ARTIFICIAL INTELLIGENCE IN ACCOUNTING PROFESSION AND EDUCATION: A CONTENT AND BIBLIOMETRIC ANALYSIS (2007-2024)

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Abstract

Research on the accounting profession and education regarding artificial intelligence (AI) has significantly increased in the past decade, yet the opportunities and challenges posed by AI continue to be debated. This study aims to provide a comprehensive overview of the literature by synthesizing existing research. Using bibliometric techniques and content analysis, this study offers a comprehensive review of the relevant literature. Bibliographic data from the Web of Science database spanning from 2007 to 2024 were utilized, and 48 academic studies were analyzed. VOSviewer was employed for citation and network analysis, while Excel was used for content analysis. The study identified influential authors, journals, countries, trending articles, and significant network collaborations through bibliometric analysis. One of the most notable findings of the study is the substantial reference to the four major accounting firms in academic research. Content analysis revealed a scarcity of in-depth and specific studies. It was concluded that research and academic applications related to AI are still at a nascent stage, highlighting the need for comprehensive research involving regulatory bodies, academia, companies, and practitioners in future studies. Additionally, the study found evidence suggesting a sluggish pace in academia's adoption of AI applications and education.

Keywords *: Accounting Profession, Accounting Education, Artificial Intelligence, Content Analysis, Bibliometric Review*

Jel Classification *: M40, M41.*

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MUHASEBE MESLEĞİ VE EĞİTİMİNDE YAPAY ZEKA: İÇERİK VE BİBLİOMETRİK ANALİZ (2007-2024)

Öz

Muhasebe mesleği ve eğitimi ile yapay zeka (AI) üzerine yapılan araştırmalar son on yılda önemli ölçüde artmakla birlikte AI'nın yarattığı fırsatlar ve zorluklar tartışılmaya devam etmektedir. Bu çalışma, literatürün kapsamlı bir özetini sentezlemeyi amaçlamaktadır. Bibliyometrik teknikleri ve içerik analizini kullanan bu çalışma, ilgili literatüre kapsamlı bir genel bakış sunmaktadır. Çalışmada Web of Science veri tabanından 2007-2024 tarihleri arasındaki bibliyografya kullanıldı. 48 akademik çalışma analiz edilmiştir. Alıntı ve ağ analizinde VOSviewer, içerik analizinde de Excel kullanılmıştır. Bibliometrik analizde etkili yazarlar, dergiler, ülkeler, trend olan makaleler ve önemli ağ işbirlikleri belirlenmiştir. Çalışmanın en dikkat çeken sonucu dört büyük muhasebe firmalarının akademik çalışmalarda önemli ölçüde referans gösterilmesidir. İçerik analizi sonucunda derinlemesine ve spesifik çalışmaların az olduğu tespit edilmiştir.AI ile ilgili çalışmaların ve akademik uygulamaların başlangıç düzeyinde olduğu, gelecek çalışmalarda düzenleyici kuruluşlar, akademi, şirketler ve meslek mensuplarını kapsayan derinlemesine araştırma yapılması gereği ortaya çıkmıştır. Ayrıca akademinin AI uygulamaları ve eğitiminde yavaş hareket ettiği sonucuna ulaşılmıştır.

Anahtar Kelimeler   : Muhasebe Mesleği, Muhasebe Eğitimi, Yapay Zeka, İçerik Analizi, Bibliometrik Analiz

Jel Sınıflandırılması   : M40, M41.

INTRODUCTION

The rapid advancement of technology continues to profoundly influence our work and personal lives. Among these technologies, artificial intelligence (AI) has shown its impact rapidly and remarkably across various domains. With the emergence of productive AI models in recent years (such as GPT, Google Bard, Microsoft Capilot, etc.), the adoption, understanding, and usage of AI have become more accessible. Although the concept of AI dates back to the 1950s, significant technological breakthroughs occurred in the 1980s and 1990s. In brief, AI, as a term, is defined as the imitation of human intelligence using decision trees and machine learning(Parloff, 2016). It is expected that AI could effectively transform the productivity of the global economy and the potential of Gross Domestic Product (GDP), although its impacts may vary across different sectors(Pwc, 2017). Alongside big data, cloud, and blockchain, AI is among the technologies that could affect the accounting profession (Moll & Yigitbasioglu, 2019: 15). The accounting profession grapples with numerous challenges, such as constantly evolving accounting rules and standards, as well as tax regulations, while also striving to adapt to other technologies and AI applications. It is known that especially the four major audit firms have AI applications, and numerous AI projects and plans are ongoing (Faggella, 2020;Kapoor, 2020). AI not only pertains to the automation of repetitive tasks but also assists in forecasting and monitoring accounting transactions (Duffy, 2018: 44). Therefore, the next generation of accountants need to possess strong accounting knowledge, competence in accounting technologies, high communication skills, and the ability to understand and effectively present data to management teams and clients (Stancu & Duţescu, 2021: 754). Additionally, it is emphasized that disruptive technologies in accounting will undoubtedly change university curricula and teaching methods (Atanasovski & Tocev, 2022: 285;Kınay, Ciğer, & Vardar, 2023:1686).

However, it is known that there has been a longstanding gap between accounting education and accounting practice (Siegel, Sorensen, Klammer, & Richtermeyer, 2010: 41). The significant disparity between the competencies required for success in the accounting profession and those taught (Brewer, Sorensen, & Stout, 2014: 37) is emphasized. The gap between what is taught in accounting and what is required in accounting practice will further widen with the skills necessitated by AI. On the other hand, while it is anticipated that many professions, including accounting, will disappear with the onset of

Industry 4.0 applications, Greenman (2017: 1453) argues that AI applications in the accounting sector will not simply automate manual processes in accounting transactions and replace accountants. Stancheva-Todorova (2018: 139)regards the concern that AI solutions will replace accountants as a myth. Among academics and practitioners, many controversial topics are under discussion regarding how AI and human intelligence will coexist/work together, the future expectations of certain professions, the necessary new skill sets and competencies, and how humans and machines can work efficiently and effectively together.

The diversity of these controversial topics and the increase in different research questions related to AI cause AI to become an interesting topic in the academic community. Accordingly, it is observed that the number of studies is increasing. This situation creates a source of motivation for bibliometric and content analysis studies.

It is observed that there is a scarcity of bibliometric studies investigating the connection between AI and accounting. Thottoli (2022)examined the literature on information and communication in the accounting field in the Scopus database, while Kaya (2024) explored the literature on artificial intelligence and blockchain in accounting in the Web of Science (WoS) database. Agustí and Orta-Pérez (2023) analyzed the literature associating AI and big data with auditing and accounting broadly defined in the WoS database, while Romero-Carazas et al. (2023)focused on the literature concerning AI in accounting education in the Scopus database. Additionally, Ayad& Mezouari(2022) reviewed the literature on the application of AI technologies in the subfield of accounting in the Scopus database, and Muhammad, Khan, Ahmad, Javed, Nasir & Scholar(2023) conducted a bibliometric analysis of the literature on the significance of AI in business management and accounting in the Scopus database.

In this study, unlike previous bibliometric analyses, research on the intersection of AI with the accounting profession and education in the WoS database was selected as the sample. Descriptive content analysis regarding this topic is not available in the literature. Conducting an in-depth descriptive content analysis in this study contributes to its originality. The research questions of the study are as follows:

RQ1: Which authors and countries contributed the most to the studies?

RQ2: What are the key terms used in the studies?

RQ3: What are the research designs/methods, objectives, findings, recommendations, and future research topics of the studies?

