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區塊鏈在會計及審計領域之綜合性分析及可行應用

Blockchain Technology in Accounting and Auditing: A Comprehensive Analysis and Review of Feasible Applications

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區塊鏈在會計及審計領域之綜合性分析及可行應用

Blockchain Technology in Accounting and Auditing: A Comprehensive Analysis and Review of Feasible Applications

本論文係李柏霖君（R09722044）在國立臺灣大學會計學系完成之碩士學位論文，於民國 111 年 07 月 01 日承下列考試委員審查通過及口試及格，特此證明

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中文摘要

有鑒於區塊鏈為一項預期對會計及審計專業帶來重大轉變之新興科技，本研究旨在對會計及審計領域中有關區塊鏈之學術文章做文獻探討。本研究方法是遵循 Snyder （2019)所定義之半系統性文獻探討，由國外學者評定之前 60 篇國際會計期刊中篩選出 80 篇學術文章作為最終樣本，並以此 80 篇學術文章之出版年份、研究方法及所涉及會計領域之觀點進行綜合性分析。本研究發現近年來探討區塊鏈的會計學術文章有大幅增加的趨勢；而大多數學術文章所使用的研究方法為概念性，實證性研究方法較少採用；就領域方面來看，會計資訊系統及審計為此 80 篇學術文章中最多涉及之研究領域。本研究也揭示了對會計及審計專業及實務可行之區塊鏈相關概念及應用，包括：三式簿記、智能合約、持續性審計及責任與治理。此外，本研究為會計及審計領域關於區塊鏈的未來研究提供建議及明確之研究問題。

關鍵詞: 區塊鏈、智能合約、三式簿記、會計、持續性審計、責任制、加密貨幣

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英文摘要

Blockchains are an emerging technology expected to considerably transform the accounting and auditing professions. This study reviewed the academic literature on blockchain in accounting and auditing. The methodology involves a semisystematic literature review, as prescribed by Snyder (2019), of 80 studies from the top 60 international accounting journals identified by international scholars. This study also involved a comprehensive analysis of selected 80 studies to determine which year had the most studies published, the research methodologies they used, and the aspects of accounting that were involved. The number of studies published in international accounting journals has considerably increased. The most used methodology is conceptual; empirical research was rare in the data pool. Most of the studies involved accounting information systems (AIS) and auditing. This study also identified key and feasible concepts related to blockchain technology, namely triple-entry bookkeeping, smart contracts, continuous auditing, and accountability and governance, and applications for accounting and auditing. In addition, this study provides potential research questions for future research on blockchain technology in accounting and auditing.

Keywords: blockchain, smart contract, tripe-entry bookkeeping, accounting, continuous auditing, accountability, cryptoasset

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1. Introduction

Blockchains are a highly innovative and disruptive information technology that have begun to cause drastic transformations in the business models of several industries (Dai & Vasarhelyi, 2017; Yen & Wang, 2021). A blockchain has several features that make it compatible with accounting information technology, including tamper resistance, high transparency, and automatic verification capabilities (Tyma, Dhillon, Sivabalan, & Wieder, 2022). Therefore, blockchains are expected to strongly affect accounting and auditing (AICPA, 2018).

Studies have explored how blockchains can be applied to various domains, such as supply chains (Liu, Robin, Wu, & Xu, 2021), fintech (Cai, 2018), initial coin offering (ICO) (Zhang, Zhang, Zheng, & Aerts, 2021), cryptocurrency (Zhang, Zhou, Pan, & Jia, 2019), and other emerging technologies (Appelbaum & Nehmer, 2020; Church, Schmidt, & Ajayi, 2020). With the rapid development of blockchains, the amount of research on blockchains in accounting has grown considerably (Lombardi, de Villiers, Moscariello, & Pizzo, 2021). However, the large volume of information regarding blockchains prevents scholars from closely monitoring their development. Therefore, literature reviews are useful for surveying information regarding blockchains in accounting and auditing (Garanina, Ranta, & Dumay, 2021). In addition, literature reviews should be conducted to explore the uncertainty surrounding the effects of blockchains and the

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accompanying digital transformation on accounting and auditing.

In such reviews, the motivations and rationales should be explicitly stated (Snyder, 2019). Several studies have explored the effects of blockchains on accounting and auditing. In addition, enterprises have increasingly integrated blockchains into their business operations (Guo, Walton, Wheeler, & Zhang, 2021) in the form of distributed ledgers, smart contracts, and cryptocurrency; these developments represent the motivation for this literature review of how blockchains have evolved and advanced in accounting and auditing. According to Snyder (2019), the findings of studies must be clearly described and relate to the research questions (RQs) of a literature review.

The studies in this review were collected from the top 60 international accounting journals, as identified by Chin, Wang, Lee, Wu, Lin and Yu (2012). These studies were comprehensively reviewed to determine the effects of blockchain technology on accounting and auditing. Because blockchain technology has not yet been widely adopted (Karajovic, Kim, & Laskowski, 2019), we focused on concepts that may be applied to accounting and auditing in the future. Determining how blockchains have disrupted accounting and auditing can benefit these domains. we also proposed some constructive suggestions and directions for future research.

The remainder of the paper is structured as follows. In Section 2, we describe the concept and characteristics of blockchains. Section 3 presents the research method and

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workflow for this review. Section 4 presents a comprehensive analysis of the selected studies and interpretation of the results. Section 5 proposes directions for future research and suggestions. Section 6 presents a summary of the results and the implications of blockchain technology for accounting information systems (AISs). Hopefully, this review can serve as a reference for professionals, practitioners, and scholars in accounting and auditing.

2. Background

Nakamoto (2008) explored the use of blockchain technology with regard to Bitcoin, a well-known and widely traded cryptocurrency. Since then, the applicability of blockchain technology to numerous fields has increased. Blockchains have considerably changed various industries (Deloitte, 2016), such as finance and logistics. Blockchains have also transitioned from being a secure means of monetary trading to being part of an ecosystem of disruptive technology, including the Internet of Things (IoT) (Albizri & Appelbaum, 2021), artificial intelligence (AI), robotic process automation (RPA), and machine learning (ML) (Zhang, 2019). Although the applications of blockchain technology are still being explored, the focus has gradually shifted from cryptocurrency to business applications (Stratopoulos, Wang, & Ye, 2022); this shift indicates that blockchain technology has evolved into a fundamental technology in the contemporary business ecosystem. Professionals, practitioners, and scholars in accounting have

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highlighted the decentralized and distributed nature of blockchains and expect them to become key part of next-generation AISs (Dai & Vasarhelyi, 2017).

2.1. Types of Blockchain

Blockchains can be operated publicly, privately, or by a consortium. In public blockchains, also called permissionless blockchains, all participants receive the same records of transaction data, and no central authority controls the whole chain or approves transactions (Wang & Kogan, 2018). Therefore, public blockchain's advantage is that every node has equal authority to maintain the operations of public blockchains. However, one difficulty of implementing public blockchains in business is that transaction data can be leaked, which concerns companies (Vincent, Skjellum, & Medury, 2020).

Private blockchains restrict membership and thereby create a closed environment in which activity in the system is monitored (Liu, Wu, & Xu, 2019). They lack data transparency and public participation because a centralized agency controls the chain. As a result, private blockchains are more conducive to maintaining privacy and meeting businesses' needs than are public blockchains (Carrasco & Romi, 2021).

