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ORIGINAL ARTICLE

Artificial intelligence in finance studies: Bibliometric approach to literature indexed in Scopus

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ABSTRACT

Objective. This study aims to analyze the scientific production indexed in the Scopus database on the application of artificial intelligence (AI) to finance studies between 2007 and 2023.

Design/Methodology/Approach. The study design is non-experimental (transectional) and quantitative (descriptive). The most representative authors, the documentary typology that supports the results, and the principal publications were identified and analyzed. General citation indicators were calculated to ascertain the scientific impact associated with the topic. Spectral maps of country and word density were prepared to determine the main characteristics concerning these bibliographic variables.

Results/Discussion. Notwithstanding the extensive temporal scope of the study, the application of AI to finance has not been evidenced in the extant literature until 2017. No significant contributors or highly influential journals are identified; studies are sporadic and consistent with the topic's novelty. Nevertheless, this subject has a high scientific impact, with an average of 20 citations per paper.

Conclusions. The application of AI in finance is a relatively recent phenomenon. The countries of Asia and India are at the forefront of scientific production, as evidenced by Scopus's data analysis. The works analyzed exhibit a high density of terminology and a plethora of journals in the computational field that publish on this topic. Furthermore, publication practices manifest in the form of event papers, which are published at a similar rate to scientific articles.

Originality/Value. The value of this study lies in its originality, which stems from an in-depth examination of existing literature on these topics in Scopus. This approach enables a comprehensive bibliometric analysis, informing future research in this field.

Keywords: finance; artificial intelligence; bibliometrics; scientific production.

1. INTRODUCTION

The advent of artificial intelligence (AI) signals a new era. The advent of this phenomenon signifies a fundamental shift in how scientific challenges are conceptualized and addressed. AI refers to the capacity of machines to learn from data and utilize that

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knowledge to make decisions analogous to that of a human being, employing algorithms. The principal advantages of AI are that machines can perform activities or tasks without respite, process vast quantities of data and information, and exhibit a reduced propensity for error (Rouhiainen, 2018).

The advent of AI and robots with deep learning capabilities has profoundly impacted business, government, and society. Furthermore, they are influencing significant global trends in sustainability. As the AI revolution transforms our world, it may signal the advent of a utopian future in which humanity and machines coexist in harmony. A bibliometric analysis is an effective method for conducting a quantitative study of scholarly output, allowing for examining research trends within a given field.

The term "finance" describes the administration or management of money in all its manifestations, including cash, marketable securities, accounts receivable, and inventory. It pertains to transactions and money management and examines the processes by which capital is obtained for investment in productive assets, as well as the decision-making involved in investment and allocating scarce resources over time (Campos *et al.,* 2017). The advent of AI has had a pervasive impact across all disciplines, ushering in a new era of interdisciplinary and transdisciplinary research. In financial studies, bibliometric methods are employed to examine the published literature and identify prevailing trends.

In a recent study, Gera *et al.* (2023) employed a bibliometric analysis to map the impact and application of AI and financial technology. The analysis demonstrated that this is an emerging area of scientific inquiry with a relatively low impact by individual authors and journals. Furthermore, they identified nascent themes in this field, namely those of information technology, the digitization of financial processes, and the intellectual framework of the field of study. In their research, Elouidani and Outouzzalt (2023) employed a bibliometric approach to examine the application of AI in the context of sustainable finance. The authors sought to ascertain the role of developing AI techniques in facilitating sustainable finance, evaluate their advancement, and elucidate the research trajectory over the past decade. The study revealed that, despite a significant increase in publications in 2017, there needs to be more collaboration between authors, particularly at the international level. Moreover, the results offer an overview of the interdisciplinary study of the topic. AI approaches are being widely implemented as viable replacements for traditional methods, with promising results.

Explainable AI has also been recently analyzed from a bibliometric perspective (Chen, 2023), and machine learning and AI have been the subject of analysis and publication in a business journal (Ahmed, 2022). A recent study on the bibliometric analysis of AI techniques in the financial market was also identified to explore the main research areas and trends and provide a systematic overview of publications in the field of artificial intelligence in financial markets (Janková, 2021).

