Artificial Intelligence (AI) of Financial in the VUCA Era: A Systematic Mapping Study

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ABSTRACT

The purpose of the study was to systematically map Artificial Intelligence (AI) in the financial sector in the VUCA era. The research design employed a quantitative approach with a descriptive method. The study utilized a systematic literature review with bibliometric analysis techniques. Researchers collected the data from the Google Scholar database, technique analysis using VOSviewer, and descriptive statistics as data analysis techniques. The results indicated the following: (RQ1) 539 articles met the criteria for research; (RQ2) Springer was the publisher with the highest number of AI in Financial articles (58 articles); (RQ3) Karina Kasztelnik authored the most papers on AI in financial (3 documents); (RQ4) an article written by David Mhlanga titled "Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion" had the most citations (145 citations); and (RQ5) the systematic mapping results identified 8 clusters as research gaps, suggesting potential themes for future studies related to AI in the financial domain. The findings indicate a research gap and highlight the potential for further research on AI in the financial sector in the VUCA era. The role of AI in the financial industry in the VUCA era was to enhance efficiency, speed, accuracy, and security. AI can assist in addressing rapidly emerging complex challenges, providing competitive advantages for FinTech companies to navigate dynamic changes and uncertain business environments.

Keywords: Artificial Intelligence; Financial; FinTech; Mapping; Systematic; VUCA.

INTRODUCTION

The dynamics of change are high-speed, unpredictable, and influenced by various factors that are difficult to control. The truth of reality is very subjective, so it has implications for changes in business models. These dynamics were VUCA, Volatility, Uncertainty, Complexity, and Ambiguity. The VUCA influenced extreme disruption patterns, including technology and changes in consumer behavior. The rapid development of technology and the growth of the internet have changed business models from conventional to digital. The startup is one of the businesses that adopt technology into its business model. Startups are startups that are constantly looking for repeatable and scalable business models (Blank, 2013), designed to create products or services in extreme uncertainty to face changing market conditions with very high levels of uncertainty (Ries, 2011); has an original initiative initiated by its founder by focusing on high growth, has risks or benefits, is measurable, and can lead the market (Kidder, 2012). One form of startup is Financial Technology (FinTech).

FinTech is a business model that collaborates various innovations in finance and technology (Mackenzie, 2015). FinTech is a logical evolutionary step accompanied by dynamic, standardized, and technology-integrated services using e-business in enterprise application systems (Gimpel et al., 2018). The aim is to make it easier for the public to access various financial products, conduct financial transactions, and increase financial literacy.

Technological developments must continue, where development is directly proportional to the human
desire for convenience in every activity (Kholis, 2020). Technological innovation produces artificial intelligence (AI), where the availability of big data drives advances in AI implementation. Big data makes AI ‘smarter’ and more accurate in delivering results so that AI will apply to various sectors of life through electronic devices and their supporting devices. The application of financial AI is a form of revolutionizing the business model in financial services, thereby making FinTech developments faster and more customer-centric. AI in financial services includes voice and facial recognition; natural language processing; machine learning; and deep learning. AI can apply through various iterations, including chatbots, document analysis, process automation, or predictive analytics.

Several studies regarding AI of financial: AI as an innovative model for predicting risks in financial institutions (Kasztelnik, 2020); AI as a model for identifying distortions in financial applications (Asl et al., 2021); AI as an application for assessing credit risk (Mhlanga, 2021); application of AI to predict financial market trading (Cohen, 2022) and stock prices (Shahpazov et al., 2014); the role of AI in human resource management and development (Tiwari et al., 2022); AI system to predict financial risk in the banking sector (Lomakin et al., 2022); and the role of AI in detecting financial crimes (Rouhollahi, 2021).

The study related to FinTech-themed bibliometric analysis is as follows: the research results of Benziane et al. (2022) have limitations on the use of the word "Fintech Startup" and does not describe in depth the citation-metrics information; (Suryono, 2019) only uses databases originating from Scopus, ScienceDirect, IEEE Xplore, and Mendeley; and (Aysan & Nanaeva, 2022) only uses the Scopus database which discusses FinTech with the keyword Financial Disruptor. Studies on systematic mapping in financial AI still need to be created, and this research gap will examine in this study. Therefore, this study aims to systematically map Financial Artificial Intelligence (AI) in the VUCA era. There are five research questions posed, namely: (RQ1) study trends; (RQ2) the publisher that published the most articles on Artificial Intelligence Financials; (RQ3) a productive writer conducting a study on Artificial Intelligence Financials; (RQ4) the highest number of citations on articles on Artificial Intelligence Financial; and (RQ5) systematic mapping. The results of this study contribute to further research on the theme of Artificial Intelligence Financial related to the scientific field of management. Management science cannot be aloof from various perspectives as a philosophy mutually integrated as a unit in management synergy (Yulianto, 2021).

