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Bibliometric analysis of artificial intelligence in accounting: Trends and future directions

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ABSTRACT

This study investigates the application of Artificial Intelligence (AI) in accounting from 2014 to 2024 using a bibliometric approach. A total of 475 documents were extracted from the Dimensions database and analyzed to identify key trends in publications, researchers, institutions, and topics. The findings show a significant rise in AI-related accounting research from 2018, with the highest output recorded in 2023. Using VOSviewer software, three primary themes emerged: AI's role in improving accounting processes, its impact on auditing and financial reporting, and academic perspectives on AI integration in accounting. The United States leads in publications and citations, with Rutgers University and the Journal of Emerging Technologies in Accounting making notable contributions. Despite the growing interest, challenges such as limited financial data for AI systems remain. The study emphasizes the need for stronger collaboration among researchers, practitioners, and policymakers to enhance AI-driven innovations in accounting and improve business performance.

1. Introduction

Global artificial intelligence (AI) venture capital reached US$3 billion in the first quarter of 2024 and is forecast to reach US$12 billion by the end of 2024. AI has heralded the emergence of a new society with pervasive information capabilities, signaling a shift from an industrial society to one that is more connected and information-driven (Ziatdinov et al., 2024), and affects several industries, including accounting. This digital transformation with new capabilities is reshaping operational efficiencies, improving decision-making processes, and changing 'how financial data is analyzed and interpreted.' The first studies on the use of AI in accounting began in the 1980s, and concerned expert systems software that performs financial analysis using a knowledge base of financial analysis rules, enriched as they are executed. Such a system, developed in accounting (O'Leary, 1987) and auditing (Bailey et al., 1987), provides integrated process and decision support (Akoka and Comyn-Wattiau, 1996; Lenard, 2003). Research has evolved as technology and the needs of professionals have evolved. The capabilities and implications of AI technology in Big Four accounting firms have been the focus of scientific production, which dressed the task list without the self-aware intelligence that needs to be developed, highlighting the biases that could occur during the process (Holmes and Douglass, 2022; Kokina and Davenport, 2017). In addition, the legal foundations of computerized accounting and related obligations have been examined when studying the development of ERP systems (Grzeszczak, 2020; Spring et al., 2022). In addition, Rashwan and Alhelou (2020) examined the impact of AI on the accounting and auditing profession in the context of the coronavirus pandemic, while Zakaria (2021) highlighted its role in improving accounting and auditing processes. Subsequently, scientific research has focused on the perception of the use of AI in accounting during technological preparation and its adoption, which plays an important mediating role, particularly among accounting students (Damerji and Salimi, 2021). Technological readiness is influenced by the perception of the evolving nature of accounting practices (Zadorozhnyi et al., 2022) and efforts to master them, highlighting the need for ease of use and perceived usefulness. Thus, the field of technological perception seems insufficiently investigated by research and deserves further investigation due to its key role in adoption. Moreover, several recent scientific articles have looked at the various gaps that have emerged

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following the development of AI. First, some authors have identified a shortage of skilled personnel familiar with AI, data privacy concerns, and high costs of AI integration (Hasan, 2021; Odonkor et al., 2024). Due to its evolving nature, integrating AI in accounting requires continuous training; it should be attractive to future accounting candidates (Boyle et al., 2024; Kroon and do Céu Alves, 2023). Second, it highlights the lack of alignment of AI strategies with organizational goals and suggests addressing the existing skills gap among employees through training. However, the effectiveness of employment models and automated accounting systems has not been investigated thoroughly and needs further exploration. Additionally, banking and financial markets suffer from a severe shortage of financial service advisors (Odonkor et al., 2024). Employees and management must understand the objectives, benefits, and planning of the AI transition, and learn how to manage it and adapt to changes. However, AI governance is not an easy task. For this reason, the third gap in AI governance has been identified, which in particular reveals the limited understanding of the implementation of AI governance, the lack of attention to the context of this governance, the uncertain effectiveness of ethical and regulatory principles, and the insufficient operationalization of AI processes (Birkstedt et al., 2023). Although several studies have proposed awareness-raising and training measures within companies to integrate them into their organizational culture, this segment remains relatively under-researched in the dynamic context of its implementation, particularly in terms of ethics and data confidentiality (Minkkinen et al., 2023; Qian et al., 2024). AI, even with well-orchestrated governance, produces results from available data. For this reason, the U.S. Department of the Treasury in March 2024 identified a fourth gap: The lack of sufficient data available to financial organizations that increasingly rely on AI. Increasing the availability of financial data and verifying the relevance of the results generated by AI remain unfilled. Furthermore, the risk of exposing sensitive information due to AI vulnerabilities in data storage and processing should be eliminated (Giordani, 2024; Herath and Herath, 2024; Olweny, 2024). Finally, the last gap concerns the acceptance of technology by company employees. The problem is how to ensure the acceptance of machine-learning algorithm developments by company employees (Kureljusic and Karger, 2024), especially because resistance to change has been observed (Adeyelu et al., 2024; Norzelan et al., 2024; Odonkor et al., 2024). However, this remains challenging.

Overall, the literature provides valuable insights into the potential applications of artificial intelligence (AI) in accounting. The novelty of our study lies in establishing the state of the literature, identifying research gaps that compromise the success of AI, and forecasting future trends. Therefore, for a better understanding, this study consists of a bibliometric analysis, which is suitable for capturing and quantifying the scientific production of documents and other authors, institutions, and themes, and following their evolution and future (Magadán-Díaz and Rivas-García, 2022).

The main research questions guiding this study are:

1. What are the most common research topics in accounting-related AI applications?
2. Which prominent authors and journals make the greatest contributions to the discipline?
3. How has the collaboration between accounting researchers working on AI changed over time?

The remainder of this paper is organized as follows. Section 2 provides an overview of the relevant literature. Section 3 describes the study's data and methodology. The results are presented in Section 4. Finally, Sections 5 and 6 present the discussions and conclusions, respectively.

2. Literature review

2.1. New technological tools and features to serve AI

First, computer vision (CV) and natural language processing (NLP) were the primary tools that contributed to the rise of AI. CV includes many image-processing techniques such as optical character recognition (OCR), deep learning models for identifying and recognizing objects (Internet of Things), machine learning models, and facial recognition algorithms. However, the predictions of these algorithms lack transparency, which reduces their reliability. Bias in AI systems can lead to unfair consequences, such as discriminatory behavior or biased financial recommendations, if not addressed appropriately (Adelakun et al., 2024). NLP attempts to ask computers to interpret and comprehend language spoken by humans. Text classification, machine translation, automatic sentiment analysis, text generation, and part-of-speech (POS) tagging are just a few of the many activities and applications that fall within the wide range of natural language processing. Second, research on AI in accounting has significantly expanded in recent years, reflecting both technological advancements and evolving industry needs (Bose et al., 2023). The promise of AI in accounting, however, is based on fundamental ideas of automation and machine learning that have been developing since the 1990s, including those examined by Brynjolfsson and McAfee (2014) in their groundbreaking study on the economic effects of automation. These early theories provide a comparison between initial aspirations and current accomplishments and offer a benchmark for comprehending current trends. Building on this basis, subsequent research has explored AI's potential to streamline accounting procedures, including fraud detection and predictive analysis, which were previously only partially possible but were initially envisioned (Iyer et al., 2024; Kroon

