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Forensic auditing and the use of artificial intelligence: A bibliometric analysis and systematic review in Scopus between 2000 and 2024

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Abstract

A significant and successful approach to fraud detection includes artificial intelligence in forensic auditing. Forensic auditors can now respond quickly to suspicious circumstances and take preventative action before fraud spreads and causes further damage to the organization, all thanks to artificial intelligence that has enabled early fraud identification. This article analyzes forensic auditing and the use of artificial intelligence through a bibliometric analysis in Scopus and a systematic literature review. The samples were documents selected using Boolean operators with keywords in English (Forensic AND auditing, artificial AND Intelligence), analyzed in Excel and VOSviewer. This research points out that forensic auditing and the use of artificial intelligence have advanced, in the variety of topics covered, the prominence of perpetrators, and the accessibility of crucial data. Therefore, to maintain the quality and integrity of their work, forensic auditors must adapt to technological advances, training in the use of artificial intelligence, and collaborate with other specialists and professionals. Consequently, with its empirical basis, this bibliometric and systematic review critically evaluates the research, to clarify the empirical basis of current trends in this field and lays the groundwork for future research.

Keywords: Forensic auditing, Artificial Intelligence, Bibliometrics, Literature review

1. Introduction

Accounting and business in today's highly competitive and globally interconnected marketplace are evolving in response to technological advances, especially in the areas of e-commerce and innovation [1]. The CPA audit process has evolved in response to these advances [2], [3]. Consequently, the conventional roles of audit, finance, and accounting teams are being transformed with the incorporation of data management and artificial intelligence (AI) into accounting operations [4], [5].

Due to the need to take a critical and systemic view of fraud cases in organizations, a subset of financial auditing known as forensic auditing has emerged [6], [7]. Also, its main objective is to help organizations detect high-risk regions by revealing the circumstances motivation, opportunity, and pressure that may cause examined members or workers to engage in fraudulent behavior [8]. In that sense, forensic auditing is a method that attempts to assist in the investigation of fraud, which are intentional and willful violation of legal standards [9], [10].

On the other hand, the term "artificial intelligence" describes the ability of computers to learn, reason, perceive, and make decisions, all of which are usually associated with human intellect [11], [12]. In this context, artificial intelligence (AI), which is emerging as a disruptive technology, can revolutionize forensic auditing and strengthen the fight against corporate fraud [13]. Since the field of forensic auditing has made extensive use of artificial intelligence. Thus, auditors are now better able to detect and evaluate cases of potential fraud [14]. Similarly, forensic audit procedures have become more efficient thanks to the automation of repetitive work made possible by AI, this frees auditors to focus on more complicated and strategic responsibilities [15], [16].

Given that technology is constantly developing and changing, issues with AI are no longer seen as something of the future. On the contrary, more and more people are beginning to realize that technology is a catalyst for change in most business and financial operations [17], [18]. According to PricewaterhouseCoopers [19], AI will completely revolutionize organizations by improving decision-making capabilities.

According to The Institute of Internal Auditors [20], there have been several studies in the field of auditing that have explored the potential theoretical and practical applications of AI in auditing procedures in various sectors, stating that AI has diverse uses in many sectors, including public, commercial, industrial and governmental fields, as this field of study opens up new possibilities that did not exist before. The incorporation of AI into auditing presents several advantages, such as increasing the efficiency of the process, reducing long-term expenses, and automating the process to reduce the risk of errors. In addition, systems capable of accumulating knowledge from past actions, providing feedback and executing inference procedures are desirable [21], [22]. This is the main reason why it is currently receiving special attention.

In that sense, research in forensic auditing and the use of AI has increased in the last decade. Therefore, its increased use in auditing is crucial because it has the potential to automate much of the work that accountants and auditors have traditionally performed, such as the creation of documentation, reports, and presentations [23]. In any case, bibliometric research allows scholars to track the dissemination of information and determine the relative merit of different publications by analyzing written and other scholarly works [24], [25].

Therefore, databases cannot do their job of recognizing scientific background without an accurate research data collection capability [26], [27]. Consequently, bibliometric indicators are used, which are measures to calculate the amount of literature on a given topic or set of related topics [28], [29].