**LITERATURE REVIEW**

**Disruptive Innovation Theory**

In business conception, disruptive innovation is the innovation that creates new markets and enters existing markets, and eventually replaces established market-leading companies, products, and alliances. Disruptive Innovation Theory was developed by (Christensen, 2013) when he published a book entitled "The Innovator's Dilemma" (Si & Chen, 2020). The Innovator's Dilemma explains the failure of old business actors in competition with newcomers, where when technology improves from time to time, a new technology comes slowly to surpass the dominant technology in specific markets (Christensen, 2013).

The disruptive concept of innovation suggests that the winning technology is not necessarily radical or cutting-edge. The dominant design is through negotiation and social, economic, and political selection. Companies that take the first action to adopt a technology that becomes dominant usually survive and succeed, while companies that resist adopting technology are likely to fail (Nair & Ahlstrom, 2003).

The concept of disruptive technology is a disruptive innovation, which not only refers to a technological disruption but also involves disruption in other aspects, such as products and business models (Hang et al., 2015). Disruptive innovation is when a smaller company, usually with fewer resources, can challenge an established business by entering at the bottom of the market and working its way up the market. Overall, the variants of disruptive innovation still follow the original concept of disruptive technology (Alberti-Alhtaybat et al., 2019). Disruptive innovation changes performance
metrics or consumer expectations from the market by providing radical new functionality or new forms of ownership (Nagy et al., 2016).

**VUCA**

The rapid growth of technology and information has led to intense competition and innovative changes in the market (Aribowo & Wirapraja, 2018). The disruption era is entering the era of VUCA (Volatility, Uncertainty, Complexity, and Ambiguity). Volatility is a condition that fluctuates and is prone to change. Uncertainty is a condition of uncertainty and surprises that can happen anytime. Complexity is a condition full of complications. Ambiguity is a state of flux that can confuse reading directions. The VUCA era is a business condition that quickly leads to uncertainty and changes, causing anxiety among business leaders (Hendrarso, 2020). Leadership can change between organizations, leading to an increasingly changing external environment (Widowati et al., 2022).

In the VUCA era, there were rapid changes in all fields, with uncertain, ambiguous, and very complex conditions, causing several companies to experience a decline in performance and to be unable to compete, resulting in several companies experiencing bankruptcy and having to close down because they were unable to adapt. Technological developments must be utilized in the VUCA era to compete in business (Bahri, 2022). Companies that can survive in the VUCA era are companies that can combine various aspects, such as vision, competence, culture, and innovation, to support the sustainability of their business (Hendrarso, 2020). Innovation in the VUCA era is associated with digital media, namely the various digital applications utilized in providing services (Rahayu & Agus, 2022). The results of research by (Wibowo et al., 2023) show that if companies want to improve employee performance in the VUCA era, companies must increase agile leadership and employee job satisfaction. An agile approach to organizations can integrate with competent human resource capabilities using technology (Amalia, 2020). To survive and adapt, organizations will compete to get quality human resources as their primary asset (Annisa et al., 2022).

**Financial Technology (FinTech)**

The VUCA era is a challenge that must be turned into an opportunity because it provides more flexibility and functionality in various aspects of human life. Financial Technology (Fintech) is a technological development in the financial sector. Fintech is one of the innovations in the financial sector that refers to modern technology (Ansori, 2019) and is here to answer the problem of public financial access to conventional financial institutions (Darman, 2019). Fintech is a form of applying information technology in the financial sector (Wardhana, 2022). With Fintech, people living in remote areas can use various technology-based financial services without having to travel long distances to get financial services.

Organizations invest in fintech technology to meet several social and environmental needs (Nakalelo & Sahay, 2022). Fintech has low-touch economy characteristics, is customer-based, based on social capital, uses data science, and is driven by professionals. The results of research show that Fintech contributes to helping people who still need to be served by formal financial institutions to carry out financial transactions according to their needs (Marginingsih, 2021). Fintech offers various conveniences in the financial sector, namely: achieving speed, effectiveness, and efficiency of access to banking activities (Salvasani & Kholil, 2020); assisting customers in making financial decisions, reducing operational costs, and risk of loss (Rizal et al., 2018).

