

Banking and Sustainable Innovation: A Bibliometric Analysis within the Scope of SDG 9 and Environmental Sciences

Muhammed Mustafa Tuncer ÇALIŞKAN* 

ABSTRACT

The banking sector has become a key player in advancing sustainable development goals (SDGs) by addressing environmental challenges and fostering social and economic transformation. This study conducts a bibliometric analysis of the academic literature on sustainable banking within the scope of SDG 9 (Industry, Innovation, and Infrastructure) and environmental sciences. The data obtained from the Web of Science Core Collection (1980–2024) were analyzed using the R software, and the key trends, thematic focuses, and international collaboration networks in the sustainable banking literature were identified. The findings reveal a steady annual growth rate of 1.55% in publications; however, a sharp acceleration is observed after 2016, closely associated with the Paris Agreement and the adoption of the SDGs. This post-2016 surge highlights a structural shift in scholarly interest toward sustainability and banking innovation. Key themes include sustainability, corporate social responsibility (CSR), green finance, and emerging topics such as fintech, ESG (Environmental, Social, and Governance), and climate risk. Collaboration networks highlight China, the United States, and European nations as leading contributors, while developing countries, such as Türkiye, show promising potential. This study underscores the importance of interdisciplinary approaches, innovative financial instruments, and enhanced international collaborations in driving the banking sector's alignment with sustainability objectives. Future research opportunities are suggested to deepen understanding in areas such as renewable energy financing, carbon emissions, and ESG integration.

Keywords: Banking, Sustainability, Bibliometric, Green Finance, ESG

JEL Classifications: Q01, G21, O30, C80

Bankacılık ve Sürdürülebilir İnovasyon: SDG 9 ve Çevre Bilimleri Kapsamında Bibliyometrik Bir Analiz

Öz

Bankacılık sektörü, çevresel zorlukları ele alarak hem sosyal hem de ekonomik dönüşümü destekleyerek Sürdürülebilir Kalkınma Amaçları'nın (SDG'ler) ilerletilmesinde kilit bir aktör haline gelmiştir. Bu çalışma, SDG 9 (Sanayi, Yenilik ve Altyapı) ve çevre bilimleri kapsamında sürdürülebilir bankacılık üzerine yapılan akademik literatürün bibliyometrik bir analizini sunmaktadır. Web of Science Core Collection'dan elde edilen (1980–2024) veriler R programı kullanılarak incelenmiş, sürdürülebilir bankacılık literatüründeki temel eğilimler, tematik odaklar ve uluslararası iş birliği ağları tespit edilmiştir. Bulgular, yayınlarda yıllık %1,55'lik istikrarlı bir büyüme oranını ortaya koymakla birlikte, 2016 sonrası dönemde kayda değer bir ivmelenme görülmektedir. Bu artış, Paris Anlaşması ve SDG'lerin benimsenmesiyle doğrudan ilişkili olup, bankacılık ve sürdürülebilirlik alanına yönelik akademik ilgide yapısal bir dönüşüme işaret etmektedir. Temel temalar arasında sürdürülebilirlik, kurumsal sosyal sorumluluk (KSS), yeşil finans ve fintech, ESG (Çevresel, Sosyal ve Yönetişim) ile iklim riski gibi yükselen konular yer almaktadır. İş birliği ağları, Çin, Amerika Birleşik Devletleri ve Avrupa ülkelerini öncü katkı sağlayıcılar olarak öne çıkarırken, Türkiye gibi gelişmekte olan ülkeler umut verici bir potansiyel göstermektedir. Bu çalışma, bankacılık sektörünün sürdürülebilirlik hedefleriyle uyumunu sağlamak için disiplinler arası yaklaşımların, yenilikçi finansal araçların ve artırılmış uluslararası iş birliklerinin önemini vurgulamaktadır. Ayrıca yenilenebilir enerji finansmanı, karbon emisyonları ve ESG entegrasyonu gibi alanlarda derinlemesine anlayışı geliştirmek için gelecekteki araştırma fırsatları önerilmektedir.

Anahtar Kelimeler: Bankacılık, Sürdürülebilirlik, Bibliyometrik, Yeşil Finans, ESG

JEL Sınıflandırması: Q01, G21, O30, C80

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1. Introduction

The banking sector, as a cornerstone of the global economic system, plays a pivotal role in advancing the Sustainable Development Goals (SDGs). In today's landscape, where environmental challenges are worsening and social inequalities are deepening, the financial sector has emerged as a catalyst for transformation. The United Nations' 2030 Agenda highlights the SDGs as a global framework for sustainable progress (United Nations, 2015a, p. 1). In particular, SDG 9 emphasizes the importance of resilient infrastructure, inclusive industrialization, and innovation, areas where banking and green finance play a vital role (United Nations, 2015b, p.1).

SDG 9 (Industry, Innovation, and Infrastructure) emphasizes the integration of innovative financing models into sustainable infrastructure projects. The banking sector has emerged as a catalyst for transformation and continues to contribute through green financing, the adoption of ESG (Environmental, Social, and Governance) criteria, and the implementation of strategies to reduce carbon footprints. Additionally, technology plays a significant role in driving this transformation, with cutting-edge applications such as fintech, artificial intelligence, and blockchain. These combined factors demonstrate that the banking sector not only fosters economic growth but also leads efforts to address environmental and social challenges. Building on this global policy framework, the present study seeks to map how academic research reflects these priorities through a bibliometric analysis of banking and sustainable innovation.

The main goal of this study is to conduct an in-depth analysis of the existing academic literature on banking and sustainable innovation, aiming to understand its various dimensions and create a framework for guiding future research. By identifying key themes, examining their interconnections, and analyzing international collaboration networks, this study maps the current academic landscape on sustainable banking and establishes a foundation for exploring new research opportunities.

To address the growing scholarly interest in sustainable banking and its alignment with the objectives of SDG 9, this study explores several interrelated research concerns through a bibliometric lens. Specifically, it investigates the major thematic trajectories that have shaped academic discourse on banking and sustainability, focusing on how environmental sciences intersect with financial innovation and infrastructure development. The study also examines the evolving network of international collaborations, highlighting regional disparities and emerging economies' contributions, particularly in the context of countries such as Türkiye. Moreover, by analyzing patterns in keyword usage, co-authorship networks, and citation impact, this research seeks to uncover how conceptual and practical dimensions of sustainable banking have developed over time. In doing so, the study provides a structured overview of the literature and offers evidence-based insights to guide future scholarly inquiry and policymaking.

This study begins with a comprehensive literature review that explores prominent themes related to banking and sustainable innovation. Following this, the study presents bibliometric analyses of academic studies obtained from the Web of Science Core Collection database. The methodology section provides detailed insights into the selection, filtering, and interpretation of the data. The findings section evaluates the thematic focuses of international collaborations and academic productivity identified in the literature. Finally, the study summarizes the trends in the sustainable banking literature and offers recommendations for future research opportunities.

2. Literature Review

Banking and sustainability have become pivotal points of interest in the context of environmental challenges facing the world and its pursuit of the SDGs. This section synthesizes landmark contributions in the field of sustainable banking, SDG 9, and environmental sciences with a focus on innovation and infrastructure development.

Delina (2011, pp. 1355-1357) reviewed Asian Development Bank (ADB) investments in renewable energy projects and documented the increasing support of energy efficiency projects over time, but characterized this shift as fragile. This study points out that much more is expected from banks regarding climate change issues (Delina, 2011, pp. 1363-1364).

Gon and Mititelu (2016, pp. 127-153) present the results of an analysis with regard to Corporate Social Responsibility (CSR) practices in leading Indian banks, showing how this CSR policy diffusion and

integration within the banking sector serves to reinforce sustainability. Their comparative study underlines the gradual adoption of social banking regulations and is reminiscent of the need for alignment of financial practices with more general social and environmental objectives.

Climent (2018, pp. 1-12) compared ethical banking to traditional banking in 2018 and showed how investments in social and ecological projects affect profitability. He showed from the findings that while ethical banks are less profitable, customers prefer better transparency and social investments.

Yip and Bocken (2018, pp. 150-158) adapted the concept of sustainable business model innovations to the banking industry. They analyzed the perception of these models by customers. They stated that the wider acceptance of digital processes can be achieved by combining them with business models that demonstrate ecological responsibility.

Bonifacio Neto and Branco (2019, pp. 495-501) focus on controversial sectors in the sustainability reporting of banks and discuss how financial institutions address environmentally and socially sensitive transactions. Their findings indicate that disclosures are not widespread and point to the need for banks to adopt more transparent and ethically aligned practices.

Gyori et al. (2021, pp. 1-18) discuss the issue of values-based banking through the case study entitled MagNet Hungarian Community Bank. The work proves that banking activities can contribute to an inclusive, decarbonized economy when aligned in the correct way. The authors in this paper present the framework of implementing the concept of sustainability as an integral activity of financial players. As an aggregate, these papers outline CSR, ethical banking, and value-based initiatives in developing sustainable practices in banks.

Campiglio et al. (2018, pp. 462-466) describe the central banks and financial supervisors' role in climate change risk management. The paper then uses this in an attempt to offer an analytical framework, which can be utilized in studying the implications of the transition to the low-carbon economy on financial stability. The paper presents strategic insights on how climate change risk can be included in central banks' policy design framework.