In this sense, research on forensic auditing and the use of artificial intelligence is the focus of this study, which aims to provide a conceptual structure of the theoretical framework underlying this field, conducted between 2000 and 2024. Starting from this context, the aim of this paper is to conduct a bibliometric and systematic literature survey on forensic auditing and the use of artificial intelligence in Scopus between 2000 and 2024. To achieve the proposed study objective, the following questions are addressed:

1. What are the current trends of scientific publications in Scopus on forensic auditing and the use of artificial intelligence on a global scale, with respect to authors, journals or sources, year of publication, country of origin, area of knowledge and type of document?
2. What is the key term of greatest occurrence essential in research on forensic auditing and the use of artificial intelligence?
3. What are the conceptual elements of relevance, the most used methodology, and the main results in the systematic analysis?

In terms of theoretical and literary advances, this work offers the following contributions. An important aspect of this study is its comprehensive coverage of research in forensic auditing and the use of AI, emphasizing the ways in which technology is transforming all facets of the enterprise, in order to showcase AI and foresight as vital resources for auditing procedures [30]. Many researchers have analyzed the impact that auditing and the use of AI will have on the management styles of information service providers and how these factors interact with each other [31], [32]. Therefore, in order to offer alternative solutions, it is crucial to understand the effect and potential changes that these organizations are facing. Another contribution is the conceptual conceptions linked to future audits and how this topic has been treated in companies [33]. Due to the importance of staying ahead of technological curves in today's global business climate and the fact that all employees must be able to see the big picture and devise creative solutions to problems to implement continuous improvement strategies; so that companies can think critically about quality, identify its sources and impacts and, most importantly, suggest quick ways to improve it [34], [35].

This paper aims to determine the scope of the study and the associated conceptual components through a bibliometric and systematic review in Scopus. They are initially structured according to a bibliometric framework to collect knowledge on forensic auditing and the use of AI. The evaluation considers the following indicators: year of publication, country, subject, type, source, and authors. Also, starting from a fundamental conceptualization and the tools that have been explored so far, the current situation of forensic auditing and the use of artificial intelligence is described, through systematic literature review methods, for the presentation of findings. In addition, the researchers used Excel to analyze data from 270 publications in the bibliometric analysis and 7 papers for the systematic literature review.

On the other hand, unlike previously published works, this one distinguishes itself from the others by being a critical, selective, and schematic investigation that combines all the necessary data from bibliometric analysis and systematic review into a unified whole. This type of scientific work brings together all the important details on a given topic and presents them in a logical order. Its fundamental role is to contextualize published works by recognizing a study that summarizes and analyzes the current state of knowledge on forensic auditing and the use of artificial intelligence, based on an exhaustive search in Scopus.

Following this outline, the rest of the article is organized as follows. The first section briefly introduces the topic, background, current problems, and objectives. This is followed by a description of the research methodology, the sample selected, the data treatment, and the analysis performed. Then, the results of the work will be described, and the stated purpose of the study in the results section. In the third section, the results are discussed and findings and solutions are provided for forensic auditing in relation to the use of artificial intelligence. Finally, the researchers will summarize the main conclusions and offer suggestions for future research.

2. Research method

Initially, a bibliometric analysis was developed in Scopus, a database of abstracts and citations of peer-reviewed literature, whose tools allow tracking, analyzing, and visualizing academic research [36], which in turn helped to gather a sufficient theoretical corpus to address the problem statement.

On the other hand, as a search strategy, Boolean operators were used with keywords in English: Forensic AND auditing, artificial AND Intelligence. In addition, the period analyzed was from 2000 to 2024. Likewise, the following bibliometric characteristics were taken into account in the selection of 270 documents: year of publication, most relevant authors, source or journal, keywords, country, subject area, and type [37]. To generate the keyword co-occurrence map, the data were analyzed using VOSviewer V_1.6.19 and Excel for descriptive statistics and count data.

Secondly, a systematic content review was performed, which is a way of organizing the claims of a subject, in which the findings of scientific studies are discussed to improve their knowledge within the scientific

community [38]. The relevance of this method is to find new research in the existing scientific literature, streamline the research process to make it clearer and faster, and search for all accessible evidence comprehensively [39].

A comprehensive analysis of relevant data extracted from various databases was conducted using the following search terms: "Forensic AND auditing" and "artificial AND Intelligence" [40]. Seven papers were chosen and used for the qualitative systematic review. These documents arose from the identification of the following inclusion criteria: publication period between 2000 and 2024, documents in English and Spanish, original or review papers, and documents related to the topic.