The development of future financial transactions using Fintech will influence people's behavior in managing their finances, influencing consumer decisions and consumption patterns (Mukti et al., 2022). There were increasing Fintech factors, including convenience, benefits, service features, risk, and trust (Fifaldyovan & Supriyanta, 2021). The development of Fintech is beneficial for consumers, business actors, and the national economy (BI, 2018). Consumers' benefits are better service, more choices, and
lower prices. For business actors (product or service traders), Fintech helps simplify the transaction chain, reduces operational costs and capital costs, and freezes the flow of information. For the state, Fintech helps encourage the transmission of economic policies, increasing the speed of circulation of money to improve the people's economy and pushing the National Strategy for Financial Inclusion.

Artificial Intelligence (AI)

Artificial intelligence or Artificial Intelligence (AI) is a "machine" that can do various things to require intelligence when humans operate it (Disemadi, 2021). In the dynamics of the times, AI systems are also overgrowing and have increasing capabilities, where AI systems can operate autonomously without any intervention from humans. As part of information technology, AI helps businesses facilitate communication with consumers so that the marketing of the products they offer can increase (Madani, 2021).

In essence, AI's existence substantially contributes to human civilization's development and progress. One of the implications felt by the presence of AI is that humans can do their work more productively and more efficiently, thereby increasing their productivity significantly. Another impact is the ease of communicating and accessing information because the development of information technology has resulted in various conveniences, including financial services. AI can provide visualization of facilities, experiences, and tools electronically with modeling that can be used to drive financial technology (Veilleux et al., 2020).

Several research results show that the use of AI in fintech can be a source of competitive advantage for companies in the financial sector (Benziane et al., 2022); AI systems can manage a growing number of assets and can predict opportunities to increase market share by deploying services to a broader public (Jung et al., 2018); service quality, benefits and the level of convenience felt by customers have a significant impact on customer experience using FinTech services supported by AI systems (Ameen et al., 2021).

METHOD

This study uses a quantitative descriptive design. The study method uses a systematic review with bibliometric analysis techniques. A systematic review uses systematic, explicit, and reproducible methods (Garza-Reyes, 2015). According to (Khan et al., 2003), there are five steps to systematic planning: framing questions for review, identifying relevant work, assessing the quality of the study, summarizing evidence, and interpreting findings.

Fig. 1 Flowchart of research methods

Bibliometric analysis is an approach to identifying the evolution of a research domain, including topics and authors, based on the social, intellectual, and conceptual structure of scientific disciplines (Donthu et al., 2021). This study uses publication data sourced from the Google Scholar database. Google Scholar is a service from Google that allows users to search for research references in various scientifically justifiable formats (Istiana, 2016). The advantages of Google Scholar are ease of access,
cost efficiency, storage space, time, and as a media publication. This study chose the Google Scholar database because it is one of the largest databases that provides scientific literature, both journals and other validation publications.

Data search is limited to the following protocol: (1) the type of bibliography used (name of journal/proceedings, article title, author's name, year of publication, publishing institution, number of citations, abstract); and (2) the keywords used are "Artificial Intelligence Financial." Study data were obtained using Publish and Perish software, then analyzed using Excel for systematic mapping analysis using VOSviewer software. VOSviewer is an application that creates systematic maps based on network data, visualization data, and exploratory data from bibliometric results (Yulianto & Iryani, 2023). Data analysis techniques use descriptive statistics, namely the data transformation process, in tabulations so they are easy to understand and interpret (Yulianto, 2016). Descriptive statistics only describe and analyze data groups without making conclusions to generalize to larger data groups.

RESULT

Based on search results on the Google Scholar database using the keyword Artificial Intelligence Financial, there are 551 articles from 1984-2023. Furthermore, using the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) method, 539 articles on Artificial Intelligence Financial were obtained that met the criteria for analysis.