and do Céu Alves, 2023). For example, early studies of AI focused on its theoretical potential for decision support and accurate financial reporting (Davenport and Harris, 2005), but more recent research has shown that AI algorithms can be used in real-world accounting tasks to increase efficiency and decrease human error (Ma and Lei, 2024). Third, the volume of data was measured in zettabytes, which is inaccessible for human processing. Foundational research in data automation, such as that by Simon and Newell (1971), explored the fundamental capabilities of AI systems to perform human-like reasoning tasks, which laid the groundwork for automation in data processing. These foundational concepts inform the current AI applications in accounting, where automation and decision-support systems are central to streamlining workflows and reducing error rates. In recent years, AI has made it possible with phenomenal computing power, making it possible to respond to the slightest requests. Current research looks at how AI may improve real-time auditing skills, improve predictive analytics, and provide actionable insights (Ma and Lei, 2024). These advancements immediately expand on the fundamental automation concepts, which become strengthened by the processing capacity of contemporary AI systems. This development from fundamental theories to state-of-the-art implementations emphasizes how AI is changing the accounting industry and how crucial it is to modify accounting practice and education to reflect these developments. Fourth, cloud computing has contributed to AI development by enabling businesses to scale the storage capacity needed for big data used by AI without having to invest in physical infrastructure, resulting in cost savings and eliminating the need for skilled staff. It also enables different stakeholders within an organization to share accounting documents in real time, collaborate on tasks, such as budget development, and monitor financial indicators. By incorporating cloud computing with AI in accounting, organizations can enjoy these benefits while maintaining the confidentiality of sensitive financial data. However, security and privacy are crucial considerations when implementing cloud-based AI systems in accounting (Atadoga et al., 2024; Raja, 2024). Blockchain technology (BT) has emerged as a solution for addressing data security and privacy for AI. In the beginning, the foundations of blockchain's role in accounting, auditing, and smart contracts attracted researchers' attention (Dai and Vasarhelyi, 2017), who proposed its use to power real-time automated accounting systems. The BT network has enabled organizations to record operations in chronological order and share information transparently, simply, verifiably, and without a central control body. In recent years, data security and privacy have enriched BT. BT requires authentication and keys to open cash flows at each accounting and financial pathway stage, thereby making the system more secure and reliable (Ressi et al., 2024). BT allows the recording of transactions, automation of accounting processes, preparation of financial statements, and improvement of audit procedures. Stakeholders have access to the same set of accounting records and data, thus strengthening transparency (Hristova et al., 2024; Song et al., 2024). They do not have the theoretical ability to alter, duplicate, or falsify them without the consent of the majority of the network participants (security). However, potential cybersecurity risks must still be considered if a single group gains control of more than half of its computing power (51% attack) or if the private keys of digital wallets are lost or stolen.

2.2. Advantages of using AI in accounting

The benefits of AI in accounting are numerous and have been widely recognized in recent literature. One of the main benefits of AI in accounting is its ability to improve accuracy and reduce human errors. AI can improve the precision of financial data analysis by automating tasks such as data entry, receipt matching, invoice generation and distribution, and expense reporting, as well as tracking price fluctuations (Giordani, 2024; Serugendo et al., 2024). Moreover, with its self-correction capabilities, AI will continuously enhance the audit process and replace auditors in automated jobs like creating audit plans (Issa et al., 2016). By significantly reducing the time and effort spent on such tasks, AI frees up resources for strategic endeavors. AI can help streamline processes and improve global efficiency, leading to more accurate financial reporting and helping identify irregularities (Antwi et al., 2024).

Additionally, integrating AI into internal accounting processes results in streamlined operational efficiency and positions finance professionals as strategic partners within the organization (Han et al., 2024). Moreover, AI can help summarize key points from contracts, invoices, and receipts, enabling accounting firms to provide efficient and data-driven solutions, improving decision-making through data-driven insights and overall financial performance. Automating manual tasks and reducing the time required for data analysis can also lead to significant cost savings for organizations (Haluza and Jungwirth, 2023). Finally, by quick analysis and processing of large amounts of data enable users to obtain important information that is difficult to collect using manual methods (Jejeniwa et al., 2024; Odonkor et al., 2024).

2.3. AI regulation, ethics, and acceptance issues

Anderson and Anderson (2011) were pioneers in AI ethics, addressing the foundation for the need to program ethical guidelines into AI systems that handle financial records, audits, and other sensitive tasks. The ethical implications of AI in accounting were discussed in the fundamental work of Bostrom and Yudkowsky (2018), who discussed the long-term ethical challenges, such as the delegation of ethical responsibility to AI, risks in automating

decision-making, and the mobility of accounting professionals. Recently, ethical issues arising from the development of AI have evolved, ranging from thematic analysis (Fülöp et al., 2023) to technological readiness (Anh et al., 2024) and its impact on accounting processes (Ahmad, 2024). These studies showed a favorable correlation between AI adoption and technological readiness, as well as facilitating document sharing and remote monitoring during process integration. However, the solutions managed by ChatGPT for educational accounting have provided incorrect assessments (Cheng et al., 2024), questioning the relevance of current models of ethics integration in accounting and paving the way for more in-depth research.

AI can support the existing accounting rules in several ways. For example, it can streamline the calculation and payment of taxes (Korol and Romashko, 2024) or determine provisions according to the latest international accounting standards. Thus, AI can improve the accuracy of financial statements and ensure the success of markets and accounting sectors. As AI develops, regulations must follow. Thus, as AI continues to revolutionize sectors such as accounting, finance, and energy, discussions on regulating its use are becoming more frequent. The evolving legal and regulatory framework for these technologies in the financial services industry is expected to influence the growth of AI and machine-learning technologies in accounting and finance operations. Accounting and tax professionals recognize the power of AI to streamline tax law research, improve data management, and enhance client relationships. Similarly, compliance and regulatory considerations for AI in financial services are becoming a permanent pillar of corporate risk, legal, and compliance frameworks, similar to cybersecurity and data privacy measures, particularly in financial institutions. Market and prudential regulators have begun to develop rules governing the use of AI in financial markets and are considering its adoption in financial services. Similarly, the need for enhanced regulation of AI has been highlighted to ensure that the potential benefits of AI in the audit profession are realized without creating additional problems. In summary, compliance with financial regulations is critical, as not all types of AI applications can be aligned with the regulatory requirements of the financial industry, and existing financial laws, including securities laws, can potentially be applied to regulate artificial intelligence in the financial sector, providing a framework for oversight and governance of AI applications. Regulatory frameworks play a critical role in ensuring the responsible and ethical use of AI technologies in the accounting and financial sectors.

Despite its numerous benefits, the acceptance of AI by accounting professionals is crucial. First, in accounting education, Musyaffi et al. (2024) found hesitation to adopt AI among students and highlighted the importance of understanding the factors that influence their acceptance. Similarly, the resistance to change among business and accounting professionals must be understood. Recently, AI adoption has been studied using the Technology Acceptance Model (TAM) as a framework, which provides a theoretical basis for understanding the factors influencing the acceptance of AI in accounting (Amaning, 2024; Norzelan et al., 2024).

2.4. Practical implications for accounting professionals

The use of AI in accounting has significant implications for both accounting professionals and researchers. AI technologies are transforming accounting procedures, enhancing efficiency, and reshaping the roles of accountants (Hussein et al., 2024; Mgammal, 2024). For accounting professionals, AI adoption is leading to automation of routine tasks, improved data analysis capabilities, and a shift towards higher-value activities (Hussein et al., 2024). This transformation requires accountants to develop new skills, particularly in data management, data cleansing, and specialized computer skills (Holmes and Douglass, 2022). Interestingly, while AI is expected to enhance job performance by reducing repetitive tasks and human error, it also raises ethical concerns such as data privacy, bias, transparency, and accountability (Schweitzer, 2024; Zhang et al., 2023). The impact of AI varies across different sectors of the accounting profession, with public accountants in Big 4 firms showing significantly stronger agreement on AI's potential benefits compared to those in non-Big 4 firms, industry, and academia (Holmes and Douglass, 2022). Its current use in public accounting firms and their clients is not yet extensive (Bakarich and O'Brien, 2021). However, respondents strongly believe that AI will significantly impact their daily responsibilities within five years, and public accountants are very receptive to these changes (Bakarich and O'Brien, 2021). This suggests a gap between current adoption levels and future expectations, highlighting the need for proactive skill development among accounting professionals.

In conclusion, the integration of AI in accounting presents both opportunities for increased efficiency and accuracy, as well as challenges related to data privacy, security, and ethical concerns. To remain relevant and contribute to organizational success, accounting professionals must embrace AI technologies, develop new skills, and adopt a proactive and ethical approach to their use. This transformation will require ongoing learning and adaptation to the evolving landscape of AI in accounting.

3. Data and methodology

3.1. Database choice and justification

Academic literature on AI in accounting was examined using a bibliometric approach. This

method provides quantitative and qualitative data on the academic output produced over a given period. The results of this approach allow researchers to assess the overall state of a scientific field, collect and classify relevant knowledge, and identify areas that require further exploration (Snyder, 2019). The Dimension database was chosen for this study because of its multidisciplinary nature and extensive global scientific database (Singh et al., 2021), which contains approximately 146 million documents as of May 2024. This database can ensure a broad capture of research on AI in accounting. Second, Harzing (2019) noted that the database provides better coverage in business and economic fields. Finally, the Dimensions was the only base with functions allowing perfect coverage of our subject.

