance Research Letters"	5	122	24.4	11.1	2.279	1.903
"Heliyon"	5	2	0.4	4.5	1.257	0.617
"International Journal Of Ethics And Systems"	5	77	15.4	4.4	0.815	0.442

Table 4 shows the number of publications and citations for the journals included in the data set. Sustainability (Switzerland) published 34 papers and had 833 citations, with a citation rate of 24.5 citations/paper. 10 papers were published in the Journal of Environment, Development and Sustainability, for which 318 citations were received (31.8 citations per publication). In addition, their CiteScore, SNIP, and SJR values are also reported as journal-level citation performance indicators. The International Journal of Green Economics published 8 papers and received 68 citations in 2012, with an average of 8.5 citations per paper. Business Strategy and the Environment published 6 papers and received 175 citations, which is 29.16 citations per publication. The results presented here reflect the differences in number of publications and citations in the journals included in the green banking literature. Lower citation-per-publication values were obtained in the table for E3S Web of Conferences and Heliyon, with 12 and 5 citations per publication, respectively. The journal-level indicators show differences in the way journals cite and the placement of journals where green banking studies are published. The citation-per-publication rates for Qualitative Research in Financial Markets and International Journal of Ethics and Systems were 10.5 and 15.4, respectively. The top-10 list was rounded out by Environmental Science and Pollution Research, which had 5 publications and 18 citations, for 3.6 citations per publication. Combined, the journal results suggest that the field of green banking research is spread across sustainability journals, environmental science journals, finance journals, governance journals, and business journals, thus emphasizing the interdisciplinary aspect of the field.

WORLDWIDE PUBLICATIONS

The dataset includes contributions from 86 countries, indicating broad international participation in green banking and sustainability research.

TABLE 5. Top 10 countries by number of publications

Rank	Country	Number of Publications	Key Observation
1	India	81	Highest contribution, leading global research output
2	Malaysia	49	Strong and growing academic involvement
3	United Kingdom	41	Significant focus on sustainability research
4	Bangladesh	34	Active engagement in green banking studies
5	Indonesia	29	Increasing contribution to sustainability research
6	Pakistan	26	Notable involvement in green banking discourse
7	China	24	Continued participation in sustainability research
8	Spain	22	Key European contributor
9	Italy	20	Moderate but consistent research output
9	United States	20	Stable participation, relatively lower than traditional output
10	Germany	18	Important European contributor



FIGURE 4. Worldwide publications

Figure 4 reveals participation in 86 countries, although there is uneven publication across regions. The number of publications for India, Malaysia, the United Kingdom, and Bangladesh was the highest. The focus on South and Southeast Asia

is aligned with the focus of research on sustainable finance, environmental risk management, Islamic banking, and climate-responsive development. There is also evidence that established research systems were involved, from the United Kingdom, Spain, Italy, Germany, and the United States. Meanwhile, the number of publications from parts of Africa, Latin America, and the Middle East is small, indicating geographical gaps which could be bridged by comparative and cross-regional research.

MOST PRODUCTIVE AUTHORS

A total of 436 publications were examined, with 1,042 contributing authors. Table 6 presents the 10 authors with the highest number of publications in the dataset, together with total citations and h-index values reported in the source data.

TABLE 6. 10 Most productive authors

Rank	Author	TC	TP	University	h-index
1	Nisha, N.	101	8	"North South University, Dhaka, Bangladesh"	10
2	Forcadell, F.J.	169	7	"Universidad Rey Juan Carlos, Madrid, Spain"	17
3	Bukhari, S.A.A.	126	6	"Graduate School of Business , Minden, Malaysia"	7
4	Hashim, F.	126	6	"University Sains Malaysia, Minden, Malaysia"	10
5	Iqbal, M.	90	6	"North South University, Dhaka, Bangladesh"	8
6	Amran, A.	93	5	"Graduate School of Business, Minden, Malaysia"	34
7	Bouteraa, M.	50	5	"University Malaysia Sabah, Kota Kinabalu, Malaysia"	7
8	Mendez, A.	50	5	"London School of Economics and Political Science, London, United Kingdom"	7
9	Rifat, A.	83	5	"North South University, Dhaka, Bangladesh"	8
10	Taneja, S.	32	5	"Sheffield University Management School, Sheffield, United Kingdom"	3

The results by author reveal that a number of recurring contributors have ties to institutions in South and Southeast Asian countries and others from Europe. Forcadell, F. J., published the greatest number of papers (169), while the most cited was Nisha, N. (8). The disparity between the number of publications and citations provides another illustration of the fact that there are two aspects to the contribution of scholars: productivity and citation impact. The distribution of authors is also international, with authors from Bangladesh, Malaysia, the United Kingdom, and elsewhere. The author analysis reveals that there is a relatively small number of recurring authors and a wider representation across regions.