<table>
<thead>
<tr>
<th>Publication years</th>
<th>1984-2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citation years</td>
<td>39 (1984-2023)</td>
</tr>
<tr>
<td>Papers</td>
<td>539</td>
</tr>
<tr>
<td>Citations</td>
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<tr>
<td>Cites/year</td>
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<tr>
<td>Cites/paper</td>
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</tr>
<tr>
<td>Authors/paper</td>
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</tr>
<tr>
<td>h-index</td>
<td>25</td>
</tr>
<tr>
<td>g-index</td>
<td>42</td>
</tr>
<tr>
<td>hi, norm</td>
<td>21</td>
</tr>
<tr>
<td>hi, annual</td>
<td>0,54</td>
</tr>
<tr>
<td>hA index</td>
<td>13</td>
</tr>
<tr>
<td>Paper with ACC &gt; = 1, 2, 5, 10, 20, 170, 110, 44, 18, 10</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2 PRISMA identification results

DISCUSSIONS

RQ1. Study trend

Based on the mapping results, it shows that during 1984-2023, there were 551 articles on Artificial Intelligence Financial, but only 539 articles met the criteria for further analysis. The development of studies on Artificial Intelligence Financial from 1984 to 2016 was still low, but from 2017 to 2022, it experienced a significant increase. 2022 is the peak of the study trend, namely 160 publications. In March 2023, there were 18 published articles on Artificial Intelligence Financial.
This study's results indicate a research gap with the theme of Artificial Intelligence Financial related to Financial Technology (Fintech). The future development of Fintech can be remarkably rapid because it provides many conveniences for humans in conducting digital financial transactions in all aspects without being limited by space, distance, or time.

**RQ2. The publisher that published the most articles**

Based on the mapping results, it shows that the top 10 publishers publish the most Artificial Intelligence Financial articles, such: Springer (58 articles); IEEE Xplore (43 articles); ResearchGate (27 articles); SSRN (19 articles); Hindawi (19 articles); IGI Global International (13 articles); ACM Digital Library (13 articles); IOP Science (12 articles); Emerald Insight (12 articles); and Elsevier (11 articles). Springer is the publisher that publishes the most articles on Artificial Intelligence Financial. Springer is a publishing institution in the field of science spread across 50 countries and is the pioneer of the world's most prominent open-access journal. The findings of this study indicate that research on Artificial Intelligence Financial has a high chance of being published in international publishing houses and has excellent potential for collaborating with a network of scientists at the international level.

**RQ3. Author productivity**

Based on the mapping results, it indicates an author who is productive in researching the theme of Artificial Intelligence Financial, Karina Kasztelnik from Colorado State University (USA), in 3 articles during the 2020-2021 period. The study's findings indicate there are still very few researchers who publish articles on Artificial Intelligence Financial and have an excellent opportunity to conduct similar research due to the lack of productivity of researchers.
Kasztelnik from the USA publishes his articles in the Journal Open Economics, Journal of Business and Economic Studies, and Journal of Business and Economic Studies. The number of citations to Kasztelnik's article regarding the Innovative Empirical Model for Predicting National Banks' Financial Failure with Artificial Intelligence Subset Data Analysis in the United States was six.

Table 1
Author who actively write articles (top 10)

<table>
<thead>
<tr>
<th>No</th>
<th>Author (Country)</th>
<th>Title (Journal/Proceedings, Year)</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Karina Kasztelnik (USA)</td>
<td>Innovative Empirical Model for Predicting National Banks' Financial Failure with Artificial Intelligence Subset Data Analysis in the United States (Journal Open Economics, 2020)</td>
<td>6</td>
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<tr>
<td></td>
<td></td>
<td>Empirical Innovative Model for Predicting National Banks' Financial Failure With Artificial Intelligence Subset Data Analysis in the US (Journal of Business and Economic Studies, 2021)</td>
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<tr>
<td></td>
<td></td>
<td>Innovative Predicting Risk Model for Systemically Important Financial Institutions with Artificial Intelligence in the United States (Journal of Business and Economic Studies, 2021)</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Behzad Soleymanian Asl (Iran)</td>
<td>Application of Artificial Intelligence Model to Identify the Distorted Financial Application of Artificial Intelligence Model to Identify the Distorted Financial Statements (SRRN, 2021)</td>
<td>0</td>
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<tr>
<td></td>
<td></td>
<td>Application of Artificial Intelligence Model to Identify the Distorted Financial Statements (Preprints, 2021)</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>David Mhlanga (South Africa)</td>
<td>Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion (International Journal of Financial Studies, 2020)</td>
<td>145</td>
</tr>
<tr>
<td>No</td>
<td>Author (Country)</td>
<td>Title (Journal/Proceedings, Year)</td>
<td>Citation</td>
</tr>
<tr>
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</tr>
<tr>
<td>4</td>
<td>Gil Cohen (Israel)</td>
<td>1 Algorithmic Trading and Financial Forecasting Using Advanced Artificial Intelligence Methodologies (<em>Mathematics</em>, 2022)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Artificial Intelligence in Trading the Financial Markets (<em>International Journal of Economics and Business Administration</em>, 2022)</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Jassim Ahmad Al-Gasawneh (Jordan)</td>
<td>1 Avoiding Uncertainty by Measuring The Impact of Perceived Risk on The Intention To Use Financial Artificial Intelligence Services (<em>Uncertain Supply Chain Management</em>, 2022)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Moderating the Role of The Perceived Security and Endorsement on The Relationship Between Perceived Risk and Intention To Use The Artificial Intelligence in Financial Services (<em>International Journal of Data and Network Science</em>, 2022)</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Kunal Tiwari (India)</td>
<td>1 Inclusion of Financial Technology and Artificial Intelligence in Management and Development of Human Resource in India (<em>International Journal of Research in Engineering and Science</em>, 2022)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Application of Artificial Intelligence in Financial Technology and its Inclusion in Indian Banking and Financial Systems (<em>International Journal of Advances in Engineering and Management</em>, 2022)</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Nikolay Lomakin (Russia)</td>
<td>1 Artificial Intelligence System for Financial Risk Prediction in the Banking Sector (<em>International Scientific Conference on Innovations in Digital Economy</em>, 2022)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 International Financial Markets face to face with Artificial Intelligence and Digital Era (<em>Theoretical and Applied Economics</em>, 2019)</td>
<td>50</td>
</tr>
</tbody>
</table>
RQ4. The highest number of citations

