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Review Article

A Comprehensive Review of Global Research Trends in Artificial Intelligence for Sustainable Banking

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Abstract - *In recent years, scholarly interest in the role of Artificial Intelligence (AI) within sustainable banking and finance has grown significantly. This study examines the global research landscape on AI applications in banking through a qualitative approach, highlighting major developments and trends. A total of 368 research articles published between 2014 and 2024 were extracted from the Scopus database. Analysis was conducted using VOSviewer (v1.6.19) and Biblioshiny, focusing on coauthorship networks, keyword co-occurrence, and citation patterns. The highest publication output came from China (91), followed by India (86), the United States (59), Turkey (32), and Russia (31). Prominent contributing institutions included the Bucharest University of Economic Studies, University Bourgogne Franche-Comté, and Gachon University, with China also identified as a key funding source. The review uncovers core research themes, pinpoints existing gaps, and introduces a conceptual AI banking service architecture aimed at bridging the gap between academic inquiry and industry practice. The findings provide a foundation for future research directions and strategic integration of AI in sustainable banking systems.*

Keywords *- Sustainable banking, Artificial Intelligence, Bibliometrics, Scopus-indexed database, VOSviewer, Biblioshiny.*

1. Introduction

Emerging technologies in the digital age, like robotics, Artificial Intelligence (AI), and smart electronics, have become more accessible and popular (West, 2015). According to Benchea et al. (2023), digital transformation is increasing functional proficiency and capacities, which is reshaping many aspects of life, from research and business to education and skill development. AI is essential for automating tasks and supporting both individuals and businesses. It is incorporated into computers, robotics, and additional systems (Lu & Cai, 2019). With the promptness at which technology is evolving, Artificial Intelligence (AI) has expanded prevalent acceptance, predominantly in sophisticated industries like banking, where it is used to improve customer satisfaction and operational value. Due to augmented economic openness and globalisation, the banking industry is currently more potent and competitive (Chen et al., 2018) since banks are progressively using digital banking as a mode to innovate and grow. Furthermore, banks are combining AI into Environmental, Social, and Governance (ESG) ratings to build more sustainable and accountable financial models. By using AI, businesses can efficiently arrange and assess ESG-related data from a range of sources, including social media, corporate filings, regulatory documents, and financial reports (Serafeim, 2020). AI has greatly increased the accuracy and efficiency of routine corporate banking processes, endorsed 24-hour operations, decreased operating costs, and strengthened the broad customer experience. Bibliometrics is used in this study to understand how AI is impressing the banking industry. This study aims to conduct a comprehensive literature review to improve understanding of research trends and collaborations in the area. In order to facilitate bibliographic coupling, coauthorship networks, citation linkages, and keyword co-occurrence were categorised using an analytical approach. The bibliometric study and its intended outcomes were framed by a clearly defined analytical model.

1.1. Research Problem

The decisive function of AI in advancing sustainable banking based on ESG principles has not received enough notice, despite the fact that it is being used to a greater degree in banking to elevate operational efficiency and service fulfilment. The prevailing literature concentrates primarily on technical and functional applications, overlooking sustainability consequences, ethical considerations, or policy relevance (Duan et al., 2019; Kotsantonis & Serafeim, 2021).

1.2. Research Scope

With the prominence of ESG factors, the ongoing study explores universal trends in research on the use of AI in

sustainable banking. The literature records based on AI from a banking viewpoint were found from the Scopus database between 2014 and 2024 using bibliometric analysis tools like VOSviewer and Biblioshiny, to map the field's evolution and determine research gaps for future study through keyword trends, citation metrics, publication patterns, key authors, institutions, and countries.

2. Literature Review

Professionals in the banking industry have made more observations on the way AI-supported banks do business over the past ten years, which have led to changes in how banks operate, how they interact with customers, how they make decisions based on data, and how they manage risk.

2.1. AI in Banking and Environmental Sustainability

AI has helped financial institutions such as banks to better align with ESG principles by making it easier to gather and analyse vast amounts of ESG-related data from a range of sources, such as social media platforms, financial statements, and corporate disclosures (Kotsantonis & Serafeim, 2021; Deloitte, 2021). AI allows tracking real-time environmental indicators like carbon emissions and climate-related issues. Through international frameworks like the TCFD, banks can use machine learning and natural language processing to perform complex environmental risk assessments and scenario analyses (Bank of England, 2021; Barredo Arrieta et al., 2022).

2.2. AI in Customer Service and Engagement

Customer service is one of the most apparent and considerable areas where AI is changing the financial environment. Chatbots and virtual assistants with AI competence are key for navigating customer interactions. They offer real-time assistance, round-the-clock support, and understanding of queries through machine learning and Natural Language Processing (NLP) (Kumar et al., 2020).

2.3. AI in Credit Scoring and Risk Assessment

Artificial intelligence has tremendously modernised risk management and credit evaluation in the banking sector. According to Krauss et al. (2017), the use of machine learning techniques such as decision trees and neural networks to identify patterns linked to credit risk and primitive warning signs of financial concern is escalating.

2.4. AI in Fraud Detection and Security

Fraud detection is the most vital benefit of AI in the financial industry. AI systems are capable of tracking transactions in real time and promptly identifying potentially fraudulent activity through the use of anomaly detection, pattern recognition, and predictive analytics (Ngai et al., 2011).

2.5. AI in Strategic Decision-Making and Personalization

AI's enhanced operational efficiency and data analytics enrichment profoundly affect strategic decision-making in the banking sector. With AI-driven customer segmentation and behavioural analysis, banks can tailor financial products, services, and marketing campaigns to each client's individual needs (Ghosh, 2020).