CO-OCCURRENCE OF KEYWORDS

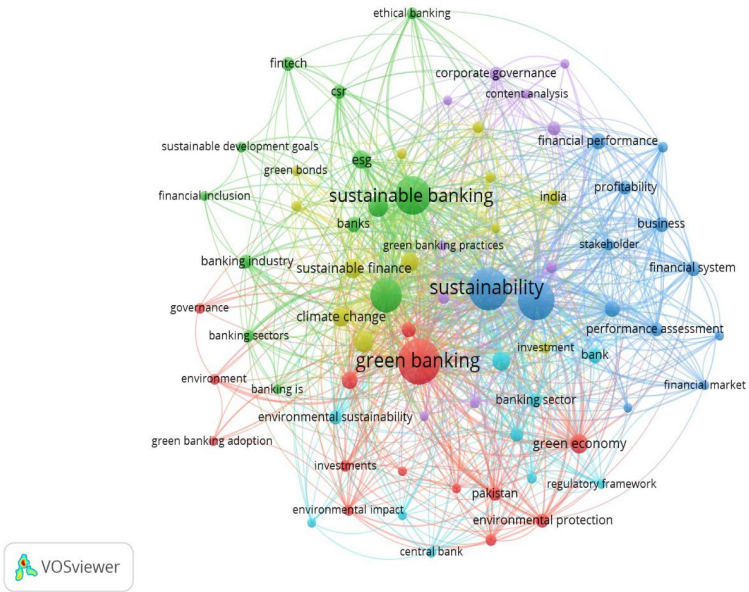


FIGURE 5. Bibliometric network of keyword co-occurrence=

The keyword co-occurrence network of the 436 documents is displayed in Figure 5. There were 72 keywords that occurred at least 5 times and a total of 1,649 keywords. Using the complete counting method, the analysis was used to find the co-occurrence relationship between keywords. This network then gives a visual representation of recurring concepts and

relationships in the green banking literature. Frequently used terms like "sustainability", "sustainable banking" and "green banking" stand out in the network and are intertwined within the themes of sustainable finance, the green economy and financial performance. The relationships suggest that the study of green banking is strongly related to the issues of financial sustainability, environmental policy, and banking performance. More specific topics are represented at the smaller nodes, such as "risk management," "COVID-19," and "renewable energy. The link between banking and sustainability is further evident in other terms, like ‘green economy’, ‘public sector’, and ‘ethical banking’. Certainly, the occurrence of specific keywords suggests important research areas, and less commonly used terms could suggest directions for future research.

TABLE 7. Top clusters in sustainable banking research

Cluster	Keywords	Derived Theme
Cluster 1 (red)	Environment, environmental impact, environmental performance, environmental protection, governance, green banking, green banking adoption, green economy, green financing, human, investments, Islamic banks, Pakistan, renewable energy,	Environmental Governance and Green Financial Practices
Cluster 2 (green)	banking industry, banking is, banking sectors, banks, corporate social response, CST, Esg, ethical banking, financial inclusion, fintech, sustainable banking, sustainable development, sustainable development goals	Sustainable and Ethical Banking Practices
Cluster 3 (blue)	Banking, business, commercial banks, conceptual framework, data envelopment analysis, environmental economics, financial market, financial performance, financial system, performance assessment, profitability, stakeholder, sustainability	Financial Performance and Sustainability in Banking
Cluster 4 (yellow)	bibliometric analysis, climate change, finance, global warming, green bonds, green finance, India, investment, literature review, public sector, sustainable development goal, sustainable finance	Sustainable Finance and Climate Change Mitigation
Cluster 5 (purple)	content analysis, corporate governance, economic development, environmental manager, environmental policy, green banking practices, Islamic banking, Modeling, policy making, sustainability performance	Corporate Governance and Environmental Policy in Green Banking
Cluster 6 (Sea Green)	Bangladesh, Bank, banking sector, central bank, covid-19, environmental sustainability, green bank, Indonesia, regression analysis, regulatory framework	Regulatory Frameworks and Environmental Sustainability in the Banking Sector