The first section of the article presents the methodology, the selected database, the selection criteria, and the tools used for analysis. The second section first presents the findings of the collected articles and bibliometric analyses, then provides the results of the descriptive content analysis to identify trends in the articles. Finally, through the discussion and conclusion section, we present the research findings and offer suggestions for further research.

I. DATA AND METHODS

I.I. Research Design

In the study, bibliometric mapping methods(Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021: 286-290) were initially adopted to determine which authors and countries have contributed to the field and the distribution of keywords in the published articles. Bibexcel was used as the bibliometric software, and VOSviewer was employed for network visualizations. Before visualizing with VOSviewer, data corrections were made using Notepad++. Secondly, to determine the trends in the published articles, the descriptive content analysis method, one of the qualitative research methods, was used (Ültay, Akyurt, & Ültay, 2021).

I.II. Keywords Selection And Data Collection

The study encompasses publications indexed in the WoS database that are accessible through library services or open access and contain the specified search strings in their titles (Table 1).

Table 1. Search strings

| DATABASE	Web Of Science (2007- 24 March 2024)
Search Strings	All Fields: "artificial intelligence" OR "CHATGPT" OR "machine larning" OR "AI" OR "generative AI" OR "natural language processing" OR "NLP" And All Fields: "accounting education" OR "accounting profession"
Identification	68 publications
Screening	2 editorial materials were excluded. 1 Chinese study was excluded. 2 review studies were excluded. 15 studies were excluded due to being unrelated to the topic.
Inclusion	48 publications were identified. • 34 articles • 14 conference papers

II. FINDINGS

The following sections present the trends identified through bibliometric and descriptive content analysis.

II.I. Descriptive Bibliometric Analysis

II.I.I. Publications by year

AI has emerged as a prominent theme starting from 2018, particularly gaining attention in the last five years. The number of publications on this topic has shown an increasing trend over the years. Although the data for 2024 appear low in Figure 1 due to the incomplete annual data, the number of studies is expected to continue rising by the end of the year.
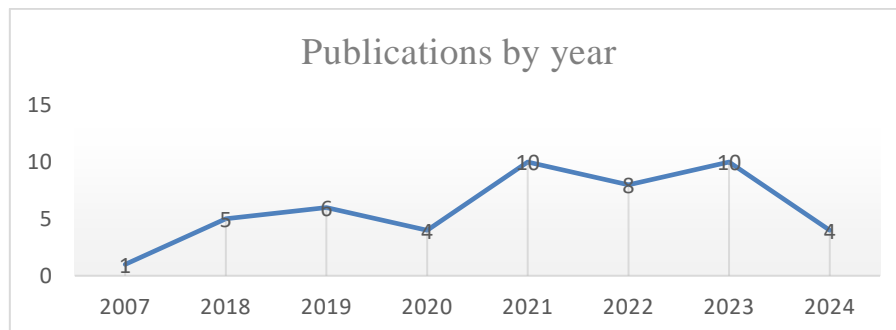
Figure 1. Publications By Year

II.I.II. Authors And Their Productivity

Qasim Amer is the most prolific author, with a total of four publications, comprising three articles and one conference paper (2020, 2021, 2022, and 2023). His work focuses on exploring the accounting education curriculum model and the use of drones in accounting and auditing tasks.

Despite having the highest number of publications, Qasim Amer ranks second among the most cited authors (Table 2). The most cited article belongs to Moll and Yigitbasioglu (2019), with a high citation count of 159.

Table 2. List Of The Most Productive Authors

Author	No of documents
Qasim, Amer	4
Eletter, Shorouq	3
El Refae, Ghaleb A	3
Topor, Dan Ioan	2
Dutescu, Adriana	2
Issa, Hussein	2
Fulop Melinda Timea	2
Smith, James	2
Ionescu, Constantin Aurelian	2

Source: The data obtained from the WoS database was analyzed by authors using the Bibexcel program

In Table 3, the top-cited first article (Moll & Yigitbasioglu, 2019) stands out with a significantly higher citation count of 159 compared to other studies. This review study focusing on four technologies related to the internet in the accounting literature has drawn attention to the need for numerous studies on these technologies and their impact on accountants' daily work, triggering many research initiatives. The second article (with 49 citations) calls for radical changes in accounting curricula to strike a balance between existing accounting knowledge and information technology skills relevant to the profession (Qasim & Kharbat, 2020). Other articles listed in Table 3 have fewer citations, ranging from 39 to 10.

Table 3. The Top 10 Cited Studies

Title	Authors	Country (first)	Source	Citation frequency	Year
The role of internet-related technologies in shaping the work of accountants: New directions for accounting research	Moll, J. and Yigitbasioglu, O.	England	British Accounting Review, 51(6)	159	2019
Blockchain Technology, Business Data Analytics, and Artificial Intelligence: Use in the Accounting Profession and Ideas for Inclusion into the Accounting Curriculum	Qasim, A. and Kharbat, F.F.	U Arab Emirates	Journal Of Emerging Technologies In Accounting, 17(1)	49	2020
How Much Automation Is Too Much? Keeping the Human Relevant in Knowledge Work	Sutton, S.G., Arnold, V. and Holt, M.	Norway	Journal Of Emerging Technologies In Accounting, 15(2)	39	2018
Mediating effect of use perceptions on technology readiness and adoption of artificial intelligence in accounting	Damerji, H. and Salimi, A.	USA	Accounting Education, 30(2	37	2021

Applying Deep Learning to Audit Procedures: An Illustrative Framework	Sun, T.	USA	Accounting Horizons, (33)3	36	2019
The Impact of Artificial Intelligence and Blockchain on the Accounting Profession	Zhang, Y.Y., Xiong, F., Xie, Y., Fan, X. and Gu, H.F.	Peoples R China	IEEE ACCESS, (8)	36	2020
A profession in transition: actors, tasks and roles in AI-based accounting	Leitner-Hanetseder, S., Lehner, O.M., Eisl, C. and Forstenlechner, C.	Austria	Journal Of Applied Accounting Research, (22)3	34	2021
The Robots are Coming ... But Aren't Here Yet: The Use of Artificial Intelligence Technologies in the Public Accounting Profession	Bakarich, K.M. and O'Brien, P.E.	USA	Journal Of Emerging Technologies In Accounting, (18)1	31	2021
Fintech Accounting And Industry 4.0: Future-Proofing Or Threats To The Accounting Profession?	Fülöp, M.T., Topor, D.I., Ionescu, C.A., Capusneanu, S., Breaz, T.O. and Stanescu, S.G.	Romania	Journal Of Business Economics and Management, (23)5	20	2022
Artificial Intelligence and Reliability of Accounting Information	Askary, S., Abu-Ghazaleh, N. and Tahat, Y.A.	Kuwait	Challenges And Opportunities In The Digital Era, (11195)	10	2018

Source: The data obtained from the WoS database was analyzed by authors using the Bibexcel program

II.I.III. Type Of Documents And Sources

Of the studies conducted in the field of AI (Table 4), 70.83% are composed of articles, while the remaining 29.17% consist of conference papers.

Table 4. Distribution by document type

Document type	No of documents	%
Articles	34	70.83
Conference papers	14	29.17
Total	**48**	**100**

Source: The data obtained from the WoS database was analyzed by authors using the Bibexcel program

The most prolific journal is "Journal Of Emerging Technologies In Accounting" (see Table 5). When this journal was examined according to the citations to the journals, it was the second most cited journal after the "British Accounting Review" journal (159 citations), where the study of Moll and Yigitbasioglu (2019) was published.