2.6. Challenges in AI Adoption in Banking

Regardless of the fact that AI has the capacity to revolutionise the banking sector fully, there are a number of significant obstacles preventing its extensive adoption. Since banks supervise extremely sensitive financial and personal data, data privacy and security protection are pivotal. The use of AI systems that process vast amounts of data requires intricate efforts to uphold secrecy and avoid breaches (Binns, 2018). Another severe issue is algorithmic bias, which occurs when misinterpreted data induces AI systems to unconsciously perpetuate social or economic inequality, leading to unfair outcomes such as biased lending decisions or inaccurate risk assessments. Moreover, barriers to larger adoption, especially in developing countries, include high implementation costs, a poor skilled AI specialists, and organisational reluctance to technological change.

2.7. Research Gap

Kotsantonis & Serafeim (2021) and Duan et al. (2019) claim that the majority of research does not link AI to broader sustainability objectives, instead concentrating on functional outcomes like efficiency, credit risk, or customer engagement. According to Zhao and Strotmann (2008) and Binns (2018), current bibliometric studies also prioritise quantitative analysis, often lacking crucial insights into multidisciplinary depth and ethical, regulatory, and implementation challenges. This indicates the need for a more thorough and inclusive investigation into AI's strategic role in sustainable finance.

3. Methodology and Data Collection

3.1. Database

A preliminary search of the Scopus database generated 917 documents, of which 570 were verified as appropriate to the study topic-AI in Banking. After applying further refinement based on the defined study period (2014–2024) and specific inclusion criteria-including document titles, author information, keywords, subject areas, and publication types-the dataset was narrowed to 368 records. These were categorised into full-text journal articles (n = 197), conference papers (n = 122), review articles (n = 19), early access publications (n = 17), book chapters (n = 8), and standalone articles (n = 5) (see Figure 1). The Mendeley Desktop reference management program was used to organise and process the chosen records in plain-text format. VOSviewer (van Eck & Waltman, 2010) software was used for bibliometric mapping and visualisation. A powerful tool for carrying out extensive bibliometric research, VOSviewer makes it easier to create citation and coauthorship networks and keyword co-occurrence maps, and it supports in-depth data mining and network analysis (van Eck & Waltman, 2014).

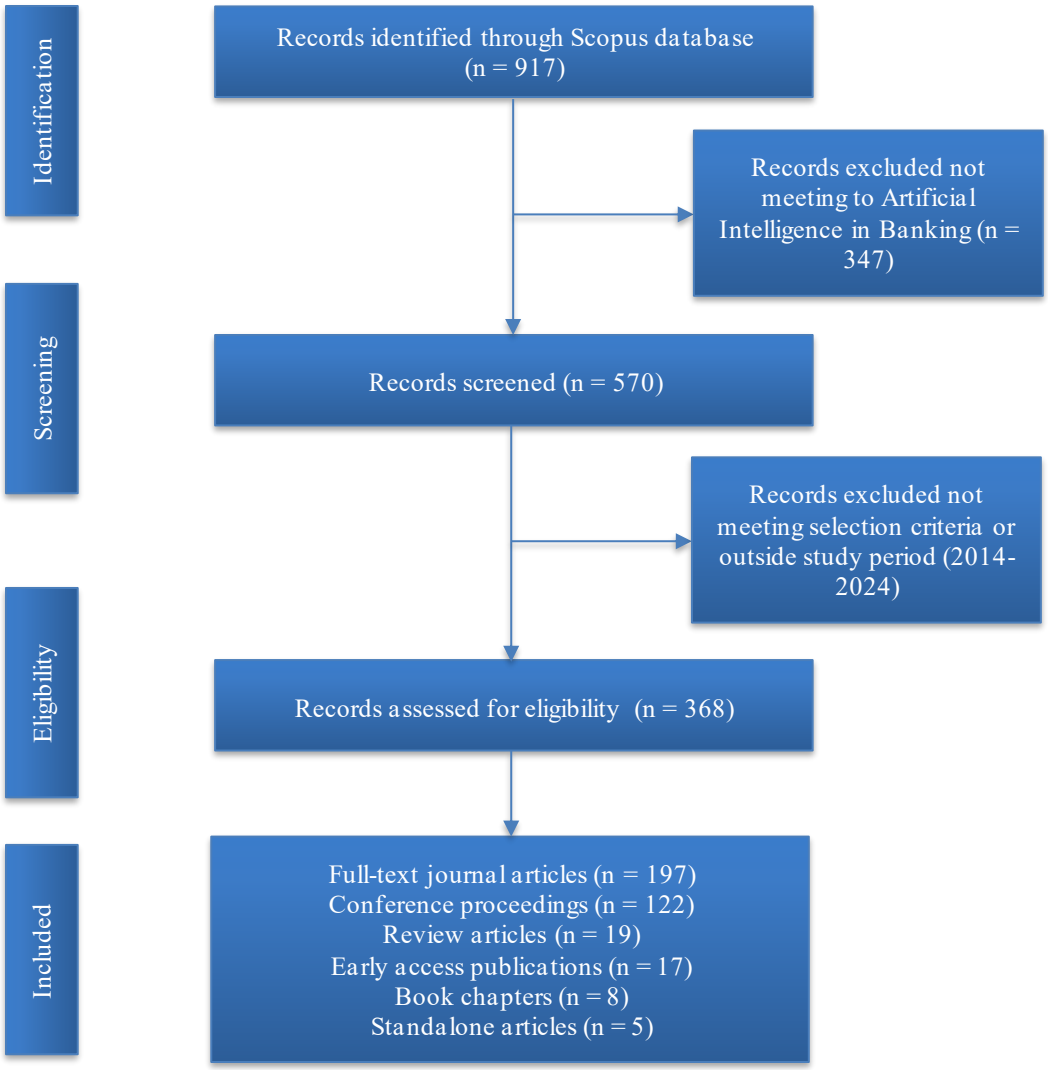

Fig. 1 PRISMA framework flowchart

3.2 Bibliometric Tools

To identify novel trends in scientific research that have been published and listed in databases such as Scopus, the statistical method known as bibliometric analysis is commonly used (Barbara Bigliardi et al., 2021). This approach facilitates the identification of leading research institutes engaged in collaborative work, scientific mapping, and publication pattern recognition. It also aids in understanding the theoretical underpinnings of a given field. Figure 2 depicts the bibliometric analysis workflow used in this study. Relevant information was supplied by the Scopus database, one of the most important sources of peer-reviewed scientific literature in a number of fields (Ramanita Pranckute, 2023). For mapping and visualisation purposes, the data were first exported in plain text format and then processed using Biblioshiny and VOSviewer software.

