Artificial Intelligence in Financial Risk Management: A Bibliometric Review

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ABSTRACT

This study presents a bibliometric analysis of research studies on the integration of artificial intelligence (AI) within the financial risk management, analyzing a dataset of 791 publications indexed in Scopus from 1987 to 2025. The primary objective of this research is to systematically map the global distribution of academic authority by identifying the core contributors: the most prolific authors, leading institutional affiliations, and the top performing countries driving the academic agenda. Additionally, the study tracks the evolution of authors' keywords to monitor shifting thematic trends over time. The results reveal a sharp increase in research output in 2024, while long-term citation impact remains concentrated in earlier works such as Barboza et al. (2017). Geographically, India and China dominate in publication amount, whereas the U.S. and the U.K. lead in citation influence. Co-authorship networks Indicate highly fragmented collaboration structures among authors and institutions, with localized regional clusters prevailing over integrated global partnerships. Thematic mapping shows strong integration of AI with risk assessment and diversification into diverse topics, including advanced analytics and sustainability. Despite limitation of reliance on a single database, this review provides a comprehensive overview of the intellectual structure and research dynamics in the evolving field. The findings offer valuable insights for scholars and practitioners, guiding future research directions and supporting the development of AI applications in financial risk management.

Keywords—Bibliometric Analysis; Artificial Intelligence; Financial Risk Management; Prolific Authors; Geographic Distribution.

INTRODUCTION

Artificial Intelligence (AI) has become a transformative force in financial risk management, reshaping how institutions identify, assess, and respond to risks. Traditional models, while foundational, often fail to capture the complexity and volatility of modern markets. AI offers real-time analytics, predictive insights, and automation, enhancing credit assessments, fraud detection, and market forecasting (Kotvics, 2025). However, its adoption introduces systemic risks such as herding behavior and cybersecurity vulnerabilities, requiring robust governance (Leitner et al., 2024).

Despite growing interest, recent bibliometric research has explored AI in the broader financial sector and general banking risk. However, there is a lack of specialized analysis at their intersection. To clarify this relationship, this study defines financial risk management through its core categories – credit, market, operational, and systemic risk – and considers AI as a multi-paradigm framework which includes machine learning (ML), NLP, and explainable A (XAI). The absence of a dedicated review at this specific intersection results in a fragmented understanding of the field's intellectual and thematic evolution. To address this gap, this study conducts a comprehensive bibliometric analysis using Scopus data to examine publication trends, influential authors, institutions, countries, and emerging themes. Research questions include: What are the publication trends? Who are the most prolific authors? Which institutions and countries lead? What are the most cited documents and dominant keywords? How do co-authorship and thematic patterns evolve?

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LITERATURE REVIEW

The literature on financial risk management (FRM) has evolved from basic hedging and regulatory compliance to data-driven strategies. Tools like Value-at-Risk and stress testing have shown limitations during crises such as 2008 and COVID-19 (Alexander, 2005; Canturk & Tolga, 2022). AI has emerged as a solution, providing flexibility and scalability to manage complex risks (Fritz-Morgenthal et al., 2022). Early AI applications in finance included rule-based systems for trading and risk analysis, advancing machine learning and deep learning for credit scoring, fraud detection, and portfolio optimization (Quinn, 2023; Buchanan, 2019). Recent developments feature NLP for unstructured data and explainable AI frameworks for transparency (Fritz-Morgenthal et al., 2022).

Several bibliometric studies examined related domains. Roy et al. (2025) mapped AI in finance, while Nguyen (2024) focused on banking risk management. Cholan et al. (2025) analyzed AI in financial risk early warning systems, and Apriantoro et al. (2025) explored Islamic banking risk management. These studies reveal thematic clusters and growth patterns but share limitations due to reliance on single databases. Table 1 summarizes previous bibliometric studies, highlighting gaps such as insufficient focus on AI-driven FRM, and limited interdisciplinary integration. This underscores the need for a targeted bibliometric review to consolidate fragmented knowledge and guide future research.

Table 1 Summary of previous studies

Author	Domain / Search Strategy	Data Source & Scope	TDE	Bibliometric Attributes Examined
Chohan et al. (2025)	AI in Financial Risk Early Warning Systems	Scopus	1,224	- Publication trends, - co-authorship networks, - keyword co-occurrence, - thematic mapping
Apriantoro et al. (2025)	Risk management in Islamic banking	Scopus	716	- Publication trends, - co-authorship networks, - keyword co-occurrence, - leading authors/institutions, - thematic evolution
Nguyen (2024)	Banking risk management	Scopus	286	- Publication & citation trends, - author/institution/country mapping, - thematic clusters
Ali & Hana (2021)	Business financial risk	Web of Science	3,024	- Keyword co-occurrence, - thematic clusters, - collaboration patterns, - influential sources
Roy et al. (2025)	AI and finance	Web of Science	607	- Production trends, - co-authorship, - citation network, - thematic mapping

MATERIAL AND METHODOLOGY

To ensure transparency, objectivity, and absolute applicability, this study adopts A systematic bibliometric design. Developmental analysis utilized mathematical and statistical metrics to evaluate the meta parameters of a designated body of literature, all free and empirical overview of a scientific fields' structure.