3. Results and discussion

3.1. Bibliometric study on forensic auditing and the use of artificial intelligence

The bibliometric analysis included papers on forensic auditing and the use of artificial intelligence published between 2000 and 2024. Figure 1 shows that there was a considerable increase in academic production on this topic starting in 2016 and that this trend continued throughout the research period. Consequently, it presents the highest production rate between 2021 and 2023, with 59% of the total production worldwide, with 159 publications.

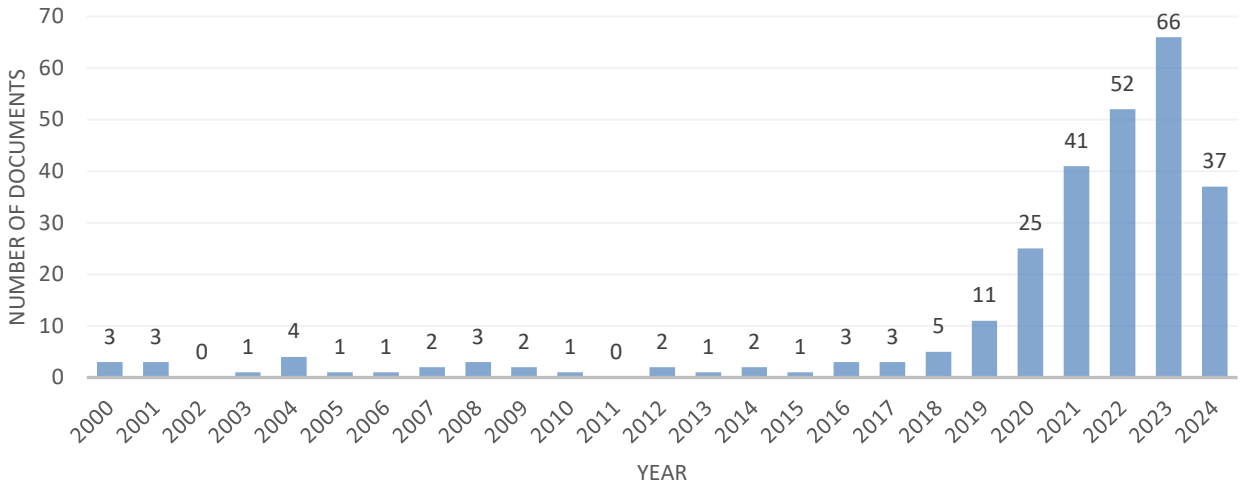

Figure 1. Evolution of publications per year

The most influential researchers in the field of forensic auditing and the use of artificial intelligence have contributed significantly to the advancement of knowledge on a global scale, and it is important to recognize their contributions. A total of 133 authors, representing various academic institutions, worked on the final publications that are the subject of this study. Table 1 shows the most productive authors according to the number of publications they have based on the information provided: Perl, Y., from the Department of Computer Science in Newark (USA), has 5 registered papers on the subject and 146 citations, standing out as the most productive researcher. Followed by Vasarhelyi, M. (n=3; 161 citations), Halper, M. (n=3; 88 citations), Spackman, K.A. (n=3; 88 citations), and Wang, Y. (n=3; 88 citations).

Table 1. Authors with the highest scientific productivity

Author	Number	Total citations	H-index
Perl, Y.	5	146	29
Floridi, L.	3	78	62
Halper, M.	3	88	21
Hsu, M.F.	3	34	12
Mökander, J.	3	79	6
Spackman, K.A.	3	88	22

Author	Number	Total citations	H-index
Vasarhelyi, M.	3	161	34
Wang, Y.	3	88	6
Xu, J.	3	38	9
Advani, A.	2	12	9
Al-Aroud, S.F.	2	19	2
Axente, M.	2	40	2
Bajardi, P.	2	76	18
Bodenreider, O.	2	23	34
Cannella, R.	2	12	18
Cazazian, R.	2	9	2

Throughout the research period, 148 sources or journals that disseminate scientific papers related to forensic auditing and the use of artificial intelligence were located. Table 2 lists the primary sources, the most relevant with 8 publications each being the journals Sustainability Switzerland and IEEE Access. Followed by the journal AI and Society (7 papers) and AMIA Annual Symposium Proceedings (5 papers), among others. In addition, with an average impact factor above 5.2, most of the journals are in the first quartiles.