Consortium blockchains combine certain characteristics of public and private blockchains. In consortium blockchains, members are selected in advance, and certain participants have authority over the network, as in a private blockchain (Tyma et al., 2022).

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Private blockchains and consortium blockchains are also known as the permissioned blockchains. However, consortium blockchains afford more flexibility to engage in activities in the network because the approval of a single central authority is not required, as in public blockchains (Tyma et al., 2022). Consortium blockchains are partially decentralized because each participant is authorized to have different levels of access (Liu et al., 2019). Thus, each form of blockchain has a distinct function.

2.2. Decentralization and Consensus Mechanisms

Without a central authority approving transactions, members cannot tamper with the system arbitrarily (Tan & Low, 2019). Transactional information is recorded through a globally distributed network of computers based on a mechanism in which each coordinate node shares identical copies of transactional data without the control of central authority. The nodes, usually called miners, are incentivized to create and verify blocks. (Kokina, Mancha, & Pachamanova, 2017). The block verification process involves numerous mechanisms, such as proof of work (PoW), proof of stake (PoS), delegated proof of stake (DPoS), proof of authority (PoA), and proof of capacity (PoC).

In PoW, miners use their computers' processing power to solve a mathematical puzzle involving a hash of a set of transactions and a hash of a prior block as quickly as possible (Kokina et al., 2017). This protocol depends on the power of the miners' computers, and the one who solves the puzzle first will receive a reward.

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PoS requires less computational power, and those who possess the cryptocurrency verify transactions on the basis of their account balance (Coyne & McMickle, 2017). Those who hold more assets have more opportunities to verify transactions. Thus, the members who are holding more units of the cryptocurrency will have greater potential to sustain the system and preserve the value of their assets.

DPoS is a popular method and represents a more democratic version of PoS. Members of a blockchain network vote to elect delegates to validate new blocks. PoA is a specialized mechanism of consensus for permissioned blockchains; nodes must pass a preliminary authentication to obtain the right to generate a new block. PoC depends on the available memory or hard disk space of miners' devices to determine mining rights and validate transactions. Several other mechanisms of consensus exist, but they are not covered in this literature review.

Through these mechanisms, network members reach a consensus and establish trust only if they can solve mathematical problems or receive verification from an authority. The key advantage of using blockchains is that once a transaction is verified by nodes in the network, modification of the sequence of blocks becomes nearly impossible (Moll & Yigitbasioglu, 2019)

2.3. Immutability and Confidentiality

A blockchain is a distributed ledger providing a secure database of transactions that

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cannot be altered, so-called immutability. When nodes reach a consensus, valid blocks are added to the blockchain chronologically to form a series of records (Kokina et al., 2017). Thus, a blockchain is a distributed and tamper resistant system that ensures that all members have accurate and identical records and that the integrity of the network is maintained (Zhang, Pei, & Vasarhelyi, 2017). The network is equipped with a robust authentication process in which all nodes are connected by trust. To maintain records, a hash function is used to ensure transaction data remain private. A hash function is a mathematical algorithm that processes a transaction and generates a fixed value known as a hash value (Lee, Appelbaum, & Mautz III; Stratopoulos, 2020). Each block generates a unique hash value and contains the hash value of the previous block (Dunn, Jenkins, & Sheldon, 2021). Any change to a block would create a new hash value, and tampering with a block requires the modification of a previous block. As a result, tampering is nearly impossible, because modifying records is extremely difficult and time-consuming.

Another aspect of blockchain technology is its asymmetric cryptography, which enables the identity of every member accessing transactional data to be verified (Harrast, Mcgilsky, & Sun, 2021). Asymmetric cryptography involves public and private keys that enable encryption and decryption (Pimentel, Boulianne, Eskandari, & Clark, 2021). A public key can generate a cryptographic number that can be shared with other users releasing information or receiving cryptoassets (Dunn et al., 2021). A private key is a

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secret code that enables users to access information or claim ownership of assets (Harrast et al., 2021).

Digital signatures involve the encryption of information by using senders' private keys, and whoever knows the sender's public key can decrypt a message and access its information. The purpose of this process is to verify senders' identity and prevent information from being modified. When the sender's information is modified, those who know the sender's public key cannot access the information. The sender can also use the receiver's public key to encrypt information, which the receiver can decrypt with their private key. This maintains the confidentiality of information and ensures that only those who have private keys can decrypt it. This cryptography mechanism is especially crucial to protecting the private keys that prevent information leaks in blockchain systems (Lineros, 2021). Failing to secure private keys can threaten the integrity and confidentiality of transaction data in blockchain systems.

2.4. Transparency and Real-Time Updates

Because a blockchain is a peer-to-peer and distributed network, all transactions recorded in blocks are shared, and any change to a ledger becomes visible to all parties (Centobelli, Cerchione, Del Vecchio, Oropallo, & Secundo, 2021). Because of the use of shared ledgers, every node has the same level of authority, resulting in decentralization. Hence, distributed ledgers can increase a company's transparency and ensure its

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information is trusted (Garanina et al., 2021). Transparency in internal operations and transaction data can help companies establish trust among market participants and help key entities understand their business models. Building robust trust among trading partners creates opportunities for cooperation and strengthens companies' competitive advantages and market positions.

Transactions are posted to the blockchain as they occur and undergo the consensus mechanism (Sheldon, 2019). Thus, every node in a blockchain network can receive information in real time (Cho, Vasarhelyi, & Zhang, 2019), which accelerates operational procedures. Yermack (2017) explored real-time accounting. Firms can achieve real-time accounting by posting their transaction records on a blockchain system and by using tokenization, as discussed in Dai and Vasarhelyi (2017). In such a system, management can provide financial reports to authorities immediately, and shareholders can obtain financial statements at any time and evaluate a company's status. Auditors can also access and inspect clients' transaction records at any time; transparency in these records and their ability to be accessed in real time substantially reduce audit risks.

2.5. Challenges and Opportunities

Blockchains entail several challenges, including contractual provisions being difficult to translate to programmable codes, a high energy demand, low scalability, and privacy issues (Garanina et al., 2021). Blockchains are also limited by a lack of strict

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regulations. Concerns regarding regulatory uncertainties and deficiencies have arisen because these factors increase risk and are associated with immoral behavior (Lineros, 2021). However, regulating blockchain networks would threaten their decentralized nature. Thus, research on blockchains must continue to identify its advantages and disadvantages.

The integration of blockchains into business operations and financial reporting means that AISs and audit procedures must be refined (Kocsis, 2019). According to Dai and Vasarhelyi (2017), blockchains are expected to strongly affect accounting and improve the associated information systems, auditing, and assurance. Therefore, a review of the literature on blockchain in accounting and auditing is worthwhile.

3. Methodology

This study is a semisystematic literature review following the methods prescribed by Snyder (2019), which involve (a) designing the review, specifying the requirement for a review, and selecting a search strategy; (b) searching the literature and documenting the sample selection process; (c) abstracting the selected studies for analysis; and (d) presenting the related results and contributions.

3.1. Designing the Review

Although blockchain technology is in the phase of early adoption, developments in triple-entry accounting and smart contracts highlight its disruptive potential. In addition,

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with the growing number of studies on blockchain technology in accounting and auditing, Big 4 accounting firms have begun to adopt blockchains to meet clients' needs. Blockchain technology has strongly affected both research and practice in accounting and auditing. Thus, the literature should be reviewed to clearly define the purpose and scope of the applications of blockchains in accounting and auditing and to develop questions for further research.

