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Research Article

Big Data Finance: A Bibliometric Exploration of Research Frontiers and Emerging Trends

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Abstract: The integration of big data in the financial sector has increasingly attracted scholarly attention, particularly in areas such as risk management, fraud detection, algorithmic trading, and investment optimization. Given the rapid development of this field, it is essential to map research trends and identify emerging directions that shape the future of financial innovation. This study applies a bibliometric approach using 3,829 articles retrieved from the Scopus database from 1981 to 2025, with data processed through R Studio and the Bibliometrix-Biblioshiny application. The objective is to explore the intellectual landscape of big data finance and reveal research frontiers as well as thematic evolution. The results show a sharp increase in publications after 2015, alongside the growth of fintech and artificial intelligence applications, with dominant themes including blockchain integration, risk analytics, and predictive modelling. Cross-disciplinary and cross-regional collaborations continue to expand. These findings provide a comprehensive overview of how big data has shaped financial studies and offer insights for potential future research directions.

Keywords: Bibliometric Analysis; Big Data; Blockchain; Finance; Risk Analytics

1. Introduction

The financial sector is currently undergoing a significant transformation driven by the rapid development of digital technologies. Among these innovations, big data has emerged as a key enabler, allowing financial institutions to capture, store, and analyze massive datasets efficiently and at unprecedented speed. The ability to extract meaningful patterns from heterogeneous financial information has opened new opportunities to enhance decision-making and operational efficiency (Subrahmanyam, 2019). Today, big data is no longer merely a supporting tool but a fundamental component of modern financial ecosystems, influencing strategic planning, regulatory compliance, and long-term competitiveness (Sharma, 2023). The integration of big data into finance has led to notable advancements across multiple domains. In risk management, predictive models based on large-scale data have been applied to credit assessment, market volatility analysis, and portfolio diversification strategies (Nobanee, 2021).In fraud detection, big data analytics has strengthened the ability to identify anomalies within vast transaction flows, enhancing regulatory compliance and consumer trust (Ellili et al., 2023).Algorithmic trading has also transformed, leveraging real-time data streams and machine learning algorithms for adaptive trading strategies (Goldstein et al., 2021). Moreover, investment optimization has benefited from data-driven forecasting of asset performance and consumer behavior, enabling investors to adjust strategies in increasingly dynamic markets (Lin & Wei, 2024). Collectively, these applications illustrate how big data has evolved from a technical tool to a central pillar of financial innovation.

Building on this transformation, the momentum of research in big data finance is closely linked to the rise of financial technology (fintech) and the growing adoption of artificial intelligence (AI). Since 2015, scholarly publications on big data in finance have surged sharply, reflecting global shifts toward digital payment systems, robo-advisory services, and peer-to-peer lending platforms (Ar-Raisi et al., 2023). Blockchain technology has also stimulated interest in decentralized financial solutions emphasizing transparency and security (Najem et

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al., 2025). These trends highlight the cross-sector relevance of big data and its impact on regulation, technology, and financial inclusion (Hasan et al., 2020). For academics, this rapid growth presents both opportunities and challenges: opportunities to study new financial paradigms, and challenges in navigating an increasingly vast and fragmented literature (Goldstein et al., 2021). Despite this rapid growth, the research landscape of big data finance remains fragmented. Many studies focus on technical applications or sector-specific cases, while systematic mapping of the intellectual structure and thematic evolution is limited (Ar-Raisi et al., 2023). Research is heavily concentrated in developed economies, with limited representation from emerging and developing regions, raising questions about inclusivity and global knowledge distribution (Sharma, 2023). These gaps highlight the importance of bibliometric approaches to consolidate dispersed literature, identify research frontiers, and understand interactions across disciplines and regions (Nobanee et al., 2022).

In response to these gaps, bibliometric methods are effective tools for analyzing publication trends, citation networks, author collaborations, and keyword patterns (Ar-Raisi et al., 2023). Although bibliometric studies have been applied in fintech, sustainable finance, and blockchain, dedicated analyses of big data finance remain scarce (Sharma, 2023). Such studies are essential to map research evolution, identify dominant themes, and highlight future directions, while also providing guidance for academics, policymakers, and practitioners (Goldstein et al., 2021). This study aims to fill this gap by conducting a bibliometric analysis of 3,829 articles published between 1981–2025, retrieved from the Scopus database. Using R Studio and Bibliometrix-Biblioshiny, the study maps publication trends, thematic clusters, and collaborative networks to reveal the intellectual structure of big data finance. The contributions of this study include: (1) providing a quantitative overview of the field's evolution, (2) identifying dominant themes such as blockchain integration, predictive modeling, and risk analytics, and (3) mapping research frontiers and cross-disciplinary linkages (Goldstein et al., 2021). In doing so, this paper offers a comprehensive understanding of the role of big data in finance while highlighting opportunities for future research.

