Research Progress and Challenges of the Application of Digital Finance Driven by Artificial Intelligence Technology

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Abstract. This study explores the integration of AI and digital finance, using bibliometrics to analyze 1,000 Web of Science core literatures (2015-2025). Key findings: Authors form symbiotic multi-disciplinary groups led by core scholars; Institutional practices show regional collaboration model differences, with industry-academia collaboration effectiveness critical; National participation trends toward multi-polar complementarity with distinct local paths; Themes evolve from technical layers to application scenarios, driven by emerging technologies. It offers empirical references for optimizing disciplinary collaboration and balancing tech innovation with financial stability.

Keywords: Artificial Intelligence, Digital Finance, Bibliometric Analysis, Collaboration

1 Introduction

The digital transformation of the financial industry is accelerating. Digital finance has become indispensable in today's economy, fundamentally reshaping how individuals access capital, businesses manage operations, and economies facilitate transactions. Artificial intelligence technology, with its powerful data processing and intelligent decision-making capabilities, has become a key force driving the development of digital finance [1][2]. Its ability to enhance efficiency, manage risk, and create personalized financial products makes it a critical enabler of the inclusive and resilient financial systems demanded by the modern world. While bringing significant benefits, it also faces many practical challenges [3]. This article uses bibliometric analysis to explore Al and digital finance progress and challenges, summarizing existing problems and trends to comprehensively overview the field's development.

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2 Research Methods and Data Sources

2.1 Research Methods

Bibliometrics is a key tool for analyzing scientific and technological information, aiming to extract valuable trend information from a vast amount of literature [4]. It quantitatively assesses research output, impact, collaboration status, and topic evolution through statistical analysis of academic literature characteristics like quantity, source, and citation [5]. This paper studies the bibliometric method with the aid of two visualization tools, VOSviewer and CiteSpace.

2.2 Data Sources

To ensure the coverage and authority of the data analyzed, the Web of Science (core collection) was selected as the data source, the indexes were selected as SSCI and SCI-Expended, the search strategy selected was TS=(("Artificial Intelligence" OR "Machine Learning" OR "Deep Learning") AND ("Digital Economy" OR "Digital Transformation" OR "Firm Performance")), with a time span starting from January 2015 to August 2025, a search time cutoff of August 6, 2025, and a literature type selected as Articles and a language of English, and 1707 literature records were obtained after the search. However, literature data directly retrieved often contains duplicates or irrelevant records, which can contaminate analysis and distort results. Therefore, preprocessing the raw data to purify the dataset is a prerequisite for bibliometric analysis [6]. The researchers of this article screened these documents and sorted out 1,000 valid ones. The 1000 papers used in this study were from 3384 authors at 1704 organizations in 84 countries and published in 438 journals.

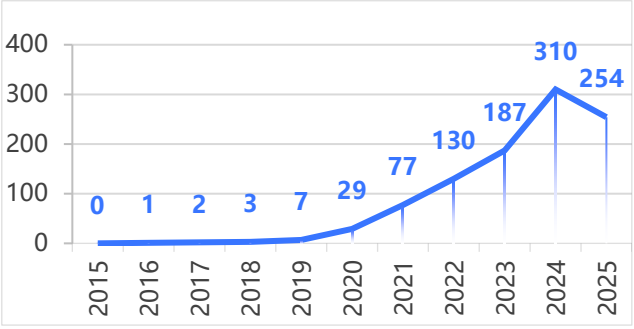

Fig. 1. Distribution of publications from 2015 to 2025

Figure 1 shows the publication trends in Al and digital finance research from 2015 to2025. Annual paper counts remained low during the initial accumulation phase from2015 to2019. A period of explosive growth began in 2020, driving publication numbers to surge exponentially. As of August 2025, the count for the year stands at 254, reflecting the field's rapid expansion fueled by advances in Al.

3 Descriptive Statistics

3.1 Bibliometric Analysis of Authors

Author group bibliometric analysis quantifies productivity, collaboration networks, and academic influence to identify core scholars, emerging forces, and cross-border collaboration hubs [7]. The following are the top 5 authors who have published the most literature in this field.