Biblioshiny, an online tool included in the Bibliometrix R-package, was used to perform thorough analyses of the dataset (Ariaa, M., & Cuccurullo, C., 2017). Specifically, VOSviewer version 1.6.19 was used to visualise the networks and patterns found in the Scopus dataset (van Eck & Waltman, 2010). Prior bibliometric studies have also employed tools such as CiteSpace, BibExcel, and HistCite for comparable purposes (Garfield, E., 2004; Jayantha & Oladinrin, O.T., 2019). These bibliometric methods are useful for structuring large datasets and developing a scientific framework to support the present study's objectives (Zupic, I., & Cater, T., 2014).

The bibliometric methodology includes quantitative techniques such as citation analysis for the extraction and analysis of bibliographic data (Broadus, R. N., 1987). The literature review's main objective is to locate, identify, and evaluate relevant material through bibliometric analysis. It also seeks to organise academic content. This approach also facilitates the identification of significant research gaps and directs future academic endeavours.

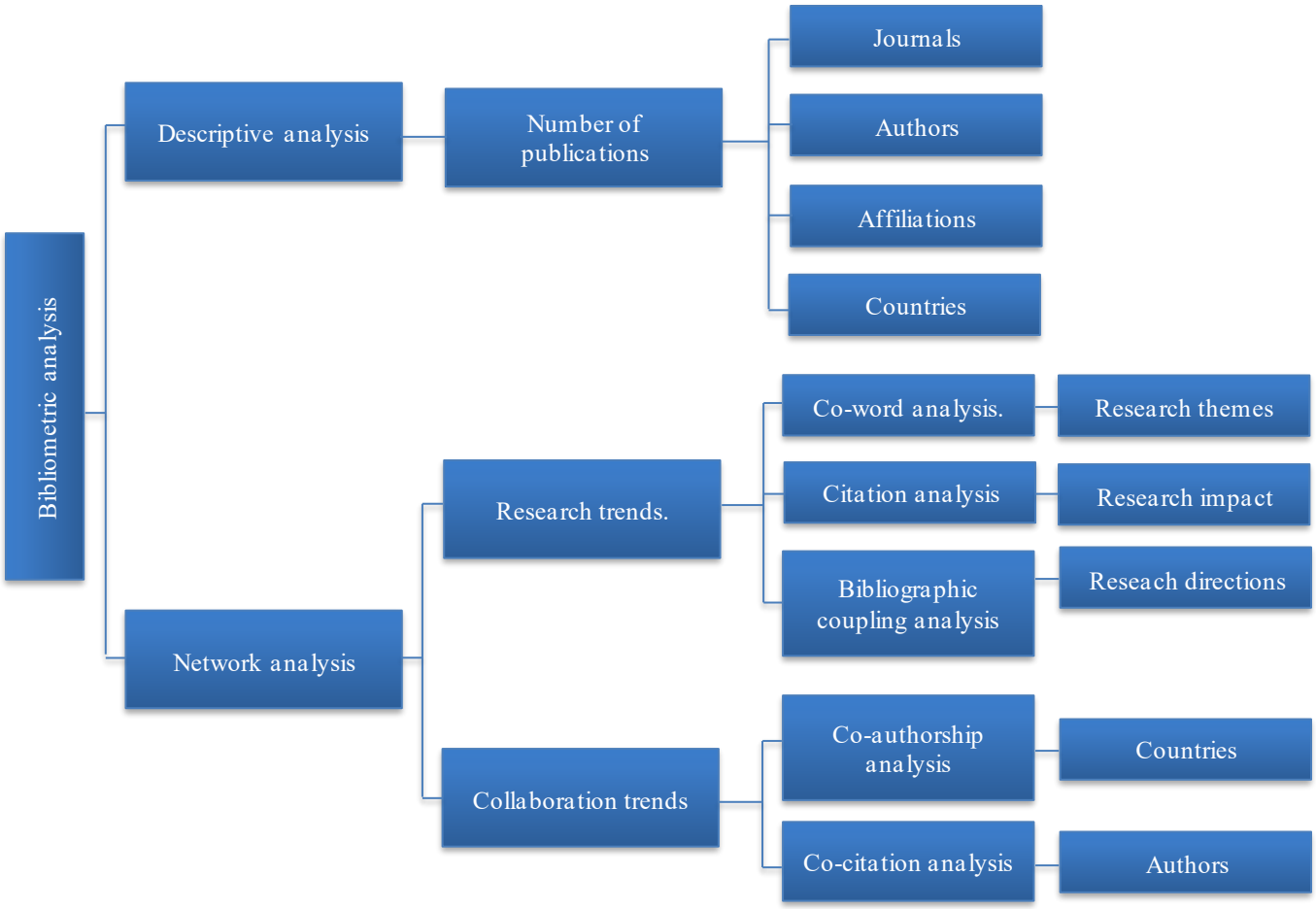

Fig. 2 Bibliometric analysis topology

4. Results and Discussions

This study utilises both literature review and network analysis approaches. While the literature records offer foundational insights by synthesising and interpreting existing research on the topic, network analysis expands the investigation by uncovering predictive relationships and patterns within the scholarly domain, beyond simple bibliographic reporting. Furthermore, scientific mapping techniques are employed to identify key research themes, knowledge gaps, and emerging trends, thereby offering a more holistic and structured understanding of the evolving academic landscape.