3.2. Methodology

In the Dimensions database, we used the Boolean terms "accounting AND AI OR artificial intelligence." These keywords were used in the search query to filter studies specifically addressing AI applications in the accounting field. We included "books chapters and articles" criteria. Other document types, such as these, preprints, and editorials, were excluded to ensure that only rigorously vetted research was analyzed. Only English-language documents were included to ensure accessibility for international researchers. We collected 3982 documents. We then limited the research to May 2015 to May 2024. 2571 documents remained. In the next step, we applied limitations to the themes of trade, management, tourism, and services (domain 35) and information and IT (domain 46). 604 documents remained, among which 17 documents are duplicates or do not concern the field of AI in accounting, such as engineering.

We suppressed them from the database. Then, we selected the subfield "3502-Accounting, Auditing and Accountability," including a sample of 475 documents. After verification of their abstracts and titles, we do not find any duplicates or off-topic documents. The final sample of 475 documents was retained for the study. In the following step, we conducted a bibliometric analysis of the final sample using quantitative, performance, and structural indicators. Excel and VOSviewer were used to evaluate descriptive statistics and examine the keywords, source co-occurrence, and mapping.

4. Results

4.1. Bibliometric outcomes for the general characteristics of the topic

Table 1 shows the production of documents during our study period, which shaped the use of AI in accounting. We selected a minimum of 80 documents per category. The analysis revealed that works in "commerce, management, tourism and services, information and computer science, and accounting, auditing, and accountability" accounted for 46% of the 20 main subject categories. We noted that the "Accounting, Auditing and Accountability" field accounts for 475 documents. We then filtered 475 documents dealing with the use of AI in accounting and presented their evolution over the period 2014-2024 (Fig. 1). A total of 389 articles (82%) and 86 chapters (18%) were included. The results show that since 2018, the number of publications has increased to reach PIC by 2023 (146). This trend seems to continue until 2024 (71 publications in the first five months).

An analysis of the countries with the most publications has been conducted with a threshold of a minimum of seven documents per country. Twelve countries have met the condition. Results revealed that the USA, Indonesia, and China accounted for more than 50% of the total number of publications in the top 12 countries (Table 2). However, the rankings of the most cited countries appear to differ. The USA remains in the lead (38.3%), followed by Australia (22.13%) and the United Kingdom (19.93%). This finding suggests that researchers prefer to cite documents with high-quality standards, which prevail in these countries.

Table 1: Total documents by subject area

#	Area	Total documents	%
1	Commerce, management, tourism, and services	1032	20%
2	Information and computing sciences	874	17%
3	Accounting, auditing, and accountability	475	9%
4	Strategy, management, and organizational behavior	384	7%
5	Psychology	301	6%
6	Biomedical and clinical sciences	260	5%
7	Information systems	200	4%
8	Engineering	161	3%
9	Biological psychology	160	3%
10	Education	145	3%
11	Philosophy and religious studies	141	3%
12	Artificial intelligence	139	3%
13	Data management and data science	134	3%
14	Business systems in context	125	2%
15	Health sciences	114	2%
16	Clinical sciences	111	2%
17	Banking, finance, and investment	105	2%
18	Social and personality psychology	104	2%
19	Applied ethics	85	2%
20	Curriculum and pedagogy	82	2%
	Total	5132	100%

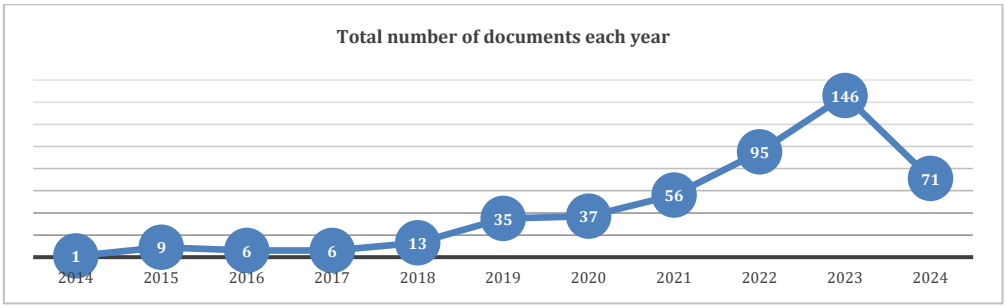

Fig. 1: Number of documents on AI in accounting published by year

Table 2: Top 12 countries by publications and citations of documents

ID	#	Country	documents	%	Citations	%	Total link strength
2	1	United States	43	22.40%	1260	38.30%	74
4	2	Indonesia	32	16.67%	65	1.98%	16
8	3	China	26	13.54%	175	5.32%	32
14	4	United Kingdom	16	8.33%	524	15.93%	53
20	5	Australia	13	6.77%	728	22.13%	26
21	6	Turkey	11	5.73%	51	1.55%	2
25	7	Russia	10	5.21%	9	0.27%	0
27	8	Finland	9	4.69%	322	9.79%	36
32	9	India	9	4.69%	14	0.43%	13
42	10	Italy	8	4.17%	112	3.40%	5
43	11	Ukraine	8	4.17%	8	0.24%	1
44	12	Bahrain	7	3.65%	22	0.67%	3
			192		3290		

Table 3 lists the sources and journals with the highest number of published documents. The selection criteria were a minimum of two documents per source or journal. The results selected 34 sources or journals, of which we present the first 15.

Table 3: Top sources and journals publishing documents on AI in accounting

#	Journal or source name	Number of publications
1	Journal of Emerging Technologies in Accounting	17
2	Lecture Notes in Networks and Systems	10
3	Advances in Finance, Accounting, and Economics	8
4	Audit Financiar	7
5	Advances in Intelligent Systems and Computing	7
6	E-Jurnal Akuntansi	7
7	E3S Web of Conferences	6
8	Sustainability	5
9	Critical Perspectives on Accounting	4
10	Accounting Auditing & Accountability Journal	4
11	International Journal of Accounting Information Systems	4
12	Journal of Accounting & Organisational Change	4
13	Journal of Applied Accounting Research	4
14	Journal of Accounting and Management Information Systems	4
15	Asian Journal of Economics Business and Accounting	4
16	Contributions to Management Science	4
17	International Journal of Science and Research Archive	4
18	Journal of Information Systems	4
19	Hita Akuntansi dan Keuangan	4
20	Computational Intelligence and Neuroscience	3
21	Review of Accounting Studies	3
22	The British Accounting Review	3
23	Issues in Accounting Education	3
24	Qualitative Research in Accounting & Management	3
25	Financial and credit activity problems of theory and practice	3
26	International Journal of Professional Business Review	3
27	Lecture Notes on Data Engineering and Communications Technologies	3
28	Accounting, Finance, Sustainability, Governance & Fraud: Theory and Application	3
29	World Journal of Advanced Research and Reviews	3
30	Meditari Accountancy Research	3
31	International Journal for Multidisciplinary Research	3
32	Atlantis Highlights in Computer Sciences	3
33	International Journal of Engineering and Advanced Technology	2
34	Journal of Corporate Accounting & Finance	2

Table 3 shows that the Journal of Emerging Technologies in Accounting, Lecture Notes in Networks and Systems, and Advances in Finance, Accounting, and Economics are the journals that publish the most documents (17, 10, and 8, respectively). With regard to journal citations, Fig. 2 highlights the clustering of the bibliographic density of citations. A threshold of 100 citations and 1 document is used. Five main clusters emerge, centered on the following sources: The Journal of Emerging Technologies in Accounting (783 citations), the International Journal of Accounting Information Systems (615), The British Accounting Review (294), the Accounting Auditing and

Accountability Journal (139), the Journal of Applied Accounting Research (122) and the Journal of Accounting and Organisational Change (92). There is a strong link between these main sources.