According to Snyder (2019), semisystematic reviews usually focus on how research in a field has developed and how certain topics progress. This review was conducted to identify and synthesize the results of studies that investigate the implications of blockchains for auditing and accounting. We developed standards and detailed plans to ensure that key studies would be included in the review and followed the methods of Snyder (2019); therefore, this study belongs to a semisystematic literature review.

The search strategy involved the use of searchable terms, databases, and inclusion and exclusion criteria. Because cryptocurrencies, smart contracts, and triple-entry accounting are based on blockchain technology, studies on these topics usually discuss blockchain technology. For this reason, we used the term "blockchain" to search the literature. In addition, studies were limited to those on accounting and auditing from international accounting journals. The detailed process of the sample selection will be discussed in the next section.

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3.2. Conducting the Review

We selected the top 60 international accounting journals, as identified by Chin et al. (2012) to ensure the quality and reliability of the literature. Appendix A lists the journals and their rankings. We searched the EBSCO database for studies in these journals from 2016 to 2021 by using the keyword "blockchain." The initial search returned 112 studies. We then searched each journal's website by following the same process to ensure the search covered all academic studies on accounting and auditing. After searching each journal's website, we obtained 194 studies.

We then determined the relevance of the studies to the effects and applications of blockchain technology in accounting and auditing by skimming the abstracts before reading the full texts. Through this process, we eliminated three types of studies: (a) those about blockchain technology that did not relate to accounting or auditing, (b) those that discussed blockchain technology in reference to possibilities for future research or noted it as an emerging technology but did not cover its applications in and effects on accounting and auditing, and (c) those for which the term "blockchain" only appeared in names of papers in the reference. After the selection process, 80 studies remained. Table 1 shows the process of sample selection.

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Table 1

Process of Sample Selection

Preliminary search results:	
Studies from 2016 to 2021 in the EBSCO database that are from the top 60 international accounting journals and contain the keyword "blockchain."	112
Studies from each journal's website.	82
Subtotal	194
Excluded:	
Those about blockchain that did not relate to accounting or auditing.	(9)
Those that discussed blockchain technology in reference to possibilities for future research or noted it as an emerging technology but did not cover its applications in and effects on accounting and auditing.	(83)
Those for which the term "blockchain" only appeared in the references.	(22)
Final sample	80

4. Results

The studies were comprehensively analyzed to map the development of blockchain technology in accounting and auditing. Table 2 presents the distribution of 80 studies among the relevant journals. Appendix B presents essential information from each paper, such as the author(s), year, research methodology, and area of accounting involved.

Table 2

Distribution of Studies

Accounting journals	**Number of studies**
Journal of Accounting and Public Policy	2
Journal of Accounting, Auditing and Finance	1
Accounting Horizons	4
Journal of Information Systems	8
Issues in Accounting Education	4
British Accounting Review	2
Accounting and Finance	2

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International Journal of Accounting Information Systems	7
Journal of Accounting Education	1
Accounting, Auditing & Accountability Journal	8
International Journal of Auditing	1
Journal of International Accounting, Auditing and Taxation	1
The ATA Journal of Legal Tax Research	2
Australian Accounting Review	6
Accounting Educators' Journal	1
Current Issues in Auditing	7
Journal of Emerging Technologies in Accounting	23

4.1. Comprehensive Analysis

The studies were analyzed to determine the year in which the most studies were published, the research methodology they used, and the implications of their results. We also analyzed themes among the studies to understand the influences of blockchain on accounting and auditing.

4.1.1 Trends in Practice and Academia

Blockchain technology can increase the transparency, traceability, confidentiality, and integrity of financial data and transaction records because of its distributed and cryptographical information-sharing mechanism (Albizri & Appelbaum, 2021). For this reason, blockchain technology can benefit AISs by eliminating repetition and the need for reconciliation, by enabling entire databases rather than samples to be tested, and by preventing human error (Dai & Vasarhelyi, 2017). Thus, blockchains can streamline numerous redundant tasks in accounting and auditing, enabling accountants and auditors

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to focus on tasks requiring human judgment (Karajovic et al., 2019).

To maintain relationships with their clients, the Big 4 accounting firms have begun to provide blockchain services to enterprises. For example, Deloitte created "Deloitte Blockchain Labs"[1] in 2017 to provide consultation services for companies adopting blockchain technology. PwC created the "Crypto Center"[2] to help inform consumers about cryptocurrency and provide digital asset strategies, the accounting and auditing of digital assets, and risk management and control. Additionally, KPMG Blockchain Services[3] collaborated with Microsoft to develop a range of professional services related to blockchain technology. EY Blockchain Solutions[4] supports contracting, ordering, fulfilling, invoicing, and payment, and it manages audit requirements for blockchain-based transactions. These services demonstrate the Big 4 accounting firms' proactiveness and openness to blockchain technology.

According to practitioners and scholars, auditors must develop new skills and knowledge related to blockchain technology to satisfy clients (Felski & Empey, 2020). It is obvious that scholars are increasingly interested in how blockchain technology affects accounting and auditing, revealed by a considerable increase in the number of studies in

[1] "Deloitte Blockchain Labs", available at: https://www2.deloitte.com/us/en/pages/consulting/solutions/blockchain-labs.html
[2] "Crypto Center", available at: https://www.pwc.com/gx/en/about/new-ventures/crypto-center.html
[3] "KPMG Blockchain Services", available at: https://home.kpmg/xx/en/home/insights/2017/02/digital-ledger-services-at-kpmg-fs.html
[4] "Blockchain solutions", available at: https://www.ey.com/en_gl/blockchain-platforms

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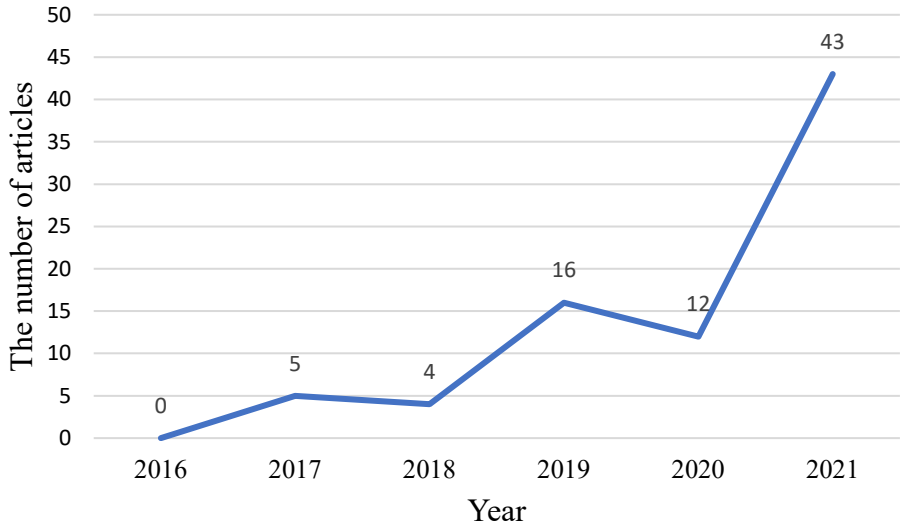
2021 (See Fig.1). Most of the relevant studies have explored how blockchain technology has progressed and how it can be applied to accounting and auditing. Once blockchain technology is widely adopted in accounting and auditing, studies will begin to investigate its effects in detail, and the number of related studies in international accounting journals will increase substantially.