4.1. Documents Analysis

A comprehensive review of relevant documents was conducted to assess this progression, focusing on key variables such as publication volume, leading journals, influential authors, and prominent research institutions across different countries over the past decade. The adoption of AI in banking has shown steady growth from 2014 onward, with a marked surge beginning in 2018 and reaching its highest point in 2022, with 99 publications. The annual distribution of publications from 2014 to 2024 is detailed in Table 1.

Table 1. Information related to documents, authors, and author collaborations

Description	Results
Timespan	2014:2024
Sources (Journals, Books, Etc.)	255
Documents	368
Annual Growth Rate %	16.23
Document Average Age	2.86
Average Citations Per Doc	6.946
References	14562
Document Contents	
Keywords Plus (Id)	477
Author's Keywords (De)	1318
Authors	
Authors	1079
Authors Of Single-Authored Docs	52
Authors Collaboration	
Single-Authored Docs	55
Co-Authors Per Doc	3.09
International Co-Authorships %	23.64
Document Types	
Article	197
Article, Book Chapter	8

Article: Early Access	17
Article: Proceedings Paper	2
Proceedings Paper	122
Review	19
Review: Early Access	3

Source: Scopus database, Biblioshiny software

The analysis of the 368 selected publications revealed the following distribution, as shown in Figure 1: 197 journal articles, 122 conference proceedings, 19 review articles, 17 early access publications, eight book chapters, and a small number of other document types.

Journal articles emerged as the most prevalent category, comprising approximately 53% of the total records. Conference proceedings followed, accounting for 33% of the publications, highlighting their significant contribution to the dissemination of research in this domain (refer to Figure 3).

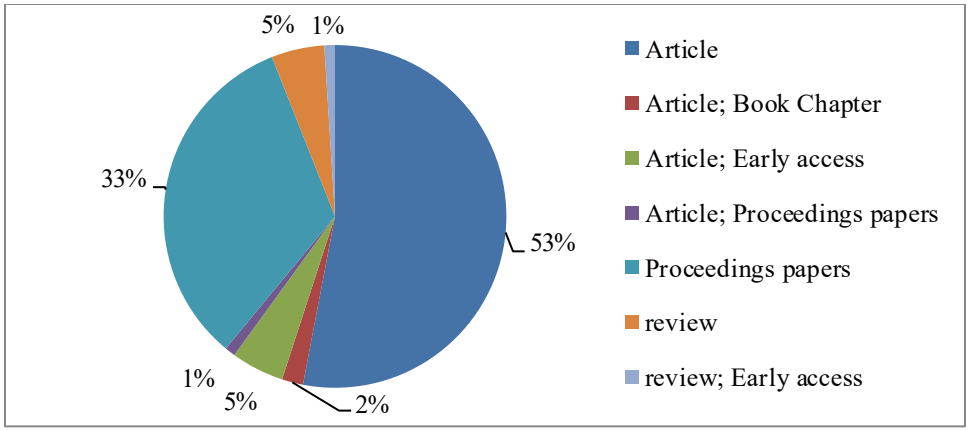

Fig. 3 Publication type

Between January 2014 and December 2024, research on the application of AI in banking has demonstrated a consistent upward trend, with significant growth observed from 2018 onward. The year 2022 recorded the highest number of publications within the decade, totalling 99, as illustrated in Table 2 and Figure 4. This upward trajectory reflects increasing academic and industry interest, suggesting strong potential for continued research and innovation in this area in the years ahead. Table 3 and Figure 5 illustrate the distribution of publications across different Scopus subject categories. Of the 368 documents analysed, the *Computer Science: Artificial Intelligence* category represented the largest share, with 114 publications. These findings highlight the interdisciplinary nature of AI adoption in banking, demonstrating strong linkages with fields such as Business, Management, Finance, and broader areas of Computer Science.

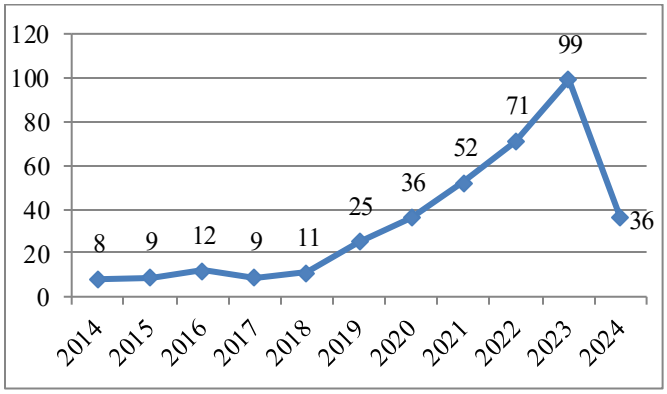

Fig. 4 Articles published (2014-2024)

Source: Scopus Database

Table 2. Number of publications (2014 -2024)

Year	Articles
2014	8
2015	9
2016	12
2017	9
2018	11
2019	25
2020	36
2021	52
2022	71
2023	99
2024	36

Source: Scopus database, Biblioshiny software

Table 3. Number of publications category wise (2014-2024)

Categories	Number of Publications in each category
Ethics	2
Social Sciences Interdisciplinary	4
Robotics	5
Multidisciplinary Sciences	10
Economics	22
Management	28
Business	40
Business Finance	40
Computer Science Information Systems	103
Computer Science Artificial Intelligence	114