Gemici and Lai (2020, pp. 149-159) conceptualized Asian equity capital market investment banking network world dynamics in particular in relation to regional financial centers and their role in sustainable finance. Their results, therefore, offer new evidence on local conditions as well as evolutionary paths charting sustainable financial diffusion.

Stoica et al. (2020, pp. 1-4) discuss the function of sustainable economic development within the context of European banking integration. The authors discuss the determinants of sustainability in EU economic growth, including convergence of assets as well as cross-border lending.

Gutierrez-Lopez and Abad-Gonzalez (2020, pp. 13-14) reviewed banks' sustainability performance against the yardstick of the European Banking Union framework and stressed that capital adequacy, liquidity, and social responsibility reporting add positively to bank health.

Santos and Rodrigues (2021, pp. 1-16) approached the positioning of banks with regard to reducing climate change risks. The information coming from banks in regard to the climate started falling within reports from 2017, according to the guidelines and requirements imposed by the European Union. This report presented an analysis regarding the adaptation degree of the banks with an emphasis on the practices regarding sustainability finance. Results point to the fact that, through better directions in their investments toward sustainability, it is possible for banks to act to decrease risk within the financial system.

Erden and Aslan (2022, pp. 1-11) investigate the impact of the COVID-19 pandemic on the sustainable development of the Turkish banking sector. The authors analyze the correlations between different banking variables before and after March 2020. According to their findings, most of the variables are highly interrelated in a positive direction, meaning that the pandemic has already made a huge difference in the development of the banking sector in Türkiye. The study emphasizes that only long-term analysis can provide a comprehensive view of the pandemic's effects on the banking industry. Collectively, these studies demonstrate how regulation, crises, and supervisory frameworks shape sustainable finance agendas.

Wellalage and Kumar (2021, pp. 3309-3321) considered whether the level of environmental performance impacts banks when they are making credit decisions. They showed evidence of favorable credit terms among companies that had the ability to offer high levels of environmental performance. It could pique banks' interest in the sustainability of their finances and serve as evidence that paying attention to environmental issues yields a financial benefit.

Ding et al. (2022, pp. 1-10) investigated green loans' impact on banks' high-quality sustainable development. The study discussed how such influence might be determined by green environmental supervision and monetary policy. There is substantial evidence that small and regional banks in particular will benefit more from the new wave of sustainable finance. This paper further develops that through green loans, financial institutions can become one of the major promoters of the achievement of sustainability goals.

Galletta et al. (2022, pp. 8-11) show that greater gender diversity on bank boards is associated with lower asset risk and higher stability, suggesting that inclusive governance structures contribute to more prudent and resilient banking practices.

Ersoy et al. (2022, pp. 1-10) provide an analysis of the relationship between ESG scores and market value in the U.S. banking industry. In their study, they found evidence for a U-shaped relationship between the environmental pillar and market value, thus highlighting the fact that effectively carried out ESG practices generate value in the long run while reducing risks related to sustainability.

Miroshnichenko et al. (2022, pp. 1-16) investigated the relationship between the banking sector's profitability and household incomes, emphasizing that income growth enriches banks' asset returns and facilitates further economic growth processes. In this respect, banks may be considered a very important part of decreasing income inequalities in accordance with the goals of sustainable development.

Gutierrez-Ponce and Wibowo (2023, pp. 1-14) investigate the influence of sustainability activities on the financial performance of Indonesian banks. The findings reveal mixed findings, whereby the social aspect of ESG had a positive effect on financial performance variables such as Return on Assets (ROA) and Return on Equity (ROE). The study underlines the importance of being comprehensive in the inclusion of ESG activities in the financial strategy in order to endure in the long run.

Galletta and Mazzù (2023, pp. 1-16) explore ESG controversies and their connection to bank risk-taking. The evidence underpins Basel Committee on Banking Supervision's argument, which insists banks' risk management systems should cover climate-related as well as environmental risk. Mirza et al. (2023, pp. 843-849) investigated commercial banks' green loans issued to Small and Medium-sized Enterprises (SMEs) of emerging markets in the BRIC countries' effect on banks' efficiency. Using an eleven-year database as a case study, evidence was put forward to support and demonstrate that there exists significant and positive association of green SME lending and net interest margin, while in banks' default risk and sustainable SME lending, there is negative association. Research shows that one potential avenue to increased banks' profitability can come from an investment in sustainable SME loans, while at the same time reducing default risk. Accordingly, authors concluded commercial banks can assist in supporting targets for sustainability by expanding their green financing products, and through this path, could set themselves to increase their prevailing financial results.

Kirikaleli and Kayar (2023, pp. 1-15) conducted an analysis of the long-run impact of economic, financial, and political stability on the banking sector in six Balkan countries, spanning a 21-year period from 1996 to 2017. Through the use of panel data analysis techniques like unit root tests, cointegration, and Granger causality tests, significant cointegration among the variables was observed. Results support the existence of bidirectional causality between banking sector performance and economic stability, and therefore, a case for simultaneous support of financial and economic stability in the quest to achieve sustainable banking growth. Such findings bring into focus the importance of robust economic, financial, and political environments as prerequisites for the long-term sustainability of the banking sector in the Balkans.

Simsek et al. (2024, pp. 5503-5513) examine the impact of governance structures on climate-related financial disclosures and mark Islamic banks apart from other banks in this context. The study reveals banks' intent to offer more climate-related disclosures, basically due to Islamic banking's prevailing

shareholder-based model of corporate governance. The study locates its findings within an overarching setting and cites notably good governance quality as one essential feature in promoting sustainable and transparent banking practices in harmony with global efforts to contain climate change.

Sendi et al. (2024, pp. 1-24) take into account how stability in Islamic and conventional bank institutions relies on environmental, social, and governance (ESG) considerations. The conclusion states that ESG activities develop institutional stability through strength in inner and outer stakeholder relationships. It can be noted here that environmental dimensions have been taken as having greater importance in stabilizing conventional banks, while Islamic banks have been more subject to social dimensions. These results provide evidence of ESG practices' transformational potential to evoke stability as much as innovation in all banks' spheres.

Altintas et al. (2024, pp. 1-8) explore renewable energy consumption (REC), banking sector development (BSD), and gross domestic product (GDP) interactions in contributing to low-carbon financing (LCF) in Malaysia, based on annual data during 1980–2018. Their findings indicate BSD having favorable influences on environmental sustainability, but renewable energy consumption has negative short- and long-run influences on environmental outcomes. These outcomes have important policy implications, foremost to Malaysian policy officials who aim to match economic growth and ecological integrity through ecologically responsive and finely calibrated policies. More broadly, the study provides evidence of how ESG integration, good governance, institutional diversification, and macroeconomic stability can, together, deliver superior financial performances and long-run bank level sustainability.

3. Methodology

Bibliometric analysis can be defined as a quantitative research method that applies statistical and computational techniques to academic publications in order to identify intellectual structures, thematic trends, and collaboration networks within a given field (Broadus, 1987, pp. 373-379). In the finance and management literature, several recent studies have demonstrated the applicability and relevance of this method. For instance, Akbaş et al. (2021, pp. 56-58) investigated the intellectual landscape of Islamic banking and highlighted cross-national collaboration patterns, while Türk and Demirci Aksoy (2025, pp. 1242-1249) provided a bibliometric profile of green finance in banking, emphasizing the role of sustainability and environmental sciences. Şekeroğlu (2021, pp. 22-23) examined the evolution of portfolio management research through a bibliometric approach using R-based techniques, and Çil-Koçyiğit et al. (2023, pp. 241-243) mapped the field of sustainability accounting with VOSviewer, identifying leading countries and journals shaping the domain. Collectively, these works illustrate the wide use of bibliometric methods in evaluating publication performance and thematic evolution across different subfields of finance, thereby reinforcing the methodological foundation of the present study.

Concurrent to this study's objective and scope, this bibliometric process was structured according to three core research questions. The first refers to identifying leading contributors in academic scholarship, such as nations, institutions, and authors having strong influence in practice in banking and sustainable innovation. The second refers to thematic structure explication and new research direction identification based on observed developments in this dataset. The third analyzes ways in which over time, volumes and publication distribution in scholarship have evolved, particularly in terms of Sustainable Development Goal 9 (SDG 9) and environment-related segments in science. These research questions provide an analytical foundation for this bibliometric study and guide results interpretation in subsequent sections.

This study conducts a bibliometric analysis of academic publications focusing on the topic of banking and sustainable innovation. Data are obtained from the Web of Science (WoS) Core Collection database, and the research process is carried out in the following steps.

a. Access to the WoS search engine is established, and the search process begins using the 'Title Searches' option. The keyword 'banking' is entered, yielding a total of 93,307 results. To narrow the results within the context of sustainable development, the "Refine Results" section was utilized, and the "SDG 9: Industry, Innovation, and Infrastructure" category from the Sustainable Development Goals (SDG) filter was selected. This step reduces the number of articles to 16,333.

b. To focus on the environmental aspects of the banking sector, scientific categories related to the environment are selected using the Web of Science Categories filter. These categories included “Environmental Studies” (460 articles), “Environmental Sciences” (339 articles), and “Green Sustainable Science & Technology” (300 articles). Following this filtering process, the total number of articles is reduced to 639.

c. The necessary software infrastructure is set up for the analyses. First, the *remotes* package, which enables the installation of packages from GitHub, is installed in R. Then, the *Bibliometrix* package, widely used for bibliometric analyses, is installed. Additionally, to visualize and interactively conduct the analysis, the *biblioshiny()* interface is employed.

d. The .bib format file downloaded from the WoS database is uploaded into the *biblioshiny* interface. This file contains extensive metadata about the literature, including citation information, authors, publication journals, keywords, and temporal distributions.