Table 2. Sources or journals with the highest scientific productivity

Source	Number of documents	Source	Number of documents	Source	Number of documents
IEEE Access	8	Studies in Systems Decision and Control	3	International Journal of Data and Network Science	2
Sustainability Switzerland	8	Accounting	2	International Journal of Medical Informatics	2
AI and Society	7	Accounting Research Journal	2	Journal of Accounting and Organizational Change	2
AMIA Annual Symposium Proceedings AMIA Symposium AMIA Symposium	5	Analysis and Metaphysics	2	Journal of Medical Systems	2
Accounting Finance Sustainability Governance and Fraud	5	Complexity	2	Journal of Open Innovation Technology Market and Complexity	2
Studies in Computational Intelligence	4	Contemporary Studies in Economic and Financial Analysis	2	Journal of Risk and Financial Management	2
Applied Sciences Switzerland	3	Contributions to Finance and Accounting	2	Review of Accounting Studies	2
Artificial Intelligence in Medicine	3	Decision Support Systems	2	Scientific Reports	2
Computer Law and Security Review	3	Electronics Switzerland	2	Security and Communication Networks	2

Source	Number of documents	Source	Number of documents	Source	Number of documents
Edpacs	3	Information Polity	2	Surgical Endoscopy	2
International Journal of Accounting Information Systems	3	Information Processing and Management	2	Technological Forecasting and Social Change	2
Journal of Emerging Technologies in Accounting	3	Information Sciences	2	Indefinite	111
Managerial Auditing Journal	3	Insights Into Imaging	2	**Total sources**	**148**

Figure 2 shows five categories linked to the keywords chosen by the authors. To obtain the data shown, the publications were filtered according to the terms that appeared more than three times in the abstracts, keywords, and titles. Similarly, the co-occurrence network was constructed using keywords that, according to VOSviewer's prediction of the degree of relationship between them, were classified into five distinct groups, each represented by a different color. Thus, the lines joining the labels represent the total number of records and help to visualize the degree of clustering.

- Purple cluster: "artificial intelligence" (n=145 occurrences), with the keywords related to forensic audit, external auditor, accounting practices, auditing practices, accounting training, and industry 4.0 readiness.
- Red cluster: "professional services" (n=104 occurrences), is associated with the following words: adoption, service industries, technology adoption, organization, innovation, marketing.
- Yellow cluster: "human" (n=86 occurrences), keywords focus on software, procedures, social group, minority group, communication.
- Blue cluster: "explainable ai" (n=54 occurrences), refers to a group of related words including language model, digital store, legal, blockchain, potential risk, Fintech, lending, and sensitive data.
- Green cluster: "monitoring" (n=37 occurrences), keywords focus on privacy, deep learning, monitoring, internet of things, machine learning, authentication.