Figure 1

Number of Studies by Year



4.1.2. Methodology of selected articles adopted

To categorize research methods, we referred to Moll and Yigitbasioglu (2019). According to Figure 2, most of the relevant studies used conceptual methods (approximately 45% of them). Others used literature reviews and case studies. Only three studies involved empirical research.

One study examined determinants of the early adoption of blockchain technology

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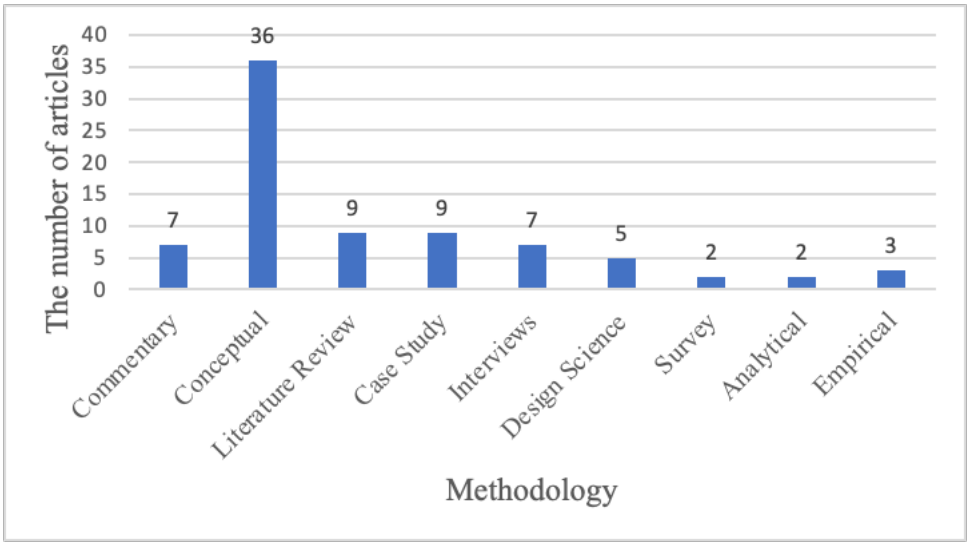
among public companies, namely the number of patents, agency costs (managerial discretion), complexity, and the degree of external monitoring through the release of financial statements and online business news (Guo et al., 2021). The study revealed that several early adopters were in high-tech industries and that companies with more patents had more opportunities to implement blockchain technology earlier. In addition, the study indicated that managers with the authority to make risky decisions can encourage early adoption, whereas strong external monitoring discourages early adoption.

Figure 2

Number of Studies by Methodology



Another study explored the stock price relevance of the voluntary disclosure of information regarding blockchain technology and cryptocurrency (Yen & Wang, 2021). The study revealed that the release of information regarding blockchain has positive stock

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price relevance but regarding cryptocurrency does not. The study also involved a thematic analysis of relevant information; information regarding blockchain solutions and risk factors has positive stock price relevance, whereas that regarding bitcoin transactions has negative stock price relevance.

The other study investigated how communication among managers and auditors regarding companies' adoption of blockchain technology affects nonprofessional investors (Austin & Williams, 2021). The study demonstrated that investor evaluations are generally unfavorable when auditor reports include critical audit matters related to companies' adoption of advanced technology and when Form 10-K specifically references blockchain technology. However, that study also revealed that specific mentions of blockchain technology in managers' descriptions of advanced technology did not affect investors' judgment when audit reports did not note companies' use of advanced technology.

Each of these aforementioned studies analyzed the release of financial reportings noting blockchains. Few of the studies focused on blockchain technology's effects on accounting and auditing as an immature and rarely adopted technology, resulting in a lack of empirical data. Despite this lack in such data, several studies have proposed novel ideas and made substantive contributions to the literature. For example, Dai and Vasarhelyi (2017) proposed the concept of triple-entry AISs. Centobelli et al. (2021) designed a

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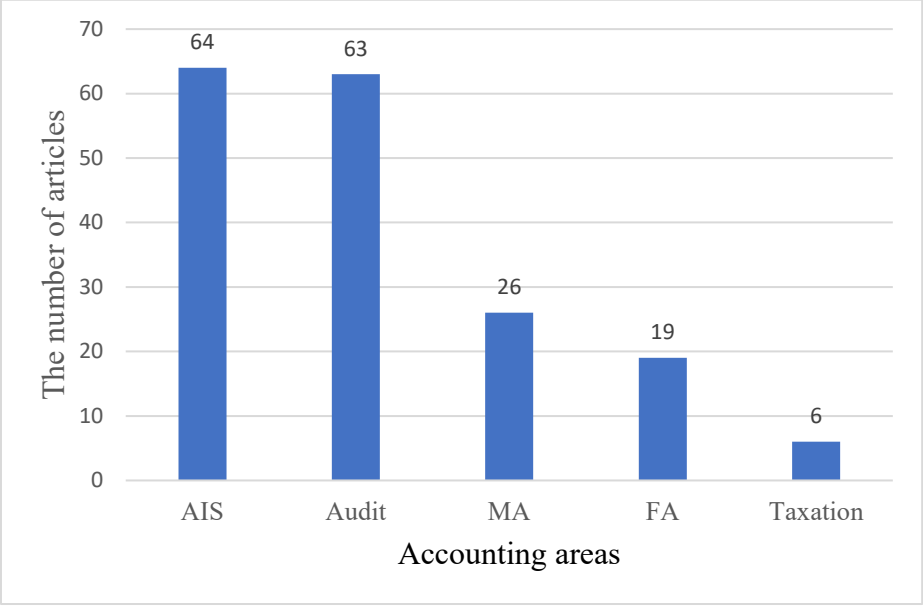
conceptual framework for a blockchain-based accounting ecosystem comprising a technological infrastructure layer, control layer, and business application layer. Liu et al. (2021) conducted a case study to illustrate how a blockchain system traces transaction flows and records transaction data. The results of these studies have thus contributed to the development of blockchain technology in accounting and auditing.

4.1.3 Aspects of Accounting

By following the methods of Qasim and Kharbat (2020), we subdivided accounting into financial accounting (FA), management accounting (MA), auditing, AISs, and taxation. Figure 3 presents the number of studies related to each subdivision; because a single study can cover multiple areas of accounting, the total number exceeds 80.

Figure 3

Number of Studies by Accounting Field



* Because a single study can cover multiple areas of accounting, the total number of exceeds 80.

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Because blockchain technology can serve as a disruptive AIS and transform audit procedures, most of the related studies involved AISs and auditing topics such as smart contracts, triple-entry accounting, and continuous auditing. Blockchain technology can improve AISs because it ensures the integrity of data and enables the immediate sharing of transaction information and the programming and automatization of procedures. A total of 64 studies proposed blockchain-based AISs and investigated how blockchain technology can improve AISs. For example, Cai (2021) used three case studies to explore a triple-entry AIS and discovered that it increased trust and transparency. Furthermore, Tan and Low (2019) examined how blockchain technology can transform accounting by digitizing the AIS databases. In brief, AIS is an important and crucial domain to observe the development of blockchain.