The mapping results indicates the article by David Mhlanga in 2020 entitled "Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion" was the most widely cited, with 145 citations. Wall from the USA with 119 citations, Popkova and Parakhina from Russia with 114 citations, Lui & Lamb from the UK with 112 citations, Mogaj et al. from the UK with 109 citations, Faccia et al. from UK with 88 citations, Choi and Lee from the Republic of Korea with 71 citations, Melnychenko from Poland with 71 citations, Kruse, et al. from Germany with 60 citations, and Fernandez from Spain with 51 citations.

The findings of this study indicate that researchers cite many articles on Artificial Intelligence of Financial as reference material. Most of the research on Artificial Intelligence of Financial is of good quality and has a great opportunity as a reference source for similar studies.
Table 2
Authors with the highest number of citations (top 10)

<table>
<thead>
<tr>
<th>No</th>
<th>Author (Country)</th>
<th>Citation</th>
<th>Title (Journal/Proceedings, Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>David Mhlanga (South Africa)</td>
<td>145</td>
<td>Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion (International Journal of Financial Studies, 2020)</td>
</tr>
<tr>
<td>4</td>
<td>Alison Lui &amp; George William Lamb (UK)</td>
<td>112</td>
<td>Artificial Intelligence and Augmented Intelligence Collaboration: Regaining Trust and Confidence in The Financial Sector (Information &amp; Communications Technology Law, 2018)</td>
</tr>
<tr>
<td>5</td>
<td>Emmanuel Mogaji; Taiwo O. Soetan &amp; Tai Anh Kieu (UK)</td>
<td>109</td>
<td>The Implications of Artificial Intelligence on The Digital Marketing of Financial Services To Vulnerable Customers (Australasian Marketing Journal, 2020)</td>
</tr>
<tr>
<td>7</td>
<td>Dahee Choi &amp; Kyungho Lee (Republic of Korea)</td>
<td>71</td>
<td>An Artificial Intelligence Approach To Financial Fraud Detection Under IoT Environment: A Survey and Implementation (Hindawi, 2018)</td>
</tr>
<tr>
<td>9</td>
<td>Luisa Kruse; Nico Wunderlich &amp; Roman Beck (German)</td>
<td>60</td>
<td>Artificial Intelligence For The Financial Services Industry: What Challenges Organizations To Succeed (Proceedings of the 52nd Hawaii International Conference on System Sciences, 2019)</td>
</tr>
<tr>
<td>10</td>
<td>Ana Fernandez (Spain)</td>
<td>51</td>
<td>Artificial Intelligence in Financial Services (SSRN, 2019)</td>
</tr>
</tbody>
</table>

RQ5. Systematic mapping

Systematic mapping is carried out based on the results of network visualization, layer visualization, and density visualization. The results of the network visualization indicate that there are 8 clusters. The related links could be more robust and spread over 8 clusters marked with small circles. The small circle indicates that there is still little research on Artificial Intelligence Financial and means that there is an opportunity for new studies to carry it out.