Table 1. Most important authors in the Artificial intelligence technology and digital finance research field

Rank	Author	Documents	Citations	Average Citation
1	Chatterjee Sheshadri	7	622	88.86
2	Prida Vinit	6	560	93.34
3	Gupta Shivam	6	364	60.67
4	Mikalef Patrick	5	714	142.80
5	Dubey Rameshwar	5	595	119.00

In table 1, High-impact scholars in Al and digital finance demonstrate dual strengths in quality and quantity. Mikalef Patrick leads with pioneering work on financial Al governance. Parida Vinit and Dubey Rameshwar show sustained innovation, while prolific contributors such as Chatterjee Sheshadri drive knowledge expansion.

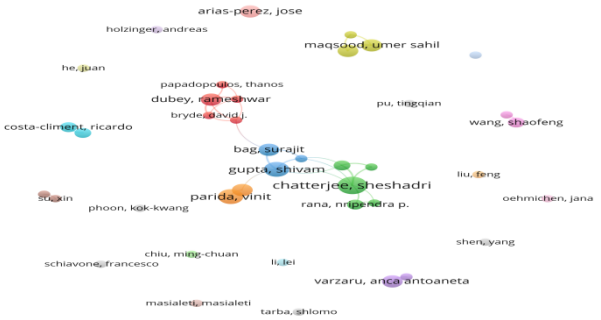

Fig. 2. Co-occurrence of Authors

Figure 2 has undergone visual analysis. It is a co-occurrence graph of authors who have published at least three papers in the field. The larger the circular nodes in the graph, the more articles have been published. The connection lines of nodes represent the strength of association. The thicker the lines, the more articles the two authors have jointly published. The colors of nodes indicate different clusters. Three structural barriers cause fragmented collaboration in this field: (1) Cognitive barriers: Incompatible terminology between technical, application, and regulatory groups, like technical "model robustness" versus regulatory "compliance level"[8]. (2) Methodological

barriers: Isolated methods prevent compatibility between technical solutions, business needs, and regulatory frameworks. (3) Institutional barriers: Differing academic evaluation systems and resource allocation create data isolation across groups.

3.2 Bibliometric Analysis of Institutions

Institutional research identifies authoritative institutions' distribution, reveals collaboration among top universities, corporate labs, and government platforms, and informs innovation strategies [9]. The following are the top 5 institutions which have published the most literature in this field.

Table 2. Five major institutions in the Artificial intelligence technology and digital finance research field

Rank	Institution	Documents	Citations	Average Citation
1	Royal Melbourne Institute of Technology	13	267	20.54
2	Xi'an Jiaotong University	12	193	16.08
3	Norwegian University of Science and Technology	9	679	75.44
4	University of Vaasa	9	577	64.11
5	NEOMA Business School	9	503	55.89

In table 2, the field exhibits a dual-track pattern: European institutions dominate quality with an average citation of 65.15, while Asia-Pacific leads volume exemplified by Royal Melbourne Institute of Technology's 13 papers. Norwegian University of Science and Technology commands influence through industry collaborations such as its real-time financial data sandbox with Norse Bank. University of Vaasa directly shaped EU regulatory guidelines. Conversely, Asia-Pacific institutions face constraints like Royal Melbourne Institute of Technology's missed blockchain opportunities due to technical path dependence, reflected in their lower average citation of 18.31. Europe's 3.6-fold citation advantage underscores the decisive role of industry-academia-regulation integration.

Figure 3 is a visualization analysis of the co-occurrence of institutions that have published at least three papers in the field. The larger the circular nodes in the graph, the more articles have been published. The connection lines of nodes represent the strength of association. The thicker the lines, the more articles the two institutions have jointly published. The colors of nodes indicate different clusters. It can be seen that this cooperation network presents the characteristics of isolation between the two cores of China and Europe and the disconnection between industry and academia: The Chinese research cluster, with Xiamen University and Central University of Finance and Economics at its core, forms a close collaboration network, but the scope of cooperation is limited to domestic universities. The Norwegian University of Science and Technology only maintains a weak cooperation with Dresden University of Technology. What is more serious is that enterprise entities are isolated from academic networks: universities focus on theoretical innovation but are unable to meet

the demands of enterprises. This triple barrier of system, technology and application is not conducive to the sustainable development of this field [10].