Source: Scopus database, Biblioshiny software

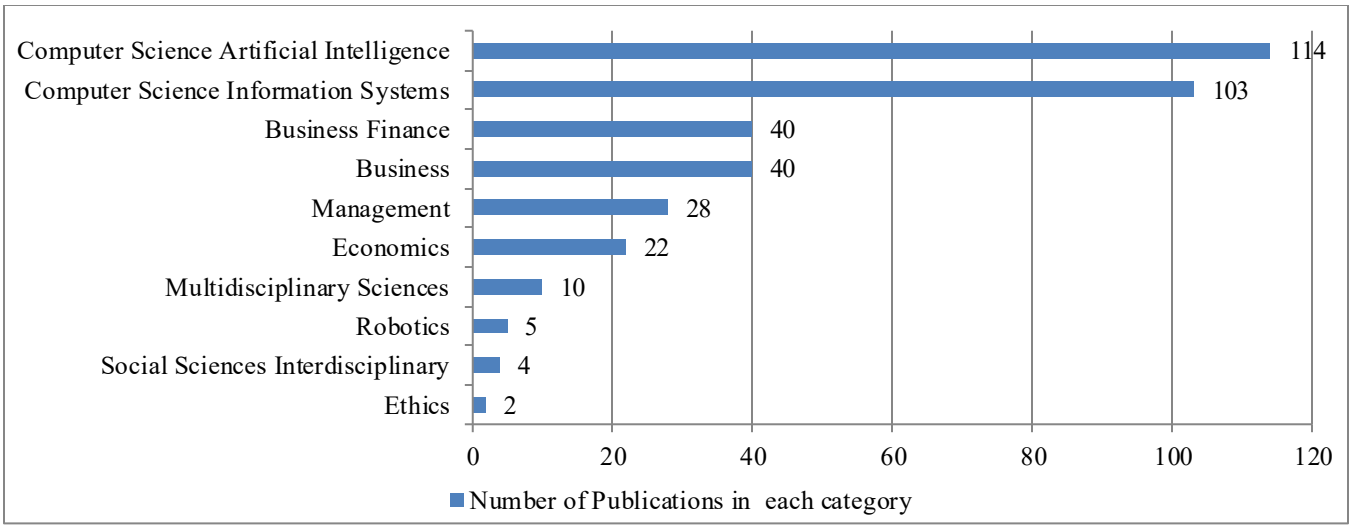

Fig. 5 Number of publications, category-wise

Source: Scopus Database

Table 4 highlights the top ten contributing authors in the domain of AI in banking. Among them, author KHANS stands out with the highest contribution of four publications, while the remaining authors have each published between two and three articles, collectively accounting for a total of 29 publications. These results suggest that many of these contributors may be in the early or developmental stages of their research trajectories, aligning with the characteristics of a predominant author group as described by Feng, Zhu, and Lai (2017).

Table 4. Authors' publications on AI in banking

Author	Articles	Articles Fractionalized
KHAN S	4	1.23
DVORAK J	3	1
JANKOVA M	3	1
KUMAR A	3	1.17
LI B	3	1
PIOTROWSKI D	3	3
SHARMA S	3	0.92
URBADECSKY K	3	1
ALYAS T	2	0.31
ASHTA A	2	1

Source: Scopus database, Biblioshiny software

Table 5 presents the research institutions and sources with the highest number of publications related to AI in banking. IEEE Access emerges as the leading contributor, with 12 indexed publications, followed closely by *Expert Systems with Applications*, which accounts for 11 publications and contributes to a broader corpus of 112 related articles. The data suggests that many institutions involved in AI research within the banking domain are still in the nascent stages of development, as indicated by their relatively modest publication output-typically ranging between three and four articles.

Table 5. List of the top affiliations based on publications

Source	Articles
IEEE Access	12
Expert Systems With Applications	11
Strategic Change-Briefings in Entrepreneurial Finance	9
Wireless Communications & Mobile Computing	6
AI & Society	5
Electronics	5
Journal Of Financial Services Marketing	5
Journal Of Intelligent & Fuzzy Systems	5
Proceedings of the International Conference on Business Excellence	5
Computational Economics	4

Source: Scopus database, Biblioshiny software

Table 6. Number of publications - country wise

Country	Publications
CHINA	91
INDIA	86
USA	59
TURKEY	32
RUSSIA	31
SPAIN	30
FRANCE	25
UK	25
SAUDI ARABIA	23
ITALY	22

Source: Scopus database, Biblioshiny software

As illustrated in Table 6 and Figure 6, the analysis reveals that the majority of citations stem from two leading countries: China and India. China contributed 91 citations, followed closely by India with 86. Collectively, these two countries cited 117 articles, accounting for approximately 80% of the total citations among the top ten citing nations in the field of

AI in banking. This concentration suggests that, although scholarly contributions to the literature are globally distributed, citation activity-and thus scholarly influence-is predominantly centralised in China and India.