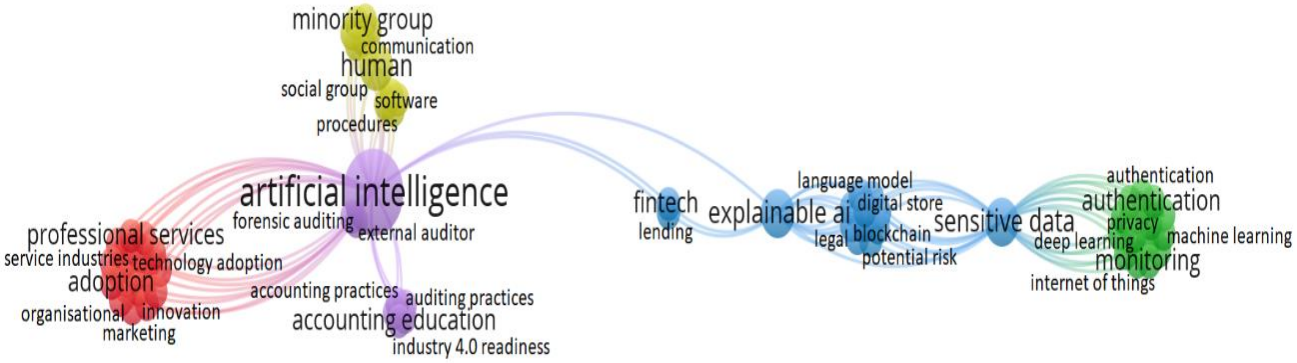

Figure 2. Co-occurrence of keywords

Likewise, the participation of several states with a high production of publications is observed when comparing the thematic areas of the publications evaluated between countries. It was determined that 71 countries contributed at least one paper according to the evaluation of productivity by nations based on the affiliation of the relevant author's institution. According to Table 3, the top three nations in terms of publication of scientific papers were the United States (n=58; 14.4%), the United Kingdom (n=32; 7.9%) and China (n=23; 5.7%). As for the languages used in the publications, English is the dominant language, with 78.1% of the total, and Spanish accounts for 15.6%. The remaining 6.3% of the content was published in Portuguese.

Table 3. Productivity by country of origin

N°	Country	Number of documents	%	N°	Country	Number of documents	%
1	United States	58	14.4%	17	Jordan	6	1.5%
2	United Kingdom	32	7.9%	18	Portugal	6	1.5%
3	China	23	5.7%	19	United Arab Emirates	6	1.5%
4	India	19	4.7%	20	Austria	5	1.2%
5	Australia	16	4.0%	21	Finland	5	1.2%
6	Germany	16	4.0%	22	Oman	5	1.2%
7	Italy	14	3.5%	23	South Korea	5	1.2%
8	Canada	12	3.0%	24	Sweden	5	1.2%
9	Spain	12	3.0%	25	Switzerland	5	1.2%
10	Netherlands	11	2.7%	26	Bahrain	4	1.0%
11	Turkey	11	2.7%	27	Belgium	4	1.0%
12	France	9	2.2%	28	Ireland	4	1.0%
13	Taiwan	9	2.2%	29	New Zealand	4	1.0%
14	Romania	8	2.0%	30	Norway	4	1.0%
15	Saudi Arabia	8	2.0%	31	Undefined	71	17.6%
16	Brazil	6	1.5%		**Total**	**71**	

Table 4 shows all papers related to forensic auditing and the use of artificial intelligence published between 2000 and 2024, organized by area and type of publication. Out of a total of 22 subject areas, the most significant share of scientific production is attributed to computer science (21%), followed by business, management, and accounting (17%), social sciences (11%) and economics, econometrics and finance (11%). In addition, most of the production (86%), broken down by the type of document, consists of scientific articles. This is followed by book chapters (12%) and books (2%).

Table 4. Publication of documents by subject area and type

By area	Quantity	%
Computer Science	120	21%
Business, Management and Accounting	95	17%
Social Sciences	63	11%
Economics, Econometrics and Finance	62	11%
Engineering	43	8%
Multidisciplinary	39	7%
Decision Sciences	25	4%
Arts and Humanities	21	4%
Mathematics	14	2%
Environmental Science	12	2%
Other areas	67	12%
Type of document	**Quantity**	**%**
Article	231	86%
Book Chapter	33	12%
Book	6	2%

3.2. Systematic literature review

Articles qualifying for inclusion in the systematic literature review covering the years 2000-2024 are included in Table 5, along with their authors, research objectives, methodologies, and main findings. Most seek to analyze the factors that influence forensic auditing and the use of artificial intelligence. Conceptual elements, the impact of change, key roles, determinants, challenges, improvements, reliability, variations, and realities influencing forensic auditing and the application of AI were identified in the selected papers.

In general terms, the papers chosen for the systematic review attempt to identify, describe, analyze, and investigate the elements that have an effect, positive or negative, on forensic auditing and the use of artificial intelligence. The methods used in the research are mostly qualitative and include descriptive, exploratory, theoretical, conceptual, and bibliographic designs, as well as systematic and critical literature reviews. In order to gain insight into the methods and tools used to collect data, phenomenological approaches to examine the literature and bibliometric reviews were employed.