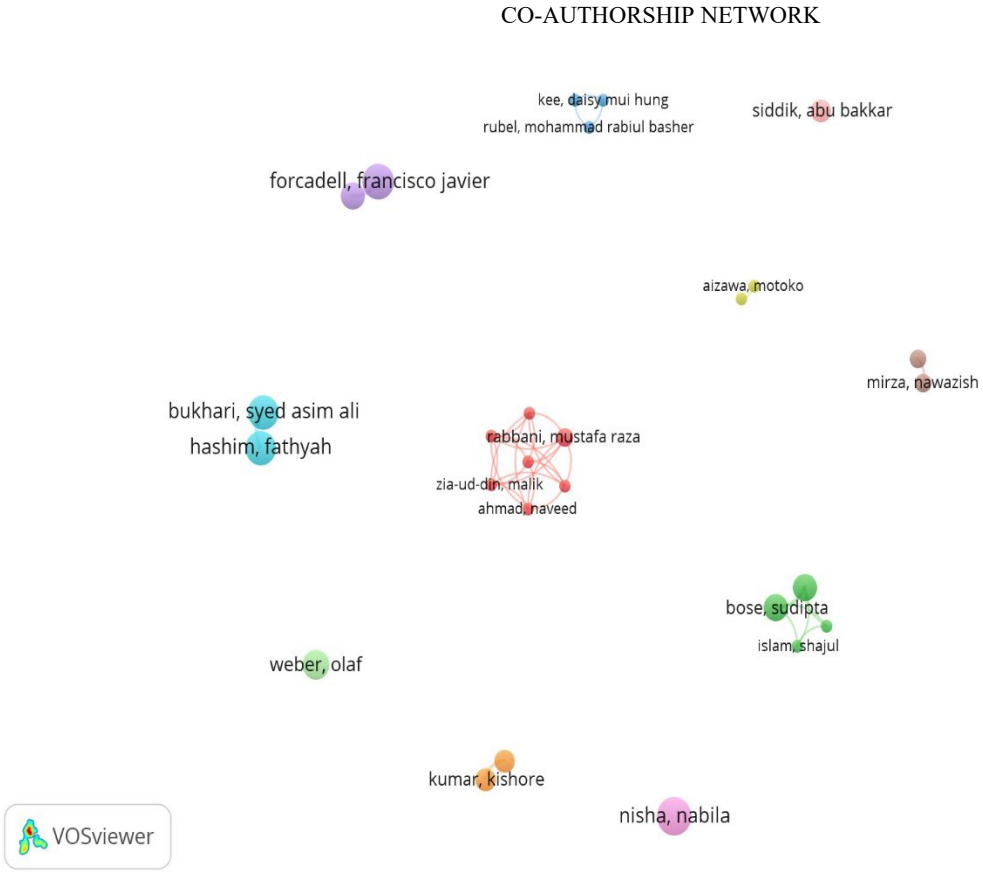


FIGURE 6. Bibliometric network of author co-authorship

The co-authorship network of publications analyzed by VOSviewer is shown in Figure 6. The plot contains authors associated with at least 100 citations to their publications. The visualization shows a clustering of collaboration, with some groups of authors linked by their publications. For instance, Sun, Huadong and Qurban, Cheng are in the red cluster; Weber,

Olaf is in the green cluster; Forcadell, Francisco Javier is in the purple cluster; and Bukhari, Syed Asim Ali and Hashim, Fathyah are in the cyan cluster. Each of the two women, Nisha and Nabila, is found in separate clusters, which suggests less collaborative interaction between them in the network studied. A visualization is thus created that gives an overview of the collaboration structures and research groups in the data set.