From a bibliometric perspective, the valuation of AI as a digital asset and its capacity to generate intangible value for companies has been discussed. This will facilitate advancement towards a superior economic and financial standing, enhancing a company's competitiveness in securing financing (Parra-Domínguez, 2023). Another study examined the applications and benefits of integrated AI and blockchain platforms in various business sectors (Kumar, 2023). The study identified the most influential articles on the topic, the citations, and the degree of importance within the intellectual network. A content analysis revealed the intellectual structure of the topic, which is underpinned by four major thematic clusters: supply chains, healthcare, secure transactions, and finance and accounting. The study identified ten business application areas that can benefit from these technologies.

As can be observed, bibliometric techniques have been applied to finance studies that integrate AI. However, comprehensive research has yet to be conducted to update the general characteristics of this topic as indexed in Scopus. Accordingly, this study aims to examine the scientific output indexed in the database, as mentioned earlier, on the application of AI to finance studies between 2007 and 2023.

2. MATERIALS AND METHODS

The following section provides a detailed account of the methodology employed in the study, delineating the various stages of the research design.

2.1. Source of data

The Scopus database was employed to retrieve published literature. From this source of information, a search strategy was formulated using the advanced search function with field codes that allow the retrieval of information on a specific thematic or research topic. In this regard, the Scopus database provides the option of combining title, abstract, and keywords (TITLE-ABST-KEY) through the AND operator, which enabled the retrieval of studies that referenced both categories within their content. The search equation was formed as follows: (TITLE-ABS-KEY (artificial AND intelligence*) AND TITLE (finance*)) AND PUBYEAR > 1984 AND PUBYEAR < 2024 AND (LIMIT-TO (DOCTYPE, "cr") OR LIMIT-TO (DOCTYPE, "re") OR LIMIT-TO (DOCTYPE, "ch") OR LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ar")). As can be seen, the records recovered were delimited by documentary typology. The sample consisted of a total of 627 records.

2.2. Study design, approach and methodology

The study design is non-experimental (cross-sectional) and quantitative (descriptive). The sample is intentional and non-probabilistic, as the records addressing the topics of IA and finance were selected based on their content in the abstract, title, and keywords. A quantitative approach was employed, combining documentary analysis and bibliometric techniques to analyze the calculated indicators.

The fundamental methodology applied was based on bibliometric techniques. It consisted of four principal stages: (1) determination of the metric object of study, (2) search, retrieval, and processing of information, (3) definition of indicators, and (4) quantitative and qualitative analysis of the resulting information.

2.3. Data analysis and processing

Once the information had been searched and retrieved in Scopus, the 615 records were exported in CSV and RIS format to process the bibliographic records, determine the variables to be measured, and define the indicators. Indicators were calculated to determine authors' productivity, ascertain the evolution of the subject matter through the number of documents per year, and determine the variation rate. The documentary typology and the number of journals or publications registered by Scopus during the specified period for the subject in question were identified. Furthermore, the papers with the highest scientific impact and citation indicators were identified to ascertain the extent of their usage. The VOSviewer tool generated two spectral maps of countries and words. In both cases, the presence of both variables in documents with more than five frequencies was established. Furthermore, Excel was employed for the presentation of tables and graphs.

3. RESULTS AND DISCUSSION

The primary bibliographic characteristics of the retrieved records indicate that most scientific output is in English, although other languages, including Chinese, Spanish, Turkish, and Italian, are also represented. The sample comprises 1,823 authors across 627 documents, including 428 publications such as academic journals, conference proceedings, and book chapters. A noteworthy aspect of the analyzed scientific production is the equal distribution of event papers published through the monographic series and journals, with 294 and 250, respectively. Furthermore, 83 book chapters were identified.

The presence of AI in financial studies, as recorded in the Scopus database between 1987 and 2023, revealed a lack of literature on the subject until 2016. In 2017, the number of documents began to increase. This theme has become increasingly significant in recent years and is in line with the growing prominence of AI techniques. From 2019 onward, there has been an accelerated increase in scientific production and a systematic increase in literature on the subject (see Figure 1).