Table 5.Journals according to h-index and number of citations

No	Journal Names	Occurrences	All citations	h-index	Avg.
1	JOURNAL OF EMERGING TECHNOLOGIES IN ACCOUNTING	7	128	4	18,29
2	ACCOUNTING EDUCATION	3	46	2	15,33
3	JOURNAL OF CORPORATE ACCOUNTING AND FINANCE	3	10	2	3,33
4	JOURNAL OF BUSINESS ECONOMICS AND MANAGEMENT	2	23	2	11,50
5	BRITISH ACCOUNTING REVIEW	1	159	1	159,00
6	CHALLENGES AND OPPORTUNITIES IN THE DIGITAL ERA	1	10	1	10,00

7	COGENT BUSINESS & MANAGEMENT	1	2	1	2,00
8	IEEE ACCESS	1	36	1	36,00
9	INDUSTRY AND HIGHER EDUCATION	1	5	1	5,00
10	JOURNAL OF SCIENCE AND TECHNOLOGY POLICY MANAGEMENT	1	1	1	1,00
11	JOURNAL OF EDUCATION FOR BUSINESS	1	8	1	8,00
12	2021 22ND INTERNATIONAL ARAB CONFERENCE ON INFORMATION TECHNOLOGY (ACIT)	1	1	1	1,00
13	PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON BUSINESS EXCELLENCE	2	3	1	1,50
14	2019 INTERNATIONAL CONFERENCE ON ADVANCED ELECTRONIC MATERIALS COMPUTERS AND MATERIALS ENGINEERING (AEMCME 2019)	1	1	1	1,00
15	ISSUES IN ACCOUNTING EDUCATION	1	8	1	8,00
16	2019 5TH INTERNATIONAL CONFERENCE ON INDUSTRIAL AND BUSINESS ENGINEERING (ICIBE 2019)	1	2	1	2,00
17	PROCEEDINGS OF THE 13TH INTERNATIONAL CONFERENCE ACCOUNTING AND MANAGEMENT INFORMATION SYSTEMS (AMIS 2018)	1	1	1	1,00
18	ADVANCES IN DEVELOPING HUMAN RESOURCES	1	8	1	8,00
19	ACCOUNTING HORIZONS	1	36	1	36,00
20	PROCEEDINGS OF THE 4TH ANNUAL INTERNATIONAL CONFERENCE ON SOCIAL SCIENCE AND CONTEMPORARY HUMANITY DEVELOPMENT (SSCHD 2018)	1	2	1	2,00
21	JOURNAL OF APPLIED ACCOUNTING RESEARCH	1	34	1	34,00

Source: The data obtained from the WoS database was analyzed by authors using the Bibexcel program

II.I.IV. Publishing Activity By Country

When Table 6 is examined, almost half of the studies belong to 3 countries (USA, Peoples' R China and Romania, respectively). There is only 1 study in 12 countries.

Table 6. Publishing Activity By Country
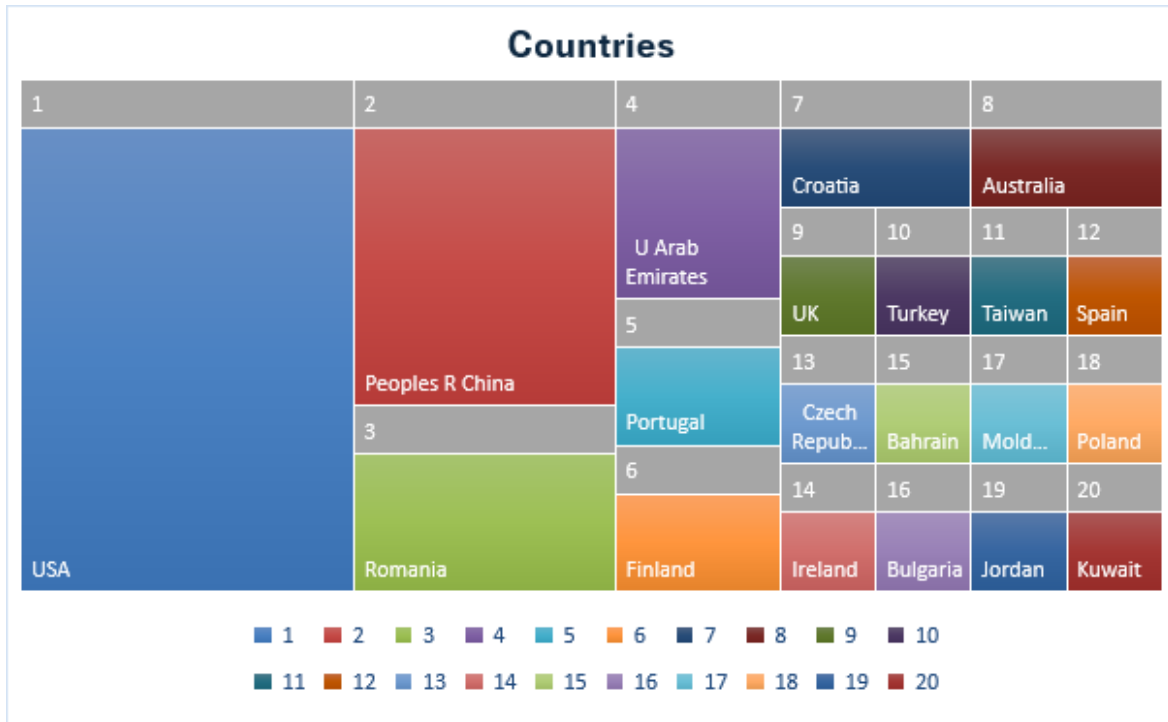
Source: The data obtained from the WoS database was analyzed by authors using the Bibexcel program

II.II. Bibliometric Mapping Analysis

II.II.I. Co-Authorship Of Authors

Based on the criteria of at least 1 publication and at least 1 citation, a network map was created to identify the most interconnected and collaborative authors in terms of co-authorship analysis. Among them, those with the highest 9 connections are Fulop, Melinda Timea, Ionescu, Constantin Aurelian, and Topor, Dan Ioan. It is also observed that the most cited authors (Moll, Jodie with 159 citations and Yigitbasioglu, Ogan with 159 citations) are not the most connected authors. Furthermore, the most prolific authors do not appear to be among the most connected authors (namely, Qasim Amer, Eletter, Shorouq, and El Refae, Ghaleb A).
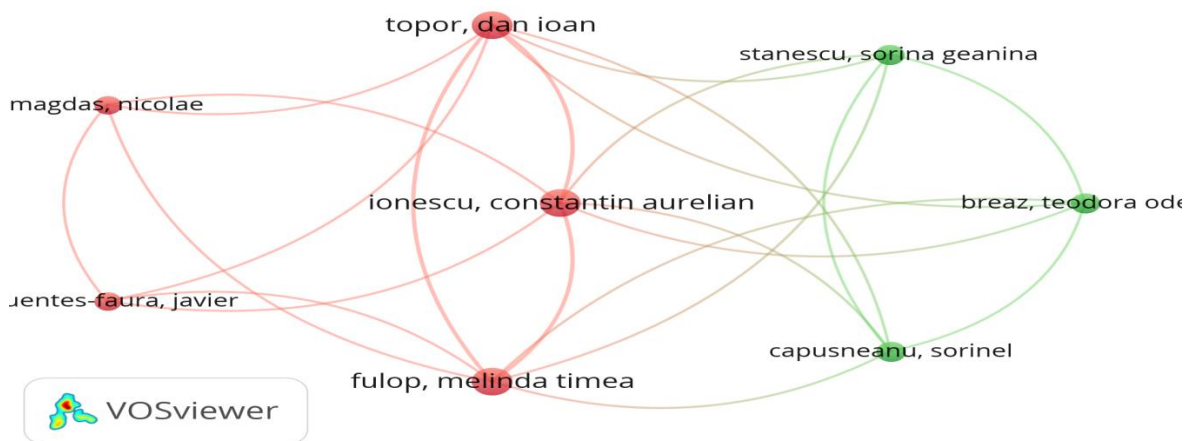