Data retrieval and search strategy

The Bibliometric data for this study we retrieve exclusively from the Scopus database. Scopus was selected as the sole repository due to its strict peer review vetting standards and comprehensive indexation of high impact journals spanning economics finance and computational sciences. The data extraction was constrained strictly to title comma abstract comma and keyword fields with ("artificial intelligence" AND ("finance OR financial") AND "risk management") as the search query. The intention is to capture the integrated domain of artificial intelligence in financial risk management, rather than focus on specific risk mitigation instruments such as hedging and derivatives. All records obtained through the search query retained without exclusion based on document type, language, or subject area to ensure an unbiased representation of the field's publication landscape. This search covers publications from 1987 to 2025, beginning in 1987 as it is the earliest indexed publication in Scopus that met the defined search criteria. A total of 791 records retrieved, and metadata files downloaded for detailed analysis.

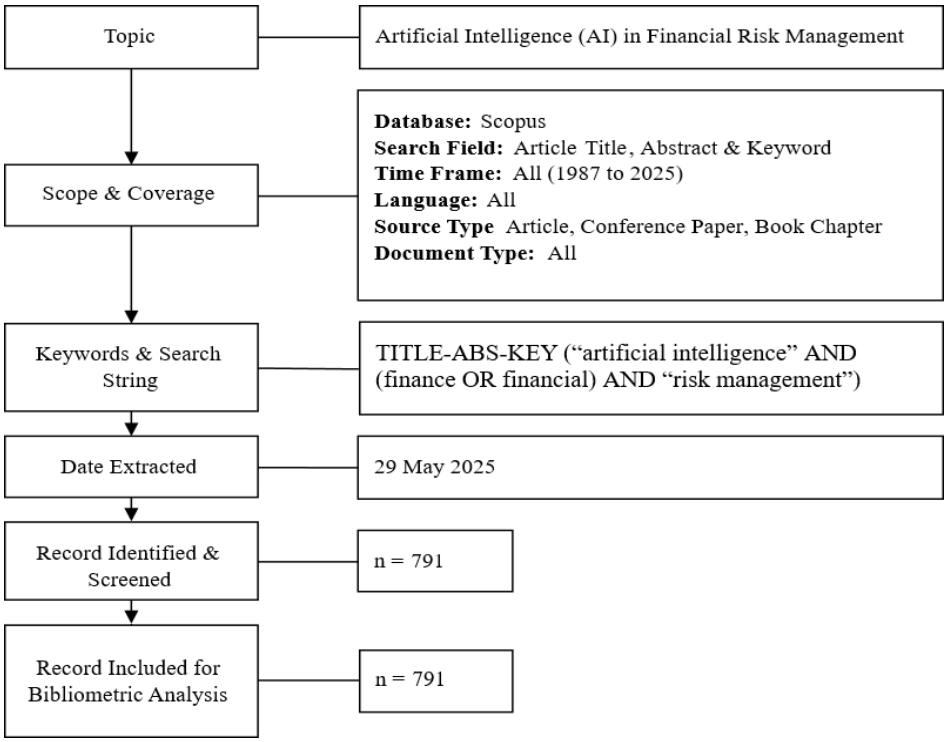

Figure 1 Flow diagram of the search strategy.

Source: Zakaria et al. (2021), Moher et al. (2009)

Data processing and cleaning

To resolve metadata inconsistencies and maximize analytical precision prior to analysis, a rigorous data cleaning protocol was conducted. The raw metadata was first imported into OpenRefine to normalize typographical variations, correct keyword spelling inconsistencies, refine author name formats, and standardize institutional and country naming conventions to prevent distortions in the final productivity and citation rankings. Following this refinement phase, the entire normalized dataset was imported into and process through BiblioMagika®, which serves as the primary computational and statistical engine for this study. BiblioMagika® executed the comprehensive calculation of all core descriptive bibliometric metrics, institutional rankings, publication volumes, geographic yields, and citation distributions.

Visual mapping

Once the primary data processing and statistical calculations were finalized via BiblioMagika®, they generated analysis files were imported into VOSviewer. Within this study, VOSviewer was utilized exclusively as a visual mapping application to construct networks from the pre-processed data. This application generated the visual

co-authorship networks used to map out global collaboration dynamics and keyword co-occurrence structures to illustrate the thematic evolution of the discipline over time.

RESULTS AND DISCUSSION

Documents profiles

The bibliometric analysis encompassed 791 publications retrieved from Scopus between 1987 and 2025. The most prevalent document type was conference papers (38.56%), followed by journal articles (37.17%). However, in terms of source type, most publications are journals (42.10%), followed by conference proceedings (32.36%), This discrepancy is due to the sizable portion of conference papers formally published within indexed journals or specialized book series rather than standalone proceedings. The high volume of conference-based research is typical for the AI field, where rapid technological shifts favor the faster dissemination cycles of international conferences, many of which later mature into journal publications. This indicates a balanced mix of peer-reviewed and scholarly dissemination platforms.