The overlay visualization results show the colors on the nodes that represent keywords in the year of publication and indicate the publication period. The dark blue indicates the publication of articles around 2018, and the yellow indicates the publication of articles around 2021. Based on the visualization overlay illustration indicates AI of Financial has a green node which means many articles were published around
2020. Article with keywords AI of Financial with a green color associate with several items in each cluster. It means that there is still an opportunity to conduct a study with the theme of Artificial Intelligence Financial related to several items in each cluster.

The results of the density visualization show that each point has a color that indicates the density of the items at that point. Color categories range from blue to green to yellow. The greater the number of items around the dot and the higher the weight of the items, the closer the dot's color is to yellow. Conversely, the smaller the number of items around the point and the lower the weight of the items, the closer the point’s color is to blue. Based on the illustration, the density visualization shows that the highest weight is Artificial Intelligence. At the same time, the other items have a relatively low density because there is still a faint yellow color. It means there are still opportunities to carry out the latest studies by taking these items as sub-themes for further research.

The results of systematic mapping obtained 8 clusters, such: Cluster 1 (Fundamental AI Financial) consisting of 11 items (artificial intelligence, benefits, big data, customers, financial, financial inclusion, financial system, financial technology, fintech, study, technology); Cluster 2 (AI Financial Approach) consists of 9 items (artificial intelligence algorithm, artificial intelligence method, artificial intelligence technique, challenge, enterprise, financial market, opportunity, risk, system); Cluster 3 (AI Financial Management) consists of 7 items (application, artificial intelligence application, artificial intelligence technology, financial field, financial industry, financial management, intelligence); Cluster 4 (AI Financial Development) consists of 7 items (automation, financial services, financial services, financial services industry, future, machine, machine learning); Cluster 5 (AI Financial Database) consists of 5 items (artificial intelligence models, data, financial accounting, financial statements, management); Cluster 6 (Financial AI Field) consists of 4 items (banking, company, financial data, industry); Cluster 7 (AI Financial Collaboration) consists of 3 items (finance, financial sector, process); and Cluster 8 (Fraud AI Financial) consisting of 3 items (banks, financial crime, financial institutions). Several items in each cluster can be an opportunity for further study related to the theme of AI of Financial.
Table 3  
Clustering results

<table>
<thead>
<tr>
<th>Cluster 1 (11 items) Funda-mental AI Financial</th>
<th>Cluster 2 (9 items) AI Financial Approach</th>
<th>Cluster 3 (7 items) AI Financial Management</th>
<th>Cluster 4 (7 items) AI Financial Development</th>
</tr>
</thead>
</table>

In the VUCA era, the role of AI in fintech is becoming increasingly important. AI enables fast data processing and in-depth analysis to deal with complex and uncertain challenges in the financial industry. The role of AI in the financial industry in the VUCA era was to enhance efficiency, speed, accuracy, and security. AI can assist in addressing rapidly emerging complex challenges, providing competitive advantages for fintech companies to navigate dynamic changes and uncertain business environments. In financial management theory, AI assists in better decision-making, more effective risk management, more accurate forecasting, optimal portfolio management, and better company cash and finance management.

This study only uses the Google Scholar database. Several databases use for further research, such: Scopus, PubMed, Crossref, Microsoft Academic, and Web of Science. For further studies, use a combination of these databases, so the results will be more varied in identifying trends in the study of Financial Artificial Intelligence (AI) in the VUCA era. Data analysis techniques in this study only use bibliometrics. Subsequent studies suggest adding meta-synthesis and meta-analysis techniques to obtain interpretations of similar study themes to gain a deeper understanding of the concept of AI Financial scientifically, both from a qualitative and quantitative approach.
CONCLUSION

The results of the study answered several research questions: RQ1, during the period 1984 to 2023, there were 551 articles on Artificial Intelligence Financial, but only 539 articles met the criteria for further analysis; RQ2 Springer is the publisher that publishes the most articles on Artificial Intelligence Financial (58 articles); RQ3 Karina Kasztelnik who has written the most articles on Artificial Intelligence Financial (3 articles); RQ4 article written by David Mhlanga entitled Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion which was published in the International Journal of Financial Studies in 2020 with the most citations (145 citations); In RQ5, the results of systematic mapping contained 8 clusters which became gaps in the study and several items could become themes for further studies related to Financial Artificial Intelligence.

AI significantly contributes to the fintech industry by improving efficiency, security, and customer experience in the VUCA era. In financial management theory, AI assists in better decision-making, more effective risk management, more accurate forecasting, optimal portfolio management, and better company cash and finance management.

REFERENCES


* Corresponding author

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