2. Literature Review

Big data has emerged as one of the most transformative forces in the financial sector, primarily due to its ability to capture, process, and analyze vast amounts of structured and unstructured data in real time. This capability enables financial institutions to respond quickly to market dynamics, improve operational efficiency, and reduce the risks associated with uncertainty and information asymmetry (Hasan et al., 2020). Predictive analytics derived from big data allows institutions to enhance risk management by improving the accuracy of credit scoring and portfolio diversification (Nobanee, 2021). The integration of big data into digital banking also accelerates fraud detection and helps banks comply with complex regulatory requirements, thereby strengthening institutional resilience (Sharma, 2023). Moreover, the convergence of big data, fintech, and artificial intelligence reshapes financial services by enabling personalized customer experiences, real-time credit assessment, and automated financial advisory services (Sharma, 2023). Collectively, these developments illustrate that big data is no longer a supporting tool but has become the backbone of financial innovation, influencing everything from algorithmic trading to customer relationship management and regulatory compliance, while institutions that fail to adopt these technologies risk being left behind in a rapidly digitizing financial landscape (Hasan et al., 2020).

The role of big data in finance can be framed through several well-established theories that provide a conceptual foundation for its applications. Decision Theory suggests that big data enhances rational decision-making by providing access to broader, more accurate, and more timely information, thus reducing uncertainty and the likelihood of costly mistakes in investment or lending decisions (Subrahmanyam, 2019). The Efficient Market Hypothesis (EMH) has been revisited in light of big data analytics, as predictive models can uncover inefficiencies and arbitrage opportunities that traditional models may overlook, challenging the conventional notion of fully efficient markets (Lin & Wei, 2024). Financial Intermediation Theory highlights how big data strengthens the role of financial institutions in reducing information asymmetry, improving credit evaluations, and enhancing capital allocation between savers and borrowers (Ellili et al., 2023). Collectively, these theories suggest that big data is not merely a technological innovation but also a strategic resource in line with the

Resource-Based View (RBV), providing sustainable competitive advantages and driving innovation across financial markets (Nobanee et al., 2022).

Several prior studies have examined the applications of big data in various financial contexts, providing extensive insights into both theoretical and practical implications for the financial sector. The adoption of big data in digital banking has been demonstrated to significantly improve fraud detection, enhance operational efficiency, and enable financial institutions to respond more effectively to complex regulatory requirements and dynamic market conditions, which are increasingly volatile in global financial markets (Nobanee, 2021). Moreover, big data has played a critical role in investment optimization, where predictive analytics not only improves the accuracy of forecasting asset performance but also allows portfolio managers to design strategies that are better aligned with investors' risk preferences and market trends, thereby enhancing returns while minimizing potential losses (Lin & Wei, 2024). In the domain of algorithmic trading, the integration of big data provides access to real-time data streams and advanced machine learning models that allow trading strategies to adapt instantly to market fluctuations, resulting in higher profitability, reduced exposure to market shocks, and improved decision-making under uncertainty (Goldstein et al., 2021). Additionally, the intersection of big data and blockchain technology has emerged as a powerful tool for enhancing transparency, accountability, and security in financial transactions, as distributed ledger systems combined with large-scale analytics create immutable records and improve trustworthiness across financial ecosystems (Najem et al., 2025). Collectively, these studies indicate that big data has become an indispensable driver of innovation across multiple areas of finance, ranging from operational efficiency, risk management, and regulatory compliance to algorithmic trading and fintech development, highlighting the growing importance of data-driven strategies in shaping the future trajectory of the financial industry and establishing new paradigms for research, policy-making, and practical applications.

3. Research Method

This study adopts a bibliometric approach to provide a comprehensive overview of the intellectual structure and research dynamics within the domain of big data finance. The methodological procedure was conducted in three sequential stages (Figure 1). In the first stage, specific search parameters were established and applied to the Scopus database to retrieve relevant scholarly records, followed by a refinement process to ensure the accuracy and consistency of the dataset (data collection stage). In the second stage, the curated records were imported into VOSviewer software to generate bibliometric maps, enabling the visualization of publication networks across authors, institutions, countries, journals, and subject areas (data visualization stage). In the third stage, the visualized data were systematically analyzed to identify prevailing research themes, emerging trends, and potential avenues for future investigation in the field of big data finance (data analysis stage).