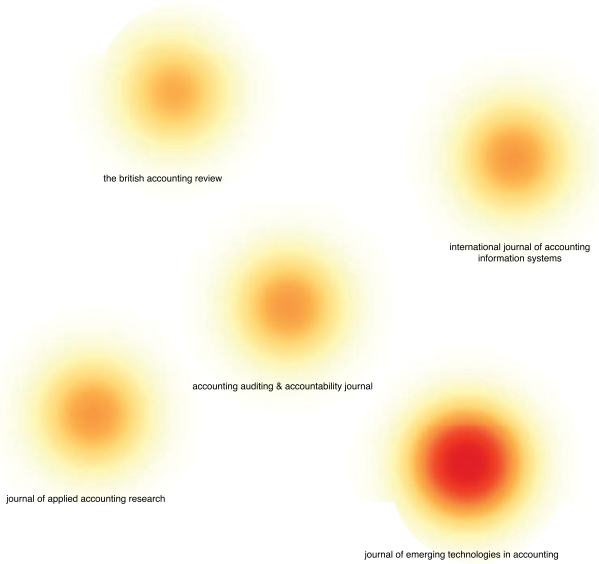

Fig. 2: Bibliographic citation density clustering of journals

Our 475 filtered documents on AI in accounting come from 358 organizations and concern 1070 researchers. Using a threshold of a minimum of three documents, results revealed 15 institutions that produced the most documents during our study period (Fig. 3). Rutgers-State University of New Jersey is in the top ranking (10 documents), followed by Ahlia University, Bahrain (7), Anken School of Economics, Finland, and Udayana University, Indonesia (5). However, manipulation of the threshold for two or more documents revealed that, in terms of the country of origin of most publishing institutions, five American and five Chinese universities were active in our field of study, producing 19 and 11 documents, respectively.

Using a threshold of 100 citations minimum and one document, the institutions with the most cited documents (Fig. 4) were Rutgers, the State University of New Jersey, the United States (587), Queensland University of Technology, Australia (508), Babson College, the United States (309), the Hanken School of Economics (221), and the University of Applied Sciences Upper Austria (117).

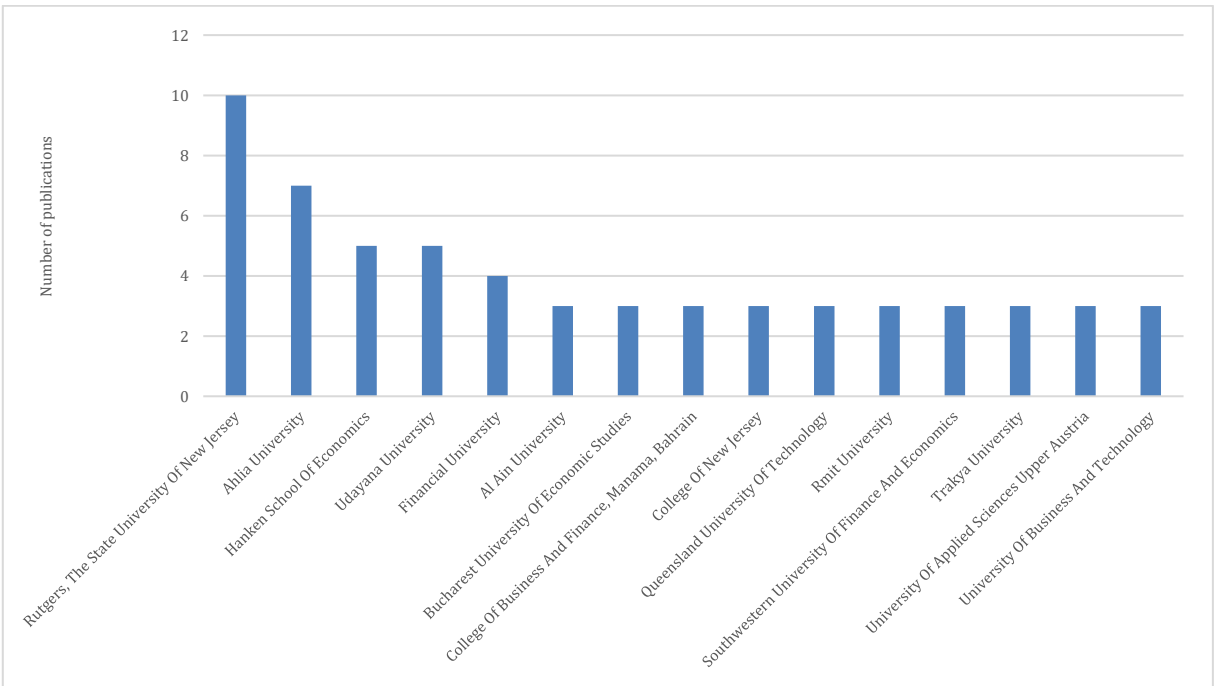

Fig. 3: Institutions publishing the most documents on AI in accounting

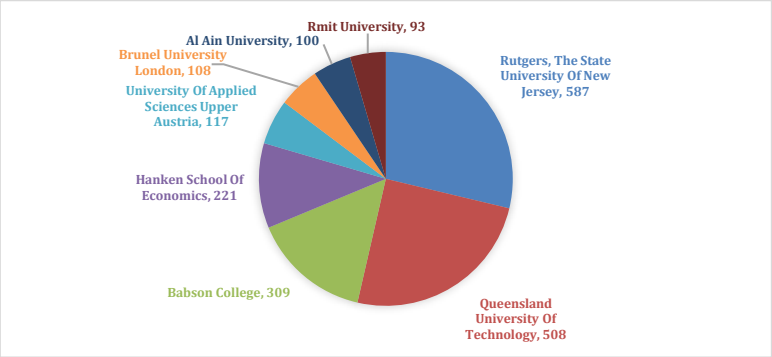

Fig. 4: Institutions with the most cited documents on AI in accounting

The co-authorship of organizations is analyzed with a threshold of a minimum of two documents per institution (Fig. 5). Among the 42 selected institutions, three from the Middle East are among the most important organizations that collaborate with at least two co-authors: Ahlia University (Bahrain), the College of Business and Finance (Bahrain), and the University of Business and Technology (Saudi Arabia) between 2022 and 2023. However, most cited universities do not collaborate sufficiently. The bibliographic coupling of organizations (Fig. 6) shows institutions with at least three common references. Three clusters emerged.

1070 researchers produced 475 documents. Table 4 lists the largest number of authors per document and citations, applying a one-document and 100-citation threshold. Lehner and Vasarhelyi counted seven published accounting documents on AI. Vasarhelyi was the most cited author, followed by Yigitbasioglu, Davenport, and Kokina (565, 473, 290, and 290 citations, respectively). The most cited authors were from the Queensland University of Technology, Australia, Rutgers, the State University of New Jersey, and Babson College, USA. In other words, there was a strong correlation between citations and institutions.

We then analyzed the collaboration (co-authorship) between authors with a minimum threshold of three documents. Results (Fig. 7) show that two clusters emerged and that there was no co-authorship between the most cited authors.

In the following, we conducted a bibliographic coupling of the authors with at least three documents per author. 16 authors are selected among which nine are connected to each other (Fig. 8). The most cited authors appear, without surprise.