Table 5. Studies selected for the systematic review

Authors/year	Objective	Methodology	Results
Erazo-Castillo & De la A-Muñoz (2023)	"Determine conceptual aspects related to the audit of the future and how this topic has been addressed in educational institutions and companies."	"A qualitative approach using a systemic and critical research process. Analysis of descriptive studies and documentary review"	"It is revealed that foresight and artificial intelligence applied in auditing have become tools to achieve higher levels of quality, improve processes, reduce time and money, and provide reliable data for decision making and risk identification."
Morán (2020)	"Determine the impact and changes brought by the digital age and artificial intelligence in the business environment and in the approach of the audit sector."	"Qualitative approach, with exploratory documentary-type scope."	"Updating the regulations governing modern auditing and the regulation of artificial intelligence is indispensable, as this would ensure an orderly digital transition and at the same time provide legal certainty to the society that could be affected by it even indirectly."
Benites (2023)	"Examine the fundamental role of artificial intelligence (AI) in fraud detection and prevention in the context of forensic auditing"	"Quantitative approach, use of numerical data and statistics to analyze and quantify fraud patterns detected using artificial intelligence techniques."	"Advanced AI techniques such as machine learning and natural language processing have revolutionized the way fraudulent activities are identified and analyzed in organizations"
Lima et al. (2024)	"Reflect on the reliability of the sampling tool in accounting audits, and discuss its improvement with the use of Artificial Intelligence (AI)"	"The research was basic, using bibliographic data, seeking to understand in depth its results."	"The study serves as a basis for further studies on applications in audits and improvements in sampling processes, in the accounting/statistical field in the effectiveness of sampling in audit processes"
Becerril (2022)	"Analyze the various questions on the legal regulation of AI and its impacts in the field of cybersecurity"	"Documentary-type qualitative approach."	"The expanded use of AI and its machine learning, along with market growth and decreasing prices, will greatly expand the impact of these systems in national security"

Authors/year	Objective	Methodology	Results
Velandia-Pacheco & Escobar-Castillo (2019)	"Characterize the empirical approach in forensic auditing that researchers have used to study fraud"	"It was a bibliographic review of descriptive-exploratory scope, using the SCOPUS database."	"The study contributes to the theoretical framework of forensic auditing by identifying redress or damage compensation as an alternative theoretical approach to fraud prevention and detection"
Almache & Márquez (2023)	"Approximate the international legal liability criteria that included principles of humanity and public conscience in AI computational programming."	"It was qualitative, applying documentary research based on the historical method, logical examination, and comparative-legal analysis."	"It was identified that in the face of the impact of AI, International Law demands the accompaniment of a new system that supports and enforces transnational and mandatory, regulation to the existing subjective bias."

The objective of forensic auditing-also referred to as investigative auditing or fraud auditing to identify, investigate, and prevent irregularities in an organization by combining the principles of auditing and investigation [41]. In this regard, when irregularities in the form of fraud, corruption, irregularities, or other illegal or inappropriate behavior are suspected in a business or financial environment, forensic auditing can be used [42].

On the other hand, the study of programming computers to mimic human intellect in areas such as decision-making, pattern recognition, machine learning, and natural language processing is known as artificial intelligence [43], [44]. In any case, with the help of AI, forensic auditors can automate data collection and analysis, use machine learning algorithms to detect patterns, extract useful information from documents using natural language processing, and produce reports that present their findings clearly and concisely [45], [46].

Based on the data obtained in the bibliometric analysis, since 2016 there is evidence of a progressive growth with slight fluctuations in the production of literature related to forensic auditing and the use of artificial intelligence. Likewise, one of the most relevant authors was Perl, Y., a computer science professional from the United States, focused mainly on topics such as natural language processing (NLP), bioinformatics, logical observation identifier codes, unified medical language systems, etc. Similarly, the IEEE Access journal showed a publication trend of 8 papers in thematic areas of computer science and engineering in general. As for the keywords analyzed, it shows the existing relationship of AI with forensic auditing, which serves as a support in accounting practices, education, and training for Industry 4.0.

According to the research of García-Peñalvo et al. [47], they state that AI has a long history and, according to the efforts of many researchers, a bright future as a subfield of computer science dedicated to the development of intelligent systems that can simulate human intellect. However, the study by [48] is not consistent, because they indicate that forensic auditors are just beginning to apply AI, stating that it is still in its early stages and is not widely or consistently applied.

In addition, accounting and auditing are just two of the many fields that have found AI to be an invaluable tool in the modern digital age [49]. Because, with its ability to process large amounts of data, monitor employee actions, detect signs of fraud as they occur, track employee social media accounts, and examine documents, it is an invaluable tool for any forensic audit team [50].