This systematic approach ensures transparency and replicability, providing the basis for the bibliometric analyses presented in the findings section.

4. Findings

The dataset contained 639 academic articles that had been written in the period from 1980 until the year 2024. The information covers 118 recordings that include the outputs of 1,734 original writers. The latter provide the grounding upon which banking, environmental science, and sustainable development objectives (SDGs) can be researched in academic scholarship.

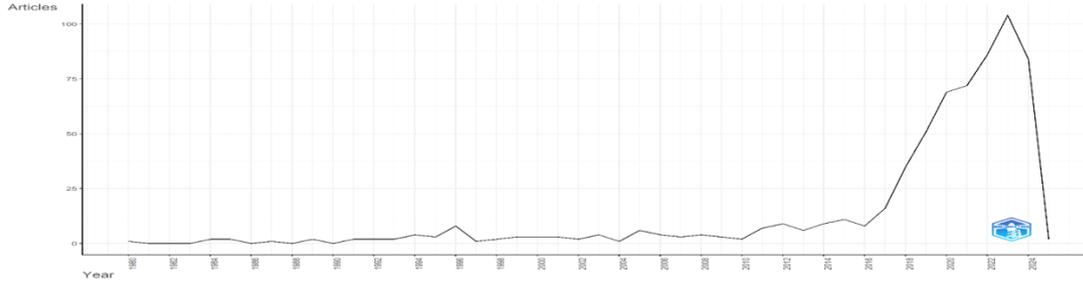
The figures account for an annual growth rate of 1.55%. Such an annual growth reflects that the interest in the relationship of banking with the SDGs is growing but is yet to achieve the expected threshold. Though the absolute annual growth is just 1.55%, the post-2016 period sees an outsize growth in the activity of publications. Such an uplift can be correlated with the Paris Agreement's (2015) implementation as well as the official adoption of the SDGs, which cumulatively reshaped the research environment in banking and sustainability. Therefore, the post-2016 trend remains remarkable in special reference due to the evidence of the paradigm shift in the research environment. Adherence with the aim of the innovation and infrastructures outlined in SDG 9, the banking system holds unprecedented opportunities in the future with regard to new modes of finance and sustainable investments. Such an advancement in new instruments like the green bonds or environmentally focused credit schemes may be accountable for this growth in the future.

The percentage of international collaborations in research is 30.83%, evidence that studies of banking and sustainable development are being approached on a global scale, with various countries collaborating on one project. International collaboration enhances the sharing of knowledge on sustainable infrastructure and innovation topics, and consequently, increases the diversification of academic contributions. Furthermore, an average of 3.1 co-authors per document shows how complex such studies are, needing interdisciplinary teams of researchers.

Keyword diversity also highlights the multidimensional nature of the research. The dataset includes 1,948 unique keywords, indicating that scholars are connecting banking not only with financial aspects but also with environmental and social goals. These connections show the growing relevance of sustainability in banking research. The average citation rate is 22.72 per document, suggesting that the work produced in this field is influential and widely referenced.

The average age of the documents is 6.65 years. This shows that the literature combines both recent studies and foundational research. In recent years, there has been a noticeable rise in interest in green banking, especially in the context of financing carbon reduction and supporting sustainable infrastructure.

Overall, the data offer strong evidence of the banking sector's growing engagement with sustainability goals. In line with SDG 9, the sector is well-positioned to support innovation and infrastructure development through tailored financial solutions. As academic attention continues to increase, research in this area is likely to generate even broader impact.



Graph 1. Trend of Banking Articles in the WoS Database Between 1980 and 2024

Graph 1 depicts the trend of annual academic production related to banking. The production stood at a relatively low level at the beginning of 1980, remained at the same level for many years, and increased after 2016. This change demonstrates that, in recent years, environmental sustainability and innovation have become increasingly important priorities for the banking sector.

In the graph, from 1980 to 2015, the general trend is flat. That means that from that period, environmental sciences and sustainable development goals were not a prime factor for banking. The minor peak in 1996 did not materialize into further growth. This may partly be because such environmental issues had not yet become mainstream in the banking literature then, and the issue of sustainable development was addressed only in a limited way.

The sharp rise after the year 2016 indicates much higher interest both in sustainability aspects and innovative financing models within the banks. This appears to be indirectly influenced by the United Nations' announcement of the Sustainable Development Goals in 2015. In particular, the focus, under SDG 9 itself, on aspects of infrastructure investment and innovative financing approaches could have directly increased the publications on these same topics in banks.

The decline observed in 2023 and 2024 may indicate a real slowdown in publication activity. While minor data coverage gaps cannot be entirely excluded, the stability of earlier years suggests that this decrease is more likely linked to shifting academic priorities, funding constraints, or broader economic and political dynamics that have influenced research in sustainable banking.

The graph therefore shows that academic interest in the banking sector, in terms of environmental sciences and sustainable development, has grown rapidly in recent times and has opened up new avenues. Further research may provide the critical insights necessary for such growth to be sustained and deepen the banking sector's contribution to global sustainability goals.

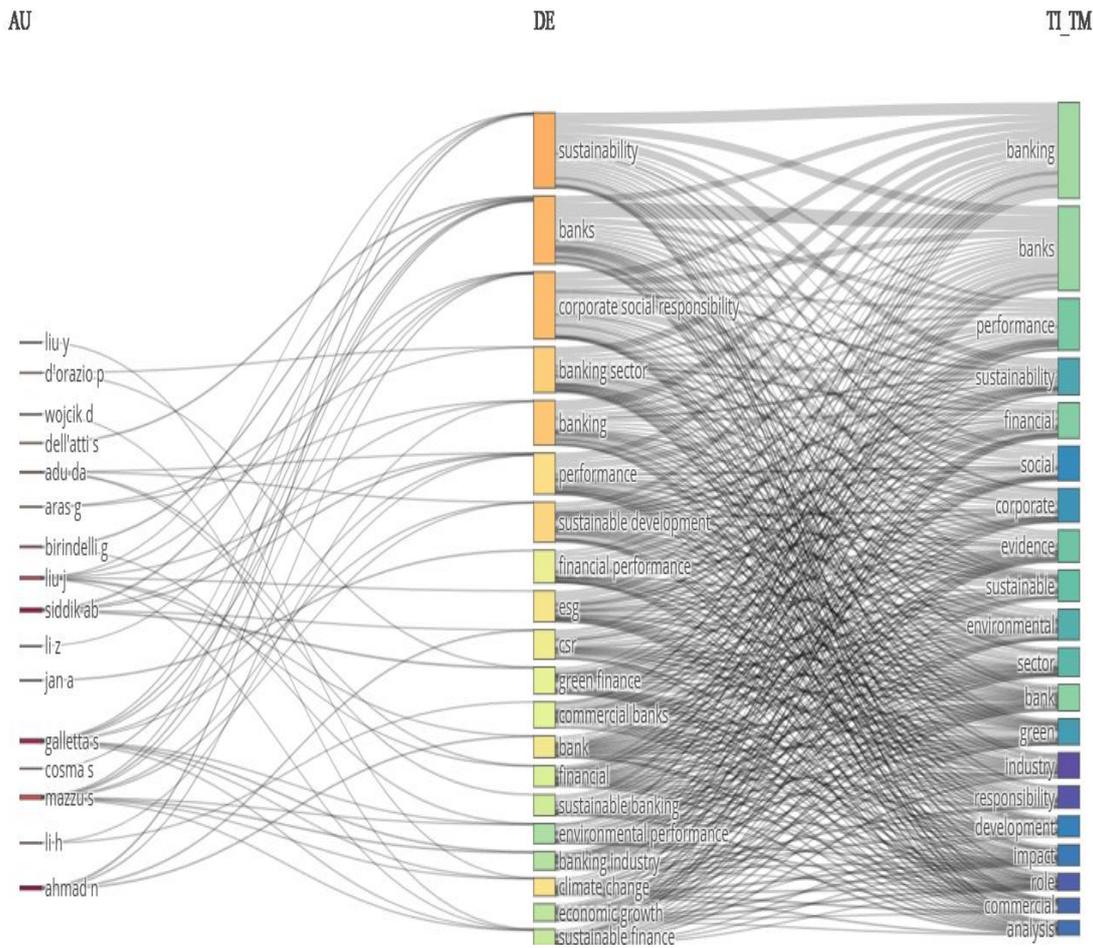


Figure 1. Network of Authors, Keywords, and Titles in Banking Articles Indexed in the WoS Database

Figure 1 illustrates a network structure that will help explain the relationship between authors (AU), keywords (DE), and titles (TI_TM). It will provide insight into how different authors contribute to particular keywords and themes, and what is discussed.

The primary insight from the figure is the strong correlation of "sustainability" with "banking" with numerous authors and research topics. In other words, the field of banking is closely intertwined with sustainability, offering research opportunities across a wide range of subjects. Moreover, terms such as "corporate social responsibility" and "green finance" appear as recurring themes explored by both scholars and research agendas. This indicates that banking is no longer regarded solely as an economic instrument but also as a domain encompassing environmental and social responsibility.

