A Study of Accounting Using Bibliometric Methods in the Age of Blockchain

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Abstract. Combined with a bibliometric study, the purpose of this research is to carry out a full blockchain and accounting analysis. Using the terms "accounting" and "blockchain," we selected 67 papers from Scopus database that were published between the years 2017 and 2021 to use as our sample. The VOSviewer program was applied in this study to give a graphical analysis of bibliometric data as well as a display of the research results. As a visualization result, three primary groups consisting of nine clusters had produced. The design science research approach is represented by the keywords found in the cluster area that symbolized by green section. Last but not least, the blue section focuses on accountants, particularly younger generation accountants. According to the findings of the network analysis, it is possible to draw the conclusion that accountants, including millennial accountants, have come to terms with the existence of blockchain technology.

Keywords: Age of Blockchain · Accounting · Bibliometric · Blockchain

1 Introduction

Blockchain underpins Bitcoin transactions [1]. This is a cryptographically secured, consensus-based transactional database [2]. Blockchain technology may reduce fraud, promote transparency, increase trust, save time and cost by removing mediator institutions. Blockchain is a popular technology. Blockchain might disrupt corporate ecosystems [3].

This technology is expected to disrupt finance and accounting [4]. By enabling smart contracts, blockchain can minimize costs and risks [5] and boosting transaction security [6]. This technology might also affect how transactions are originated, handled, authorized, recorded, and reported. Blockchain may be used to auditors' clients' business operations, thus they must comprehend it [7, 8]. New blockchain-based methodologies and processes may redefine auditors' function and competence. Standardized reporting and accounting might improve data analysis and extraction. Blockchain is a new shared database, retains records of transactions, transparant, and guarantees data against

deletion, manipulation, and change [9, 10]. After a transaction is conducted, changes are immutability. This system also facilitates transaction sharing and smart contracts. Blockchain records transactions efficiently, sustainably, and forever [2].

Blockchain technology might affect accounting and auditing. This technology records and stores assets, liabilities, and transactions and reconciles accounts. It's hardly unexpected that cloud-based technology is hurting the accounting environment, which relies on paper channels. Traditional accounting systems can be prone to mistakes and fraud [11].

Blockchain technology would boost company-to-customer communication and data transparency [7]. Auditing efficiency and effectiveness may be improved by using blockchain technologies. Blockchain technology has potential for the big four and smaller accounting firms. Blockchain reduces manual work, increases transaction speed, and prevents false financial reporting [7, 12–14].

Bibliometric is done by identifying article linkages based on citation numbers [15]. Bibliometrics estimates, analyzes, and visualizes scientific field construction [16]. Bibliometrics are used to describe the growth of a topic of knowledge [17, 18].

Bibliometric analysis (quantitative) and content-analysis are utilized in the social sciences (qualitative) are popular data analysis approaches. Although these methodologies are neglected in business research, economics and finance are more likely to anticipate future trends [19]. Costa et al. [20] used bibliometrics to uncover economic and financial behavior. Accounting and blockchain bibliometric research is limited. This study uses bibliometrics to evaluate scholarly articles on accounting and blockchain. The communication process may access bibliometric data such as author names, journal data, descriptive features, and citation analysis [17]. Bibliometric analysis can quickly assess research and give a systematic, and transparent literature review.

2 Literature Review

Nakamoto developed Bitcoin in 2008, introducing blockchain (2008). Bitcoin is "mined" by solving mathematical challenges with blockchain technology. Blockchain and Bitcoin are different. Bitcoin runs on Blockchain, which is an operating system like Windows. Blockchain's immutability can prevent fraud, promote trust and transparency, and eliminate intermediaries. This technology makes corporate transactions cost-effective and secure. Blockchain is a decentralized database. Each network participant may read, verify, and edit chain transactions.

This openness might be problematic in many current applications. In many circumstances, blockchain read and write permissions should be limited in a firm or set of organizations. Private blockchains include few participants [21]. This blockchain's information can only be accessible by certain entities. This design safeguards company data. Permissioned Blockchain is another form [22]. A central authority selects trusted parties to validate transactions in this blockchain. Permissioned Blockchains restrict extraneous parties from verifying transactions, simplifying the process and preventing manipulation. Few participants can check transactions, therefore consensus is obtained faster.

Blockchain 1.0, 2.0, and 3.0 have progressed since its inception [5]. Blockchain 1.0 only trades cryptocurrencies. Blockchain 2.0 has comparable trading but more financial

uses. Derivatives and digital assets are examples [5]. Second-generation blockchain incorporated smart contracts to broaden trade beyond digital currency to other things [5, 23]. Smart contracts automatically fulfill pre-determined tasks or contracts by assessing changing contract regulations [5, 24].