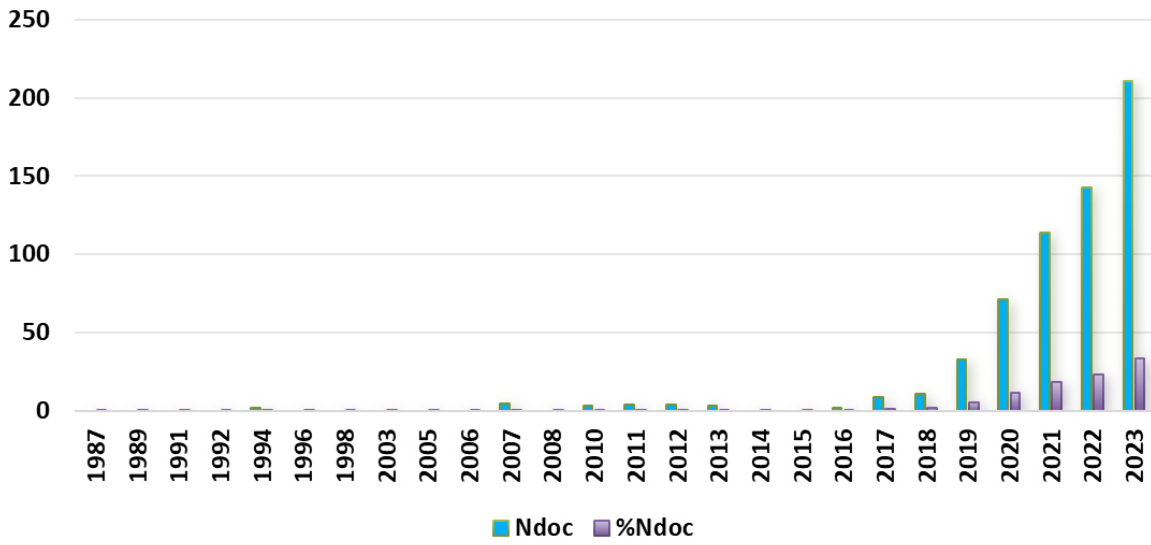

Figure 1. Evolution of scientific production on artificial intelligence in finance studies (Scopus, 1987-2023).

The authors' analysis revealed that 82% of the researchers had published a single paper, indicating a high degree of transience in AI in finance studies. This suggests that there is a lack of specialization within the field and that, despite the involvement of 1,823 authors, the majority have published infrequently on these topics. Conversely, there are no authors who can be considered highly productive. However, some can be described as moderately productive, having produced between six and seven articles over the entire period (see Table 1). Furthermore, the transience and lack of specialization in the subject are also associated with the overall low scientific productivity observed during the analyzed period.

Authors	Ndoc	Institution, Country
Khan, S.	7	University College of Bahrain, Bahrain
Sharma, S.	7	University of Petroleum and Energy Studies, India
Li, Y.	6	Wuhan College, China
Singh, R.	6	Quantum University, India
Yang, Y.	6	Zhengzhou Normal University, China

Table 1. Most productive authors publishing on the application of AI in finance (Scopus, 1987-2023).

As can be observed, the authors who have published the most significant number of papers are primarily from the Arabian Peninsula, China, and India. Most of these authors are affiliated with business schools, and their research focuses on applying AI techniques to finance-related topics. Conversely, the publications that stand out most in the analyzed corpus are more concentrated in computational disciplines. Similarly, the number of publications is not substantial, indicating that research activity on this topic is also limited. Conversely, the publications in question are not found in business, economics, or accounting journals. Instead, they are found in publications within the computational field.

Conversely, the analysis of citations yielded intriguing and promising outcomes for applying artificial intelligence (AI) to financial studies. In this case, the study demonstrated a high scientific impact, as evidenced by the total number of citations received up to the time of the information search, which reached 12,619. Of the 627 retrieved papers, 67.8% received at least one citation, indicating a high flow of scientific information. In other words, it is

Publicaciones	Ndoc
ACM International Conference Proceeding Series	25
Lecture Notes in Networks and Systems	15
Journal of Physics: Conference Series	13
Lecture Notes in Computer Science	13
Advances in Intelligent Systems and Computing	11
Studies in Computational Intelligence	11
Wireless Communications and Mobile Computing	10

Table 2. Core publications on the application of AI in finance (Scopus, 1987-2023).

frequently cited in subsequent works. This also contributes to the high average number of citations per paper (20.1).