Figure 2.Co-Authorship Networks Illustrating Collaboration Among Authors

II.II.II. Citation Of Authors

To determine citation networks, a author-citation analysis network map (Figure 3) was created based on the criteria of at least 1 publication and at least 1 citation. A total of 6 clusters were identified. In terms of total link strength, the top authors are Qasim, Amer (25) and Khartbat, Faten F. (20). The most cited authors, Moll, Jodie and Yigitbasioglu, Ogan, have a total link strength of 9.
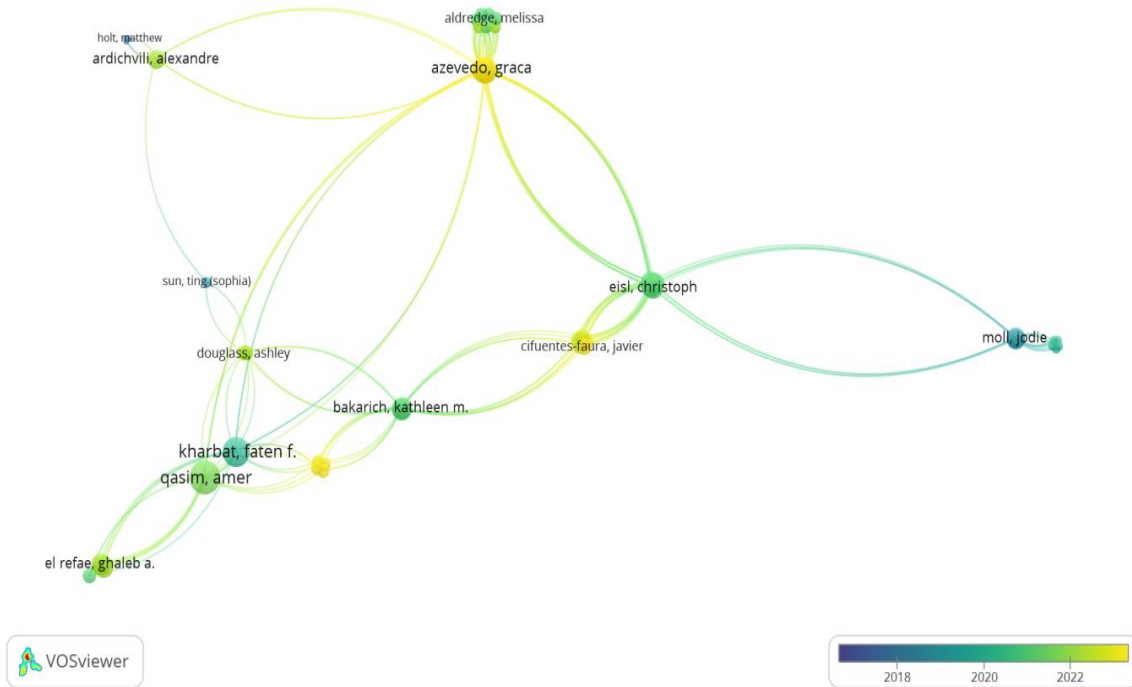
Figure 3.Citation Networks of Authors

II.II.III. Citation Of Countries

To create a network map (Figure 4) illustrating citations received by the origin countries of publications, 20 countries were identified based on the criterion of having at least 1 publication and receiving 1 citation. An analysis was conducted based on the total link strength. A total of 6 clusters were identified. The top-cited countries are the USA (15 publications, 189 citations, and 38 total link strength), Australia (2 publications, 167 citations, and 11 total link strength), and England (2 publications, 159 citations, and 8 total link strength). In terms of total link strength, the top three countries are the USA (38), U Arab Emirates (25), and Australia (11).
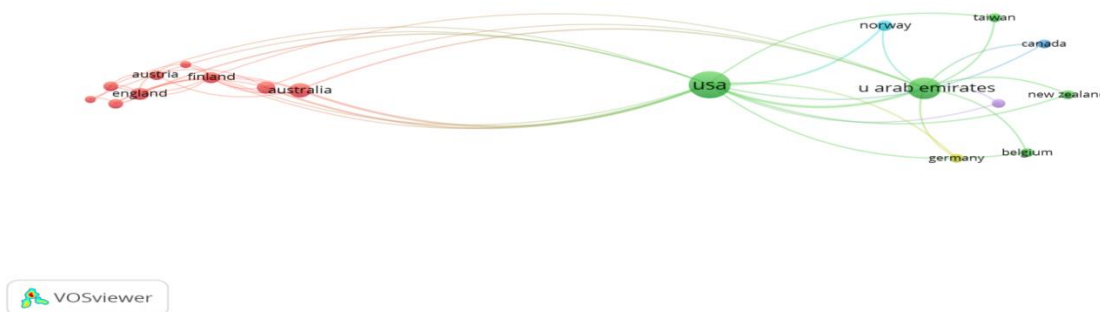

Figure 4.Citation Networks of Countries

II.II.IV. Co-Occurence Of All Keywords

When examining the most frequently used keywords and total link strength in publications related to AI, the following expressions stand out: AI (34 and 141), accounting education (12 and 58), accounting profession (11 and 40), accounting (8 and 36), blockchain (5 and 23), machine learning (4 and 19), and data analytics (4 and 17) are among the top-ranked terms (Figure 5).
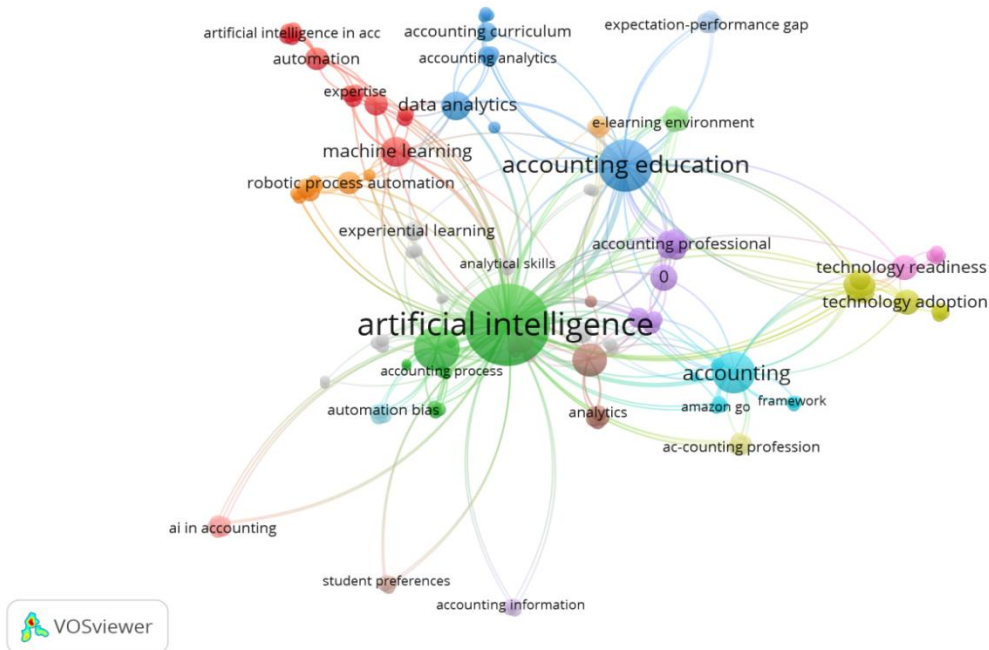