The variety in authors and their contributions underscores the interdisciplinary nature of the issue. Indeed, as an example, authors like "Liu Y." and "Siddik AB" are among the most linked authors in the graph. Their contributions to the work in the field of banking and sustainability are considered highly strong. Likewise, the wide spread in the linking of authors with various keywords further justifies the convergence of various outlooks and research tracks in this field.

Another impactful relation, which can be concretely experienced here, is the one between the terms and the themes themselves. As an example to begin, "environmental performance" and "financial performance" provide for concretely defined meaning, in such a way that sustainable finance approaches can bring an optimization of economic and environmental value, in particular. In particular, it aims to attain targets in SDG 9, based upon sustainable development as well as infrastructure innovation.

The dense network in the visual means that there are actually relatively few of the banking- and sustainability-related topics that occur in absolute isolation, but are instead interconnected. These

associations provide a very strong foundation upon which future research may be based, and they illuminate the in-depth exploration of the function that the banking sector plays in the attainment of sustainable development goals. Further research in more defined keywords and topics may be undertaken with the purpose of filling any gap in current knowledge within this area of interest.

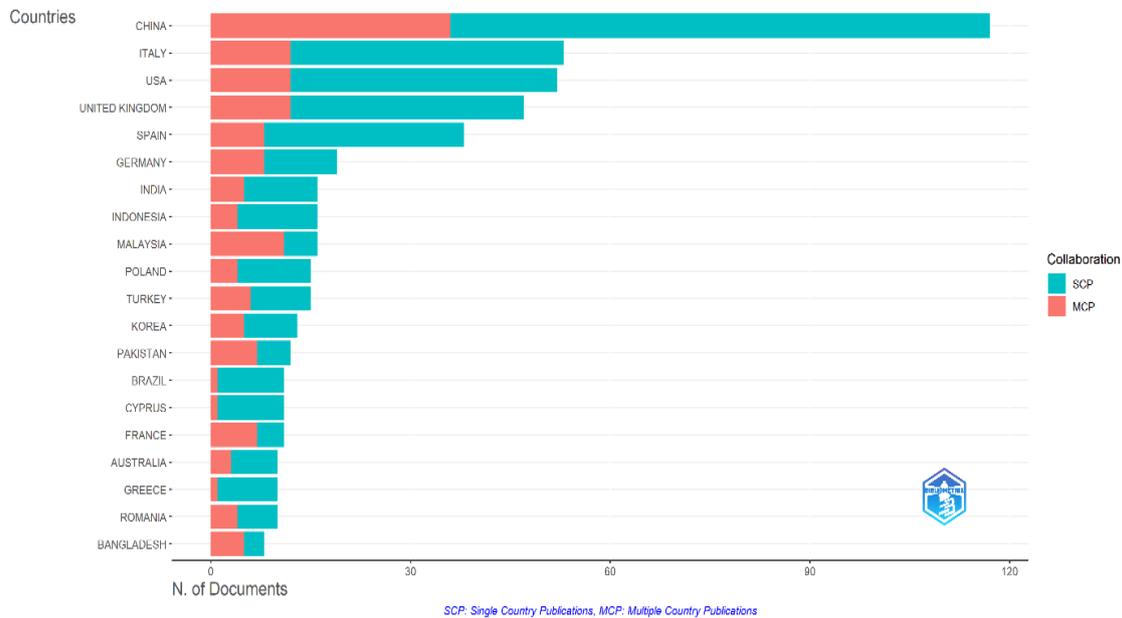


Figure 2. Country Collaboration in Banking Articles Indexed in the WoS Database Between 1980 and 2024

Figure 2 represents countries of authors contributing to publications on sustainable banking and other related topics, including the nature of their contributions. SCP refers to Single Country Publications, meaning articles written by authors from a single country, while MCP stands for Multiple Countries Publication, referring to articles coauthored by researchers from more than one country.

China comes out as the leading country in terms of publication output. The predominance of SCPs shows that China is very focused on sustainable banking within the national context. This would suggest an academic interest in innovative financing and sustainability practices in the country, profiling its fast economic growth together with its environmental sustainability goals.

Italy and the United States are the second and third, respectively, with a more equitable distribution between SCPs and MCPs. This may indicate that global work is easier with Western countries, making the results more helpful in achieving global sustainable goals. Varied experience is blended together, so the results are more comprehensive, too.

The other major contributor nations are the United Kingdom, Spain, and Germany, with high shares of MCP in the outputs from such nations. In fact, the research emphasis on sustainability policy and leadership in green finance in Europe is comparable to that of such nations in academic output.

Such countries as India, Indonesia, and Malaysia lead the list because of rising academic demand in sustainable banking in these countries. In fact, the expansion of economies in nations highlights the role of the banking sector in implementing sustainable development goals and inspires greater creativity in green finance, as well as environmental sustainability.

The ranking also covers Türkiye, which indicates that it produces equally significant work in banking as in sustainability. The equilibrium in the ratio of SCPs versus MCPs in this Türkiye output is indicative of contributions in national-level research along with international partnerships in this body of work.

Figure 2 is a significant instrument in the comprehension of the geographical diffusion of sustainable banking papers as well as country networks of collaboration. The increase in the number of the MCPs is significant and forms an integral part in improving the fight in order to meet the global sustainability

targets. Going forward, more contributions in the broader suite of countries as well as more solid international collaborations may shed more light on the possible effects on environmental as well as economic sustainability from the banking sector.

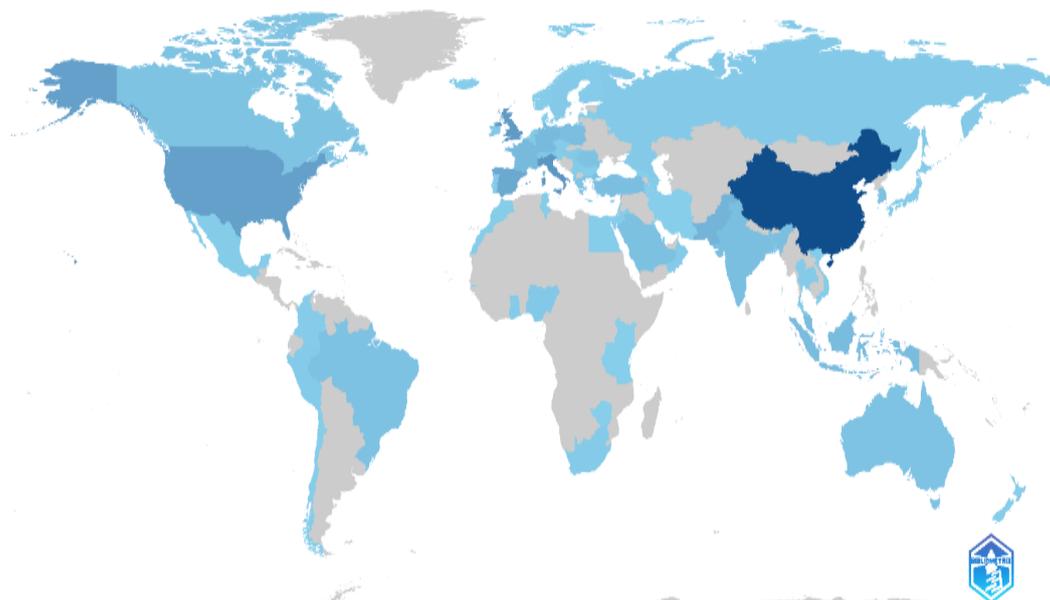


Figure 3. Global Distribution of Banking Articles in the WoS Database Between 1980 and 2024

Figure 3 displays a world map that illustrates the academic contributions of various countries to the field of sustainable banking and related research areas. The color intensity on the map indicates publication volume, with darker blue tones representing higher academic productivity, while lighter shades signify lower contributions.

China appears as the most dominant contributor, shown in the darkest blue, which reflects its leading position in publication numbers. This high output can be linked to China's increasing commitment to integrating sustainability principles into its rapidly evolving financial system. Most of these publications are single-country studies (SCP), suggesting a strong national research agenda rather than international cooperation.

The United States and Italy follow China in terms of academic output. Both countries demonstrate a more balanced distribution between single-country and multi-country publications (MCP), pointing to the active role of international collaborations in advancing research. In the U.S., cutting-edge fintech developments, ESG integration, and green finance have driven sustained academic interest. Italy, on the other hand, aligns its academic priorities with the European Union's Green Deal and SDG 9 targets.

Other major contributors include the United Kingdom, Germany, and Spain, all of which show a mix of national and collaborative research efforts. Their work reflects not only domestic sustainability concerns but also a broader engagement in regional and global policy debates.

Other emerging Asian nations, such as India, Indonesia, and Malaysia, also present impressive academic productivity. The rise in these economies has thrown up the demand for the need to adapt sustainable practices in the banking sector, thus diversifying and expanding research into sustainable banking.

Based on the current data, Türkiye emerges as a country with a moderate contribution to the literature on sustainable banking. This academic productivity suggests an emerging awareness at a national level of how the financial sector may contribute towards the Sustainable Development Goals; however, international cooperation and further research could significantly raise its impact in this field.

Figure 3 visualizes the global landscape of sustainable banking research, determines leaders in the field, and indicates areas with potential for increased contributions. The insights brought about by the map

underline the need to increase international collaborations and broaden academic participation to contribute more effectively to global challenges.



Figure 4. Word Cloud Representing the Most Frequently Used Keywords in Banking Articles in the WoS Database Between 1980 and 2024

Figure 4 presents the most frequently used keywords in the literature on sustainable banking and related topics. The horizontal axis shows the number of times each keyword appears, while the vertical axis lists the keywords in descending order based on their frequency.