3.3 Bibliometric Analysis of Countries

Country analysis is a core methodology for decoding technological geopolitics, the allocation of innovation resources, and the adaptability of systems and technologies [11] The following are the top 5 countries which have published the most literature in this field.

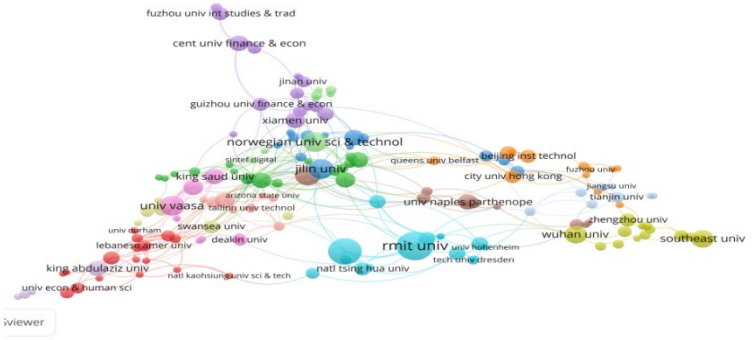

Fig. 3. Co-occurrence of Institutions

Table 3. Five major countries in the Artificial intelligence technology and digital finance research field

Rank	Country	Documents	Citations	Average Citation
1	China	362	4627	12.78
2	USA	141	5867	41.61
3	England	88	3506	39.84
4	Germany	66	1640	24.84
5	France	60	2963	49.38

From table 3, China ranked first with 362 published articles, but the average citation per article was the lowest. The 141 articles in the United States have achieved an average citation count of 41.61, demonstrating the dominance of industry-academia collaboration in innovation. France topped the list with 49.38 citations per 60 articles, relying on its mathematical tradition to lead the way in computing. European division: England is deeply engaged in regulatory technology, while Germany focuses on industrial applications.

Figure 4 has undergone visual analysis. It is a co-occurrence graph of countries that have published at least five papers in the field. The larger the circular nodes in the graph, the more articles have been published. The connection lines of nodes represent

the strength of association. The thicker the lines, the more cooperation there is between two countries. The colors of nodes indicate different clusters. Figure 4 reveals a significant Top effect: China, the US, and the UK form a core triangle accounting for over 60% of publications. Here, US tech giants deeply integrate with China's fintech ecosystem and UK regulatory frameworks, showcasing core cooperation shaped by distinct institutions. Europe exhibits fragmented multi-centrism due to leadership absence. Divergent EU GDPR implementations for financial data hinder initiatives like the European Payments Initiative, reflecting institutional fragmentation. Emerging forces show gradient stratification: Gulf countries lead Islamic finance through capital advantages, supported by unified Sharia regulators in Bahrain and UAE DIFC enabling regional collaboration, while Southeast Asia emerges as a research pole. ASEAN's push to harmonize digital payments through standardized QR codes shows institutional alignment fostering cooperation. This confirms Al finance's geopolitical rule: leading nations reshape ecosystems via technological radiation and scale spillover, whereas leaderless regions face marginalization.

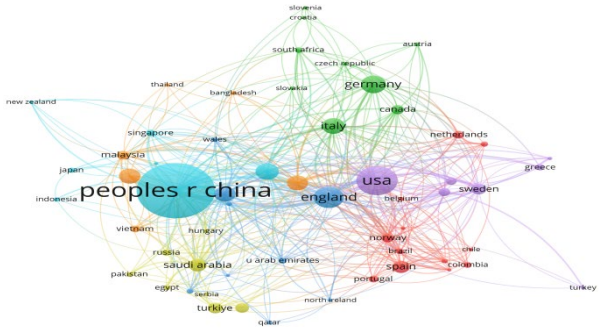

Fig. 4. Co-occurrence of Countries

4 Visual Analysis and Discussion

4.1 Co-Occurrence Analysis on Keywords

Keyword analysis is conducive to providing anchor points of mainstream trends and coordinates of hotspots for resource investment [12]. To optimize the competitiveness of the papers, the researchers used VOS viewer to conduct keyword density mapping on 1,000 papers and selected keywords with a occurrence frequency of greater than or equal to 5 for visualization. The result is as shown in the figure. The higher the brightness in figure 5, the more frequently the keyword appears. High-frequency keywords such as Al, big data, digital economy reveal a three-layer framework: technical core (Al/big data), economic loop (digital economy/ fintech), and innovation frontier (generative Al/digital twin). Generative Al introduces tension with traditional finance's stability principles, yet rational application can enhance financial efficiency when regulated by traditional robustness [13]. Establishing a multi-party responsibility

framework with algorithmic diversity and transparency is essential to balance innovation and stability