Language analysis shows English overwhelmingly dominates (98.23%), with minor contributions in Chinese (1.39%), and German, Korean, Spanish, and Turkish (0.13% each). Additionally, the publications span multiple disciplines, with Computer Science (61.44%) and Engineering (30.34%) as leading subject areas. Business, Management and Accounting (25.79%), Economics (25.41), and Mathematics (21.11%) also feature prominently, underscoring the interdisciplinary nature of AI in financial risk management.

Publication trends

Annual publication trends show a sharp increase in research output post-2017, peaking in 2024 with 250 publications. Despite this surge, citation analysis indicates that 2017 was the most impactful year, with 1,073 citations across 12 publications (Figure 2). The g-index peaked at 26 in 2020, while the h-index reached its highest value of 15 in 2022.

This disparity suggests that recent research in AI has surged in quantity, transforming it from a theoretical concept into a structural necessity for institutional resilience, but its foundational intellectual quality still relies on earlier studies. This reflects an evolutionary shift in the field, transitioning from significant theoretical discovery to a phase characterized by high-volume, data-driven practical applications.

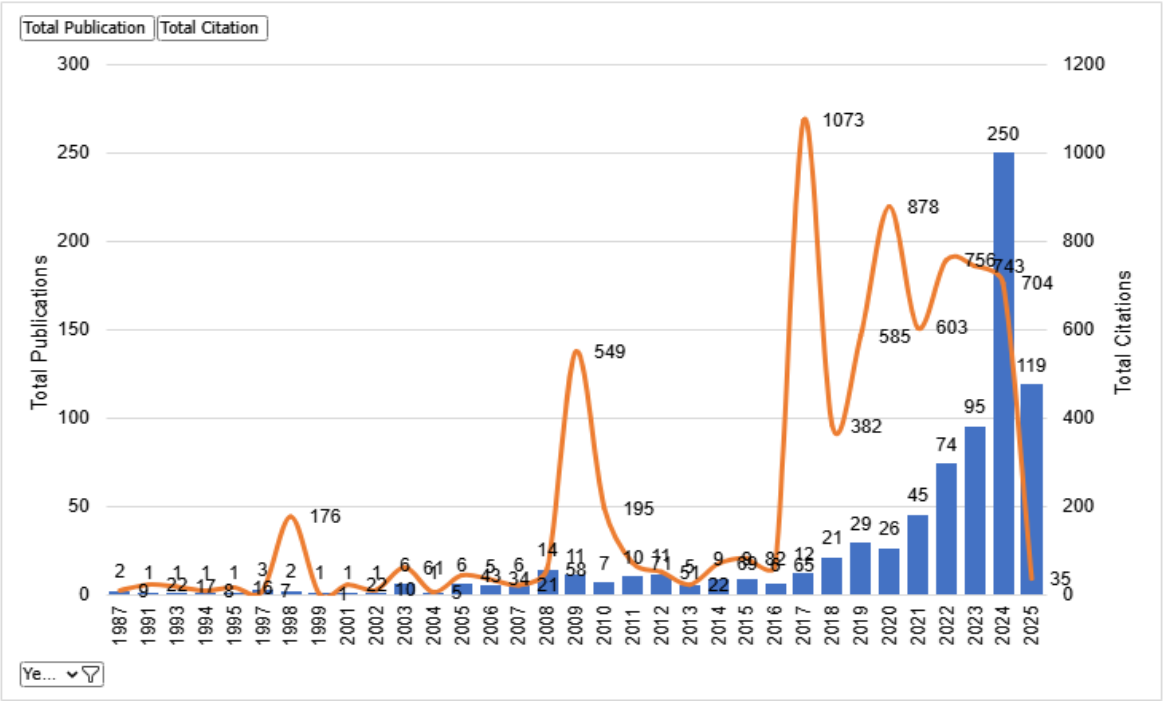

Figure 2 Total Publications and Citations by Year

Publications by Authors

Author analysis identifies Giudici, Paolo (University of Pavia, Italy) as the most prolific contributor, with 6 publications and 432 citations. Other notable authors include Ahn, Hyunchul and Kim, Kyoung-jae From South Korea, each with 3 publications and 190 citations (Table 2).