The most frequently used term is “Sustainability,” appearing 58 times. This underscores the central role of sustainability in banking research. The concept is treated as multidimensional, encompassing environmental, social, and economic aspects. Its prevalence suggests that academic studies increasingly evaluate and shape banking practices through a sustainability lens.

Some other significant terms include “Banks” and “Corporate Social Responsibility” (CSR), with 55 and 43 instances, respectively. They have emphasized the banks' leadership role in this CSR drive, environmental issues, and protection of social welfare. They illustrate shifting perspectives from the conventional role of mere financial intermediaries to highly environmentally and socially aware institutions.

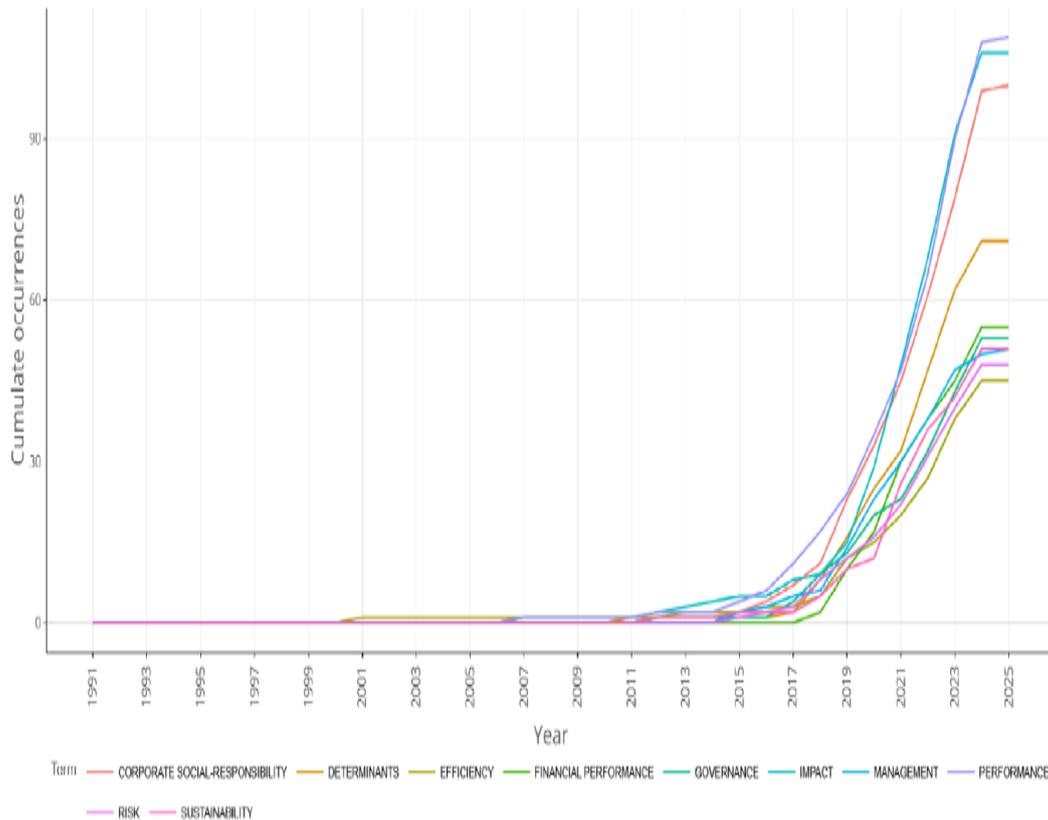
Terms like “Banking” (37 mentions) and “Banking Sector” (30 mentions) also appear frequently. This points to a specific focus on how the banking industry contributes to achieving sustainability goals. These keywords signal the sector’s role in allocating capital, supporting green investments, and aligning financial operations with sustainable development principles.

“Sustainable Development” and “Performance,” with frequencies of 26 and 25, respectively, evidence the interaction between banking operations and wider development imperatives. This demonstrates academic interest in how banking performance meets and supports the Sustainable Development Goals (SDGs).

The frequent appearance of “Climate Change” and “ESG” highlights the integration of environmental considerations into banking strategies. These terms highlight the growing emphasis on the banking sector as a key driver of financial solutions in addressing climate change and promoting governance practices that align with sustainability goals.

Figure 4 gives a number of indications about the dominant themes and trends in the literature on sustainable banking. The occurrence of these keywords reflects the priorities and areas of inquiry of the

academic community, with a growing emphasis on environmental and social dimensions in banking. These keywords may act like a roadmap for more focused and detailed research in the future, helping to identify gaps and opportunities within the field.



Graph 2. Trend of Key Themes in Banking Articles in the WoS Database Between 1980 and 2024

Graph 2 illustrates the annual frequency of some keywords in the sustainable banking literature. The yearly usage of keywords has increased over time for keywords such as "Performance," "Impact," and "Corporate Social Responsibility" (CSR). This upward trend reflects a growing focus on issues of sustainability, performance, and CSR in banking literature.

Whereas in 2016, terms such as "Performance" and "Impact" were hardly mentioned, in fact, the word "Performance" was used a total of only six times, the frequency in 2024 reached 109 usages. Such significant growth indeed indicates that, more academically, there has been an increase in research studies focusing on performance aspects within sustainable banking practice. In the same vein, the term "Impact" has equally been in vogue to emphasize measurement efforts for tangible.

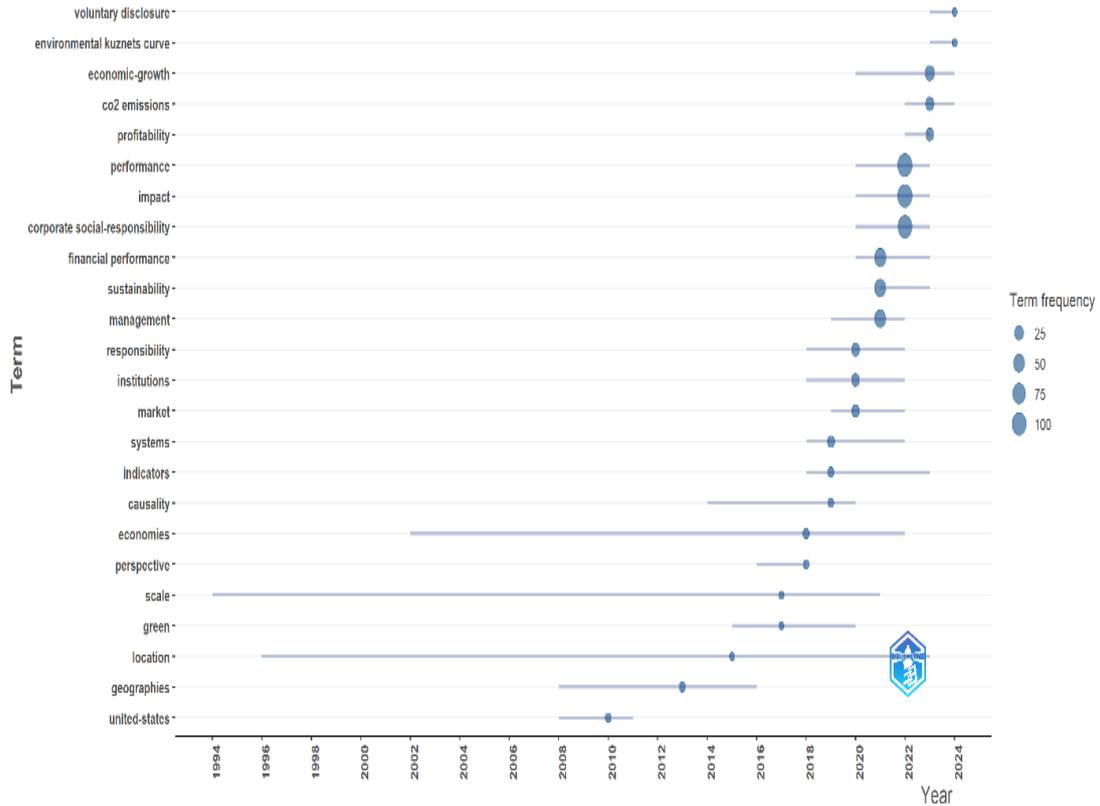
The term Corporate Social Responsibility also saw steady growth, especially after 2020. Its rise shows that CSR has become a prominent theme in the banking sector. In 2024, it appeared 100 times, reaffirming its relevance in ongoing academic discussions.

Other terms, such as "Governance" and "Management," also experienced a surge in usage starting in the early 2020s. This highlights growing interest in how sustainability strategies are organized, led, and governed in financial institutions.

The keyword "Sustainability" itself jumped from just five mentions in 2016 to 51 in 2024, showing a consistent rise in attention. Similarly, "Risk" began appearing more often, indicating a deeper focus on risk management as a core part of sustainable banking.

Overall, Graph 2 illustrates the evolution of academic interest in sustainable banking between 2016 and 2024. The increasing use of terms like performance, impact, governance, and risk reflects a shift toward

practical and strategic engagement with sustainability in the financial industry. These patterns suggest a broader and more interdisciplinary future for research in this area, one in which banking plays a more active role in supporting global sustainability goals.