DISCUSSION

The findings suggest that green banking research is a relatively narrow but also transdisciplinary field from a regulatory and financial-innovation view. The initial research focused on the conceptual linkage between green banking, environmental responsibility, sustainable finance, and environmentally responsible lending (Bahl 2012; Bhardwaj & Malhotra 2013; Jeucken 2010; Zhelyazkova & Kitanov 2015; Biswas 2016). The literature gradually broadened to cover application- and policy-related matters such as sustainability performance, disclosure, regulatory framework, environmental risk management, etc. (Bose et al. 2018; Kumar & Prakash 2019; Park & Kim 2020; Sharma & Choubey 2022; Zhang et al. 2022). This reinforces the growing incorporation of climate action and responsible financial governance in sustainable finance research, as detailed in prior scholarship (Bouma et al. 2017; Mikliński 2023; Mir & Bhat 2022; Weber & Feltmate 2016). The country distribution shows that India, Malaysia, Bangladesh, and the United Kingdom all contributed significantly. These publication trends reveal research focus on sustainable topics, banking reform, Islamic finance, climate-risk governance, and other related issues. The private commercial banks' role in green finance and environmental sustainability has been highlighted in the studies conducted in Bangladesh (Khairunnessa et al. 2021; Zheng et al. 2021). The studies conducted in India have focused on sustainable banking performance, banking practices, and customers' awareness (Chitra & Gokilavani 2020; Kumar & Prakash 2019; Sharma & Choubey 2022). Malaysian studies have also linked green banking to Islamic banking governance and the environmental and ethical aspects of finance (Bukhari et al. 2019; Jan et al. 2021; Khan et al. 2023). The contributions of the United Kingdom and Europe also reflect a continued research focus on sustainability, governance, disclosure, and responsible banking (Bose et al. 2018; Mendez & Houghton 2020; Paolone et al. 2024; Terpilih 2010). Thematic patterns show an evolution from conceptual discussions to governance-, performance-, and implementation-oriented research. Previous research viewed green banking as an ethical and strategic response to environmental and financial-responsibility issues (Aizawa & Yang 2010; Bahl 2012; Bouma et al. 2017). Further studies examined the correlation between green banking practices and environmental performance, green banking-financing outcomes, the credibility of banks, and the sustainability of banks (Chen et al. 2022; Khan et al. 2021; Zhang et al. 2022). The research efforts on green banking and green recovery, green financial regulation, and green disclosure of sustainability continued to expand the scope towards institutional outcomes (Park & Kim 2020; Chen et al. 2022; Sharma et al. 2024). The identified clusters can also be analyzed using stakeholder theory, institutional theory, and the resource-based perspective, all of which can explain the organizational responses to external expectations and how the internal capabilities contribute to performance and innovation (Freeman et al. 2021; McGahan 2021; Govindan et al. 2021; Beamish & Chakravarty 2021; Andersén 2021; Paolone et al. 2024). The results also identify important geographical research gaps. Many countries publish, but the output is not equally distributed between the countries; for example, there are relatively few publications from Latin America, Africa, and parts of the Middle East. This indicates that green banking education is still limited to specific institutional and regional settings. Comparative and context-based research is also highlighted as a necessity in green finance in previous studies (Akomea-Frimpong et al. 2022; Debrah et al. 2023; Vanishvili & Katsadze 2022). Comparisons between countries with respect to regulatory frameworks, Green Finance practices, disclosure quality, customer awareness, and bank reputation could be made in future studies (Ganesan & Bhuvaneswari 2016; Khan et al. 2023; Chitra & Gokilavani 2020). Other kinds of comparative studies can also provide insights into the relationship between institutional capacity, market maturity, and sustainable policies and outcomes of green banking across different economies. There is also a need to look at other aspects, such as green recovery, responsible banking, ESG performance, and climate-related financial governance (Mendez & Houghton 2020; UNEP FI 2018; United Nations 2020).

The results also highlight the increasing socialization of sustainability, environmental policy, and financial institutions within international development policy. As a banking practice, green banking is increasingly being considered as a tool to help achieve sustainable development, climate action, and responsible financial transition (United Nations 2020; UNEP FI 2018; Zioło et al. 2019). The literature associates green banking with various SDGs, such as SDG 7, SDG 9, SDG 12, and SDG 13, and links the field to sustainable development finance and environmental risk management (United Nations 2020; Muff et al. 2017). In general, the bibliometric results indicate that the knowledge production around the concept of green banking is growing in different areas of environmental governance, climate responsibility, sustainability, and financial-system transformation.

IMPLICATIONS OF THE STUDY

The methodology of bibliometric analysis shows trends within the scholarly output, including publication outputs, citation patterns, keyword clustering, and collaborations. Bibliometrics do not measure whether the practices and policies related to green banking are successful or not. The implications listed below have been classified in relation to their direct relevance to the findings from the analysis. Implications for academic research are listed first, as they derive directly from the results of the analysis. Implications for practice and policies follow, and they depend on the areas where research evidence is abundant or scarce.

Green banking research appears to be structured in terms of six clusters, with "green banking", "sustainable banking" and "sustainability" being the dominant nodes in the keyword co-occurrence network (Figure 5, Table 7). These three nodes are closely related to financial performance (Cluster 3), governance and disclosure (Clusters 1 and 5), and the regulatory environment (Cluster 6). Hence, green banking research seems to have emerged based on the interplay of sustainability and institutional performance and governance, and not based on any unifying theoretical approach. The distribution of 436 papers among 276 journals in fields of sustainability, environment, finance, governance, and business (Table 4) is consistent with this conclusion, as researchers from various approaches seem to answer similar but different questions. Thus, future work might consider bringing together these clusters under frameworks that integrate such perspectives as the stakeholder, institutional, and resource-based ones.