Table 2 10 Most productive authors

Author's Name	Affiliation	Country	TP	NCP	TC	C/P	C/CP	*h*	*g*
Giudici, Paolo	University of Pavia	Italy	6	6	432	72.00	72.00	4	6
Irfan, Mohammad	NSB Academy	India	5	5	8	1.60	1.60	2	2
Al Janabi, Mazin A. M.	Monterrey Institute of Technology	Mexico	4	4	42	10.50	10.50	3	4
Nwogugu, Michael	Business Consultant	USA	4	4	41	10.25	10.25	3	4
Hsu, Ming-Fu	Chinese Culture University	Taiwan	4	4	23	5.75	5.75	2	4
Grima, Simon	University of Malta	Malta	4	2	3	0.75	1.50	1	1
Ahn, Hyunchul	Kookmin University	S. Korea	3	3	190	63.33	63.33	3	3
Kim, Kyoung-jae	Dongguk University	S. Korea	3	3	190	63.33	63.33	3	3
Raffinetti, Emanuela	University of Pavia	Italy	3	3	48	16.00	16.00	2	3
Lin, Sin-Jin	Chinese Culture University	Taiwan	3	3	22	7.33	7.33	2	3

Analysis of the most prolific authors reveals a clear distinction between high-frequency productivity and long-term scholarly impact. While top-ranked authors lead in publication counts, their citation metrics vary, indicating high output does not correlate with widespread influence.

Publications by institutions

Institutional productivity analysis highlights Chitkara University, India as the most prolific institution with 18 publications, followed by MIT World Peace University and Koneru Lakshmaiah Education Foundation (15 publications each). In terms of citation impact, University of Pavia, Italy stands out with 706 citations from 11 publications, averaging 64.18 citations per publication (Table 3).

This indicates a fragmented landscape of knowledge production, where research intensity concentrated within localized technical clusters instead of a cohesive global network. Consequently, institutional research influenced by regional financial regulations and specific national AI mandates, hindering the establishment of a unified global framework for AI-driven risk management.

Table 3 Most productive institutions with minimum of eleven (11) publications

Affiliation	Country	TP	NCP	TC	C/P	C/CP	*h*	*g*
Chitkara University	India	18	10	27	1.50	2.70	3	5
MIT World Peace University	India	15	3	11	0.73	3.67	1	3
Koneru Lakshmaiah Education Foundation	India	15	2	6	0.40	3.00	2	2
Via del Politecnico SNC	Italy	14	0	0	0.00	0.00	0	0
Uttaranchal University	India	13	10	318	24.46	31.80	6	13
China Agricultural University	China	13	9	91	7.00	10.11	2	9
Symbiosis International (Deemed University)	India	13	3	15	1.15	5.00	3	3
Hunan University of Finance and Economics	China	12	12	564	47.00	47.00	6	12
Graphic Era	India	12	10	85	7.08	8.50	5	9
University of Pavia	Italy	11	11	706	64.18	64.18	6	11
Christ University	India	11	5	17	1.55	3.40	3	4

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Publications by countries

Geographically, India dominates with 583 publications, followed by China (363) and the United States (186). However, citation impact is highest for the United Kingdom (23.10 citations per publication) and Germany (22.56). South Korea and Brazil exhibit exceptional citation performance relative to their publication volume (Table 4; Figure 3).

The dominance of India and China in publication counts highlights a shift toward emerging-economy research dynamics, driven by large-scale digital transformation and AI investment. However, the higher citation per paper ratios in the U.S. and U.K. suggest that while research quantity is growing rapidly in emerging markets, the foundation methodological influence still largely originates from established western financial institutions.

Table 4 Top 10 countries contributed to the publications.

Country	TP	NCP	TC	C/P	C/CP	*h*	*g*
India	583	240	2059	3.53	8.58	27	45
China	363	215	2597	7.15	12.08	24	50
United States	186	131	3045	16.37	23.24	22	55
Italy	109	78	1665	15.28	21.35	23	40
United Kingdom	96	74	2218	23.10	29.97	18	47
Russian Federation	57	36	538	9.44	14.94	18	23
Taiwan	50	40	375	7.50	9.38	11	19
Ukraine	48	31	106	2.21	3.42	7	10
Saudi Arabia	48	18	129	2.69	7.17	6	11
Germany	45	34	1015	22.56	29.85	12	31