Graph 3. Evolution of Term Frequencies in Banking Articles in the WoS Database Between 1980 and 2024

Graph 3 visualizes how keyword usage in sustainable banking literature has evolved over the past two decades. In the early 2000s, the most common terms were “banking,” “financial,” and “banking industry.” Research during this period largely focused on the role of banking within the broader economic system. Environmental and social aspects had not yet entered the mainstream discussion.

Starting in the 2010s, phrases such as "corporate social responsibility" and "sustainable development" gained more prominence. The shift coincided with the initial efforts to explore the financial sector's potential role in supporting the United Nations Sustainable Development Goals (SDGs). Similar terms such as "climate change" and "climate policy" also gained popularity, particularly after the Paris Agreement drew the world's spotlight onto the necessity of climate action. By this time, banking was increasingly being explored as a way of helping address environmental as well as societal challenges.

After the year 2020, the landscape of the literature radically changed. Terms such as “green finance,” “ESG,” and “fintech” emerged prominently. Green finance and ESG strategies have gained popularity in an effort to mitigate the environmental and social risks associated with banks' activities. Meanwhile, fintech came to represent digital transformation in the field, as much as signaling that sustainability and innovation are no longer two distinct topics. Studies during this period tended to examine how digital tools enable climate-conforming investment and risk management.

The past two years witnessed the rise of new terms, such as "environmental" and "energy efficiency." The trend is indicative of an increasingly clearer grasp of the role of banking in enabling clean energy transitions and the management of ecological risk. The trend is also indicative of a broader view of

sustainable banking, the means of the future economically, but also the driver of environmental and social progress.

Overall, the transition from early banking-focused research to today's sustainability-driven themes highlights a clear expansion in scope. Sustainable banking has become an interdisciplinary field, combining finance, environment, and technology, with even more room for innovation in future research.

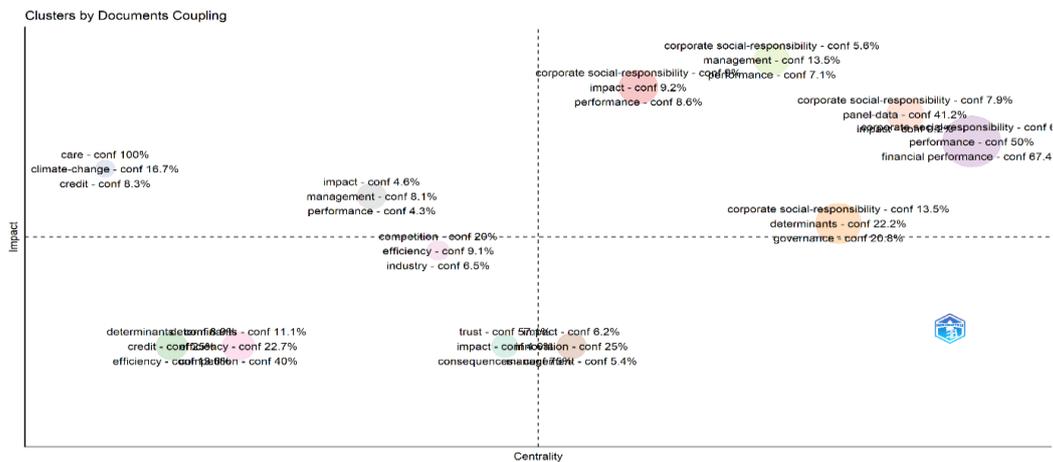


Figure 5. Clusters by Document Coupling in Banking Articles in the WoS Database Between 1980 and 2024

Figure 5 shows the conceptual relationships between documents using a clustering analysis, categorizing terms by their "centrality" and "impact." Centrality refers to how often a term is related to other terms, while impact describes the importance of a term within the literature. This helps explain the function of terms within sustainable banking literature and their relationships to one another.

The "care" and "climate-change" clusters in the upper-left quadrant identify those terms that present high impact with relatively lower centrality. That means these terms are highly significant within focused areas but are less connected to other conceptual aspects. For example, "climate-change" is a central topic within sustainability but has weaker associations with broader banking dimensions.

In the upper-right quadrant, we see high-centrality and high-impact terms such as "corporate social responsibility," "performance," and "financial performance." These keywords appear often and link to many topics, showing their wide relevance. They form the core of both academic and practical debates in sustainable banking, especially regarding how sustainability is measured and managed.

In the lower quadrants, terms like "competition," "efficiency," and "industry" have lower impact scores but may still hold central positions. These words relate more to the structural or operational side of banking. They help explain how banks optimize resources or navigate competitive markets while integrating sustainability goals.

Overall, this figure offers a clear view of how concepts are positioned in the literature. Highly central and impactful terms show well-established themes. Less connected but still impactful terms may point to emerging or underexplored areas. This type of mapping is useful for understanding research gaps and setting directions for future studies in sustainable banking.

Table 1. Clusters and Centrality-Impact Analysis of Banking Articles in the WoS Database Between 1980 and 2024

| Label | Group | Freq | Centrality | Impact |
|--|-------|------|------------|--------|
| corporate social-responsibility - conf 9% impact - conf 9.2% performance - conf 8.6% | 1 | 20 | 0.321 | 2521 |
| determinants - conf 8.9% credit - conf 25% efficiency - conf 13.6% | 3 | 11 | 0.211 | 1000 |
| corporate social-responsibility - conf 60.7% performance - conf 50% financial performance - conf 67.4% | 4 | 101 | 0.505 | 2344 |
| corporate social-responsibility - conf 13.5% determinants - conf 22.2% governance – conf 20.8% | 5 | 35 | 0.403 | 1661 |
| impact - conf 6.2% innovation - conf 25% management - conf 5.4% | 6 | 9 | 0.311 | 1000 |
| determinants - conf 11.1% efficiency - conf 22.7% competition - conf 40% | 7 | 12 | 0.215 | 1777 |
| impact - conf 4.6% management - conf 8.1% performance - conf 4.3% | 8 | 2 | 0.233 | 1000 |
| trust - conf 57.1% impact - conf 4.6% consequences - conf 75% | 9 | 7 | 0.274 | 1000 |
| corporate social-responsibility - conf 7.9% panel-data - conf 41.2% impact - conf 9.2% | 10 | 18 | 0.446 | 2468 |
| care - conf 100% climate-change - conf 16.7% credit - conf 8.3% | 11 | 4 | 0.169 | 1874 |

The labels in Table 1 are based on keyword co-occurrence clusters created with VOSviewer. The abbreviation “conf” shows the percentage frequency of how often a term appears with others in the same cluster. It reflects the thematic strength of each group. The “Impact” score shows the total number of citations that articles in each cluster received. To allow comparison, this score is normalized to a base of 1000. Together, “conf” and “Impact” values give insights into both the focus and influence of each thematic cluster.

Table 1 presents thematic clusters in the literature of sustainable banking to show their influence and importance. Clusters such as “corporate social responsibility,” “impact,” and “performance” in Groups 1 and 4, respectively, are among the most influential themes. More precisely, Group 4 focuses on the “financial performance”-CSR relationship, with a centrality value of 0.505, showing that this is one of the core aspects, both theoretical and practical, of sustainable banking.

Group 10, which includes terms like “panel-data” and “impact,” has a very high centrality value of 0.446. This reflects the prominence of panel data-based analyses in building strong connections within the literature and demonstrates their effectiveness as a research methodology. In contrast, Group 11, which includes “care,” “climate-change,” and “credit,” has a lower centrality value of 0.169 but a high impact score of 1.874. This indicates that while the linkage between climate change and finance is a niche topic, it carries substantial influence within its specific scope.

Group 7 has a low centrality score of 0.215 and an impact score of 1, characterized by sector-specific terms such as “determinants,” “efficiency,” and “competition.” These terms are, therefore, more operational and sector-focused, with fewer links to larger themes. In Group 9, the concepts of “trust,” “impact,” and “consequences” describe the relationship between trust in financial transactions and sustainability. This group occupies a less central position in the literature.

The table underlines that, overall, CSR, financial performance, and climate change are pivotal and impactful themes at the core of sustainable banking literature, while sectoral analyses on determinants and efficiency are less represented but remain important at the operational level. This analysis thus serves as a critical guide for understanding current trends in the literature and identifying further areas of research in sustainable banking.

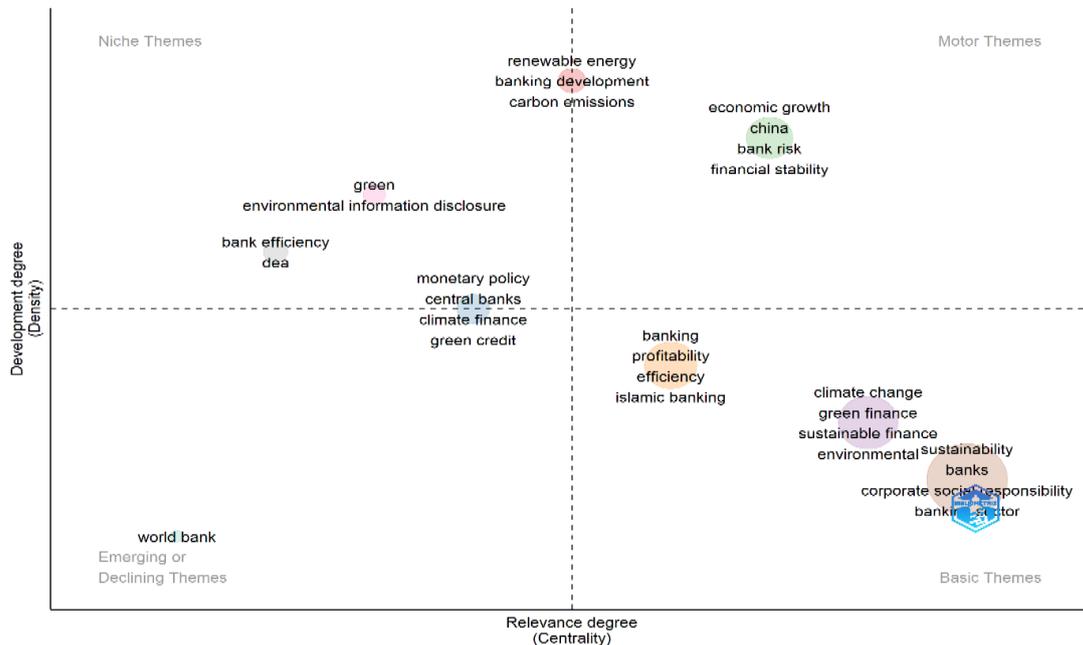


Figure 6. Thematic Map of Banking Articles in the WoS Database Between 1980 and 2024

Figure 6 categorizes the themes in sustainable banking literature according to their density and centrality, providing insights into their prominence and significance within the academic discourse. The four main quadrants highlight the roles and importance of various themes in the literature.