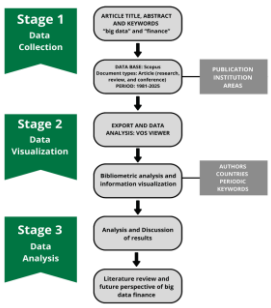

Figure 1. Stages of the methodological process adopted in this study

This research employed bibliographic records retrieved from the Scopus database spanning the period 1981–2025 (Fig. 1). A total sampling approach was applied, meaning that all documents resulting from the search query were systematically included for analysis without further random selection. The dataset was constructed to cover multiple bibliographic attributes, such as publication titles, authors, abstracts, keywords, years of publication, source journals, document types, and institutional affiliations. These attributes were selected because they provide a comprehensive picture of research productivity and

knowledge dissemination in the domain of big data finance. Data collection was conducted by extracting metadata directly from Scopus with the aid of Mendeley Desktop, which served as both a repository manager and reference organizer. The search query was formulated using predefined English keywords associated with big data and finance to ensure the inclusion of relevant records while minimizing the risk of retrieving unrelated works.

The search results obtained from Scopus were exported in comma-separated values (.csv) format, which facilitated compatibility with various software tools for subsequent processing. The exported dataset was then synchronized with Mendeley Desktop to maintain proper organization of references and to avoid duplication of records. In the descriptive stage of analysis, Microsoft Excel was utilized to generate statistical summaries that captured the overall characteristics of the research landscape. Indicators such as the annual growth of publications, productivity of individual authors, distribution of publisher journals, and diversity of publication types were systematically examined. This process not only provided a clear overview of the temporal dynamics of big data finance research but also allowed the identification of the most active contributors, leading publication outlets, and the dissemination trajectory of the field over more than four decades of development.

Beyond descriptive statistics, a bibliometric mapping procedure was conducted to uncover the thematic structures and intellectual linkages within the field. This step employed VOSviewer version 1.6.19, a widely recognized software for bibliometric visualization and network analysis. The unit of analysis chosen was keyword co-occurrence, which enables the detection of how frequently specific research terms appear together and thus reveals conceptual relationships between topics. By applying this method, the study generated network visualizations that mapped clusters of interconnected keywords, highlighting core areas of inquiry and their relative proximity. In addition, density maps were produced to identify research hotspots, signaling areas of intense scholarly attention and potential emerging trends. The combination of network and density visualizations provided a multidimensional perspective on the evolution of big data finance, making it possible to trace dominant themes, peripheral topics, and the likely future directions of the field.

4. Results and Discussion

The bibliometric analysis of publications on big data finance within the timespan 1981–2025 shows a total of 3,829 documents derived from 1,079 different sources. Over this long period, the research output has grown steadily with an annual growth rate of 12.44%, which demonstrates the increasing academic interest in the intersection of data analytics and financial studies. A total of 9,654 authors contributed to the dataset, yet only 919 of them produced single-authored works, confirming that collaboration has become the dominant mode of knowledge production in this area. On average, each paper involved 2.78 co-authors, while 17.03% of the documents resulted from international collaboration, indicating that global partnerships, although present, remain at a moderate level compared to overall productivity. In addition, the dataset comprises 29,892 references and 18,066 author keywords, reflecting the wide range of theoretical and methodological approaches that enrich the field of big data finance. The overall distribution of these metrics is summarized in Figure 2.

From a citation and document profile perspective, the results further emphasize the dynamism of this research domain. The average age of documents is 4.64 years, suggesting that the literature is relatively young and strongly driven by recent advancements in technology and finance. Each document received an average of 13.24 citations, pointing to a notable academic impact and visibility across disciplines. The consistent growth in publications, coupled with the intensity of keyword use, demonstrates the diversification of research themes ranging from algorithmic trading and risk modeling to financial technology and digital banking. These findings indicate that big data finance is progressing from an emerging area into a well-established research frontier, supported by methodological innovations and the growing demand for data-driven solutions in the financial sector. Figure 2 provides a visual illustration of these bibliometric indicators.