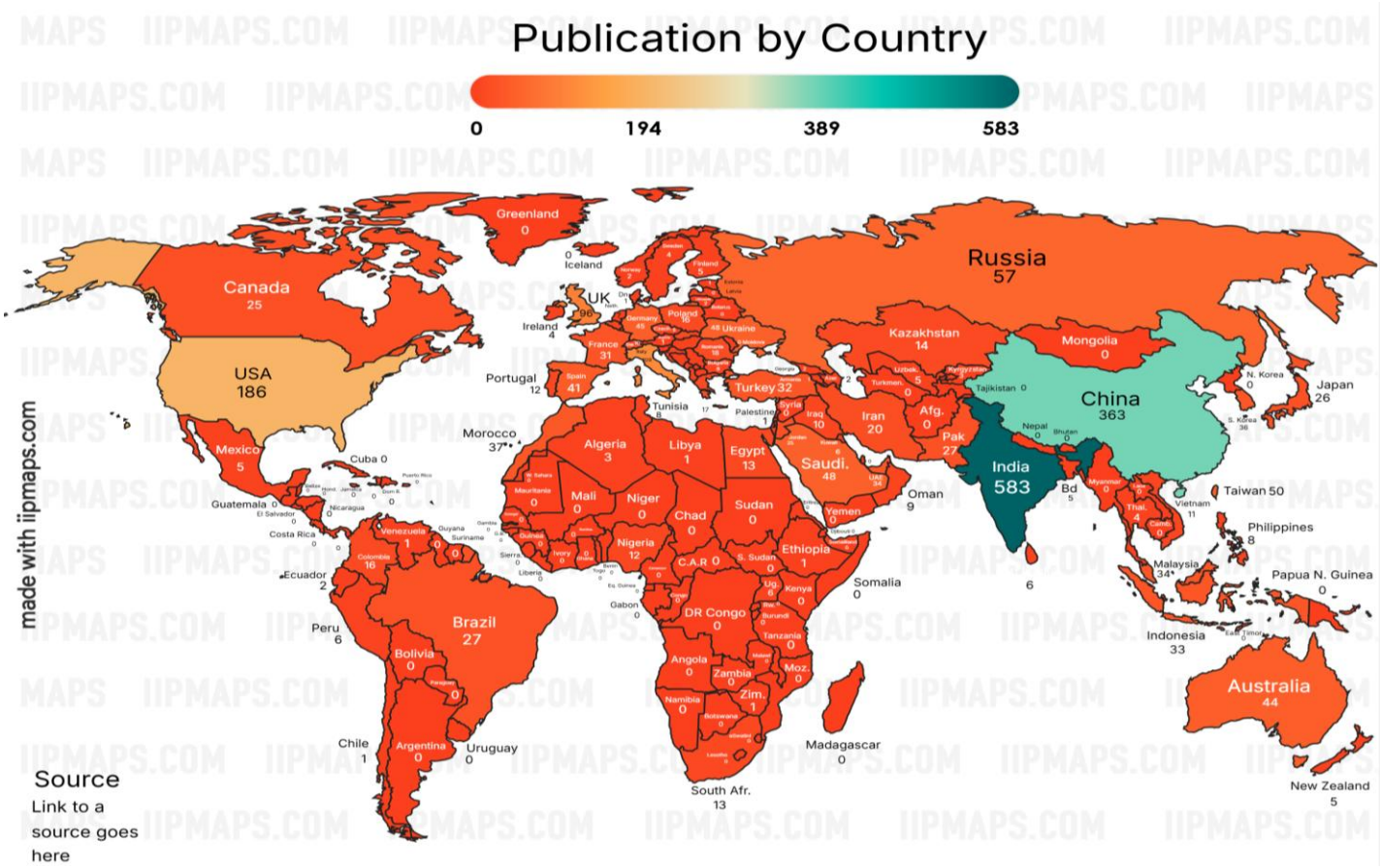

Figure 3 Worldwide publications indexed by Scopus on AI in financial risk management.

Citation metrics

Overall, the dataset comprises 791 papers, accumulating 7,373 citations over 39 citable years, averaging 194.03 citations per year and 9.32 citations per paper. The h-index stands at 38, and the g-index at 72, indicating a robust scholarly footprint.

Highly cited documents

The most cited paper is Barboza et al. (2017) on machine learning models for bankruptcy prediction, with 589 citations and average 65.44 citation per year. Other influential works include Singh et al. (2020) on blockchain-AI convergence (426 citations) and Heaton et al (2017) on deep learning for finance (367 citations).

Table 5 Top 5 highly cited articles

No.	Authors	Title	Cites	C/Y
1	Barboza F.; Kimura H.; Altman E. (2017)	Machine learning models and bankruptcy prediction	589	65.44
2	Singh S.; Sharma P.K.; Yoon B.; Shojafar M.; Cho G.H.; Ra I.-H. (2020)	Convergence of blockchain and artificial intelligence in IoT network for the sustainable smart city	426	71.00
3	Heaton J.B.; Polson N.G.; Witte J.H. (2017)	Deep learning for finance: deep portfolios	367	40.78
4	Bussmann N.; Giudici P.; Marinelli D.; Papenbrock J. (2021)	Explainable Machine Learning in Credit Risk Management	225	45.00
5	Varetto F. (1998)	Genetic algorithms applications in the analysis of insolvency risk	176	6.29

Top keywords

Keyword analysis shows that “artificial intelligence” (281 occurrences), “risk management” (151), and “machine learning” (130) are the most frequent terms. Other commonly used keywords include “fintech”, “deep

learning”, “blockchain”, and “credit risk”, indicating the breadth of research themes within this domain.

Co-authorship and co-occurrence analysis

Co-authorship by authors

Figure 4 illustrates the author collaboration network, showing links among authors with at least 2 publications. The visualization reveals several small clusters, indicating fragmented collaboration patterns. Central nodes like Zhang L. and Wang X. act as connectors between clusters, suggesting their role in bridging research groups. The network shows limited cross-cluster connections, indicating that collaborations mostly confined within specific groups.

The fragmented structure highlights the need for knowledge integration, where bridging authors and cross-group collaboration can help connect risk-specific streams (e.g., credit, fraud/operational, market/systemic) and consolidate governance-oriented discussions (e.g., explainability, model risk, cyber resilience). Limited cross-cluster ties also point to the value of methodological standardization, which can reduce comparability barriers and make collaboration easier across methods and risk contexts. Finally, the presence of connectors with persistent fragmentation suggests a field in early-to-mid maturity. (Core groups have formed, yet broader consolidation and stable interdisciplinary collaboration are still developing.)