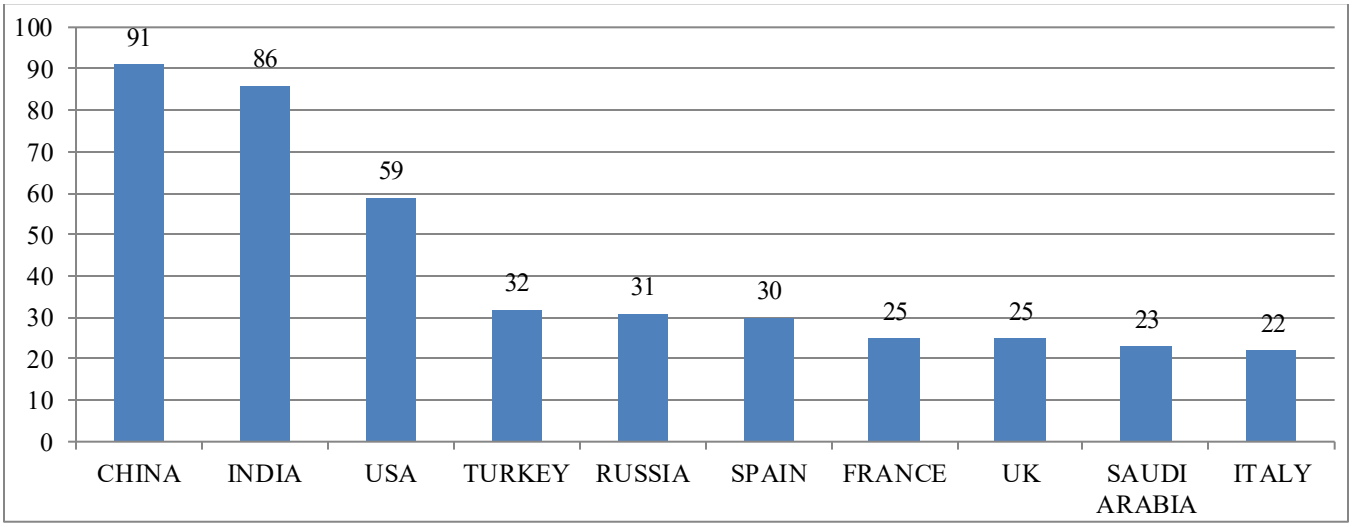

Fig. 6 Number of publications-country-wise

Source: Scopus Database

Table 7 presents the results of a co-occurrence analysis of the most frequently used keywords, measured by total link strength. Total link strength reflects the intensity of associations among keywords, indicating how frequently they appear together within the literature (van Eck & Waltman, 2017). The analysis reveals that the term "Artificial Intelligence" has the highest total link strength, signifying its central role in the research domain. It is closely followed by frequently co-occurring terms such as "model," "models," and "performance," highlighting key thematic focuses within the field of AI in banking.

Table 7. Co-occurrence analysis of top most keywords

Word	Occurrence
Artificial-Intelligence	21
Model	18
Models	17
Performance	13
Bankruptcy Prediction	12
Impact	12
Banking	11
Management	11
Neural-Networks	11
Acceptance	10

Source: Scopus database, Biblioshiny software

The word cloud analysis highlights the most frequently used author keywords extracted from abstracts, offering insights into the thematic focus of current research (Secinaro & Calandra, 2021). Central to the analysis is the keyword "artificial intelligence," around which closely related terms such as banking services, chatbots, technology acceptance, and satisfaction are clustered, as illustrated in Figure 7. This visualisation not only underscores the dominant themes in AI adoption within banking but also provides a valuable foundation for identifying emerging areas and guiding future research directions.

Fig. 7 Word cloud of AI in banking

4.2. Network Analysis

Network analysis serves as an advanced methodological approach for exploring the social and intellectual structures within a body of literature. Applying comparative techniques enables the classification and interpretation of bibliographic data through various forms of analysis, including coauthorship, co-occurrence, citation, co-citation, and bibliographic coupling. These analytical dimensions offer valuable insights into collaboration patterns, thematic linkages, and the evolution of knowledge within the research domain.

4.2.1. Coauthorship Analysis

This analysis examines three key bibliometric units: authors, organisations, and countries, with a maximum of 25 entities considered in each category. To maintain analytical precision, documents with multiple authors were excluded, and a minimum threshold of two publications was set for author inclusion. Among 1,095 identified authors, 37 met this criterion. The total link strength of coauthorship networks was then calculated to assess collaboration intensity. As depicted in Figure 8, DVORAK JIRI recorded the highest total link strength, approximately six, based on four citations across three publications.

4.2.2. Co-Occurrence Analysis

Keyword co-occurrence analysis identifies terms that frequently appear together in research publications, offering insights into prevailing technological themes and emerging trends (van Eck & Waltman, 2017; Secinaro & Calandra, 2021; Lu & Wolfram, 2012). Among the 1,703 keywords extracted, 169 met the minimum threshold of appearing in at least three publications. As illustrated in Figure 9, the co-occurrence network reveals strong associations among key terms.

According to Table 7, the keywords "artificial intelligence" and "model" each represent approximately 5% of total occurrences. Other prominent keywords include performance and bankruptcy prediction, reflecting the core focus areas of current research in AI applications within the banking sector.