Figure 5. Most Frequently Used All Keyword Networks

II.II.V. Bibliographic Coupling Of Documents

Bibliographic coupling refers to the situation where two independent sources cite a common work. A criterion of having received at least 1 citation was established. As a result of bibliographic coupling, 29 matches were identified. The works with the highest total link strength are Qasim (2021) with a total link strength of 61, Qasim (2020) with a total link strength of 46, and Elo (2023) with a total link strength of 37. The work most cited is Moll (2019) with a total link strength of 36 (Figure 6).
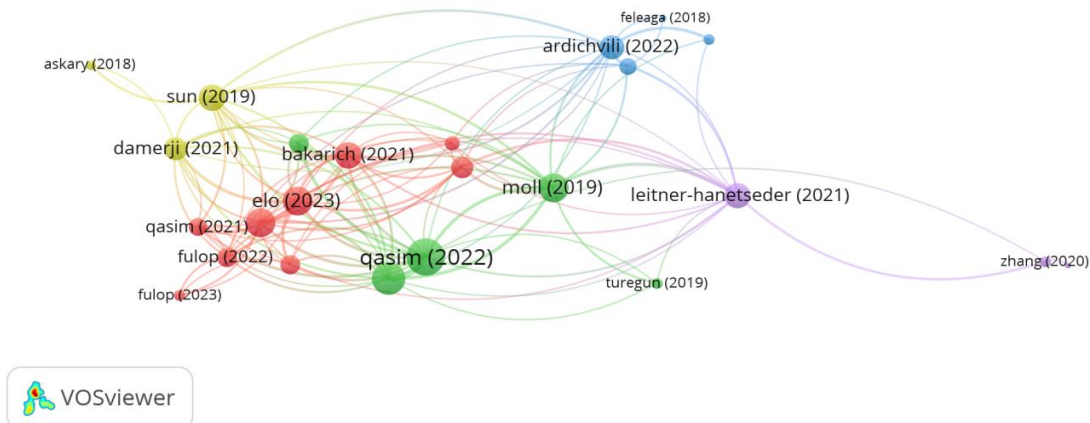
Figure 6.Bibliographic Coupling Networks Of Documents

II.II.VI. Co-Citation Cited Authors

In the examined studies, an analysis based on a total citation criterion of at least 7 citations was conducted to create a network map (Figure 7) for examining authors with common citations. A total of 3 clusters were identified. According to the analysis, the authors with the highest total link strength are J. Kokina and the Big4 firms (namely, PwC, KPMG, Deloitte, and EY), respectively.
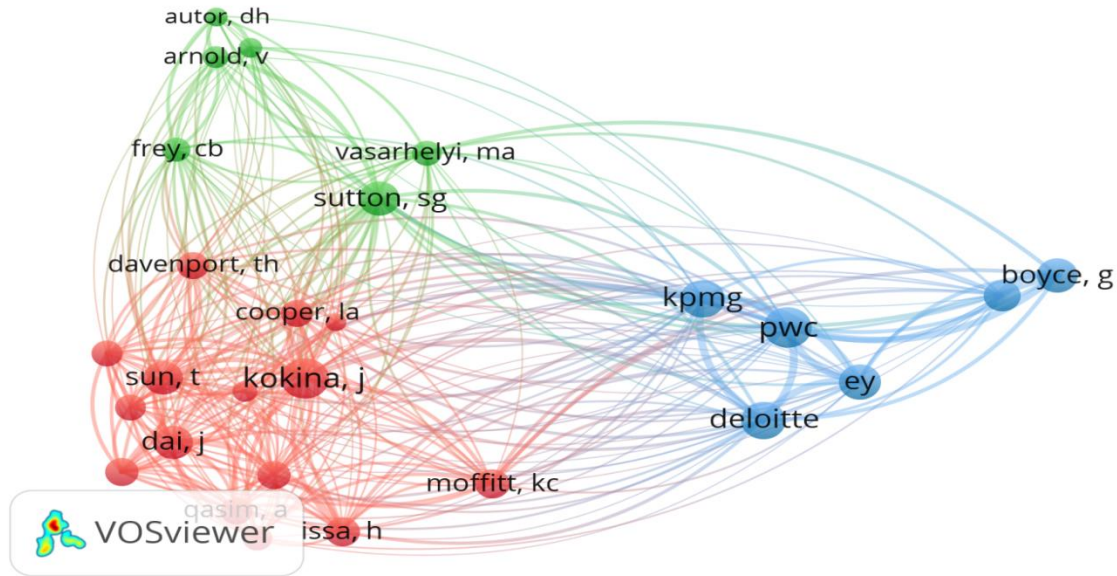

Figure 7.Co-Citation Cited Authors

II.III. CONTENT ANALYSIS RESULTS

II.III.I.Main Research Design of the Studies

Of the studies, 28 are conceptual and 20 are empirical in nature. Empirical studies were predominantly designed as surveys and focused on students and accounting professionals.

Table 7:Main Research Designs According to Chronological Order

Number Of Studies	Conceptual	Empirical	Studies
s36	✓		(Goldwater & Fogarty, 2007)
s11	✓		(Li & Zheng, 2018)
s18	✓		(Askary et al., 2018)
s33	✓		(Sutton et al., 2018)
s41	✓		(Feleagăa & Dumitraşcua, 2018)
s27		✓	(Peng & Chang, 2019)
s30	✓		(Moll & Yigitbasioglu, 2019)
s31	✓		(Knihova, 2019)
s34	✓		(Song, 2019)
s37		✓	(Türegün, 2019)
s42	✓		(Sun, 2019)
s47	✓		(Li, Li & Li, 2019)
s3	✓		(Zhang et al., 2020)

s9	✓		(Qasim & Kharbat, 2020)
s10	✓		(Žager, Decman & Rep, 2020)
s12	✓		(Le Guyader, 2020)
s43	✓		(Aldredge, Rogers & Smith, 2020)
s4	✓		(Simina & Adriana, 2021)
s15		✓	(Leitner-Hanetseder et al., 2021)
s17		✓	(Bakarich & O'brien, 2021)
s19		✓	(Grabińska, Andrzejewski & Grabinski, 2021)
s23		✓	(Damerji & Salimi, 2021)
s26	✓		(Qasim, El Refae, Issa & Eletter, 2021)
s32	✓		(Novak, Zager & Barisic, 2021)
s39			(Stancheva-Todorova & Bogdanova, 2021)
s44	✓		(Xu & Xiao, 2021)
s1		✓	(Holmes & Douglass, 2022)
s5	✓		(Li & Zhao, 2022)
s20		✓	(Qasim, El Refae & Eletter, 2022)
s22	✓		(Ardichvili, 2022)
s25		✓	(Mihai & Duțescu, 2022)
s28		✓	(Fülöp et al., 2022)
s29	✓		(Cai, 2022)
s38		✓	(Moore & Felo, 2022)
s7		✓	(Wood et al., 2023)
s13	✓	✓	(Ng, 2023)
s14		✓	(Fülöp, Tupor, Ionescu, Cifuentes-Faura & Magdas, 2023)
s16	✓		(Tavares, Azevedo, Marques & Bastos, 2023)
s21		✓	(Rawashdeh, 2023)
s24	✓		(Igou, Power, Brosnan & Heavin, 2023)
s35		✓	(Marques, Gonçalves, da Costa, Pereira & Dias, 2023)
s40		✓	(Elo, Patari, Sjögren & Mattö, 2023)
s45		✓	(Grosu, Cosmulese, Socoliuc, Ciubotariu & Mihaila, 2023)
s48	✓		(Qasim, El Refae & Eletter, 2023)
s2	✓		(Zhao & Wang, 2024)
s6	✓		(Ballantine, Boyce, & Stoner, 2024)
S8		✓	(Al Wael, Abdallah, Ghura & Buallay, 2024)
s46		✓	(Jackson & Allen, 2024)