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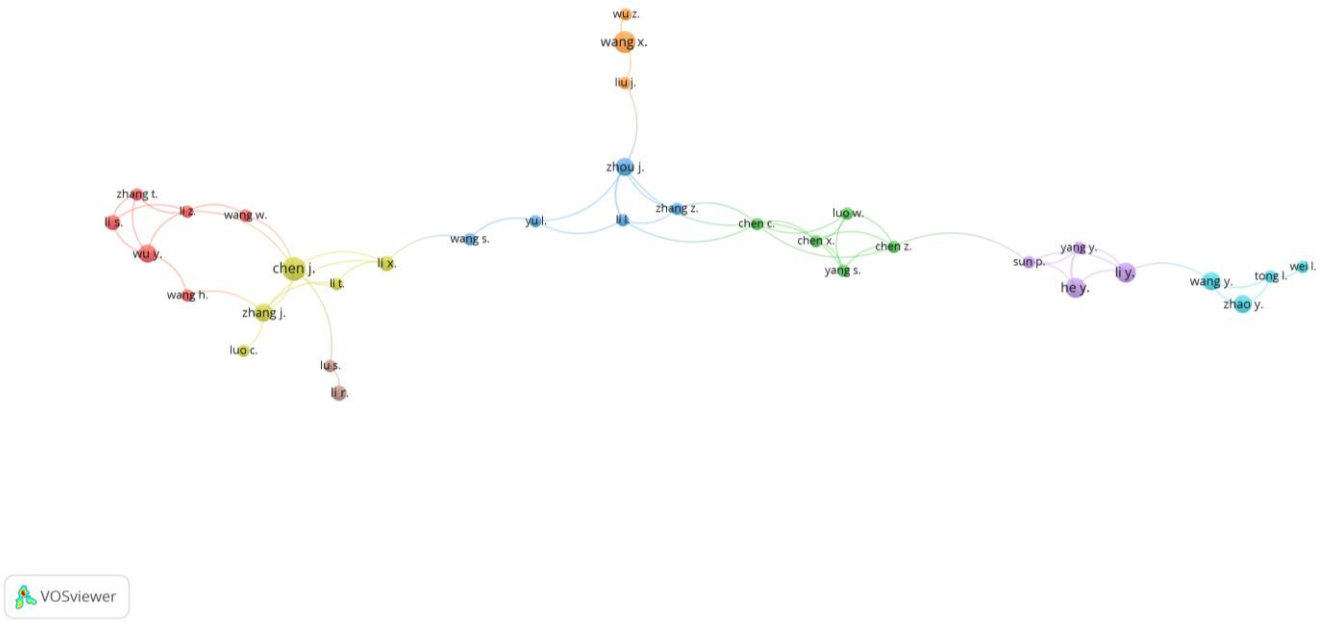

Figure 4 Network visualization map of the co-authorship by authors.

Co-authorship by institutions

The collaboration network for organizations with at least 2 publications. The network is sparse, with few visible links. Notable connections include Volgograd State University and Volgograd State Technical University, along with ties to National Technical University. Overall, collaboration limited, implying research concentrated within individual institutions.

Sparse institutional ties indicate that knowledge integration is not yet strongly institutionalized research appears to progress in parallel rather than through coordinated centers which can slow synthesis across risk categories and governance perspectives. Strengthening methodological standardization at the institutional level would support joint projects and improve the transferability of findings across contexts. From a field-development perspective, limited organizational collaboration signals partial maturity. The topic is productive, but institutional networks have not yet converged into dense, globally coordinated structures typical of more mature research domains.

Co-authorship by countries

Figure 6 shows the international collaboration network, highlighting countries with at least 2 publications. India and China have largest nodes, reflecting their high publication volume, followed by the United States and the United Kingdom. The visualization reveals strong regional clusters, with India connected to Asian countries and China linked to Europe and the U.S. Overall, global collaboration exists but is less extensive than regional partnerships.

Regional clustering suggests opportunities for stronger knowledge integration through cross-regional collaboration, especially to align research agendas on governance, systemic risk, and regulatory expectations that vary across different areas. Plus, expanding global ties linked closely to methodological standardization: internationally shared benchmarks, harmonized reporting, and comparable risk taxonomies would make results easier to validate across markets and regulatory environments. The combination of visible hubs with regional links indicates a field progressing toward greater maturity, but not yet exhibiting the dense, diversified global collaboration patterns seen in fully consolidated research areas.