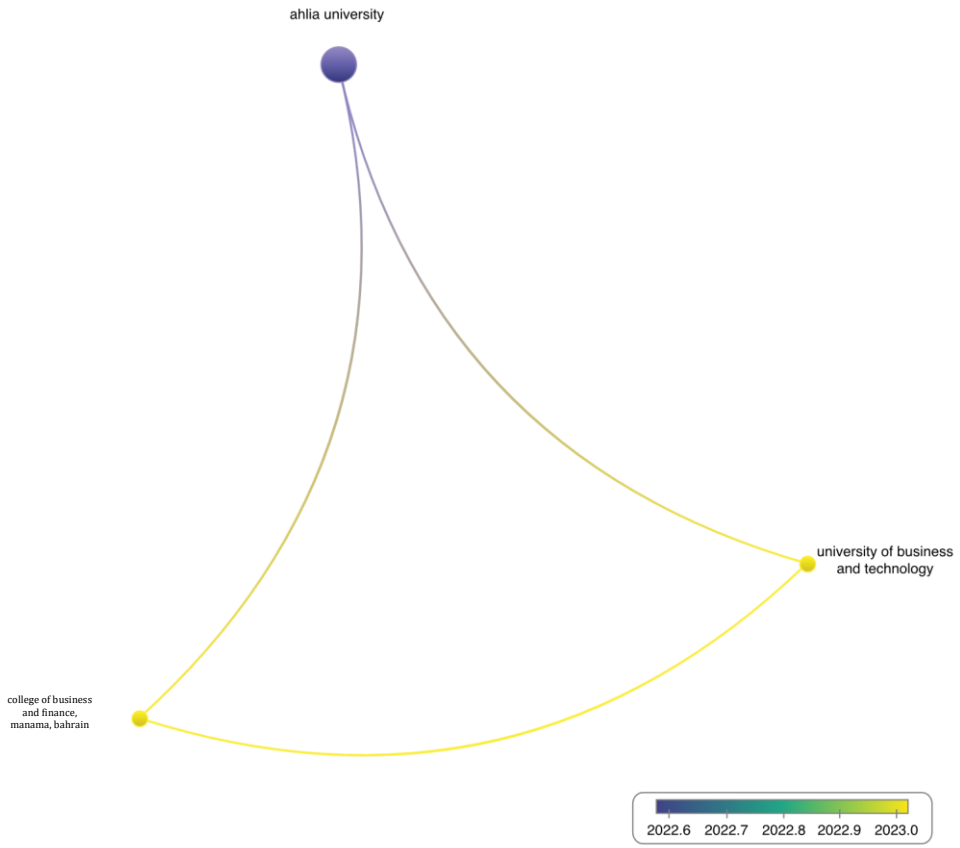

Fig. 5: Co-authorship by organisations

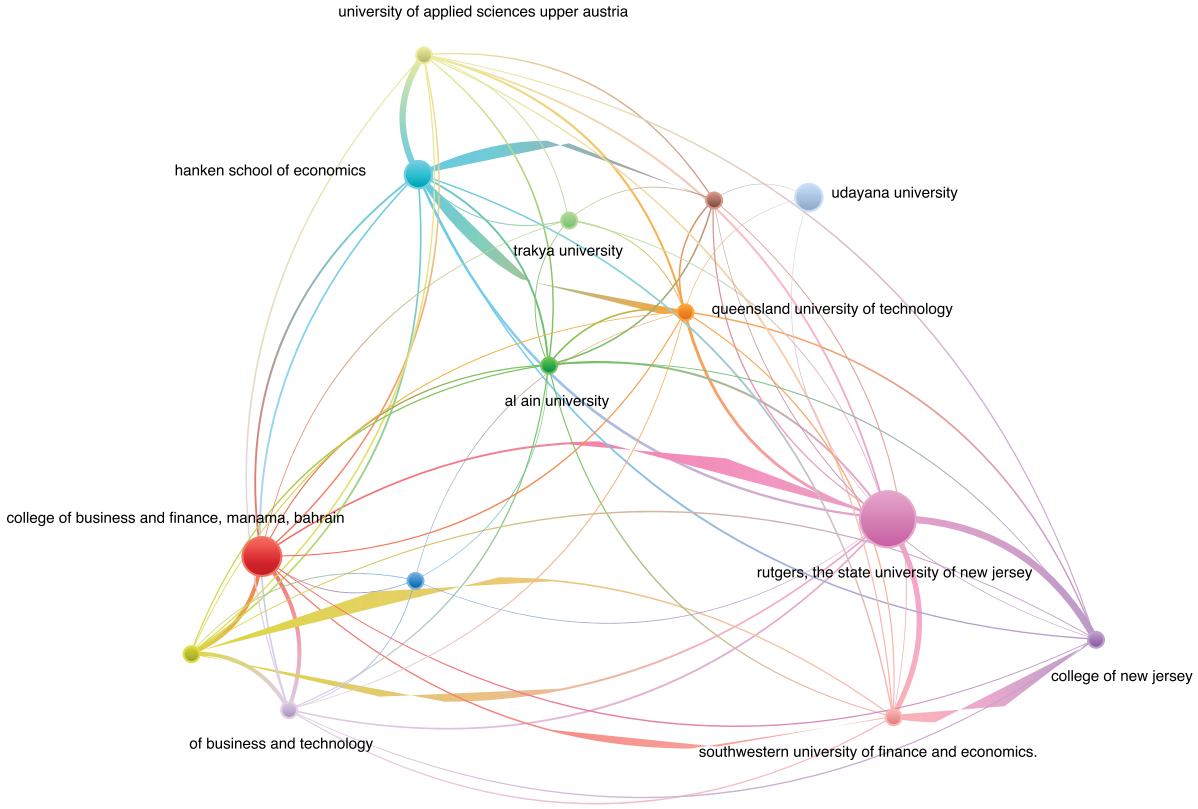

Fig. 6: Bibliographic coupling of organizations

Table 4: Main authors by affiliated country, number of documents, and citations on AI in accounting

#	Author	Country	documents	citations
1	Lehner, Othmar M.	Finland	7	123
2	Vasarhelyi, Miklos A.	USA	7	565
3	Sun, Ting	USA	4	198
4	Qasim, Amer	UAE	3	100
5	Yigitbasioglu, Ogan	Australia	2	*473*
6	Appelbaum, Deniz	USA	1	274
7	Botchie, David	UK	1	106
8	Davenport, Thomas H.	USA	1	290
9	Han, Hongdan	UK	1	106
10	Issa, Hussein	USA	1	196
11	Jarvis, Robin	UK	1	106
12	Kogan, Alexander	USA	1	274
13	Kokina, Julia	USA	1	290
14	Moll, Jodie	Australia	1	272
15	Mordi, Chima	UK	1	106
16	Rikhardsson, Pall	Iceland	1	201
17	Shiwakoti, Radha K.	UK	1	106
18	Yan, Zhaokai	USA	1	274

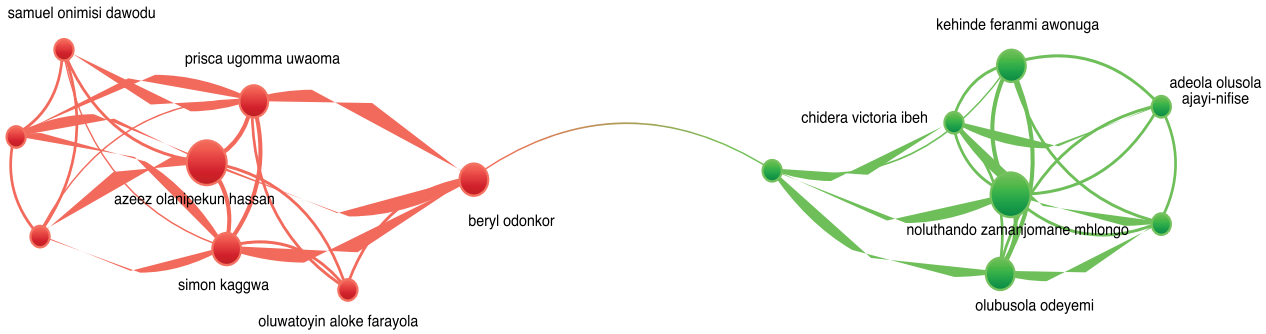

Fig. 7: Co-authorship by authors

The authors' co-citation analysis (Fig. 9) shows the strength of the link collaboration between authors with a threshold of at least 30 citations. Fig. 9 shows the emergence of two main clusters. Vasarhelyi remained at the top of co-citations.