II.III.II. Purposes of the Studies, Results, Recommendations and Future Studies

First, classification was made on 48 studies in line with the purposes. 8 main research streams have been identified: 1. Impacts of AI on the accounting profession and accountants, 2. Potential applications and challenges of ChatGPT in accounting, 3. Impacts of AI on accounting education, 4. Evaluation of CHAT GPT performance, 5. AI' adoption of, 6. Ethics of using AI in accounting firms, 7. Effects of AI on the internal control system, 8. Effects of AI in the remote audit process. Two research streams that stand out clearly from these research streams are the impacts of AI on the accounting profession and accountants and the impacts of AI on accounting education.

Consequences of AI impacts on the accounting profession and accountants; It can be classified as increasing efficiency and performance by reducing error and risk, the changing role of the accountant,

adaptation to AI, unemployment and inequality, education and learning, data privacy and reliability. When the recommendations are examined; It can be classified as developing knowledge and skills, updating curricula, making necessary arrangements and support by business management, designing and implementing experiential learning activities and being in line with developments. The sheer number of proposed future study topics demonstrates gaps in the impact of AI on the accounting profession and accountants.

Consequences of the effects of AI on accounting education; It can be classified as the gap between academia and the sector, the training of educators and the financial difficulties of educational institutions. When the recommendations are examined; It can be classified as updating curricula and new learning models. Future study topics are; It focuses on in-depth examination of the opinions of all stakeholders and researching new teaching models in order to update the curricula.

Specifically researching ChatGPT, one of the AI tools, it can be said that ChatGPT represents an important role (topic) in the accounting profession and education.

Tablo 8.Results of Studies

Number Of Studies	Purposes	Results
s1,s3,s10, s11, s12,s15, s16, s21, s22, s24, s25, s27, s28, s30, s31, s32, s33, s35, s41, s45, s17, s4, s48,s37	The impact of AI on the accounting profession and accountants	1. Performance and salary increase 2. Continuous learning 3. Data privacy and cyber risk issue 4. Real-time inspections 5. Compliance problem of small companies 6. Insufficiency of regulatory bodies 7. Replaces repetitive operations. Prominence of the consultancy role of accountants 8. No risk of job loss in the long term 9. Training requirement 10. Need for qualified personnel and job creation potential/opportunity 11. Risk of dismissal 12. Problem of learning from experienced people 13. Digitalized companies are more likely to implement 14. Saving time and increasing the possibility of making the right decision 15. Providing transparent and reliable information 16. Academics do not show sufficient interest in the subject 17. Cost optimization in the long term 18.Reshaping the management accounting profession 19. Resistance to change 20. Emphasis on the role of financial analysis, planning, consultancy and decision-making 21. Ease of using digital tools, performance level, organizational culture and regulatory policies influence AI adoption 22. Opportunity to increase competitiveness 23. Reduces the need for on-site auditing
s2	Potential applications and challenges of Chat GPT in accounting	1. Reshaping various accounting processes 2. Increases the effectiveness of audit processes

s5,s6,s9,s13, s19, s20, s29, s34, s36, s38, s39, s40, s43, s44, s47	Impacts of AI on accounting education	1. Blended learning provides flexibility 2. It has had a profound impact on accounting education and other fields. 3. Presenting threats and opportunities in accounting education 4. Imbalance between academia and practice 5. The need to change the curriculum 6. High awareness of graduates and those with more professional experience 7. Competent accounting graduates fall behind the demand 8. Not using AI in cases 9. Change in the academic world lags behind the sector 10. Insufficient curriculum of universities other than Association to Advance Collegiate Schools of Business (AACSB) 11. Technologies other than data analytics are not included in the curriculum 12. Educators have the responsibility of teaching new developments 13. Training of educators 14. Financial inadequacy of universities
s7	Evaluating CHAT GPT performance	1. It inhibits the ability to learn 2. Purpose of cheating 3. Risk of plagiarism
s8, s23, s46	AI adoption	1. Automates repetitive tasks and reduces errors 2. University determines whether students are ready for AI adoption 3. Need for management and institutional support. 4. Data security and privacy issue 5. The problem of cooperation between institutions (Academy-Professional Associations-Sector-Accreditation Bodies)
s14	The ethics of using AI in accounting firms	The problem of interaction between AI and ethical values
s18	Effects of AI on internal control system	1. Improve internal control 2. Possibility to create new control methods, targets and methodologies
s26, s42	The effects of AI in the remote audit process	1. Cost and time savings, improving auditor tasks and quality data collection 2. Regulators and educators face challenges

As shown in Table 8, studies on the relationship between AI and the accounting profession/accountants have examined various phenomena to enhance the profession and accountants with AI. Accounting professionals (s1, s17, s45), auditors (s45), management accountants (s35), practitioners and academics (s15), and literature sources (s3, s4) have conducted research on AI and evaluated the results. Table 8 presents the significant findings of these studies. For instance, s1 discusses performance and salary increases; s10 and s41 highlight the emerging advisory role of accountants; s15 advocates for job creation opportunities; s3 addresses data privacy concerns; s17 discusses small firms' challenges in adapting to technology; s21 examines the risk of layoffs; and s30 criticizes the insufficient academic attention to the challenges and threats posed by AI.

The theoretical study exploring the potential applications and challenges of Chat GPT in accounting concluded that Chat GPT reshapes various accounting processes and enhances the efficiency of auditing processes. However, a practical study evaluating Chat GPT's impact on students' performance found that it hinders students' learning abilities, is used for cheating, and poses a plagiarism risk.

Studies investigating the relationship between AI and accounting education have highlighted how accounting education can be integrated with AI, exploring how it can be adapted to technology and meet the market's needs for graduates. These studies have addressed various aspects of accounting education, including curriculum content (s20, s38), evidence of student learning related to data analytics goals for graduate students (s13), the usefulness of AI-related courses (s19), case studies on the application of AI techniques in accounting curricula (s39), and the readiness of accounting students for future accounting roles (s40). Table 8 presents the findings on the use of AI in accounting education.

For example, S5 found that blended learning provides flexibility; s9 discussed the imbalance between academia and practice; s13 emphasized the need for curriculum changes; s20 highlighted the insufficient number of competent accounting graduates; s38 pointed out the inadequacy of curricula at universities outside AACSB accreditation; and s43 identified financial shortcomings of universities.

Studies on AI adoption have aimed to understand how it is perceived by professionals (s8), accounting students (s23), and accounting managers (s46). The results presented in Table 8 include findings such as s8 highlighting the automation of repetitive tasks and error reduction as key benefits; s46 emphasizing that management and institutional support, as well as collaboration between institutions, influence AI adoption. A qualitative study examining the relationship between AI use in accounting firms and ethics found interaction issues between AI and ethical values (s14).