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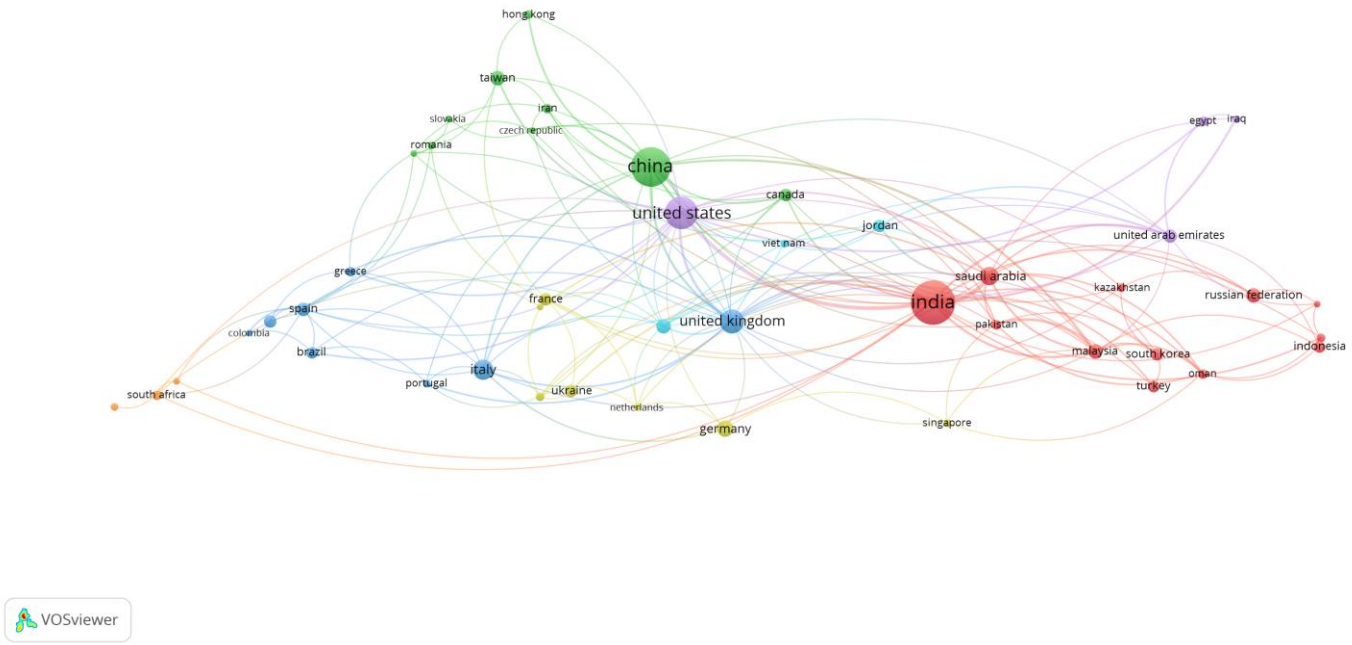

Figure 5: Network visualization map of co-authorship by countries.

Co-occurrence of author's keywords

Figure 6 illustrates strong connections between clusters, showing that certain themes frequently co-occur in the same studies. For instance, data indicates that machine learning techniques often paired with risk assessment, while blockchain-related terms are associated with financial security topics. The overlay visualization includes a timeline, revealing that earlier clusters focused on fundamental AI and risk concepts, while recent years emphasize emerging areas like sustainability and advanced analytics. This trend highlights the expansion and increasing interconnection of research themes over time.

Importantly, the observed shift toward sustainability-related keywords can be interpret as a movement toward ESG oriented risk research, where AI is applied in climate risk measurement, sustainability reporting, reputational risk monitoring, and governance-related decision support. This development also triggers regulatory and supervisory pressure for greater transparency, stress testing, and disclosure prompting stronger demand for analytics that can process large-scale, unstructured ESG and translate it into risk signals. In parallel, the rise of advanced analytics indicates a push toward higher performing models for complex risk environments, while simultaneously intensifying concerns around explainability, validation, and model governance in regulated settings.