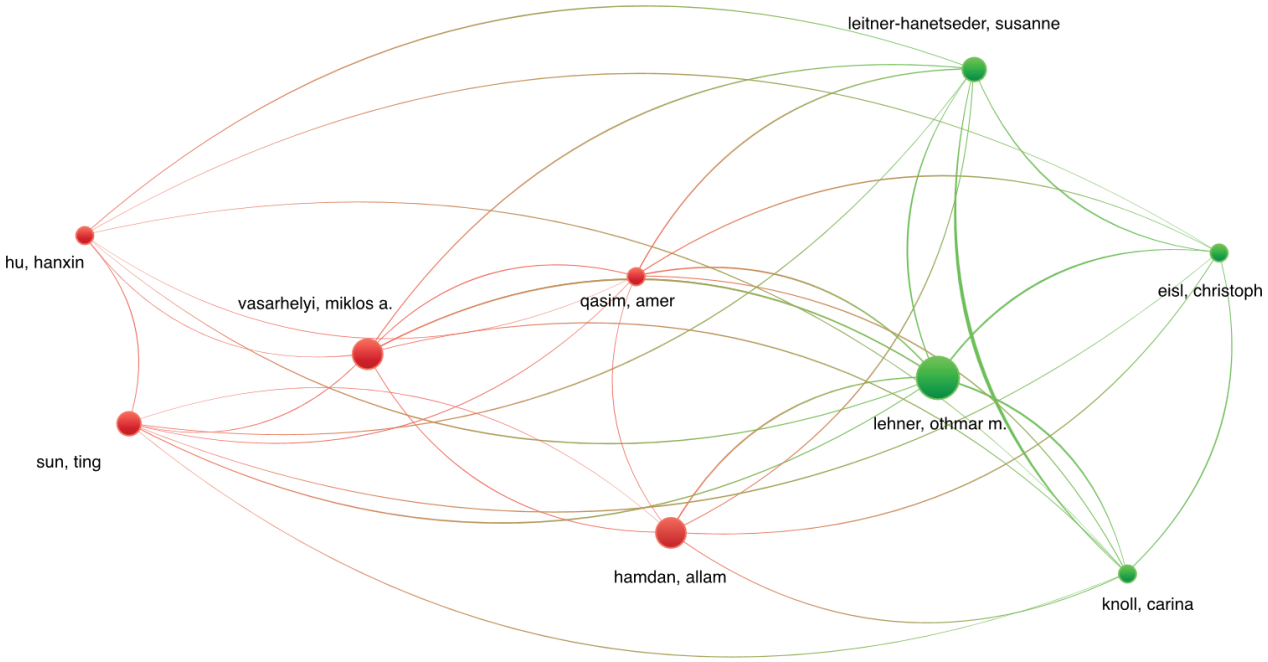

Fig. 8: Bibliographic coupling by authors

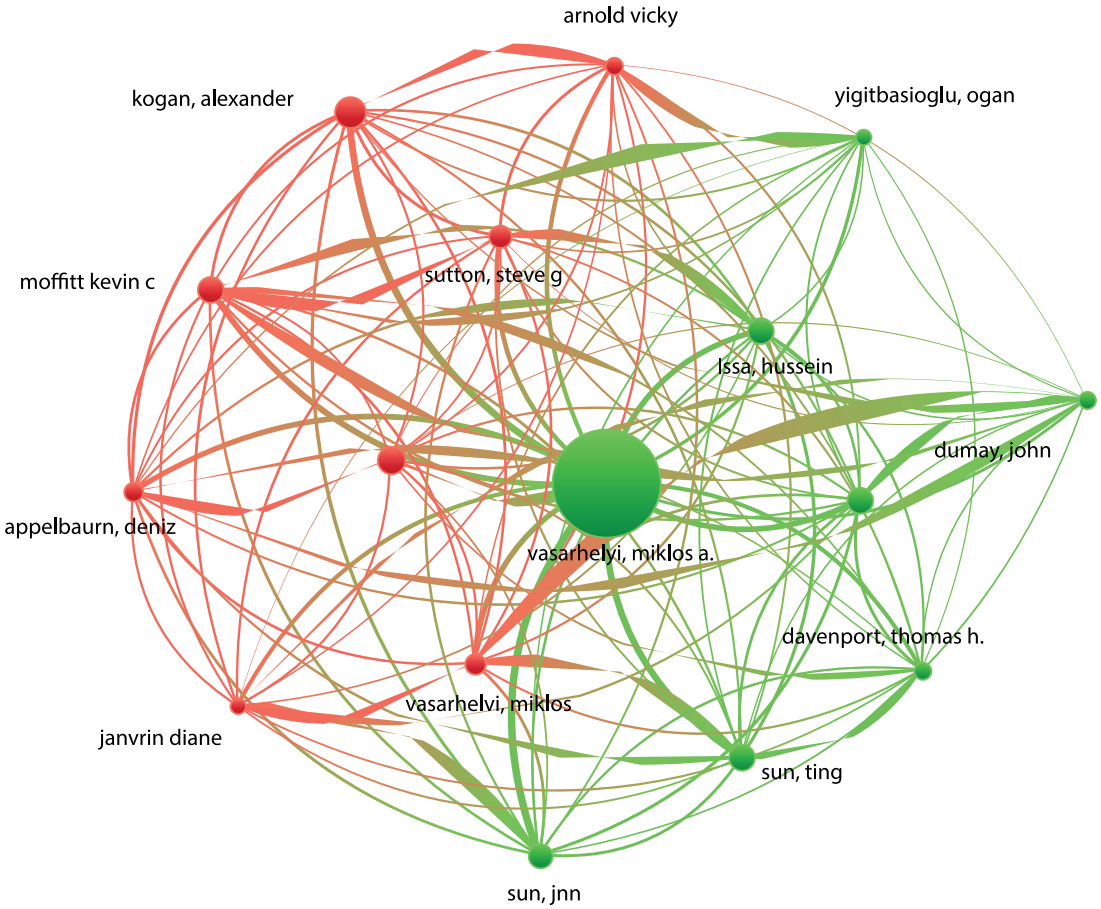

Fig. 9: Co-citation by authors

Fig. 10 shows the keywords that appeared more than 30 times in the abstract, title, and keywords of all selected documents during the period 2014-2024. A total of 125 words were extracted from the 8836 terms, and after merging small clusters, 50 items remained. VOSviewer identifies three main clusters.

- The red cluster "Artificial Intelligence" (304 occurrences) encompassing 25 keywords contains the main following terms: Technology (217), system (131), development (123), information (104), challenge (88), article (77), efficiency (74), change (73), and the accounting profession (66).

- The green cluster "study" (266 occurrences), including 18 terms, refers to research (209), data (158), effect (110), auditor (89), level (70), quality (69), sample (69), and influence (60).
- The blue cluster "paper" (136 occurrences), incorporating seven items, includes implication (62), issue (59), author (53), originality value (36), design methodology approach (30), and future research (30).

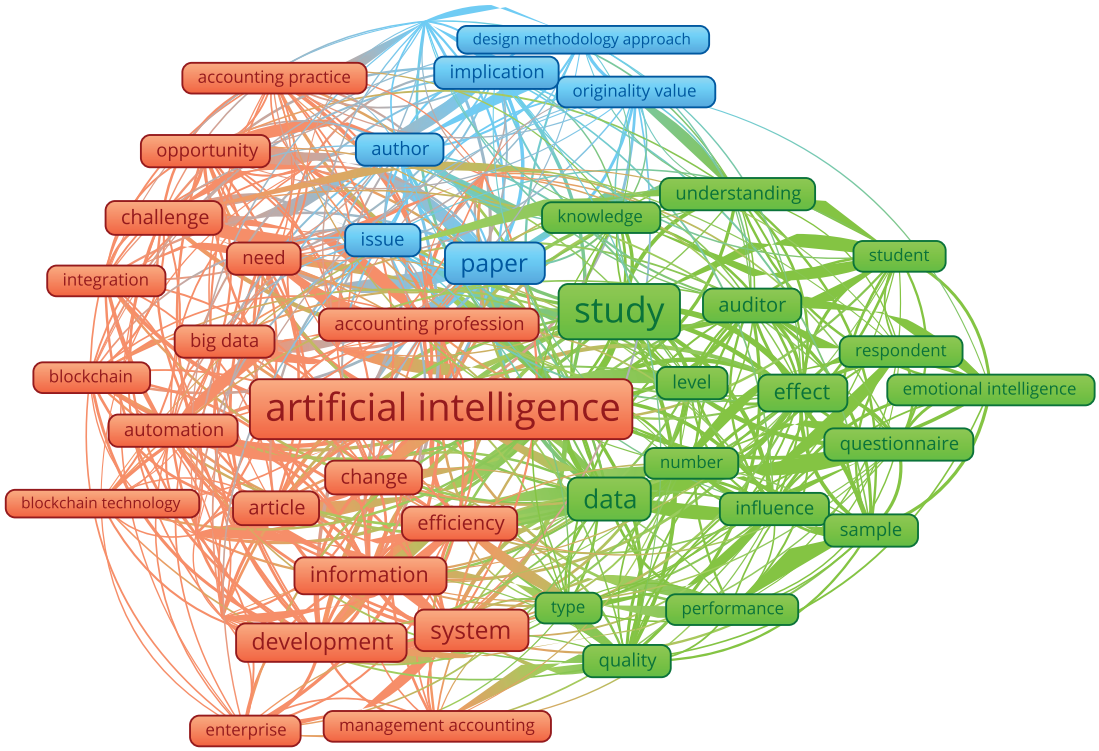

Fig. 10: Keyword co-occurrence network map

Three main themes emerged: AI development and efficiency in the accounting profession; the impact of AI on auditing and accounting; and academic research and future perspectives on AI in accounting. However, to find the most important recent themes (2023-2024), we looked at an overlay visualization of keyword co-occurrences (Fig. 11) for a minimum of two co-occurrences to include the most recent relevant words that have not yet been sufficiently cited. As we can see, the keywords from the green to the yellow clusters cover global issues related to healthcare accounting, financial stability and operations, regulation, and data security. These latest keywords illustrate the recent trend of AI in accounting; however, other topics such as technology acceptance models for stakeholders may develop in 2024.