3   Research Method

This quantitative study used bibliometrics. The communication process makes biblio-metric data, such as identity, its descriptive qualities and citation analysis, available [17]. Bibliometrics ensures objective publication data, generally as mathematical and statistical performance statistics [25]. The bibliometric technique employs statistical and quantitative on article structure [16]. Unit analysis in bibliometrics comprises citations, authors, journal sources, scientific families, and nations. This bibliometric investigation requires software for analysis and visualization, VOSviewer [26].

This study sampled from Scopus. Scopus is the biggest database of peer-reviewed abstracts and citations for monitoring, analyzing, and visualizing research and literature. It efficiently tracks scientific research. Scopus comprises 24,500 current titles from 5,000 publishers in the sciences, technology, health, social sciences, and arts and humanities.

This study collected data from Scopus by searching for 'blockchain and accounting' in three dimensions: title, abstract, and keywords. The search found 67 Scopus docu-ments from 2017 to 2021, with the cutoff in December 2021. 67 papers met sample collecting criteria: Q1-Q4 scientific publications (Q4). Thus, 67 materials were ready for research and were the focus of this study. A bibliometric study of the 67 documents was undertaken, including the number of publications, genres of publications, sources of publications, and quantity of most-cited publications. VOSviewer software was used to map bibliometric analysis results, which revealed multiple clusters.

4   Result and Discussion

Table 1 shows annual publications. In the first two years of the sample, yearly publica-tions rose steadily. After 2018, the growth rate increased in the third to fourth years. The surge in publications may be linked to the amount of worldwide corporations imple-menting blockchain technology, notably in accounting (Fig. 1). Many firms realized that blockchain may boost corporate value since financial transactions are transparent, irre-versible, and increase confidence from all parties. It's improbable that accounting and blockchain research trends will rise in 2022 and 2023.

This research includes blockchain and accounting-related papers. Table 2 shows accounting and blockchain-related articles by kind. Most documents fell into two groups, according to data. These are conference proceedings or review articles. More than 50% of publications originated from review articles.

The total number of publications with conference-related articles was minimal. Low conference publication numbers may be due to COVID-19, which canceled several face-to-face meetings (conferences). Many scientists diverted their manuscripts to the journal platform.

Table 1. Publications each Year

Year	The quantity of published works	Annual Growth Rate (%)	Total Publications (%)
2017	3	0	4.48
2018	5	40	7.46
2019	15	200	2.39
2020	19	27	28.36
2021	25	32	37.13
Total	67	100	100.00
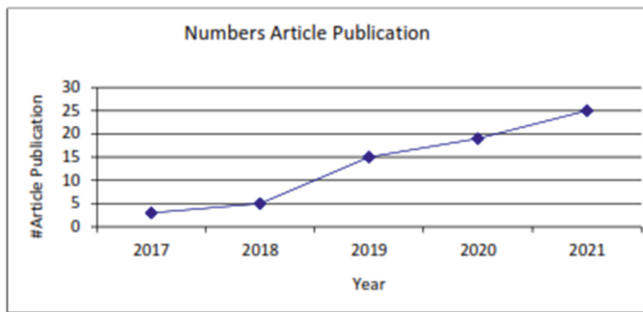
Fig. 1. Article Publishedhed each Year

Table 2. Blockchain and Accounting -Related Articles by File Type

Type of Articles	Total Publication	Percentage of Publications (%)
Proceedings	9	13.43
Journal Article	58	86.57
Total	67	

Table 3 summarizes the 5 primary accounting and blockchain articles. The journal encourages, supports, and disseminates high-quality research on new technologies and artificial intelligence applied to accounting concerns. CPA Australia publishes Australian Accounting Review (AAR). AAR aspires to inspire and foster a dynamic debate between academics, practitioners, and policymakers. AAR papers serve professionals in accounting, government, academia, and policymaking. Accounting and blockchain are two big study areas to be investigated in Scopus-indexed top-tier publications.

Table 4 ranks the authors with the most citations. The most frequently cited articles may have had an impact on the field due to their scientific rigor and excellence, or because they were published in the early years when accounting and blockchain were

Table 3. Top 5 Blockchain and Accounting Publications

| Source	Total Publication	Type of Publication
Journal of Emerging Technologies in Accounting	4	Journal article
Australian Accounting Review	4	Journal article
IEEE Access	3	Journal article
Accounting, Auditing and Accountability Journal	3	Journal article
Journal of Information Systems	2	Journal article

Table 4. The Authors of the Most Cited Scientific Articles

Researcher and Year of Publication	Total of Citation
Dai & Vasarhelyi (2017)	186
O'Leary, D (2017)	89
Kokina et al. (2017)	86
Schmitz & Leoni (2019)	56
Demirkan, S (2020)	31
Bonson, E (2019)	26
Kwilinski, A (2019)	25
Tan, B (2019)	24
Karajovic, M (2019)	18
Faccia, A (2019)	14
Sheldon, M (2018)	14
Casado-Vara, R (2019)	14

just beginning to be discussed, or when accounting and blockchain were still a major debate in academic circles. However, 2019–2020 scientific works have begun to be mentioned. Blockchain and Accounting are becoming topics for artificial intelligence (AI) industries, the accounting profession, and accounting information systems.