The number of studies on auditing is similar to that on AISs. Because it automatizes certain audit procedures through smart contracts, continuous auditing is used to examine companies' transaction data and internal controls at any time, rather than at the end of quarters or years (Carlin, 2019). Transaction records being recorded in a blockchain system enables real-time auditing and helps auditors understand their clients. Rozario and Thomas (2019) suggested that smart contracts can enable auditors to automatize audit procedures by using predetermined parameters in a blockchain network, thereby increasing efficiency and preventing human error. Moreover, Cong, Du and Vasarhelyi

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(2018) noted that continuous auditing can enable the real-time detection of misstatement and automatic correction, thereby ensuring companies provide financial reports in real time.

One-third of the studies covered MA. In MA, blockchain technology usually relates to interorganizational relations, accountability, and corporate governance. Blockchain technology's ability to enable instantaneous, high-fidelity, low-cost reporting can facilitate interorganizational communication and collaboration (Heister, Kaufman, & Yuthas, 2021). Kostić and Sedej (2021) presented that interorganizational cooperation can reduce monitoring costs, which may improve cost structures. Tyma et al. (2022) explored the various accountability mechanisms in blockchain technology and revealed that even immature applications of blockchain technology can ensure accountability. Besides, Brennan, Subramaniam and Van Staden (2019) indicated that blockchain-based corporate governance is decentralized, with decisions being made through consensus mechanisms; therefore, management must consider the degree of decentralization and the appropriate consensus mechanism to implement. Management must also determine the appropriate response to the transformation of MA caused by the use of blockchain technology. Liu et al. (2019) suggested that permissioned blockchains can satisfy the need for corporate governance because they entail robust authority and accountability mechanisms.

FA involves the classification and evaluation of cryptocurrencies. As Ramassa and

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Leoni (2021) indicated, the International Financial Reporting Standards Interpretation Committee (IFRSIC) indicated that cryptocurrency matches its definition of an asset. According to the IAS 2 definition, inventories are assets held for sale in normal business practice. Some enterprises holding cryptocurrencies for sale can treat cryptocurrencies as inventory in accounting (Hampl & Gyönyörová, 2021; IFRSIC, 2019; Ramassa & Leoni, 2021). Furthermore, cryptocurrencies meet the definition of IAS 38 (IFRS, 2014), which defines intangible assets as assets that are identifiable, controlled by an entity, and have future economic benefits. Therefore, they can be considered intangible assets in some cases (Hampl & Gyönyörová, 2021; IFRSIC, 2019; Ramassa & Leoni, 2021).

Under U.S. generally accepted accounting principles (U.S. GAAP), AICPA (2022) indicated that cryptocurrencies are not tangible assets and therefore do not satisfy the definition of inventory for general companies. However, in the light of a broker-dealer's business practice, AICPA regarded cryptocurrencies as inventories that are held for trading is feasible. AICPA (2022) also indicated that cryptocurrencies meet the definition of intangible assets and would generally be accounted for under U.S. GAAP.

Whether cryptocurrencies should be treated as inventory or intangible assets depends on the given situation. Beigman, Brennan, Hsieh and Sannella (2021) developed an approach for dynamically specifying principal markets and evaluating the fair value of cryptocurrency for financial reporting because cryptocurrency markets are too globally

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distributed to identify a principal market. The real-time fair value derived from the approach is expected to enhance the quality and the faithful representativeness of financial reporting. After the decision made by Financial Accounting Standards Board (FASB) that cryptocurrencies meeting the criteria should be measured at fair value on companies' financial statements (FASB, 2022) [5], the approach which consistently complies with the fair value accounting standards (ASC 820) would become more relevant and bring benefits to the practice.

Few studies covered taxation, and several topics remain to be investigated. Søgaard (2021) proposed a blockchain-based platform to increase the efficiency and transparency of value-added tax settlement and lighten the heavy administrative burden imposed by governments. The platform can also strengthen the relationship between companies' AISs and government agencies. In that study, Søgaard (2021) conducted a case study to demonstrate how governments lighten the administrative burdens on small and medium-sized companies while maintaining the flow of tax revenue. With the popularity of virtual currencies, several problems related to taxation have emerged. The Internal Revenue

[5] In August 2022, the FASB defined the criteria for the scope of its crypto asset project as follows:

- *Meet the definition of intangible asset as defined in the Codification Master Glossary.*
- *Do not provide the asset holder with enforceable rights to, or claims on, underlying goods, services, or other assets.*
- *Are created or reside on a distributed ledger or "blockchain."*
- *Are secured through cryptography.*
- *Are fungible.*

The board meeting minutes are available at: https://www.fasb.org/document/blob?fileName=CRYPTO-MIN-20220831.pdf

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Service's Notice 2014-21 indicates that virtual currencies, including Bitcoin, should be treated as property rather than as currency for federal tax purposes and that the tax principles applicable to property transactions also apply to virtual currency transactions (Adams & Bailey, 2021; IRS, 2014; Terando, Cataldi, & Mennecke, 2017). Inger and Mathis (2021) conducted a case study to introduce students to problems related to taxation on virtual currency for miners and short- and long-term investors; their survey indicated that 95% of the students believed or strongly believed that they had gained knowledge of this topic. As a result, case study is an efficient way to strengthen students' comprehension of virtual currencies and related tax issues.

Each domain of accounting entails unique challenges. As Albizri and Appelbaum (2021) indicated, blockchain technology's ability to store records that accurately represent physical transactions still requires independent verification. Coyne and McMickle (2017) identified several factors impeding the adoption of blockchains to support financial reporting, namely concerns regarding confidentiality, 51% attacks, and the lack of a transaction verification mechanism. Therefore, the development of blockchains in each field must continue to be researched.

Last but not least, we selected keywords from the studies to create a word cloud (See Fig.4) and identify key themes. Because nine of the studies did not provide keywords, the word cloud only contains keywords from 71 studies. The three most used keywords were

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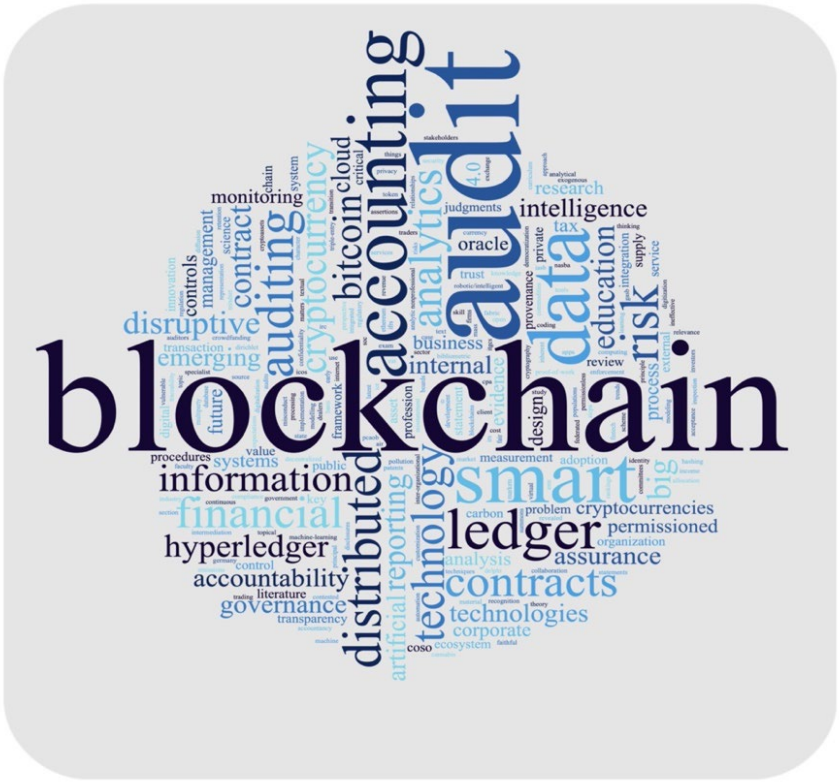
blockchain (60 studies), accounting (28 times), and audit (23 times).