The themes in the bottom-right quadrant represent basic themes like "climate change," "green finance," "sustainable finance," and "corporate social responsibility" (CSR). They are the foundation of the literature on sustainable banking because they are highly connected with other themes. Indeed, as shown by their high centrality, both CSR and "banks" have a central role in the field, being widely integrated with other subjects.

The top-right quadrant shows the motor themes, with high centrality and high density. Notice that themes such as "economic growth," "bank risk," and "financial stability" are located here, making a significant contribution to the development of the literature. In fact, these themes constitute the core of understanding the economic impacts of sustainability policies in the banking sector and the strategies for managing associated risks.

The top-left quadrant locates niche themes that are highly dense but with low centrality. Examples of such topics include "renewable energy," "banking development," and "carbon emissions." These themes represent areas where detailed discussions can be carried out in specific contexts of sustainable banking. While renewable energy and carbon emissions are not closely related to other topics, they are highly relevant for addressing environmental sustainability challenges.

The lower-left quadrant represents the emerging or declining themes, which have low centrality and low density. Examples include "World Bank," which reflects a topic that either has waned in popularity or serves a more peripheral role in the current literature. Its placement might indicate a shift in focus within sustainable banking research as newer themes take precedence.

Core topics, such as CSR and green finance, along with the strategic theme of financial stability, are foundational, while niche areas, like renewable energy, represent opportunities for specialized research. The chart, by highlighting emerging and declining themes, provides insights into evolving priorities and gaps within sustainable banking literature, guiding future research efforts.

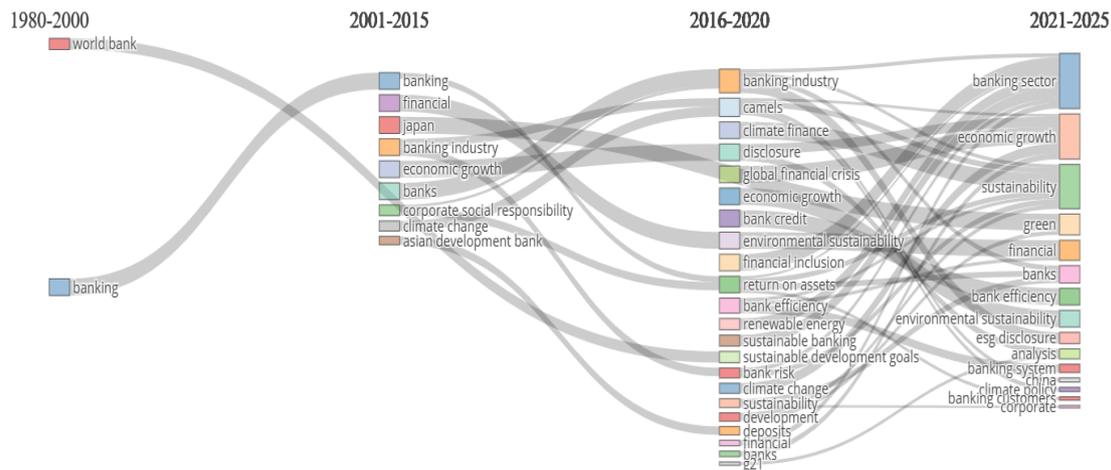


Figure 7. Thematic Evolution of Banking Research in the WoS Database Between 1980 and 2024

Figure 7 outlines the thematic evolution of the sustainable banking literature, laying out the prominent topics during different time periods and their relationships. The themes identified show how their evolution has taken place over time, specifically across four time slots: 1980-2000, 2001-2015, 2016-2020, and 2021-2024.

The period of 1980-2000 reflects the nascent stage of sustainable banking literature. During this era, the terms "world bank" and "banking" have emerged as central concepts. It therefore means that during this time, the basic functions of the banking system and the role of global financial institutions had taken precedence. Sustainability was not yet a major issue at this time, which also shows a period where economic and institutional analyses had been predominant in the discussion.

The period from 2001 to 2015 was a transitional period during which sustainability themes began to gain attention. Among the terms that emerged in the literature were "corporate social responsibility" and "climate change." Concepts such as "economic growth" and "banking industry" underlined the role of the banking industry in driving economic development. At this time, the social and environmental impacts of banking began to be more widely recognized, thus laying the groundwork for more focused, sustainability-oriented discussions.

Two dominant themes of sustainable finance and environmental sustainability emerged in the 2016-2020 period. Influenced largely by the Paris Agreement, there is increased use of terms such as "climate finance," "environmental sustainability," and "sustainable banking." This period marks the repositioning of the banking sector as a crucial tool in combating climate change. Emerged socially inclusive themes, for example, include "financial inclusion," showing increased efforts towards mitigating inequalities in practice with sustainable banking.

The period 2021-2024 represents the maturity of the sustainable banking literature. The key words characterizing this period concern "sustainability," "ESG disclosure," and "green." During this period, the integration of ESG criteria became a strategic priority of the banking industry and the focus of scholarly interest. Other, more specialized and technical themes, such as "bank efficiency" and "climate risk," also emerged, showing how the field has evolved into an increasingly interdisciplinary and analytical area of study.

Figure 7 succinctly captures the development of literature on sustainable banking from the earliest times to the present. Specifically, unlike the general and conceptual issues discussed in the earlier years of the review, the later years introduce specific or intricate issues, such as sustainability, climate finance, and ESG criteria. This development also reflects the growth and maturation of the field, with increasing complexity and focus on global issues.

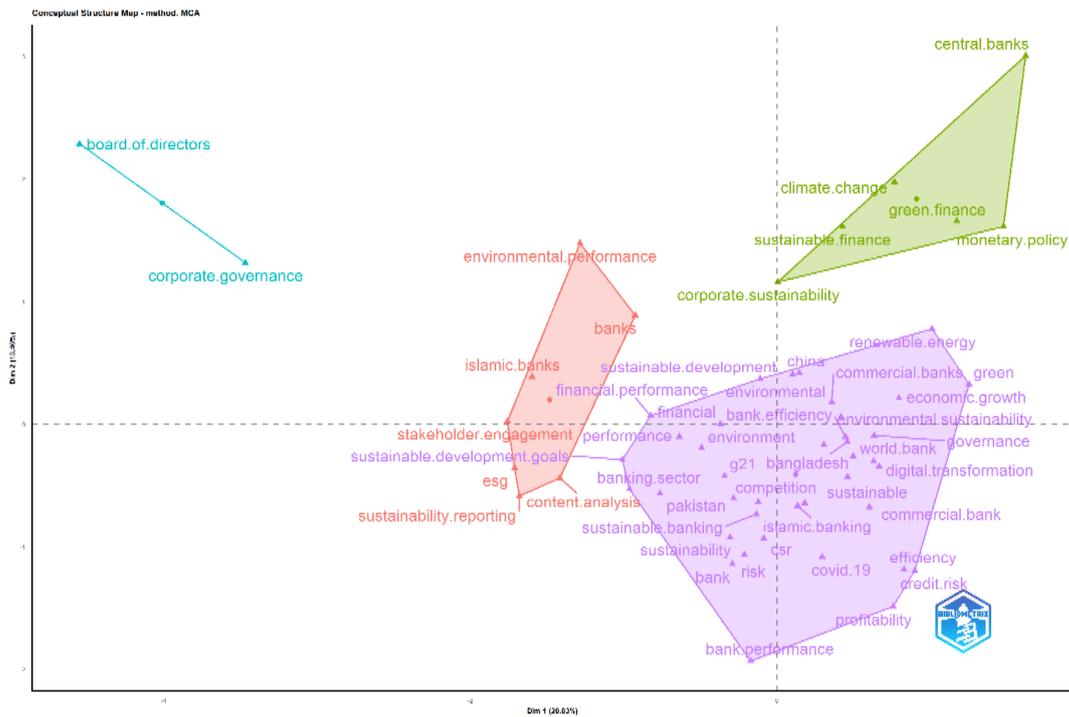


Figure 8. Conceptual Structure Map of Banking Research in the WoS Database

This conceptual map depicts the grouping and interrelations of the various themes in the sustainable banking literature. The map, organized along two axes, Dim 1 and Dim 2, provides insight into the thematic clusters' density and prominence in the literature.