VOSviewer software was used to visualize and analyze bibliometric data [27]. VOSviewer is a scholarly program that gathers data and generates maps by utilizing bibliographies, citations, and keyword repeats [26]. This clustering method divided nine groupings into three.

Figure 2 shows the analysis of NETWORK of scientific article keywords. This cloud map illustrates keyword occurrences and relationships. Some words in the network analysis are circled and labeled. VOSviewer avoids overlapping labels, therefore only select words have labels. The term's size represents the number of articles published
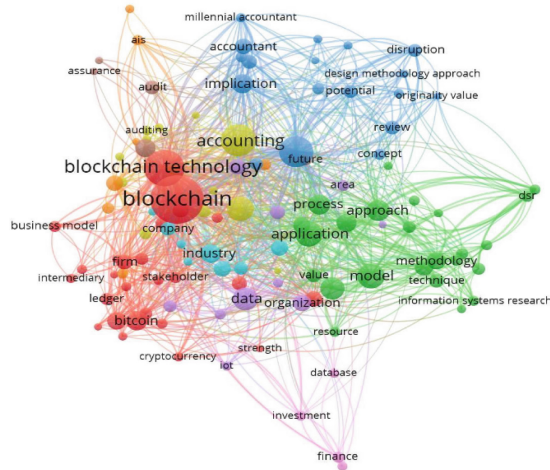
Fig. 2. The Analysis of Network

where it was found, while the relation between the two terms indicates its recurrence. Co-occurrences determined term relationships. The more articles containing two terms, the stronger their association. Each color denotes a collection of similar phrases. VOSviewer clustering detected these groupings. In the graphic, curving lines show the strongest term correlations.

Three components comprise the findings. Red includes blockchain, ledger, and Bitcoin. The green cluster comprises a design science research keywords. Blue represents accountants and young accountants. According to network analysis results, accountants and millennial accountants did not reject blockchain technology. They might use blockchain to simplify their work. From these insights, the design science research strategy arose for blockchain study.

Indonesian accountants welcome blockchain for its ease of use [28]. Another survey said Indonesian millennial accountants must use blockchain technology for the 4.0 revolution [29]. This new technology has intriguing application cases; study and practice on changing and building new business models remain in their infancy. Using design science to find blockchain-fueled patterns and highlight how enterprises might adapt their business models [30].

This research bridges the gap between how blockchain technology will impact accounting and the accounting profession, as transactions recorded on a blockchain can be compiled into financial statements and certified as authentic and accurate. This research also fills a gap in the literature by identifying particular blockchain themes that potentially affect blockchain accounting implementation and accounting profession consequences. Future research can extend this study's topics by evaluating the themes identified by the network analysis.

5   Conclusion

Accounting can completely exploit blockchain's new technological paradigm. This study analyzed accounting and blockchain literature bibliometrically. Using Scopus, this research investigated accounting and blockchain literature from 2017 to 2021. This study sampled 67 papers and found changes in the number of publications, genres of documents, sources of publications, and extensively cited studies. The quantity of accounting and blockchain publications has grown considerably, especially in 2019–2021. VOSviewer's research grouped nine clusters into three basic groups.

According to network study, accountants and millennial accountants recognize blockchain. Blockchain might be used to ease the company's job. As a result of these results, a design science research technique for blockchain study emerged. Future blockchain research won't be limited to certain domains. This study's limitations include that the data were gathered from Scopus, not other databases (e.g., Web of Sciences), and from 2017 to 2021. Future research should involve blockchain and accounting standard convergence and use Web of Science or SpringerLink data sources. Future research might elaborate on these findings by exploring the themes highlighted by the network analysis.