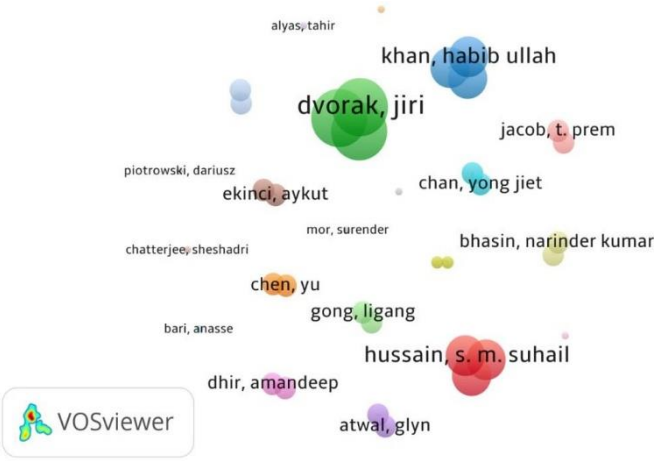

Fig. 8 Co-authorship analysis of authors

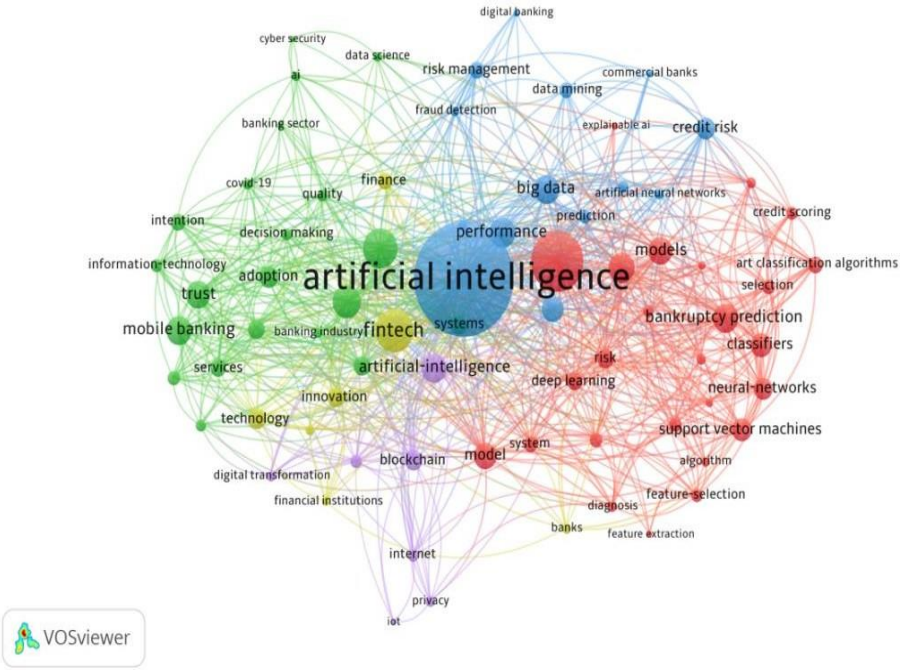

Fig. 9 Co-occurrence analysis of all keywords

4.2.3. Citation Analysis

In academic research, citation metrics play a critical role in assessing scholarly impact, with highly cited publications often reflecting greater influence within the academic community (Feng, Zhu, & Lai, 2017). Citation patterns indicate the frequency of a work's use and provide insight into its contribution to the intellectual development of the field (De Bakker et al., 2005). As illustrated in Table 8 and Figure 10, 30 out of 1,095 authors met the minimum threshold of at least two citations per publication. Leading the list is GONG, LIGANG (2014) with 71 citations, followed by ASHTA, ARVIND (52), EKINCI, AYKUT (31), JACOB, T. PREM (30), and CHEN, YU (29). Notably, ASHTA, ARVIND (2021) recorded the highest total link strength, approximately seven, indicating strong collaborative and thematic connectivity within the citation network.

Table 8. List of top cited articles

Article	No. of Citations
GONG, LIGANG; 2014; An Improved Artificial Bee Colony Algorithm on Balance-Evolution Strategy	71
ASHTA, ARVIND; 2021; Artificial Intelligence and Fintech	52
EKINCI, AYKUT; 2013; A Comparison of Various AI Methods in the Prediction of Bank Failures	31
JACOB, T PREM; 2019; AI-based Network Intrusion Detection with hyperparameter optimization tuning on the realistic cyber dataset using cloud computing	30
CHEN, YU; 2021; Implications of the use of artificial intelligence in public governance	29

Source: Scopus database, Biblioshiny software

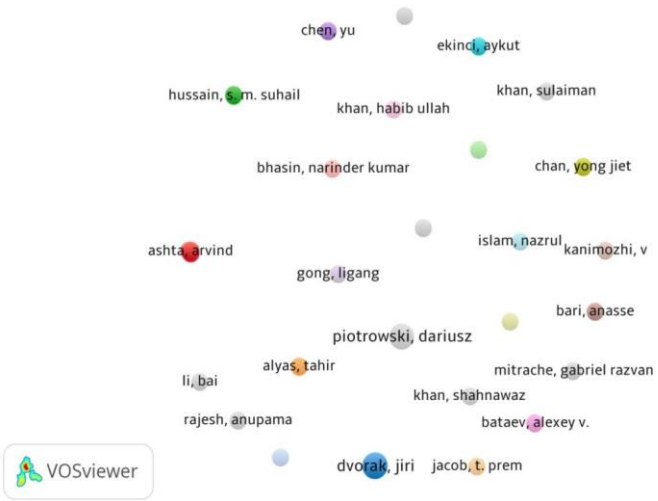

Fig. 10 Citation analyses of documents

4.2.4. Bibliographic Coupling Analysis

Bibliographic coupling occurs when two or more documents reference the same source, thereby revealing shared intellectual foundations and helping to identify thematic research clusters (Kessler, 1963; Zhao & Strotmann, 2008). It serves as a valuable technique for exploring the intellectual structure of a research field (Koseoglu, 2016). Applying a minimum threshold of two citations per document, 174 authors out of the 368 analysed papers met the inclusion criteria. As shown in Table 9 and Figure 11, ORESKI, S. (2014) recorded the highest number of citations (263), while CHI (2019) exhibited the strongest total link strength, approximately 146, indicating a central role in the development of shared knowledge within the field.

4.2.5. Co-Citation Analysis

Co-citation analysis involves identifying instances where two or more references are cited together by other articles, making it a key method for assessing the intellectual relatedness of scholarly works (Small, 1973). Unlike bibliographic coupling, which highlights shared references among citing articles, co-citation uncovers latent connections between authors who may not have directly collaborated, thereby revealing deeper thematic linkages (Lu & Wolfram, 2012; Feng, Zhu, & Lai, 2017).

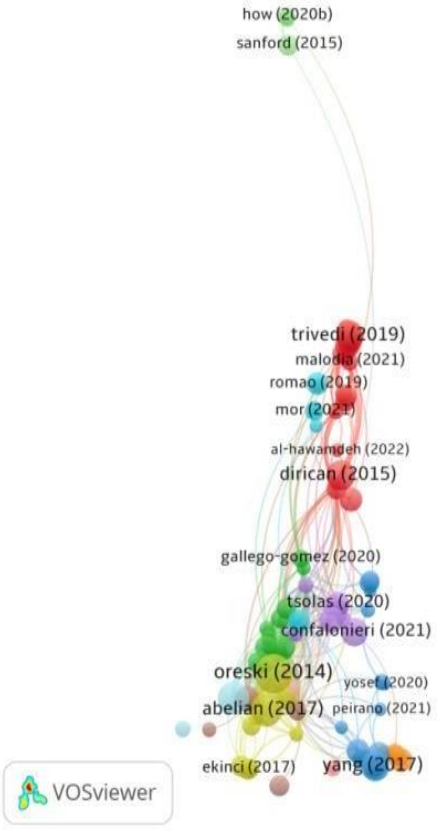

Fig. 11 Bibliographic coupling analysis of documents

Source: Scopus database, Biblioshiny software

Table 9. List of higest cited articles

Paper	DOI	Total Citations	TC per year	Normalised TC
Oreski S, 2014, Expert Syst Appl	10.1016/j.eswa.2013.09.004	263	26.30	6.30
Ala'raj M, 2016, Knowl- Based Syst	10.1016/j.knosys.2016.04.013	119	14.88	5.64
Abelian J, 2017, Expert Syst Appl	10.1016/j.eswa.2016.12.020	118	16.86	4.59
Dirican C, 2015, World Conference on Technology, Innovation And Entrepreneurship	10.1016 /j.sbspro.2015.06.134	87	9.67	7.35
Yang Xh, 2017, Inform Sciences	10.1016/j.ins.2017.01.011	87	12.43	3.38