Citation and publication trends indicate a young and quickly growing discipline. The annual number of papers increased from 20 in 2019 to 93 in 2023 (Figure 3). The highest cited papers (Table 3) are related to topics such as green credit, disclosure and greenwashing, green human resource management, consumer loyalty, Islamic corporate governance, and sustainability performance, and there is no clear leading stream of literature. This can be seen as an indication of the lack of consensus regarding foundational literature within the field. The top cited articles have been published between 2010 and 2022.

The keyword network analysis also allows the detection of underdeveloped topics. Fintech, green bonds, financial inclusion, ethical banking, renewable energy, risk management, the public sector, and COVID-19 are the smallest and most peripheral nodes. Thus, these topics have not received much attention compared to the main ones, and they represent the best options for further investigation. This needs to be viewed critically, though. The keyword frequency analysis does not display the first appearance of any theme and therefore cannot prove its emergence. An exception here is the COVID-19 theme that could only appear in publications made after 2019. The validation of the emergence of the other themes will be possible via an overlay analysis by average publication year.

Gaps are also noted in geography and institutions. South and Southeast Asian nations comprise all but one of the six highest producing countries (India, Malaysia, Bangladesh, Indonesia, and Pakistan), whereas Africa, Latin America, and the Middle East provide very few papers (Table 5, Figure 4). Such an uneven distribution is reflected in the clusters as well. Names of such countries like Pakistan, India, Bangladesh, and Indonesia are among the keywords in Clusters 1, 4, and 6, and Islamic banking is found in Clusters 1 and 5, indicating that much of the research has been done in either country-level or Islamic-banking environments. Productive authors have also tended to come from certain institutions. Three out of ten most productive authors belong to North South University, and four of them are from Malaysia (Table 6). The co-authorship network of highly cited authors (Figure 6) shows small clusters that are almost disjointed, but this reflects the citation cut-off criteria as well as refers to highly cited authors rather than the entire field.

For the practitioners and policymakers alike, the results need to be treated with caution since this analysis focuses on the literature and not on the institutions and policies themselves. This research can provide no indication of whether certain approaches or regulations are effective, but it can reveal where the evidence exists and where it is lacking. The clusters related to governance, disclosure, and performance provide an indication of the topics for which there is the largest body of academic evidence, while evidence relating to fintech, green bonds, and financial inclusion is less abundant and needs to be treated cautiously. The regulatory cluster (Cluster 6) is specific only to a handful of countries, so the lessons from these countries cannot be applied in the underrepresented geographical locations.

These suggestions that emerged from the literature are not the outcomes of this bibliometric analysis and are presented below solely as background information. Specific studies suggest the importance of integrating sustainability into performance management systems, capabilities, and governance (Rubel et al. 2021; Jan et al. 2021). Studies related to disclosure identify the need for clear reporting standards and the issue of greenwashing (Bose et al. 2018; Khan et al. 2021). Literature on regulation underlines the significance of a supportive institutional environment, guidelines, and incentives (Park & Kim 2020; Mendez & Houghton 2020). These recommendations stem from the entire body of literature and require an empirical evaluation prior to being considered well-established. Lastly, it should be noted that all these implications are based on Scopus-indexed publications in English, and the year 2024 is not yet complete. Keyword frequencies do not indicate the level of importance, while the labels of clusters were identified by the authors.

CONCLUSION

The current study has performed a bibliometric analysis on 436 papers from the Scopus database on green banking until 2024 to map the research on green banking. The primary contribution of the current study lies in presenting the intellectual structure of the research field. There are six thematic clusters of research in the field, where green banking, sustainable banking, and sustainability remain central, and these are primarily connected with issues related to governance, disclosure, financial performance, and regulation. Publication in diverse sustainability, environmental, finance, and business journals indicates the multi-disciplinary nature of the field, which lacks a common perspective.

Three clear lines of research emerge as a result of these findings. The topics of fintech, green bonds, financial inclusion, and risk management are found as mere peripheral nodes in the network and thus constitute the least explored areas within this body of research. The clustering of output in just a few countries, along with the presence of countries and Islamic banking within the keywords, necessitates comparative research and research in Africa, Latin America, and the Middle East. The fragmented authorship suggests room for collaborative research between institutions and even internationally. Due to the fact that no chronological analysis of the emergence of topics was conducted, there is no full coverage of thematic evolution.

There are certain limitations of the findings. First, the results are based on the Scopus database only; hence, research papers published in other sources are not included. Second, the search was conducted on 6th of August, 2024; therefore, the year 2024 is incomplete, and the trends by year cover the period up to 2023. Third, limiting the search to only the English language and keywords "green banking" and "sustainable bank*" may exclude some research papers that utilize different keywords like "green financing" or "green credit." Finally, keywords, citations, and co-authorship reflect patterns of the literature but do not evaluate the efficiency of banking practices/policies.

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