Triple-entry bookkeeping, smart contracts, continuous auditing, and accountability and governance are key topics. Although the authors of the studies did not use "triple-entry bookkeeping" or "continuous auditing" as keywords, 20 and 37 studies covered (or at least mentioned) these terms, respectively. Therefore, triple-entry bookkeeping and continuous auditing are also key concepts that can help scholars and practitioners understand the applications of blockchain in accounting and auditing.

Figure 4

Word Cloud



* Because nine of the studies did not provide keywords, the word cloud only contains keywords from 71 studies.

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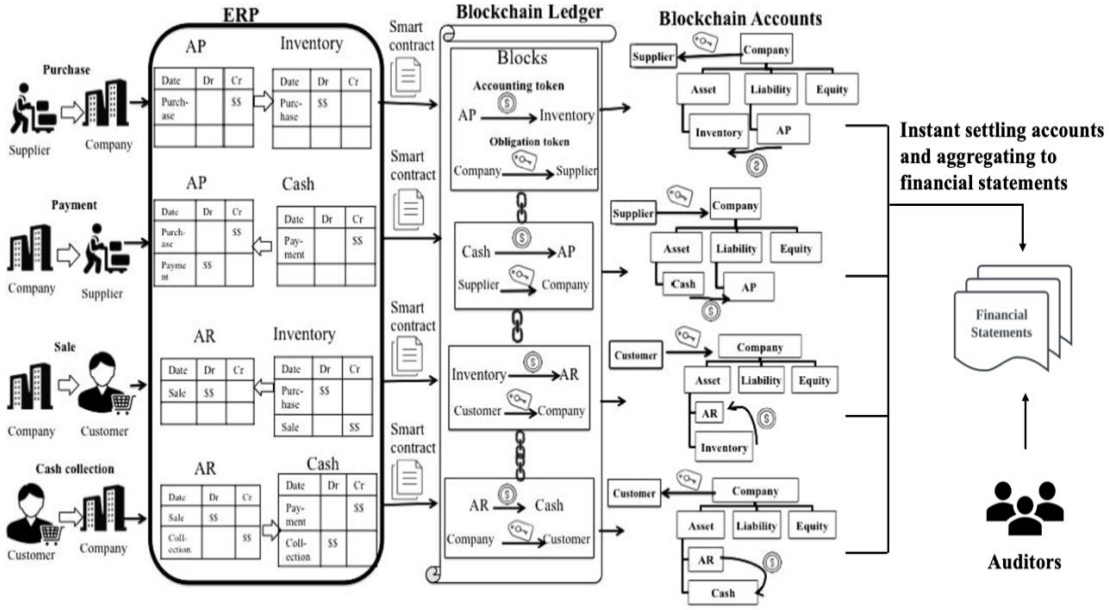
4.2. Feasible Concepts and Applications

4.2.1. Triple-Entry Bookkeeping

Blockchain enabled triple-entry bookkeeping to serve as an AIS in which every transaction is recorded in debit and credit accounts and then encoded in the blockchain as a third accounting entry (Cai, 2021). Thus, blockchains can enhance traditional double-entry systems such as enterprise resource planning (ERP). Smart contracts can also accelerate bookkeeping in triple-entry AISs by enabling the encoding of accounting standards and predetermined conditions (Dai & Vasarhelyi, 2017). In such an AIS, each account in an ERP system has a corresponding blockchain account. Figure 5 presents a possible framework for a triple-entry AIS in Dai and Vasarhelyi (2017).

Figure 5

A Triple-Entry AIS



Source: modified from Dai and Vasarhelyi (2017)

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The third entry is recorded by tokens, indicates transaction flows, and acts as a credential to verify the rights to or ownership of assets among trading partners (Gomaa, Gomaa, & Stampone, 2019). In traditional AISs, when companies sell products or provide services to a customer on credit, they debit accounts receivable and credit sales revenue or service revenue. Companies also debit the cost of goods sold and credit inventory. With blockchains, companies can then post these transactions in a blockchain ledger by using smart contracts, thereby accomplishing triple-entry bookkeeping. Dai and Vasarhelyi (2017) described one notable advantage of this process: *"Accounts in the blockchain ledger would be organized in a hierarchical to aggregate data at various levels, which enables both instant balancing of accounting equation and different views of information for different users."* This hierarchical structure facilitates balance reconciliation and reduces costs considerably.

Encrypting information is crucial to enabling companies to retain confidentiality. Blockchains provide several solutions that ensures that problems related to confidentiality and privacy do not create a substantial risk to triple-entry bookkeeping for accounting and auditing (Coyne & McMickle, 2017). Examples of such solutions include the cryptographic function involving hash values and private and public keys that encrypt transaction data. Companies can use this function to ensure security among trading partners and the confidentiality of transactions (Dai & Vasarhelyi, 2017).

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Another solution is creating a permissioned blockchain network in which a limited number of members are authorized to access internal data. In permissioned blockchain, only trusted members such as business partners have authority over access control, which enables companies to allow certain members to record or verify transactions, with the other members only having read access (Rozario & Thomas, 2019). Permissionless blockchains is more vulnerable to 51% attacks than permissioned blockchains are. In 51% attacks, because each block is added to a blockchain through a consensus mechanism, if more than half of the members of a blockchain collude, they can considerably modify data (Coyne & McMickle, 2017). Companies prefer permissioned blockchains over permissionless blockchains because of the privacy they afford. The increased confidentiality and cryptographic nature of blockchains ensure the security of triple-entry bookkeeping and trust among trading partners.

The third accounting entry in blockchain ledgers can be used to track transaction flows and detect errors. As Cai (2021) and Dai and Vasarhelyi (2017) indicated, transactions in blockchain ledgers are stored in the form of tokens and recorded in chronological order in a triple-entry AIS. These records are also connected to the internal records of an ERP system. Companies can allow read-only access for auditors to verify transaction data in permissioned blockchains. Thus, triple-entry AISs make transactions easily observable and verifiable and leave a transparent audit trail. Although using a

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blockchain's distributed ledgers as infrastructure for accounting entails risk and requires considerable investment, it would ensure a transparent, automatically verifiable, and errorless AIS. In addition, using a blockchain's distributed ledgers as an AIS would reduce operating costs, prevent fraud, facilitate bookkeeping, and increase the operational efficiency and the auditability of transactions. Thus, blockchain technology has transformed accounting and auditing. As secure and distributed platforms, triple-entry AISs would increase accounting efficiency and improve the audit process.