The study on the impact of AI on internal control systems (s18) recommended that AI enhances internal control systems and improves audit quality by investigating the reliability of accounting information and proposing a supporting model. Another study on the effect of AI in remote auditing concluded that AI provides cost and time savings, improves auditor tasks, and enhances the quality of data collection (s26).

This section presents and evaluates the srecommendations and future research directions of these studies, as shown in Table 9.

Table 9.Recommendations of the Studies and Future Research Studies

Number Of Studies	Purposes	Recommendations	Future Research Studies
s1,s3,s10, s11, s12,s15, s16, s21, s22, s24, s25, s27, s28, s30, s31, s32, s33, s35, s41, s45, s17, s4, s48,s37	The impact of AI on the accounting profession and accountants	1. Radical changes in curricula 2. Establishing a governance board to define and implement corporate-level data governance standards to ensure data accuracy and security 3. Formulating organizational strategy 4. Identifying and reviewing the value created by technology 5. Continuously developing professional knowledge and skills 6. Possessing strong accounting knowledge, technological competence, high communication skills, and the ability to understand and present data 7. Acquiring new skills for the advisory role 8. Being adaptable to developments and engaging in continuous learning 9. Providing support for education and training from educational institutions and all professional organizations 10. Creating models for skill development 11. Designing and implementing experiential learning activities	1. Investigating the trust that professionals place in academia to provide the necessary skills for graduates to succeed, amidst changes in accounting curricula 2. Examining how the disruption caused by COVID-19 has impacted the advancement and implementation of AI technology 3. Investigating the gap between the workforce that rapidly adopts technology and those who resist it 4. Defining the authorities granted to AI-based robots and establishing ethical boundaries in AI accounting 5. Exploring how to cope with individual and collective fears and prevent a potential "digital divide" in the accounting workforce 6. Researching how to organize effective, efficient, and agile accounting structures, processes, and teams that transcend geographical and cultural boundaries 7. Investigating how to effectively collaborate and communicate between heterogeneous and dispersed, mixed AI and human accounting teams, and external (artificial) partners (e.g., chatbots) 8. Exploring the role of trust in interactions with AI-based robots in accounting 9. Investigating how universities/schools prepare their students to adopt AI technologies and be technologically ready to support the sustainability of the profession 10. Conducting in-depth research on specific areas/tasks in public accounting where AI can provide more information 11. Examining the reported differences between the Big 4 and non-Big 4 firms

		12. Human-machine collaboration 13. Demonstrating the value of AI to management accountants 14. Raising awareness among accountants 15. The necessity of employing experts in risk management, statistics, and data analysis 16. Using data obtained from AI for expense and revenue forecasting, and conducting real-time analysis 17. Establishing an audit process based on blockchain technology	12. Investigating the impact of differential adoption rates and degrees of AI technologies between Big 4 and non-Big 4 firms on competition in the audit market 13. Examining the impact of AI usage on audit quality in both small and large firms 14. Investigating the impact of AI on job quality, workforce morale, and overall job satisfaction in accounting 15. Exploring the impact of AI on decision-making within accounting and the variables that modulate this impact 16. Conducting a comparative analysis of the effects of AI on employees across different sectors 17. Examining the effectiveness of policies designed to act as buffers against the negative impacts of AI on the workforce and their broader economic effects 18. Conducting a deeper investigation into the psychological and societal changes triggered by AI-driven transformations 19. Researching the implications of AI on social structures, ethical dilemmas, and the complex interactions between humans, technology, and evolving employment areas 20. Identifying the factors that influence the intention to adopt new IT skills 21. Investigating how digitization affects the boundaries of accounting and analyzing the impact of new digital tools and techniques on the production of information for decision-making 22. Expanding philosophical discussions on the ethics of AI-based technologies and their impact on the rapid decline of professions 23. Conducting more research in different countries and cultures 24. Conducting applied research in this field to determine if theory can be utilized in actual practice
s2	Potential applications and challenges of Chat GPT in accounting	Applying Technologies to Accounting Practices	1. In-depth exploration of specific application areas of ChatGPT in accounting and business sectors 2. Investigation of the integration process of ChatGPT into existing accounting workflows, and examination of the technical aspects of accounting information system integration and data management 3. Application of AI and NLP technologies to accounting practices to ensure appropriate ethical usage 4. Identification of areas for improvement to enhance the reliability and accuracy of ChatGPT in accounting processes

s5,s6,s9,s13, s19, s20, s29, s34, s36, s38, s39, s40, s43, s44, s47	Impacts of AI on accounting education	1. Detailed examination of the challenges of AI 2. Academia's need to respond more quickly to demands 3. Curriculum changes 4. Using AI and Excel together 5. Developing case-based learning tools and utilizing technology in cases 6. The necessity for new accounting graduates to be knowledgeable about data analytics and related technologies 7. Academics taking a pioneering role in AI applications 8. Utilizing active learning models	1. In-depth examination of the challenges of AI technology in accounting education 2. Discussion of detailed topics for each course from various perspectives (students, faculty members, and other stakeholders) 3. Exploration of the views of accounting professionals, practitioners, and educators to develop accounting curriculum 4. Researching methods to revitalize accounting curriculum to respond to emerging technologies in business operations 5. Investigating educational innovations in smart financial management classes at applied colleges and universities 6. Examining perceptions and experiences to determine whether graduates working in the accounting field perceive and experience expectation-performance gaps differently based on when they studied accounting 7. Comparisons of expectations or perceptions among different stakeholder groups, particularly examining skills related to current technological developments and emerging technologies 8. Researching which qualities or characteristics may influence the expectations of various stakeholder groups such as students, practitioners, or educators 9. Examining the real or intended skill contents of accounting courses and aligning them with stakeholders' expectations and perceptions 10. Exploring assessment tools for successfully evaluating students' development levels and progress in acquiring new skills and competencies
s7	Evaluating CHAT GPT performance	1. Educators raising students' awareness about the effective use of AI 2. Assigning oral exams and presentation-style assignments in addition to conducting exams with ChatGPT	1. Investigating whether the combination of students and ChatGPT performs better or worse than the average student who does not use ChatGPT 2. Exploring how AI tools like ChatGPT should be integrated into accounting curricula 3. Examining the response of online education to ChatGPT and how it affects online assessments 4. Researching student and faculty interaction with chatbot technologies, exploring how such technologies can be integrated into accounting programs, and discussing the role of faculty and assessment design in accounting program design
s8, s23, s46	AI adoption	1. Public institutions investing in AI development to encourage adoption and educating various stakeholders about the benefits of AI 2. Leaders in the public sector aligning the structure, culture, and work methods of organizations with regulations to support the adoption of AI 3. Universities designing strategies for AI adoption by students 4. Students should adopt technology before entering university 5. Organizations should provide resources for implementing strategies	1. In-depth qualitative analysis of factors influencing the adoption of AI in accounting 2. Exploration of specific AI technologies and methods that universities may consider implementing in accounting curricula 3. Investigation of other relationships between dimensions of readiness for technology and dimensions of AI adoption 4. Researching how educational levels or other demographic characteristics such as gender or socioeconomic status may affect the adoption of AI 5. Conducting research using both qualitative and quantitative data in different regions

s14	The ethics of using AI in accounting firms	1. Creating awareness about AI 2. The necessity for proactive collaboration between accountants and IT experts to successfully integrate ethical considerations into processes conducted by AI	Determining how accountants' attitudes develop or how results change when the target group is adjusted
s26, s42	The effects of AI in the remote audit process	Using audit data warehouse based on historical data to build prediction models	Using real-life audit data to demonstrate the effectiveness of deep learning and to measure how audit quality can be enhanced through the implementation of this technology

Researchers have provided various recommendations and suggestions for future research based on their studies. They have advocated for a deeper and more specific exploration of topics. The most frequent recommendations and future research themes have revolved around studies examining the impact of AI on the accounting profession and accountants.