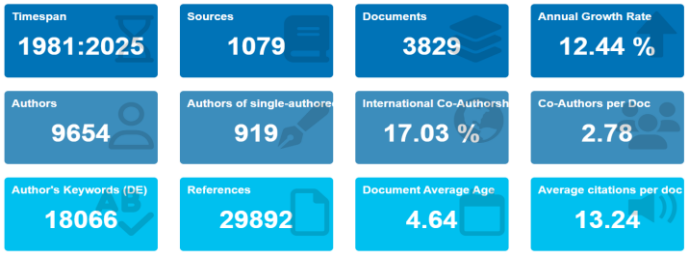

Figure 2. Main Information Overview (using R studio)

Figure 3 illustrates the annual scientific production from 1981 to 2025, reflecting the temporal dynamics of research activity in the field over more than four decades. The early stage, spanning from 1981 until the late 1990s, is characterized by a very low and almost stagnant number of publications, which indicates that the field had not yet gained substantial scholarly attention. A slight but gradual increase began to emerge in the early 2000s, suggesting a growing, albeit still limited, recognition of the relevance of the topic. A more visible expansion occurred after 2010, with the number of published articles showing a steady and more consistent upward trajectory. This trend became particularly pronounced after 2015, when annual publications grew sharply, reflecting both the maturation of the field and the increasing engagement of the global research community. The peak of scientific production was reached around 2022, with more than 450 articles published in a single year, marking the highest point of scholarly activity during the observed period. Nevertheless, the subsequent years, particularly 2023 to 2025, reveal slight fluctuations and a modest decline, which could be associated with either a temporary saturation of the field or delays in indexing recent publications. Despite these variations, the overall pattern clearly demonstrates a transformative shift from a marginal research area with limited contributions into a rapidly expanding domain that has attracted sustained academic interest, thereby underscoring the field's growing importance in contemporary scientific discourse.

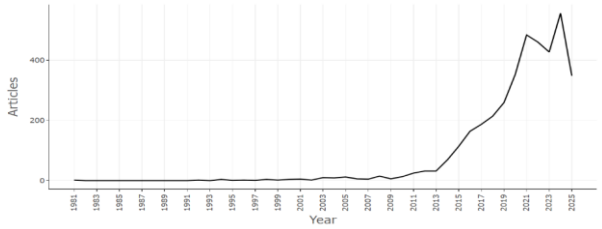

Figure 3. Annual Scientific Production (using R studio)

Figure 4 presents the distribution of citations across countries, highlighting the comparative influence of scholarly contributions in this field. The data reveal a significant disparity between Korea and Macedonia, with Korea recording an exceptionally high citation count of 742, while Macedonia accounts for only 18 citations. This stark contrast underscores Korea's dominant role in shaping the academic discourse, suggesting that research outputs originating from this country are not only more numerous but also more impactful in terms of scholarly recognition and global visibility. The concentration of citations in Korea may reflect stronger institutional support for research, more established academic networks, or the alignment of its studies with international research priorities, thereby increasing their likelihood of being referenced. On the other hand, the relatively limited citation performance of Macedonia suggests that while contributions exist, they have yet to achieve comparable resonance within the global scientific community. This imbalance illustrates the uneven distribution of research influence across countries, a phenomenon commonly observed in bibliometric analyses, where certain nations emerge as leaders while others play a more peripheral role. Ultimately, the results emphasize that global visibility and scientific impact are not solely determined by the volume of publications but are also shaped by the quality, relevance, and international integration of the research produced.

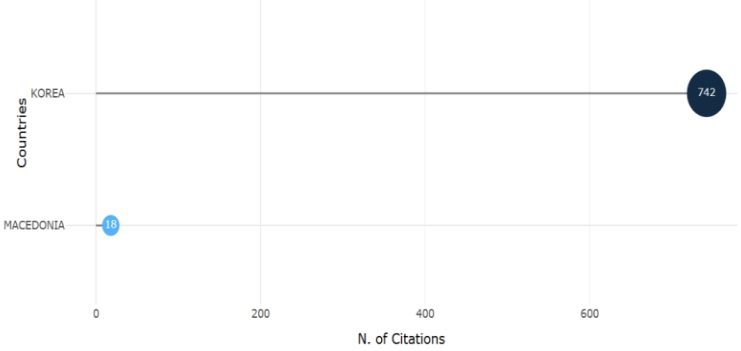

Figure 4. Most Citied Countries (using R studio)