References

1. Nakamoto S, 2008 Bitcoin: A Peer-to-Peer Electronic Cash System.
2. Iansiti Marco and Lakhani R. Karim, 2017, The Truth About Blockchain, *Harvard Business Review*, February, p. 1–11.
3. Coyne J G and McMickle P L, 2017 Can blockchains serve an accounting purpose? *J. Emerg. Technol. Account.* **14**, 2 p. 101–111.
4. Kokina J Mancha R and Pachamanova D, 2017 Blockchain: Emergent industry adoption and implications for accounting *J. Emerg. Technol. Account.* **14**, 2 p. 91–100.
5. Swan M, 2015 *Blockchain: Blueprint for a new economy* .
6. Rechtman Y, 2017 Blockchain: The Making of a Simple, Secure Recording Concept: Certified Public Accountant *CPA J.* **87**, 6 p. 15–17.
7. Psaila S, 2017, Blockchain: A game changer for audit processes?, *Deloitte Malta.* [Online]. Available: http://www.blockchain.info.
8. Schmitz J and Leoni G, 2019 Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda *Aust. Account. Rev.* **29**, 2 p. 331–342.
9. Dai J and Vasarhelyi M A, 2017 Toward blockchain-based accounting and assurance *J. Inf. Syst.* **31**, 3 p. 5–21.
10. Yermack D, 2015 Corporate Governance and Blockchains *SSRN Electron. J.*
11. Plansky, J., O'Donnell, T., & Richards K, 2016, A Strategist's Guide to Blockchain, strategy-business. [Online]. Available: https://www.strategy-business.com/article/A- Strategists-Guide-to-Blockchain.
12. Ernst & Young, 2016 Blockchain reaction - Tech companies plan for critical mass *Top Mind - Issues facing Technol. companies,* p. 1–20.
13. Seibold S and Samman G, 2016 Consensus. Immutable agreement for the Internet of value *Kpmg* **26** p. 2001–2001.
14. PricewaterhouseCoopers, 2017, Blockchain - A Catalyst for New Approaches in Insurance, *PricewaterhouseCoopers Advisory.* [Online]. Available: https://www.pwc.ch/en/public ations/2017/Xlos_Etude_Blockchain_UK_2017_Web.pdf.

15. De Solla Price D J, 2011 Networks of scientific papers *Struct. Dyn. Networks* **9781400841** p. 149–154.
16. Nicolaisen J, 2010 Bibliometrics and Citation Analysis: From the Science Citation Index to Cybermetrics *J. Am. Soc. Inf. Sci. Technol.* **61**, 1 p. 205–207.
17. Thyer B A, 2013 Bibliometrics and social work: A two-edged sword can still be a blunt instrument *Bibliometr. Soc. Work* p. 123–128.
18. Lewison G, 2005 The work of the Bibliometrics Research Group (City University) and associates *Aslib Proc.* **57**, 3 p. 637–643.
19. Helbing P, 2018 A Review on IPO Withdrawal *SSRN Electron. J.*
20. Costa D F Carvalho F de M and Moreira B C de M, 2019 Behavioral Economics and Behavioral Finance: a Bibliometric Analysis of the Scientific Fields *J. Econ. Surv.* **33**, 1 p. 3–24.
21. Viriyasitavat W and Hoonsopon D, 2019 Blockchain characteristics and consensus in modern business processes *J. Ind. Inf. Integr.* **13** p. 32–39.
22. Appelbaum D and Smith S S, 2018 Blockchain Basics and Hands-on Guidance: Taking the Next Step toward Implementation and Adoption *CPA J.* **88**, 6 p. 28–37.
23. Szabo N, 1997 The idea of smart contracts *Nick Szabo's Pap. Concise Tutorials* c p. 1–2.
24. Kiviat T I, 2015 Beyond Bitcoin: Issues in regulating blockchain transactions *Duke Law J.* **65**, 3 p. 569–608.
25. Ball R, 2017 An introduction to bibliometrics: New developments and trends *An Introd. to Bibliometr. New Dev. Trends* p. 1–90.
26. van Eck N J and Waltman L, 2017 Citation-based clustering of publications using CitNetExplorer and VOSviewer *Scientometrics* **111**, 2 p. 1053–1070.
27. Wong D and Romano L, 2018 VOSviewer, Technical Services Quarterly **7131** p. 219–220.
28. Rahmawati M I Ganis Sukoharsono E Rahman A F and Prihatiningtias Y W, 2021 From Blockchain to Accounting Profession: Evidence from Indonesia *J. Hunan Univ. Sci.* **48**, 2.
29. Haryanto S D and Sudaryati E, 2020 The Ethical Perspective of Millennial Accountants in Responding to Opportunities and Challenges of Blockchain 4.0 *J. Account. Invest.* **21**, 3.
30. Weking J Mandalenakis M Hein A Hermes S Böhm M and Krcmar H, 2020 The impact of blockchain technology on business models – a taxonomy and archetypal patterns *Electron. Mark.* **30**, 2 p. 285–305.