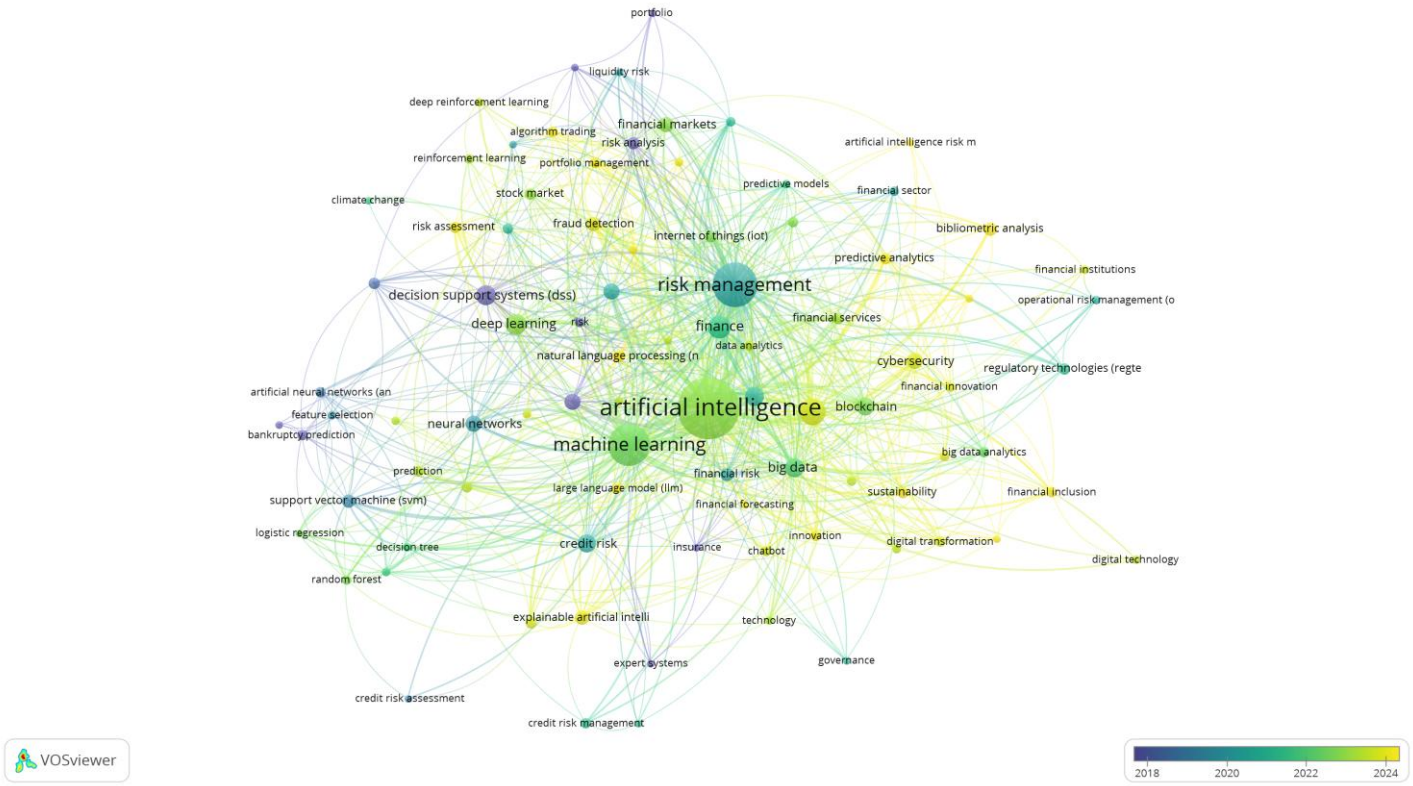

Figure 6: Overlay visualization of the author's keywords.

CONCLUSION

In conclusion, this bibliometric review reveals a critical structural divergence within the literature and artificial intelligence in financial risk management. While global research output has experienced an exponential acceleration, actual academic influence remains heavily concentrated within early, foundational publications rather than recent computational advancements. Geographically, a profound imbalance persists where emerging economic hubs such as India and China lead global production in document counts, whereas western institutions in the United States and the United Kingdom continue to command systemic citation impact. Furthermore, network mapping exposes a highly fragmented global collaboration architecture, where regionalized and isolated research clusters consistently override integrated international partnerships, highlighting a significant lack of cross-border academic cohesion in the discipline.

Overall, the collaboration and keyword analyses (Sections 4.9.1 – 4.9.4) suggest that the field is progressing toward greater knowledge integration and thematic convergence but would benefit from stronger methodological standardization and broader cross-group collaboration as it matures particularly as newer themes such as sustainability/ESG and governance become more prominent. This study contributes by structuring a fragmented research landscape into an integrated map of actors, collaboration patterns, and evolving themes that clarifies how AI is being position within financial risk governance. The findings indicate the need for more consistent benchmarking and reporting practices (e.g., shared risk taxonomies, comparable metrics, and robust validation) to improve reproducibility and comparability across studies. For financial institutions, the results reinforce that effective AI adoption in risk functions requires governance by design covering explainability, validation, monitoring, and cyber/data controls while preparing for increasing regulatory and ESG related risk expectations.

From a practical perspective, this fragmentation may lead to the development of separate and incompatible regional AI risk management frameworks. Therefore, financial institutions and international regulatory bodies should strengthen cross-border collaboration to ensure that predictive AI tools operate under more consistent global operational and compliance standards.

Several limitations should also be acknowledged in this study. First, the use of a single Database creates a with coverage limitation, as the relevant peer-reviewed studies indexed in other databases such as Web of Science (WoS) were not included. Second, citation-based metrics may introduce chronological bias by favoring older publications that have had more time to accumulate citations compared to recently published studies. In addition, search-string limitations and possible underrepresentation of non-English publications may have reduced the overall global representation of the dataset.

For future research, greater emphasis should be placed on cross-regional collaboration to reduce the current fragmentation in co-authorship networks. Future studies should also examine how the rapid growth of AI related research aligns with emerging national AI regulations and corporate environmental, social, and governance (ESG) reporting requirements. Furthermore, researchers should work toward developing standardized evaluation frameworks that integrate advancements in credit, market, and operational risk into more comprehensive early warning systems.

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