Figure 5 shows the most frequent keywords that appear in studies on big data finance, giving us a picture of where most of the discussions in this field are concentrated. Unsurprisingly, "big data" stands out as the most dominant term with 1,732 mentions, followed by "finance" with 1,492 mentions. The high frequency of these two keywords suggests that they form the central axis of research, where finance is increasingly viewed through the lens of big data applications. Other keywords such as "data mining" (366), "artificial intelligence" (365), and "machine learning" (356) indicate the heavy reliance on computational methods and advanced algorithms, which are now integral to financial research. Instead of focusing only on theoretical models, many studies emphasize applying these tools to manage and interpret large-scale datasets. This trend shows how the field has shifted towards a more data-driven approach, reflecting the practical demand for evidence-based insights in financial decision-making.

Beyond the technical focus, several keywords point to the broader applications of big data in finance. Terms like "information management" (319), "commerce" (295), and "risk assessment" (286) show that research often addresses how big data can improve organizational systems, business practices, and risk evaluation in markets. Meanwhile, "decision making" (272) and "data analytics" (242) highlight the growing role of transforming raw data into meaningful knowledge that can support managers and policymakers. Taken together, the keyword distribution suggests that big data finance is no longer a narrow research niche but has grown into a multidisciplinary space, combining ideas from computer science, economics, and management. What is interesting here is not only which keywords dominate but also how they interact, reflecting a broader trend where finance research is expanding into areas like digital commerce, predictive modelling, and regulatory practices. This makes it clear that the future of the field will likely involve even deeper integration of technology and finance, pushing research beyond traditional boundaries.

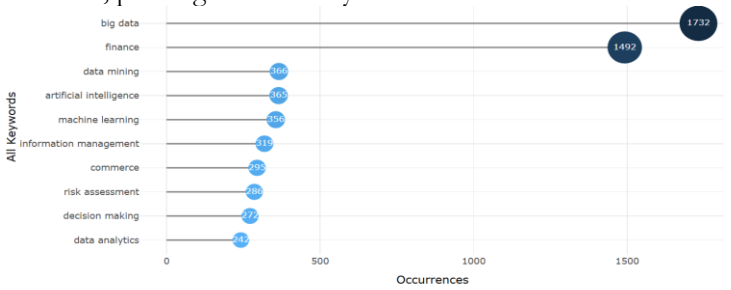

Figure 5. Most Frequent Words (using R studio)

Figure 6 displays the most relevant sources contributing to the development of research in big data finance, highlighting the venues where the largest number of related publications have been disseminated. The ACM International Conference Proceeding Series stands out with 1,285 documents, reflecting the pivotal role of computer science and information technology communities in advancing this research area. This dominance indicates that much of the discourse on big data finance has been shaped within conference settings, where rapid dissemination of new findings and methodological innovations is prioritized. Other highly ranked sources include the ACM International Conference Proceeding Series (107 documents) and Advances in Intelligent Systems and Computing (85 documents), which further emphasize the strong linkage between artificial intelligence, computational methods,

and finance applications. The presence of the Journal of Physics: Conference Series (68 documents) also reveals that interdisciplinary platforms, even those traditionally associated with physics, are increasingly hosting discussions on data-driven approaches in finance, reflecting the wide applicability of big data across scientific domains.

The inclusion of series such as Lecture Notes in Computer Science (59), Lecture Notes in Networks and Systems (51), and Lecture Notes on Data Engineering and Communication (44) underscores the methodological and technical orientation of research in this field. These venues primarily focus on computational models, systems architecture, and data engineering techniques, all of which are essential for enabling big data applications in finance. Similarly, Communications in Computer and Information Science (47) and Lecture Notes in Electrical Engineering (40) further illustrate the centrality of technical conferences in shaping the research frontier. Interestingly, the presence of the E3S Web of Conferences (34) suggests that big data finance is beginning to intersect with discussions on sustainability and energy, highlighting a diversification of its applications beyond traditional finance. Taken together, the distribution of sources demonstrates that big data finance is strongly anchored in conference proceedings and technical series rather than in conventional finance journals, signaling that the field is still in a dynamic, innovation-driven phase where computational methods remain at the forefront of scholarly contributions.