Furthermore, a spectral map of countries was presented (see Figure 2). India and China are the foremost producers of scientific output. The United States and the United Kingdom are also represented on the map, albeit with a lower but significant density. Even with their respective positions on the map, India and China are not nearby in this research. However, China is relatively close to Hong Kong, Australia, France, Vietnam, and Taiwan. India is situated near Spain, Morocco, and Saudi Arabia. Other countries located far from the primary clusters are represented on the map, including Japan, the Philippines, Ukraine, Iraq, Indonesia, Singapore, Turkey, Poland, and others.

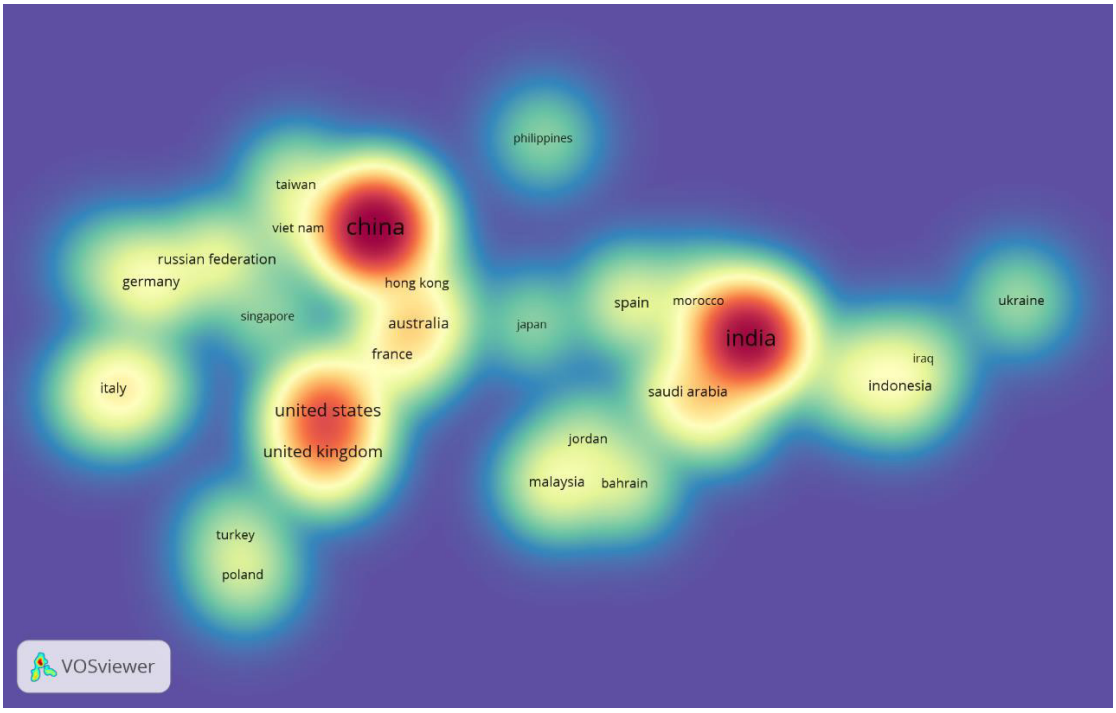

Figure 2. Spectral map of countries publishing on the application of AI in finance (Scopus 1987-2023).

Thematic analysis of the papers revealed a preponderance of conceptualization and application of AI techniques in finance. As illustrated in Figure 3, the categories of AI (machine learning, algorithms, intelligent systems, the Internet of Things, and technologies for AI) are situated towards the cluster's center and constitute the thematic word center (Figure 3A).

The keyword co-occurrence network generally comprises three fundamental nodes, as identified through the centrality method. The blue node represents basic financial terms (Figure 3B). In addition, the term "AI" is associated with other concepts, including risk management and ethical considerations related to using AI in various scientific fields (Vartumyan, 2023). The potential dangers of AI in the financial sector have been highlighted, with banks being a particular concern (Sadok, 2023).