The green cluster in the upper-right corner highlights topics like "central banks," "climate change," "green finance," and "monetary policy." It focuses on the broader economic side of sustainable finance and the regulatory challenges that come with it. In particular, terms like "central banks" and "monetary policy" point to studies that explore how financial systems can help meet sustainability goals. This is seen as a key theme in the literature.

The top-left cluster (blue cluster) consists of themes such as "board of directors" and "corporate governance." This cluster reflects the relationship between sustainability and governance structures. The theme of "corporate governance" plays a critical role in driving companies toward environmental and social goals; hence, the intersection of governance and sustainability is well-marked in the literature.

Near the center of the map, the red cluster includes terms like "banks," "environmental performance," "financial performance," and "Islamic banks." This group focuses on how banks deal with environmental and social issues. The link between financial and environmental performance shows how banks can align profits with sustainability. Also, growing interest in Islamic banks highlights their expanding role in sustainable finance.

The salient themes for the purple cluster in the bottom-right region are "sustainable banking," "sustainability," "competition," and "efficiency." This cluster represents more operational and applied themes. In particular, sustainable banking and competition underline sector-level impacts and the practical aspects of implementing sustainability within banking operations.

In the bottom-left area, which is gray, themes such as "World Bank" are less connected and could refer to topics that have lost their importance in the literature or have been replaced by other newer developments. This may suggest a shift in focus away from historical themes and toward emerging areas of interest.

It gives a good overview of the scope of the literature contributions in sustainable banking, the interconnectedness of themes, and the centrality or niche status of the research areas. The green cluster focuses on strategic and macroeconomic dimensions, while the purple cluster holds the discussion of

sectoral and operational aspects, both showing depth and variety in the literature. It provides valuable insights for identifying research trends and opportunities for further exploration in sustainable banking.

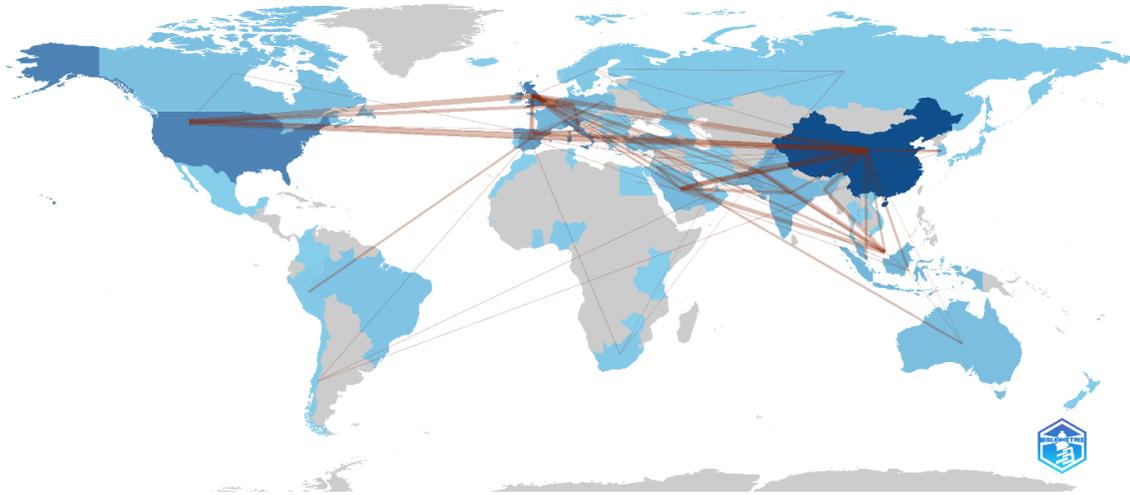


Figure 9. Global Collaboration Map of Banking Research in the WoS Database

This is a mapping of country collaborations on the theme of sustainability in banking and finance. The ties between the different countries outline the strength of their collaboration-developing activities such as co-publishing, partnering, etc., and the color used shows the relevance ranking of the given country within the literature.

The most collaborative countries include China, the United States, and European countries. China presents a tight network with the regional neighboring Asian countries; thus, it indicates that China is taking the lead in the region on the issues of promoting sustainable finance. This is explicable by the fact that Chinese policy on green finance aligns well with the country's goals for sustainable development.

The United States plays a significant role globally, establishing strong collaborative ties with European nations. This highlights the international impact of U.S.-led research on sustainable finance and banking. Additionally, the U.S. maintains extensive partnerships with both Asia and Europe, signifying its pivotal position in global academic networks.

European countries lead in this area, represented by the United Kingdom, Germany, and France. Intra-European and international networks from these countries also appear to be robust. Such intensification is likely the effect of focusing policies on sustainability and green finance issues within Europe. Finally, underpinning this will be its lead in academic and regulatory frameworks and substantial contribution to the literature.

Another noteworthy observation is the presence of collaboration between developing countries such as Türkiye, India, and South Africa. These nations contribute to sustainable banking research at both regional and international levels. In particular, the academic output from India and Türkiye reflects their growing focus on crafting sustainability-oriented financial strategies.

Overall, the map highlights that international collaboration is a core element of sustainable banking literature. Strong research partnerships facilitate deeper knowledge exchange and lead to more robust policy frameworks. The documented cooperation patterns underscore that sustainable finance is increasingly treated as a global concern, with cross-border collaboration serving as a key driver for progress in this domain.

5. Conclusion

The paper conducts a bibliometric analysis of the academic literature on "Banking and Sustainable Innovation" within the context of achieving SDG-9 and environmental science perspectives, aiming to elicit deeper insights into a better present, and potentially, a more complete, roadmap for sustainable

banking studies. It reviewed 639 articles from the Web of Science Core Collection that ranged in date from 1980 through 2024. Growth within the content reflects a continuous annual increase, as per findings, with a 1.55% growth rate, being highly and positively associated with growing rates since the post-2016 linkages with the Paris Agreement regarding global warming and the adoption of SDGs. It would indeed hint at a consequence from the side of global environmental policy and goals about sustainable development with regard to the influence carried upon the conduct of academic research.

The study identified several pivotal themes in the realm of sustainable banking literature, including sustainability, corporate social responsibility (CSR), green finance, fintech, Environmental, Social, and Governance (ESG) criteria, and climate risk. These themes exemplify the progressive evolution of the banking sector from its traditional role as a purely economic intermediary to an entity that actively integrates environmental and social responsibilities. The prominence of ESG criteria and green finance reflects their strategic significance in aligning banking operations with broader sustainability objectives. Furthermore, the adoption of innovative financial technologies, such as fintech and digitalization, underscores their critical role in facilitating and advancing the sector's sustainability initiatives. This shift not only enriches the theoretical framework of sustainable banking but also underscores its practical application in addressing global challenges.

The analysis of international collaboration networks has revealed that China, the United States, and European countries are the leading contributors to the sustainable banking literature, whereas some emerging economies like Türkiye have promising potential. This shows that international collaboration will significantly enhance sustainable finance practices. Strong leading countries in collaboration networks provide an enabling environment where knowledge can be shared, which is a major boost toward addressing sustainability challenges that require an interdisciplinary approach.

This research underlines the fact that interdisciplinary approaches, together with innovative financial instruments, lie at the core of sustainability within the banking industry. Further, these international collaborations will hasten the pace of development in the arena of sustainable banking. It also reveals that the large-scale impact on economic growth and environmental sustainability, such as the creation of green bonds or eco-friendly credit programs, could well be induced through sustainable banking practices. This means that policymakers and financial authorities must develop strategies that ensure the implementation of sustainable banking initiatives to promote economic growth, with a full focus on environmental sustainability.

The limitations of this study are the usage of only the Web of Science Core Collection database; hence, studies from other databases may not have been covered. In addition, bibliometric analysis has its own limitations because it only covers published papers and therefore cannot provide a comprehensive picture of the research activities underway. This is achieved by considering multi-database data and exploring the more nuanced bibliometric techniques, which may give a holistic view of the literature on sustainable banking.

These future research opportunities involve in-depth analysis of renewable energy finance, carbon emissions, and ESG integration within the banking sector. Second, comparative analyses across various regions may bridge prevailing gaps in knowledge and extend the understanding of how different economic and regulatory contexts influence sustainable finance initiatives. Furthermore, an investigation into how specific sustainability policies and governance frameworks influence bank performance may provide further insight into the mechanisms through which banks support sustainable development goals.

The study concludes with a general review of the literature on sustainable banking, underlining the importance of interdisciplinary approaches, innovative financial instruments, and international collaboration in driving the banking industry toward sustainability goals. These findings have important implications for academic researchers, policymakers, and practitioners seeking to advance the sustainability of banking operations and contribute to global sustainability objectives. In this way, the financial sector can really help towards the accomplishment of a more sustainable and resilient global economy by fostering deeper integrations of sustainability principles within banking practices.

Çıkar Çatışması Beyanı / Conflict of Interest

Çalışmada herhangi bir kurum veya kişi ile çıkar çatışması bulunmamaktadır.
There is no conflict of interest with any institution or person in the study.

İntihal Politikası Beyanı / Plagiarism Policy

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Bu çalışmada Yükseköğretim Kurumları Bilimsel Araştırma ve Yayın Etiği Yönergesi kapsamında belirtilen kurallara uyulmuştur.
In this study, the rules specified within the scope of the Higher Education Institutions Scientific Research and Publication Ethics Directive were followed.

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