5. Discussion and implications

Since 2018, research has shown an increased interest in the use of AI in accounting. Scientific production reached its peak in 2023 (146 publications) and will continue on the same path in 2024. Scientific interest in artificial intelligence in the accounting discipline has gained immense popularity in recent years (Bose et al., 2023). Two main factors have contributed to an increase in academic production**.** First, by lowering burnout and assisting with talent retention, AI adoption has the potential to enhance accounting working conditions, as highlighted in the literature (Bose et al., 2023; Boyle et al., 2024). A better work-life balance is important for younger accountants. This supports Kroon and do Céu Alves's (2023) assertion that for accounting professions to continue to be appealing, they must adjust to the demands of contemporary employment. Second, according to the CPA (cpajournal.com), the accounting profession has suffered from a lack of young accountants since 2019, who prefer spending their time in other less restrictive and more remunerative jobs, such as in the United States, the most publishing-source country. AI could be a useful tool for closing this gap by automating monotonous work, freeing up accountants to work on more difficult projects, and lessening the pressure that deters aspiring young professionals from entering the industry. Boyle et al. (2024), who advocated for additional research on how AI might draw talent to the field, are in agreement with this finding. This deep gap between offer and demand in professional accounting competencies enhances research on AI in accounting and requires suitable regulations and training for current and new accountants. The literature review underlines that legal changes and ongoing training for accounting professionals are necessary due to the rapid progress of AI. Our previous findings showed that the current talent gap is exacerbated by the lack of flexibility in accounting training programs.

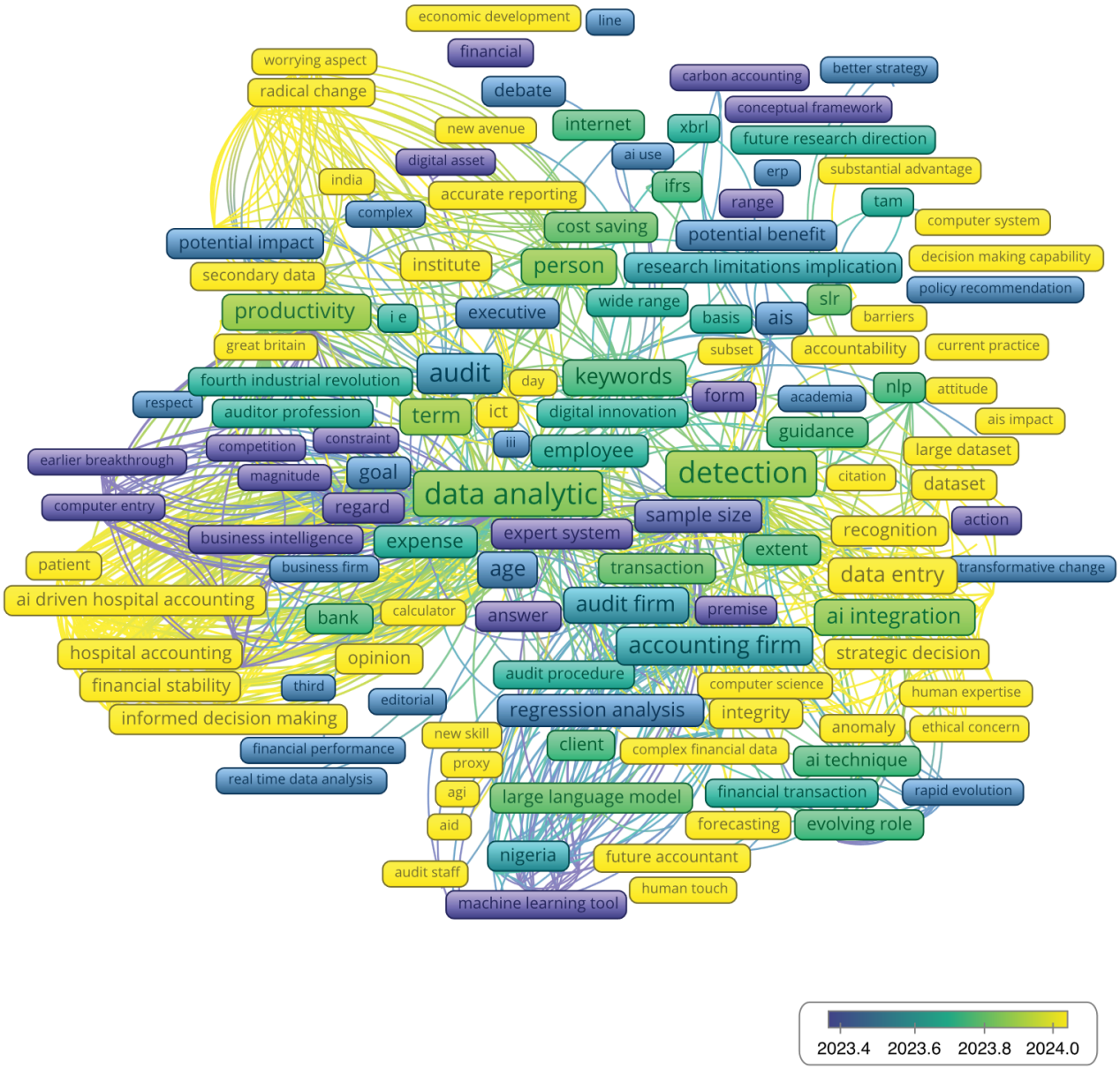

Fig. 11: Overlay visualization of keyword co-occurrences

Our findings also lend credence to the argument made by scholars such as Jejeniwa et al. (2024) that industry, government, and academia should work together more closely to address the changing skill sets needed for AI integration in accounting. Furthermore, the co-authorship analysis revealed a total absence of collaboration between the most cited authors or universities, which may alter the quality and pertinence of future scientific production. This can explain why researchers have not cited documents sufficiently since 2021, as shown in Table 2. Consequently, managerial implications involving universities and governments must be considered to stimulate collaboration through funding or new project elaboration, and to enhance research in this field. Additionally, the ethics and educational modalities of AI in accounting that were identified as important to enhance by researchers in the literature are not sufficiently considered in publications and are absent from the occurrences of the main keywords. Li and Li (2024) affirmed that international cooperation makes it possible to conduct technical and in-depth exchanges with top international research institutions, which will undoubtedly significantly improve scientific research and international influence. However, Kwiek (2021) affirmed that researchers often work together across borders to boost their academic standing, scientific acceptance, and opportunities for financial support in their field. According to de Jong and del Junco (2024), cooperative research projects involving academics and non-academics promote knowledge production and bolster the higher education system's position as an external knowledge provider. Practitioners can play a vital role, particularly in the context of growing AI technologies (Jackson et al., 2023). However, Jejeniwa et al. (2024) and Lardo et al. (2022) underscored the lack of qualified accountants who are up-to-date with new technologies, such as blockchain, in the accounting domain. In short, all stakeholders must make more efforts to improve accounting and auditing research and professional promotion.