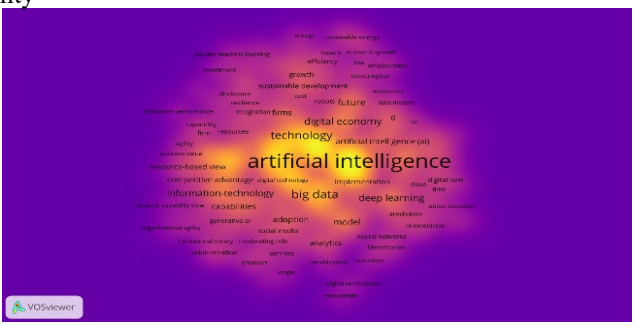

Fig. 5. Map of keyword density

4.2 Evolution Analysis on Keywords

Co-occurrence diagrams focus on describing the total number of times something appears, while burst diagrams are good at showing the time periods during which it appears. To present the trend of heat changes more intuitively and analyze the causes of the outbreak, researchers have drawn the outbreak chart of keywords. In figure 6, from focusing solely on the application of "machine learning" technology in 2017 to expanding to business intelligence and entrepreneurship orientation in 2020, with an emphasis on enterprise operation and entrepreneurship; In 2021, it further extended to Industry 4.0, service quality and data science. In 2022, we shifted to knowledge management. The overall trend is from single-point technological breakthroughs to the integration of technology and enterprise operations, and then to industrial upgrading and knowledge management. The research scope is expanding, gradually covering the entire process of enterprises and industrial development from technology application, reflecting the evolution of field research from basic technology exploration to multiple dimensions such as practical application and management optimization.

Keywords	Year	Strength	Begin	End	2015 - 2025
machine learning	2017	5.18	**2019**	2020	
business intelligence	2020	3.1	**2020**	2022	
entrepreneurial orientation	2020	2.81	**2020**	2021	
industry 4	2021	5.44	**2021**	2022	
science	2021	2.86	**2021**	2022	
customer relationship management	2021	2.64	**2021**	2022	
service quality	2021	2.64	**2021**	2022	
data science	2021	2.64	**2021**	2022	
knowledge management	2022	2.82	**2022**	2023	

Fig. 6. Keyword explosion chart

5 Conclusion

This article focuses on the integration field of artificial intelligence technology and digital finance. Through quantitative techniques such as productivity statistics, co-occurrence network analysis, and keyword burst detection, achieve cross-scale analysis of the overall picture of this field, and the conclusions are as follows: (1) Scholars: Core scholars lead the knowledge production system. Future work requires mutual term recognition among technology developers, financial users, and regulatory researchers. Future research should prioritize developing standardized taxonomies and frameworks to bridge communication gaps across these diverse groups. (2) Institutions: Models for industry-university-research collaboration differ by region. Exploring new forms of collaboration is key to unlocking global innovation potential. Research must identify and evaluate novel incentive structures and data-sharing protocols that can overcome institutional barriers and foster effective partnerships. (3) Nations: Global research is becoming multipolar, with countries leveraging local advantages to form distinct paths. Further investigation is needed into mechanisms for cross-border regulatory harmonization and technology transfer to mitigate fragmentation and harness global synergies.(4)Themes: Research focus is shifting from technological foundations to financial applications. As technologies spread, establishing governance that balances innovation efficiency and system robustness is critical for sustainable development. For industry stakeholders, these findings underscore several critical implications. Financial institutions must invest in developing cross-functional expertise and collaborative platforms to effectively integrate Al solutions. Technology providers need to prioritize transparency and explainability to build trust and meet evolving regulatory expectations. Regulators face the challenge of designing agile oversight mechanisms that foster innovation while safeguarding financial stability and consumer protection.

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