4.2.2. Smart Contracts

Another popular blockchain-based feature is smart contracts. In smart contracts, contractual parties transform the clauses of the covenant into computer program codes to execute transactions (Chou, Hwang, Schneider, Wang, Li, & Wei, 2021). Smart contracts are event-oriented digital contracts, the terms of which are prespecified by users that execute conditions automatically (Rozario & Thomas, 2019). Because data on blockchains cannot be modified, the provisions in smart contracts cannot be changed arbitrarily by any party (Cai, 2021). Once certain situations arise, smart contracts initiate predetermined functions automatically; Figure 6 demonstrates this process. For example, a company and its suppliers can set the conditions of a purchase by using smart contracts. Once the company receives goods it ordered on credit, the smart contract will automatically become active, settle the accounts payable, and write off the accounts

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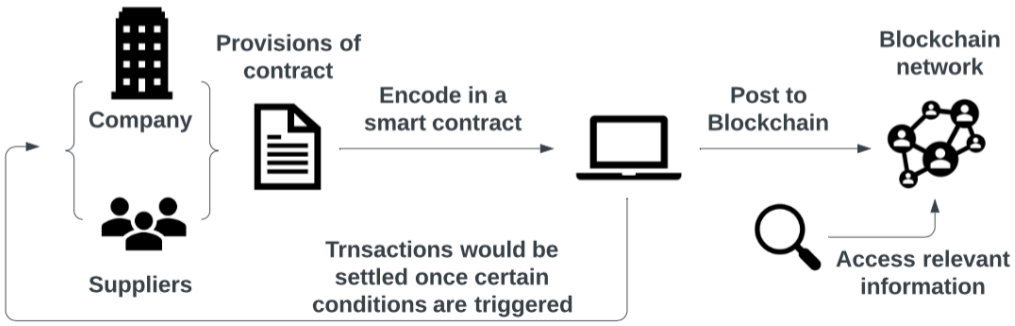
receivable of the supplier when payment is received. Thus, transactions are managed in real time, which accelerates information flow and bookkeeping.

Figure 6

A Demonstration of Smart Contract



Because blockchain technology offers real-time data sharing, each node can monitor companies' activity and breaches of smart contracts at any time. Centobelli et al. (2021) indicated that smart contracts enable nodes to monitor transactions, accelerate processes, and ensure automatization and decentralization. Smart contracts in blockchain technology can also eliminate the requirement for balance reconciliation among trading parties. Because agreed-upon requirements are encoded in smart contracts, trading partners can avoid disputes and prevent deceit (Vincent & Barkhi, 2021). Thus, smart contracts are advantageous tools that can transform businesses by increasing efficiency, eliminating transaction costs, and preventing fraud and human error, especially in accounting and auditing.

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In addition to covenant provisions, smart contracts can encode conditions for specific procedures to assign tasks in accordance with preestablished rules, such as accounting standards, audit procedures, and operational routines (Dai & Vasarhelyi, 2017). As discussed in previous section, Cai (2021) demonstrated that smart contracts can be applied to triple-entry AISs. This framework both increases operational efficiency and creates audit trails, enabling auditors to collect evidence with little effort. Chou et al. (2021) developed a model of decentralized accounting contracts and used five case studies involving revenue recognition to demonstrate how accounting principles are embedded in smart contracts. Their results revealed that smart contracts can solve numerous accounting issues. Smart contracts also enable action on a real-time basis and reduce transaction costs considerably (Vincent & Barkhi, 2021). Therefore, smart contracts can increase the efficiency and automation of accounting.

Auditors can determine whether the predetermined conditions of smart contracts are upheld. Dai, He and Yu (2019) explored how smart contracts can facilitate Auditing 4.0 by enabling the monitoring of companies' operations and warning auditors when quantitative indicators of critical audit issues exceed predetermined numeric thresholds. For example, auditors can encode prespecified thresholds for account balances on financial statements into a smart contract. The smart contract then automatically reviews the account balance and alert auditors when the balance exceeds the relevant threshold.

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Accounting firms should adopt smart contracts because completely automated audit procedures prevent human error and improve audit quality (Tiberius & Hirth, 2019). The process of translating audit procedures into computer programs by using smart contracts is called ”smart auditing” (Alles, Dai, & Vasarhelyi, 2021; Rozario & Thomas, 2019). As Rozario and Thomas (2019) indicated, smart auditing enables audits to be performed automatically without auditors' professional judgment. This would leave time for auditors to address other problems and thus improve audit quality and reporting.

Smart contracts increase the efficiency of triple-entry bookkeeping and enable auditors to obtain synchronous, accurate financial data to present more precise opinions for financial statements. In addition, smart contracts can be used to detect abnormal transactions and irregular activity that would compromise the integrity of the smart audit process in real time on the basis of the prespecified numeric thresholds. Thus, the automated audit procedures of smart contracts facilitate the testing of control and substantive tests and increase the quality and efficiency of auditing (Appelbaum, Showalter, Sun, & Vasarhelyi, 2021). Users of financial statements and investors can also acquire more transparent and reliable information in real time to make informed decisions.

4.2.3. Continuous Auditing

Most audit practices and procedures are labor-intensive. However, blockchains' distributed nature and smart contracts may simplify and streamline several accounting

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and auditing procedures. In addition, blockchains can enhance financial reporting processes by providing more reliable and timely evidence to improve management assertions in relation to transactions (Brennan et al., 2019). As a result, auditing has shifted from being periodical or annual to continuous (Schmitz & Leoni, 2019).

Evidence collected from audit procedures should be relevant, sufficient and reliable. Alles et al. (2021) indicated that auditors can use rule-based auditing and monitoring paradigms to provide adequate assurance for financial reporting through smart contracts in blockchain networks. Thus, auditors can translate some audit procedures into computer programming codes to test transaction data, which would support management assertions. Because blockchains are shared databases, auditors can access clients' transaction records with little effort, which would enable auditors to examine entire populations in real time rather than selected samples periodically (Kokina et al., 2017; Rozario & Thomas, 2019). This mechanism can help auditors collect a sufficient volume of evidence from their clients to make informed judgments. Rozario and Thomas (2019) demonstrated that the administrators of permissioned blockchain networks can authorize write and read access for clients' blockchains. Auditors can thus participate in clients' permissioned blockchain systems as read-only nodes without engaging in their clients' business operations and acquire transaction data to increase the reliability and authenticity of audit evidence. In addition, auditors can execute procedures automatically by using blockchains and smart

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contracts. These emerging technologies also enable auditors to determine the validity of transaction data and identify material misstatements in clients' financial statements instantaneously rather than at the end of the reporting period (Schmitz & Leoni, 2019).

In blockchain networks, the occurrence and bookkeeping of a transaction are nearly simultaneous. This facilitates balance reconciliation and creates a detailed transaction trail that auditors can easily track (Kokina et al., 2017). Because of the efficiency of continuous auditing, auditors can save a considerable amount of time and refine their audit procedures. Appelbaum and Nehmer (2020) identified tasks that auditors should perform to continuously collect evidence in permissioned blockchains, namely observation, inquiry, confirmation, inspection, recalculation, and analysis. They also suggested that auditors should determine whether clients' blockchains are connected to data flows and transactions with trading partners during the confirmation step. Unlike traditional auditing, continuous auditing helps auditors understand their clients' businesses at any time rather than at the end of financial reporting periods (Cong et al., 2018; Schmitz & Leoni, 2019).