The analysis of keyword occurrences and document co-citations revealed three main themes throughout the study period, reflecting topics of research interest in the field. In 2024, research themes evolved into topics in which gaps remained, such as healthcare accounting, financial stability, operations, regulation, data security, and privacy. Therefore, future trends are crucial for conducting additional research in this field to investigate the potential advantages and difficulties associated with incorporating AI into accounting processes. AI is relevant for combating fraudulent activities (Bello and Olufemi, 2024). In addition, despite the use of blockchain technology, data security and privacy are not 100% immune to hacking, and researchers must develop new frameworks and models to avoid risks and enhance security and privacy. According to Iyer et al. (2024), it has predictive utility related to fraud, bankruptcies, accounting estimates, and increased efficiency in the decision-making processes. Al-Mughairi and Bhaskar (2024) added the importance of understanding the determinants of AI adoption in educational settings, and Ma and Lei (2024) examined perceptions of technology readiness and shed light on the factors that affect accounting students' decisions to adopt AI. Finally, Vărzaru (2022) highlighted the importance of addressing ethical concerns in implementing AI in accounting practices as a key point, underlining the need for more in-depth studies. To summarize, owing to its evolving nature, the challenge of AI in accounting remains open, with constant changes in professional implications.

5.1. Implications for accounting practitioners and academics

5.1.1. Accounting practitioners

- Automation of routine tasks: Accounting departments and corporations can save money and produce more accurate financial reporting by increasing productivity and decreasing errors in regular labor.
- Enhanced decision-making: Artificial intelligence-powered technologies can analyze substantial volumes of financial data to generate forecasts, investment recommendations, and budgetary projections. By leveraging these data-driven insights, accountants can potentially improve organizational performance and competitive positioning.
- Fraud detection and risk management: The utilization of artificial intelligence enhances the efficacy of fraud detection and risk management protocols, consequently minimizing financial losses and protecting corporate resources.
- Regulatory compliance and audit efficiency: The automation of these processes reduces the time and resources required for audits and minimizes the risk of non-compliance, thereby facilitating improved adherence to legal regulations and industry standards.
- To maintain competitiveness and retain personnel, organizations must make continuous investments in employee training. Accountants who enhance their skills are likely to attain more valued positions within their respective companies.
- Data security and privacy concerns: Sensitive financial data necessitates protection during the utilization of AI tools, particularly in light of evolving cyber threats and persistent privacy concerns. To enhance data security, accounting firms must collaborate with AI developers and implement more robust data-protection systems.

5.1.2. Academics

- Development of new accounting models and theories: Artificial Intelligence (AI) presents opportunities for the formulation of novel accounting models due to its capacity to process extensive datasets and generate innovative financial insights. Researchers can explore advanced AI-driven methodologies for fraud detection, auditing, and financial reporting. Through the development of frameworks that elucidate the integration of AI technologies into accounting processes, researchers can contribute to the advancement of the accounting profession.
- Exploration of ethical and legal issues: The proliferation of AI systems necessitates a comprehensive analysis of ethical concerns, including decision-making transparency, bias in AI algorithms, and the management of sensitive financial information. Researchers may focus on developing frameworks and ethical guidelines for the implementation of AI in accounting, which could potentially influence corporate governance and policy formulation.
- Collaboration between academia and industry: To maintain relevance, researchers must engage in close collaboration with accounting professionals to develop artificial intelligence solutions that address practical challenges. Universities, corporations, and technology developers must engage in collaborative projects to produce efficacious artificial intelligence applications. This facilitates the conduct of applied research that directly influences the practical implementation of artificial intelligence, ensuring that scholarly findings are applicable in professional settings.
- Examining how AI affects workforce dynamics: The implementation of artificial intelligence in accounting raises concerns regarding the requisite skills for future accountants and the broader implications for employment. Researchers can investigate how AI alters job functions and explore methods to balance machine assistance with human expertise. The findings will inform training and education initiatives, ensuring that prospective accountants are adequately prepared for careers incorporating artificial intelligence.
- Addressing security and privacy issues: To address concerns regarding unauthorized access, data breaches, and potential hacking of sensitive

information, researchers should focus on developing artificial intelligence models that enhance data security and privacy in financial systems. Consequently, this approach will lead to the development of more secure accounting technologies and the establishment of new protocols for data management in AI-driven systems.

- Cross-disciplinary research: The application of artificial intelligence in accounting intersects with disciplines such as ethics, computer science, and law. Scholars may initiate interdisciplinary projects to investigate the broader implications of artificial intelligence on accounting standards, legal frameworks, and business ethics. This approach facilitates collaborative efforts to develop comprehensive solutions and policy recommendations that address the technological and ethical complexities of artificial intelligence.

In summary, the utilization of artificial intelligence to enhance productivity, decision-making processes, fraud detection, and compliance, while addressing skill development and security concerns, represents the primary implications for practitioners. Researchers may now explore novel approaches to investigating accounting models, ethics, security, and collaboration, facilitated by artificial intelligence, with a significant emphasis on aligning research with industry requirements. It is imperative that both practitioners and researchers innovate and adapt to maximize the potential of artificial intelligence in the field of accounting.

6. Conclusions, recommendations, and limitations

This study consists of a bibliometric search of academic research on the use of AI in accounting to identify the current state-of-the-art and future trends. Research interest in this topic has been growing since 2018, peaking in documents published in 2023. Academic production in the first five months of 2024 suggests a continuation of this trend. The United States is the leader in this field, being the most productive country (22.40% of the total number of published documents) and the most cited (38.3% of the total number of citations), as well as its university (Rutgers), journal (Journal of Emerging Technologies in Accounting) and author (Vasarheleyi). Specifically, in terms of publishing institutions, five American and five Chinese universities have published at least two documents in the field, demonstrating their intense scientific activity. In terms of authors, Vasarheleyi and Lehner have published the same number of documents (7), but in terms of citations, Vasarheleyi and Yigitbasioglu are dominant (565 and 473, respectively). However, we did not find any co-authorship between the most cited authors, which may affect the potential value-added resulting from their synergy. The resulting management implication would be to strengthen their collaborative links by establishing partnerships and joint projects between laboratories or institutions, within a favorable incentive and regulatory framework. In addition, the study identified three main themes for the period 2018-2024: AI development and efficiency in the accounting profession, the impact of AI on auditing and accounting, and academic research and future perspectives on AI in accounting. These themes reflect a publication approach that is sometimes descriptive, consequential, preoccupying, or problematic. With the continued development of AI in accounting, topics of interest in 2024 have evolved toward healthcare accounting, financial stability and operations, regulation, and data security. They examined unfilled gaps that continue to be of concern for the profession. They illustrate the premises and trends for future research.

Overall, as the technology continues to advance, further research and exploration of AI applications in accounting are essential to optimize its potential benefits in the field; however, great care must be taken in the conditions of its application to maximize its effectiveness and minimize gaps. Therefore, based on the literature and discussion, we provide some recommendations, followed by the limitations of this study.

First, stakeholders must align their AI strategies with their business objectives. Second, AI should be taught in all accounting schools, and accounting professionals should be prepared for future technological advances. Therefore, the concept of AI in accounting needs to be simplified and explained. Third, professional ethics should be strengthened through university education, awareness raising, training of company employees, and the implementation of government regulations. Fourth, to address the lack of financial data required for AI to provide reliable solutions, we propose measures to enhance the collaboration between researchers and practitioners. This can be achieved through collaborative projects aimed at developing evolving models and frameworks to protect sensitive private financial data. For example, the development of an “unhackable” blockchain can be considered. Finally, as AI advances, it will be necessary for stakeholders to regain acceptance. To achieve this, companies should communicate advances in simple terms, highlighting their advantages and disadvantages and outlining any operational changes that may result.

This study has several limitations. First, the results were specific to a particular period and may not be applicable in the future. However, further studies are required to provide additional insights. Second, the choice of the Dimensions database was based on its exhaustiveness and ability to delimit subject matter. However, this choice was arbitrary, and a comparative study of other databases using different criteria could have strengthened the results. Third, the thresholds used to generate the results, such as the minimum number of authors or citations, may have influenced the analysis to some extent. However, the overall trend was consistent. Finally, the study did not consider cultural

differences, which could lead to misinterpretation of recommended management strategies, especially in situations where understanding behavior is crucial for stakeholder AI adoption. Future studies that consider this cultural aspect will be more relevant.

In conclusion, as AI continues to evolve, research must make greater efforts to keep up with its progress and quickly find answers to the issues it raises, to contribute to business performance and the economy.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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