The red cluster (Figure 3C) is primarily concerned with studies in machine learning, deep learning, natural language processing, automation and integration, and financial services. In this regard, research has been conducted that analyzes tools such as Python to develop AI (Khandare, 2023), which is linked to the financial analysis of health services (Hasan, 2023; Mumtaz, 2022; Ma, 2022). Conversely, the green cluster (Figure 3D) is comprised of terms with higher centrality and node size, including studies on the financial effects of data mining, the social and economic implications of AI, financial management, and the efficiency of financial activity using AI (He, 2023; Rutkauskas, 2021).

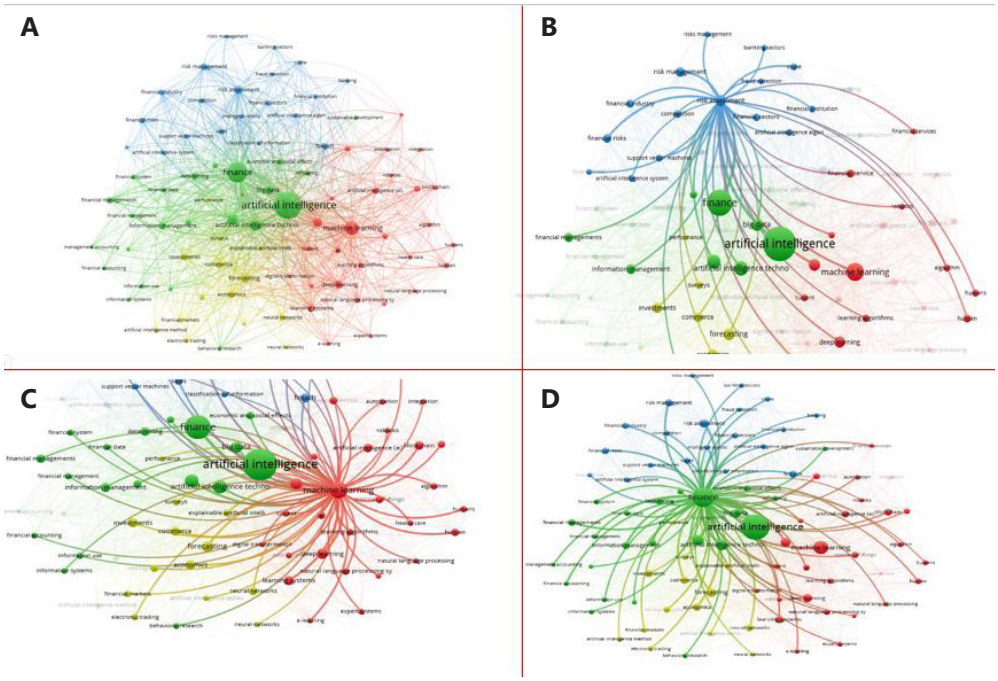

Figure 3. Keyword co-occurrence network on the application of AI in finance (Scopus 1987-2023).

4. CONCLUSIONS

As previously indicated in reports on this subject, the recent upward trend in scientific output was confirmed. This results in a high frequency of studies and authors. In other words, while a corpus of research documents the use of AI in finance, there needs to be discernible specialization in the subject, either in terms of authorship or the publications that report on it. Conversely, the scientific impact is considerable, resulting in a steady stream of scientific data on the subject that bolsters these studies. The application of bibliometric techniques was identified from a variety of bibliographic perspectives.

The countries of Asia and India are at the forefront of scientific production, as evidenced by the analysis of Scopus data. Additionally, there is a notable prevalence of AI-related terminology in the papers under review and in the journals publishing on this topic within the computational field. Conversely, publication practices manifest as event papers, which are published in a similar proportion to scientific articles.

Ultimately, the network of co-occurrence of terms revealed the existence of three fundamental clusters. AI techniques marked the first, the second by the relationship of AI with financial categories, and the third was more entrenched in finance studies specific to the research area.

Conflict of Interest

The authors declare that there is no conflict of interest.

Data consent statement

Data generated during this research have been included in the article.

Declaration of authorship

Conceptualization, formal analysis, research: William Joel Marín Rodriguez, Elia Clorinda Andrade Girón.

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Initial draft-writing: William Joel Marín Rodriguez.

Writing-revision and editing: William Joel Marín Rodriguez, Timoteo Solano Armas, Elia Clorinda Andrade Girón. ●

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