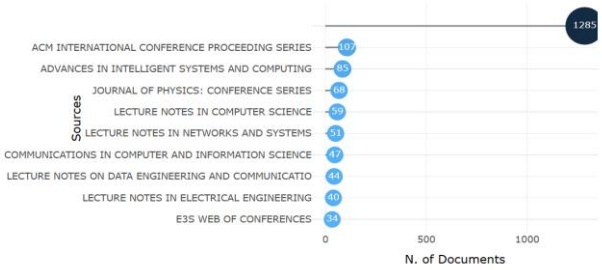

Figure 6. Most Relevant Sources (using R studio)

Figure 7 presents a three field plot that connects cited references, authors, and merged keywords, offering a comprehensive visualization of the intellectual structure within the domain of big data finance. The visualization shows that highly cited references such as Chen Hsinchun's study on business intelligence and analytics and Chen Min's survey on big data applications form a strong foundation that continues to shape research trajectories in this field. These seminal works are connected with prolific authors including Alesso Faccia, Li Zhang, Meikang Qiu, and Noura Metawa, who have expanded the discussion from conceptual frameworks toward more applied methodologies. On the keyword side, terms like big data, finance, artificial intelligence, and data mining appear as dominant themes that not only represent the central focus of the field but also demonstrate how technological innovation is increasingly integrated into financial studies. The dense network of connections between references, authors, and keywords indicates a highly collaborative and multidimensional research landscape, where foundational insights are continuously extended through new applications and thematic expansions. This structure suggests that big data finance has evolved into a mature interdisciplinary area that bridges computer science, economics, and management while simultaneously opening pathways to emerging discussions such as risk management, blockchain, decentralized finance, forecasting, and data driven decision making. The interrelation of these components reflects both the continuity of reliance on foundational research and the dynamic innovation that characterizes the evolution of the field.

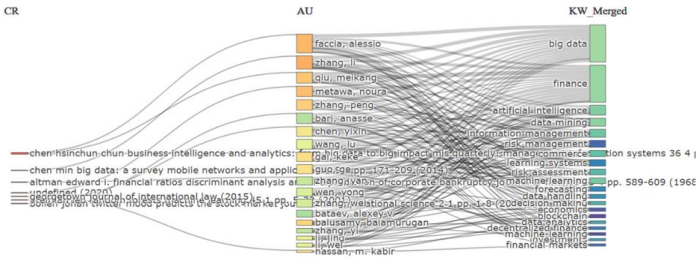

Figure 7. Three-Field Plot (using R studio)

Figure 8 presents a tree map visualization that highlights the distribution of the most dominant research themes in big data finance. The largest clusters are clearly "big data" with 1,732 occurrences (16 percent) and "finance" with 1,492 occurrences (14 percent), confirming their role as the central pillars of this research field. Mid-sized clusters such as "data mining," "artificial intelligence," "machine learning," and "risk assessment" each account for around 3 percent of the total, reflecting the methodological backbone of big data finance research. Smaller clusters, including "blockchain," "deep learning," "fintech," and "cloud computing," signal the growing diversification of topics and the integration of emerging technologies into financial studies. Unlike Figure 5, which simply listed the most frequent words in descending order, the tree map emphasizes both the relative weight of each theme and their visual distribution. This representation provides a clearer picture of thematic dominance while simultaneously showing how new and emerging concepts contribute to the overall research landscape in big data finance.

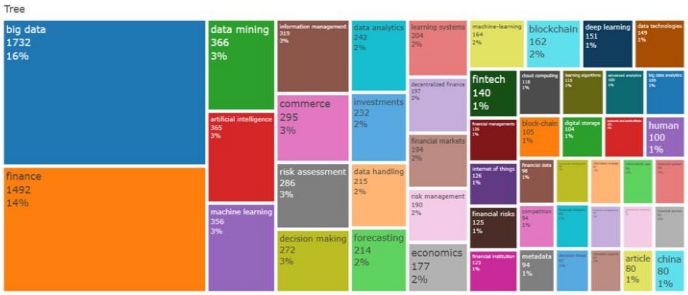

Figure 8. Tree Map (using R studio)

The co-occurrence visualization of keywords using VOSviewer in Figure 9 shows that "big data" emerges as the central focus of research with the largest node size. This keyword is closely connected to other terms such as machine learning, data analytics, and information management, emphasizing that the development of research is predominantly directed toward technical and managerial aspects. The purple and yellow clusters highlight methodological dimensions such as forecasting, random forests, logistic regression, and sentiment analysis, while the green cluster reflects the application of big data in socio-economic issues including sustainable development, investment, and tourism. Meanwhile, the blue cluster underscores the link between big data and the health sector through keywords such as health care, human, covid-19, as well as demographic factors like students and female. Although the keyword finance appears in the network, its position is less visually prominent due to the dominance of big data, suggesting that at this stage the interpretation leans more toward highlighting the breadth of cross-disciplinary applications rather than emphasizing the financial sector. This indicates that big data research has expanded into a wide range of disciplines, strongly penetrating methodological development, information management, healthcare, and sustainable development.