In studies focusing on the effects of AI on the accounting profession and accountants, recommendations have primarily centered on acquiring skills for education and teaching (s1, s3, s4, s10, s11, s12, s15, s27, s31). In studies focusing on the effects of AI on the accounting profession, recommendations have primarily centered on acquiring skills for education and teaching (s1, s3, s4, s10, s11, s12, s15, s27, s31). Additionally, to enhance professional quality and increase job retention potential, suggestions have been made to, for example, develop organizational strategies (s3), establish expertise enhancement models (s22), foster human-machine collaboration (s37), and utilize AI in accounting tasks (s48).Future research topics, as indicated in Table 9, are more specific and directly linked to the recommendations. For instance, suggestion s1 proposes exploring the gap between professionals' trust in academia and their adoption or resistance to technology. Another example, suggestion s15, recommends determining the authority granted to AI-based robots and ethical boundaries in AI accounting, as well as addressing individual and collective fears to mitigate potential "digital divides" in the accounting workforce. Additionally, suggestion s17 proposes investigating the impact of AI usage on the audit market between Big4 and non-Big4 firms. Furthermore, suggestion s21 suggests examining the effect of AI on job quality, workforce morale, job satisfaction, and decision-making in accounting. Lastly, suggestion s48 proposes research on the applicability of theory in practical accounting contexts.

Recommendations in studies examining the effects of AI on accounting education have predominantly focused on university leadership. For instance, curriculum revision has been the most emphasized recommendation (s9, s13, s20, s39, s40, s43). Suggestion s6 highlights the need for academia to respond quickly to emerging demands, while s38 suggests that new accounting graduates should possess knowledge of technologies beyond data analytics. Moreover, s39 recommends the necessity of AI-based case usage. Studies have proposed in-depth research topics, as shown in Table 9. For example, suggestions such as exploring various perspectives on detailed topics for each course (s9) and investigating stakeholders' views to develop the curriculum (s20, s40) are future research areas.

Researchers conducting studies on Chat GPT applications have suggested that educators should raise awareness among students about the effective use of AI and incorporate tasks such as oral exams and presentation-style assignments using Chat GPT (s7). They have also recommended the implementation of Chat GPT in accounting practices (s2). Future research topics related to these recommendations could include in-depth exploration of specific application areas of Chat GPT (s2), determining how AI tools like Chat GPT should be integrated into accounting curricula, analyzing the performance of students who use Chat GPT compared to those who do not, and investigating the role of instructors and assessment design in accounting program development (s7).

In studies related to the adoption of AI, researchers have suggested that public institutions invest in AI development and educate various stakeholders about the benefits of AI (s8). They have also

recommended that universities design strategies for the adoption of AI by students (s46). As a result of these recommendations, factors influencing the adoption of AI could be investigated using qualitative methods (s8), the impact of demographic factors on adoption could be examined (s23), and qualitative and quantitative research could be conducted in different regions (s46).

A study on the ethics of using AI suggests the necessity of proactive collaboration between accountants and IT experts for the successful integration of ethical considerations into processes conducted by AI (s14). On the other hand, a study on remote auditing recommends the use of a data warehouse as a predictive model (s42).

The suggested future research topics related to this issue include, for example, determining how accountants' attitudes have evolved and changed (s14), and using real audit data to measure how audit quality can be improved (s42).

DISCUSSION AND CONCULUSION

The aim of this research is to examine the existing literature in the WoS database that associates the accounting profession and accounting education with AI. A bibliometric and descriptive content analysis of 48 studies on the subject between 2007 and 2024 was conducted. Prior to these analyses, a descriptive analysis was performed to determine the number of publications by year, authors and prolific authors, the most cited studies, document types and sources, and the number of publications by country. According to this analysis, it was revealed that the number of studies related to the research topic has been on an upward trend over the years. The increasing trend in the number of studies is not a surprising result. In the ranking of researchers with the most publications related to AI, Amer Qasim ranks first, consistent with the findings of Romero-Carazas et al. (2023: 353), while the study by Moll and Yigitbasioglu (2019) is the most cited one. The study of Moll and Yigitbasioglu (2019) is considered an important reference source as it helps researchers more easily evaluate the latest technology concerning the future of the accounting profession (Agustí & Orta-Pérez, 2023: 426). While the document type is predominantly composed of articles, proceedings follow. The USA stands out as the leading country in terms of the number of publications, followed by China and Romania. However, in the study by Romero-Carazas et al. (2023: 353), China emerged as the leading country in terms of the number of publications.

According to the results of the bibliometric analysis, the USA distinctly stands out among the countries of origin of publications in terms of the most citations and total link strength. This result is similar to the findings of Kaya (2024: 13-16). After AI (excluding accounting education and profession), the most frequently used keywords are blockchain, machine learning, and data analytics, which aligns with the findings of Kaya (2024: 11). However, when the content analysis of the studies is examined, the term blockchain is not emphasized enough to be considered a keyword. No findings were encountered that would necessitate its inclusion as a keyword. In the studies, the most common co-cited references are J. Kokina and the Big4 firms (namely, PwC, KPMG, Deloitte, and EY). The use of the Big4 firms as common references in studies indicates that publications by the Big4 firms are significant enough to impact academic research (Atanasovski & Tocev, 2022: 285).

According to the content analysis, most of the literature focuses on the potential impacts or opportunities that AI might bring. However, there is still a lack of applications that allow us to develop a body of evidence beyond predictive or theoretical approaches (Agustí & Orta-Pérez, 2023: 428). Regarding the main design method of the studies, 28 are conceptual, while 20 are empirical studies predominantly designed as surveys, focusing on students and accounting professionals.

When evaluating the content analysis of studies in the field of accounting related to AI, based on Tables 8 and 9, it can be said that the use and adaptation of AI are still at an initial stage. In this period where the pace of technological change is very rapid, it is observed that accounting firms outside the Big4 firms and universities (students, academics, curriculum) are slow to adapt to AI. While financial insufficiencies are also noted as affecting the use of technology, it is essential for professional

organizations and regulators to support AI investments and education. We believe that practitioners and recent graduates must act agilely and proactively regarding AI usage to create job opportunities and ensure job continuity.

The study has revealed detailed information on the relationship between AI and accounting through both bibliometric and content analyses. In the bibliometric analysis, important articles were identified by listing the countries where the studies were conducted, the researchers involved, and the most referenced sources. The content analysis classified the studies according to their purposes. It provided detailed information on the methods, results, recommendations, and future research directions of studies examining the relationships between AI and the accounting profession, accounting education, and accounting fields. The study demonstrates the current level of AI usage in the accounting profession and education and trends in expectations.

As a result, the studies we classified according to their purposes contribute to the field of accounting. They help accounting professionals, students, and academics understand how to adapt to AI technologies to be qualified, improve performance, remain employed, and stay competitive. The study also provides information on how AI can be integrated into business processes to achieve benefits such as accurate cost calculation, improved audit quality, real-time auditing, time savings, and cost optimization in areas like auditing and management accounting. Additionally, the study identifies gaps in the literature and suggests future research topics, offering ideas for researchers..

When examining the recommendations and future research topics, it can be said that studies related to AI are still at an initial stage. Future studies have identified in-depth research topics involving regulatory bodies, academia, companies, and professionals. According to the content analysis results, academia is moving slowly in AI applications and education.

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