According to the systematic review analysis, according to Morán [11] the field of auditing and quality control is facing new possibilities and problems arising from technological advances. Innovation has the potential to change the forms and skills needed to advance the accounting profession, but traditional auditing services will continue to be important for third parties to have confidence in the financial statements of companies. Consequently, the impact of the technological revolution and digital transformation must support the current approach to auditing in the context of the digital and AI era.

Likewise, the research conducted by Velandia-Pacheco & Escobar-Castillo [51] points out that through the systematic collection of forensic audit studies from Scopus, the empirical method adds to the theoretical basis of the field, highlighting damage compensation as a viable theoretical alternative for fraud prevention and detection. Similarly, [52] states that as AI and machine learning capabilities continue to expand at a dizzying pace, the cybersecurity industry is taking into account the potential benefits of AI in decision-making.

The Almache and Marquez [53] study considers the importance of simulating the ethical and moral aspects governing the ensuing conflict between forensic regimes that must pass laws regulating AI, and also, discovers a fragmentation and disintegration of their legal framework in relation to the implementation of their learning protocols, the incorporation of human rights and the use of their programming that could be codified into national laws in response to the ethical principles informing their decision making in this crucial situation.

Meanwhile, Erazo-Castillo & De la A-Muñoz state that as technology continues to transform all facets of business, foresight, and AI can position themselves as essential tools for auditing, helping to achieve better quality, save time and money, streamline processes, and provide reliable data for risk assessment and decision making [54].

For Lima et al. [55] it is crucial to think of other ways to use applications in audits and how to improve current methods, this could open new avenues of research in the fields of accounting and statistics, specifically on the success of sampling in audits. Finally, Benites [14] in his developed research shows that the integration of AI in forensic auditing has been a successful method of detecting fraud. The reason why, machine learning, natural language processing, and other cutting-edge AI methods have completely altered the way companies detect and investigate fraud.

4. Conclusions

Consistent with the stated objective of the study, the number of research conducted on forensic auditing and the use of artificial intelligence has seen a spike in research activity in recent years. The bibliometric analysis found an increase of 59% (n=159) when examining all documents indexed by Scopus between 2020 and 2024, with the years of highest productivity being 2021, 2022, and 2023. In addition, the United States has the highest production rate (14.4%, n=58) among all nations considered, while the highest percentage of publications edited in English was 78.1%. Also, the work of Vasarhelyi, M. was cited 161 times, with IEEE Access and Sustainability Switzerland being the two most notable sources, with 8 scholarly papers each.

Likewise, scientific articles accounted for 86%, with computer science accounting for 21% of the total, while business, management and accounting made up 17%. The term "artificial intelligence" had a number of occurrences of 145 times in the VOSviewer keyword analysis. Moreover, the 270 publications reviewed underline the importance of forensic auditing and the use of artificial intelligence, as it is presented as a revolutionary tool that could radically alter the way audits of administrative processes are conducted, thanks to its remarkable improvements in operational efficiency, analytical accuracy and proactive identification of anomalies.

With restraint, ethics, and responsibility, AI can be a powerful tool for forensic auditors. AI is not intended to supplant forensic auditors, but rather to augment and enhance their work. However, reliability, ethics, transparency, regulation of algorithms and data, and security are just some of the limitations and concerns that AI brings to the work of forensic auditors.

Finally, it is concluded that forensic auditing and the use of artificial intelligence have advanced, in the variety of topics covered, the prominence of perpetrators, and the accessibility of crucial data. Therefore, to maintain the quality and integrity of their work, forensic auditors must adapt to technological advances, training in the use of artificial intelligence, and collaborate with other specialists and practitioners. Consequently, with its empirical basis, this bibliometric and systematic review study critically evaluates the research, to clarify the empirical basis of current trends in this field and lays the groundwork for future research.

Declaration of competing interest

The authors declare that there is no conflict of interest.

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Author contribution

Rafael Romero-Carazas is the leader of the research, in charge of the methodology, work plan, and corresponding author; Antony Espiritu-Martinez and Marleny Aguilar-Cuevas were in charge of putting together the theoretical framework of the research; Maribel Usuriaga-Palacios was in charge of finding the appropriate journal; Luis Aguilar-Cuevas and Miriam Espinoza-Veliz put together the part of the results extracted from the Scopus database; Melvi Espinoza-Egoavil and Sonia Gutiérrez-Monzón were in charge of the translation and final revision of the article.

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Ethical approval statement

Ethical approval is not applicable to this research.

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