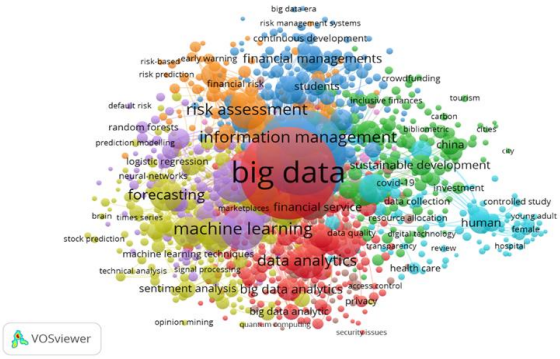

Figure 9. Co-Occurrence Network of Keywords on Big Data Research (using Vosviewer)

The co-occurrence visualization in Figure 10 provides a more comprehensive overview by revealing that, in addition to "big data", the keyword "finance" also occupies a large and central node within the network. This demonstrates that big data research is strongly associated with the financial sector, particularly in relation to risk assessment, risk management, financial technology, banking, and digital finance. The strong linkage between

big data and finance reflects the growing relevance of data analytics in supporting financial decision-making, risk detection, profitability prediction, and innovation in financial services. Furthermore, other clusters continue to illustrate the diversity of applications, such as artificial intelligence, cloud computing, and commerce that highlight technological aspects, as well as economics, marketing, and sustainable development that emphasize socio-economic perspectives. Compared with the previous visualization, the pattern suggests that finance plays a significant role and should not be overlooked, but rather considered as one of the core pillars in big data research. Therefore, studies at the intersection of big data and finance hold substantial potential to generate impactful contributions not only in academia but also in industry practices and public policy.

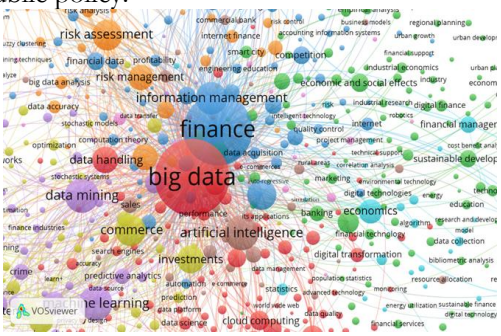

Figure 10. Keyword Co-Occurrence Map Highlighting Big Data and Finance (using Vosviewer)

Beyond highlighting thematic associations, the visualization also underscores the dynamic evolution of big data finance as a research domain. The simultaneous presence of methodological keywords (e.g., machine learning, forecasting) and socio-economic terms (e.g., sustainable development, commerce) indicates that the field is no longer confined to purely technical inquiries but is increasingly positioned at the intersection of technology and societal challenges. This convergence points toward a future in which financial research will play a pivotal role in addressing broader developmental issues, reinforcing the importance of cross-disciplinary collaboration and the integration of diverse perspectives into the study of big data in finance.

5. Conclusion

This study provides a comprehensive bibliometric exploration of big data finance, analyzing 3,829 publications spanning 1981–2025. The findings highlight a sharp increase in research activity after 2015, driven largely by the growth of fintech, artificial intelligence, and blockchain applications. Core themes such as big data, finance, risk analytics, and predictive modeling dominate the landscape, while emerging clusters indicate the expansion of research into areas like sustainable development, healthcare, and digital commerce. The analysis further shows that collaboration among authors and across countries has intensified, though disparities in research productivity and citation impact remain evident between developed and developing regions. By mapping intellectual structures, keyword co-occurrences, and thematic clusters, this study demonstrates that big data finance has evolved from a niche area into a well-established interdisciplinary field. The results provide valuable insights for academics seeking to identify research frontiers, for practitioners aiming to adopt data-driven solutions, and for policymakers addressing the inclusivity and regulation of digital financial ecosystems. Future research should focus on strengthening global collaboration, enhancing representation from under-researched regions, and exploring cross-sector applications to ensure that big data finance contributes inclusively to innovation and financial stability.

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