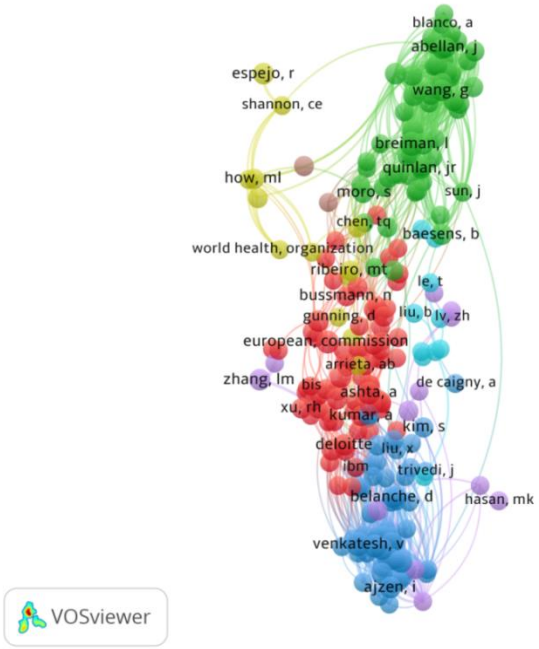

Fig. 12 Co-citations analysis of authors

As illustrated in Figure 12, the co-citation network analysis reveals three major clusters, each differentiated by color. Out of 11,471 authors, 238 met the minimum threshold of five citations. VENKATESH, V. (2018) leads the network with 26 citations and the highest total link strength of 414, signifying substantial influence within the literature. The blue cluster comprises authors such as VENKATESH, specialising in Information Technology; the green cluster includes figures like WANG, G., associated with Business Information Science and Technology; while the red cluster, featuring ASHTA, ARVIND, focuses predominantly on Microfinance.

5. Conclusion

This study explores the integration of Artificial Intelligence (AI) with Environmental, Social, and Governance (ESG) principles to advance sustainable banking practices. Technological innovation has driven profound changes in the banking sector, with AI emerging as a pivotal force due to its transformative capabilities. AI enables efficient processing and analysis of large volumes of banking data, supporting a wide range of applications such as chatbots, robotic process automation, risk assessment, personalised financial services, and enhanced competitive strategies. Through a comprehensive literature review, this study identifies and analyses these key themes, reflecting the growing global interest in AI's role in financial services.

To systematically assess the academic landscape, bibliometric analysis was conducted using tools such as Biblioshiny and VOSviewer. Documents were evaluated based on citation frequency and total link strength, with higher citation rates reflecting increased scholarly attention and the expanding importance of AI in banking. The findings underscore the rising research momentum surrounding AI-driven innovations in sustainable and responsible banking. Consequently, this research provides valuable insights for academicians, industry practitioners, and stakeholders, facilitating a deeper understanding of AI integration within the banking sector.

5.1. Recommendations for Future Studies

Network analysis uncovers valuable opportunities for future research in the application of Artificial Intelligence (AI) within the banking sector. Given that AI-driven digital banking and financial inclusion remain emerging areas of study, this research provides foundational insights for both scholars and practitioners. Policymakers can utilise thematic cluster analyses to inform strategic planning and policy development, while comprehensive bibliometric reviews help pinpoint research gaps and underexplored domains. To strengthen the analytical framework, future studies are encouraged to broaden bibliometric approaches by incorporating additional databases and diverse citation metrics. This expanded scope will enhance understanding of AI's evolving role in sustainable banking, ultimately delivering value to customers and contributing to the advancement of the financial services industry.

5.2. Managerial Implications and Limitations

The integration of Artificial Intelligence (AI) into banking operations significantly enhances the credibility of ESG practices, contributing to improved customer retention, increased access to sustainable finance, and a strengthened market position. This study provides valuable insights for managers and policymakers regarding the strategic application of AI technologies.

While innovations such as chatbots and IoT enhance operational efficiency, they may also reduce the demand for manual skills, posing challenges to the labor market. Policymakers should independently assess the strategic potential of each thematic cluster to support targeted interventions. For banking professionals in India, this study highlights actionable opportunities to improve AI utilisation in areas such as credit scoring, risk management, and customer service through tools like chatbots. By automating routine tasks, AI allows human resources to focus on higher-value functions while enhancing marketing segmentation for more tailored and effective service delivery.

This study has several limitations that should be acknowledged. First, the analysis relies exclusively on the Scopus database, which may exclude relevant literature available in other sources such as Web of Science, IEEE Xplore, or Google Scholar, potentially limiting the comprehensiveness of the review. Additionally, bibliometric analysis, by nature, emphasises quantitative metrics-such as publication counts and citation frequencies-over the

qualitative depth of content, which may overlook the nuanced contributions of individual studies. The selection of keywords was also partially subjective, possibly influencing the scope of identified themes.

Future research should consider integrating multiple bibliographic databases and employing diverse bibliometric tools to capture a broader and more representative spectrum of scholarly output.

Moreover, this study presents a static snapshot of a rapidly evolving field. Ongoing advancements in AI technologies, changes in ESG regulatory frameworks, and shifting global banking dynamics may affect the long-term relevance and applicability of the current findings. As such, longitudinal studies and continuous updates are essential to maintain accuracy and relevance in this domain.

Author Contributions

MAH: Wrote the original draft and Database Collection.
AH: Metadata analysis.
AUR: Conceptualisation, Ideation and Method.
AG: Visualization & Mapping.
AP: Design the methodology and revisions.

All the authors read and approved the final manuscript.

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