With the convenience and automated nature of blockchain systems, auditors can avoid tedious procedures and concentrate on high-risk matters (Rozario & Thomas, 2019). The continuous auditing enabled by blockchain also increases the efficiency and quality of audits because auditors have more time to address risky material misstatement,

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malicious fraud, and other problems of financial statements. Wang and Kogan (2018) developed a prototype of a blockchain-based transaction processing system for continuous auditing that deters fraud through blockchain, zero-knowledge proof, and homomorphic encryption. The system helps auditors access transaction data and continuously monitor firms' transaction activity. This continuous auditing and monitoring helps prevent earnings manipulation and other illegal activities from management.

Because blockchain technology increases the efficiency of auditing and facilitates automation, ERP systems and auditors may be replaced by blockchain technology (Church, Smith, & Kinory, 2021; Vincent et al., 2020). However, to replace ERP systems with blockchain-related distributed ledgers, companies must invest a considerable amount of capital into establishing new AISs. Because the applications of blockchain technology remain immature and underadopted, using it to create a new system entails risk (Vincent et al., 2020). Whether the information encoded in blockchains accurately represents transaction data is difficult to determine (Alles & Gray, 2020), and the differences between the records in blockchain and the actual transactions must be identified for auditing. To reduce the gap between the physical and digital worlds, Albizri and Appelbaum (2021) developed a model by introducing the IoT as one a node in a blockchain, thereby enabling peer-to-peer traceability and transparent provenance. Miners' verification processes aim at checking whether a block submitted by an

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authorized user of blockchains is valid rather than examining the authenticity of information (Richardson & Watson, 2021). Miners do not always know the details and authenticity of transactions, and transactions on blockchains can be unauthorized or fraudulent. Concerns that ERP systems and auditors may be replaced by blockchains are unjustified because some procedures still require auditors to determine the authenticity of transactions. Once blockchains become prevalent in business, a new demand for auditing will arise to bridge the gap between digital and physical worlds (Fotoh & Lorentzon, 2021; Sheldon, 2021a, 2021b). Moreover, if auditors can participate in clients' blockchain with read-only authority to acquire data directly (Rozario & Thomas, 2019), audit quality will improve considerably then help auditors and users of financial statements meet others' expectations.

4.2.4 Accountability and Governance

Accountability refers to entities' responsibilities (Tyma et al., 2022). Increasing attention to blockchain has led to several studies on accountability and governance in the literature on accounting. Secinaro, Dal Mas, Brescia and Calandra (2021) conducted a literature review to explore accountability as it relates to accounting and auditing. Because decentralization removes the need for an intermediary or trusted third party to process and verify transactions among trading partners, accountability is distributed to each node in blockchain systems. Tyma et al. (2022) explored accountability in public,

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private, and consortium blockchains. Each type of blockchain system requires a different mechanism of accountability. Because public blockchains do not have central authorities, users are incentivized to verify blocks that depend on consensus mechanisms. Therefore, consensus mechanisms helpfully align the incentives of members to maintain a public blockchain's operation and each other's accountability. On the other hand, the accountability of private blockchains is mainly driven by trust in a central authority, which plays a key role in the operations of private blockchains.

Blockchain-based AISs can strengthen trust among members of a network. Thus, blockchain-based accounting platforms compensate for lacks in transparency and accountability by automatically recording, verifying, and tracing transactions (Carrasco & Romi, 2021). Although blockchain systems optimize accounting and auditing, they do not fully eliminate the responsibilities of accountants and auditors. To communicate the information of the (misconduct) behavior of certified public accountants' (CPAs) among all states of the U.S., Sheldon (2018) proposed using blockchains to aggregate and share information regarding negligence and misconduct in real time. Specifically, he suggested that CPAs and constituents such as AICPA, the National Association of State Boards of Accountancy, and the Public Company Accounting Oversight Board (PCAOB) create accounts in blockchains. These constituents then assign endorsements to CPAs' accounts, including those for passing the CPA exam, state licenses, and records of misconduct.

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Because CPAs in the US are state-based registration, this approach may facilitate the interstate information sharing and communication, and help accounting authorities review practitioners' accounts and oversee their activity at any moment, thus ensuring accounting practitioners uphold their responsibilities.

Brennan et al. (2019) and Smith and Castonguay (2020) have suggested that the structure of blockchain-based corporate governance depends on the degree of decentralization. Each type of blockchain creates different organizational structures; therefore, management should consider the degree of decentralization when determining firms' corporate governance structure, strategies, internal control procedure, and risk assessment procedure with regard to blockchains. Auditors should also consider their clients' governance processes in peer-to-peer ecosystems such as blockchains to understand their internal control mechanism, develop audit plans and control objectives. (Appelbaum & Nehmer, 2020; Dyball & Seethamraju, 2021b). Smith and Castonguay (2020) suggested that auditors should assess policies for internal control and the operational effectiveness of controls in blockchains. They also advised auditors to understand the underlying code embedded in blockchains for internal control audits if auditors want to depend on the information on blockchains. Auditors should thus investigate how various entities establish corporate governance mechanisms and refine the accountability mechanism of their management and employees in blockchains.

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Under the situation of air pollution control in China, Dai et al. (2019) considered accountability essential to monitoring government officials' performance and reporting. If monitoring authorities and regulatory agencies can obtain evidence and original transaction records from a blockchain system in real time, then monitoring costs can be reduced considerably (Gietzmann & Grossetti, 2021). Thus, authorities should use the traceability afforded by blockchain networks to strengthen accountability mechanisms and monitor officials releasing information (Bora, Duan, Vasarhelyi, Zhang, & Dai, 2021). Tang and Tang (2019) also considered blockchains to be emerging tools for increasing the efficiency of governance, because blockchains are integrated networks that create direct connections between each other.

In sum, either accounting practitioners or government officials must acquire blockchain-related knowledge and skills related to adapt to blockchain ecosystems. For internal control and corporate governance, managements need refine companies' organization and operation model to adopt blockchain as their new systems. Moreover, accountants and auditors should explore how to uphold their responsibilities and maintain neutrality in the blockchain environment.

5. Directions for Future Research

This section presents possible implications related to blockchains and specific RQs for studies on accounting and auditing based on the literature review. Table 3 summarizes

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the RQs.

5.1. Opportunities and Challenges for Accounting Practitioners

Oracles are operated outside blockchains, collect external data, and transform them into a format that can be transferred to blockchains (Sheldon, 2021a). The external data provided by oracles are essential for the operation of smart contracts to confirm whether the specific conditions of smart contracts are met. Once agreed-upon conditions meet, smart contracts will execute the predefined subsequent actions automatically. However, the consensus mechanism of blockchain ensures data reliability only for transactions that occur within the blockchain system. Because oracles are regarded as intermediaries that operated outside blockchains, those external data provided by oracles may threaten the authenticity and reliability of transaction data[6] recorded in blockchains (Sheldon, 2021a). Therefore, on-chain and off-chain data must be reconciled, and accountants and auditors must determine the authenticity of transaction data (Alles & Gray, 2020; Church et al., 2021). Studies should explore solutions to this problem and determine the audit procedures required for management assertions in financial reporting by interviewing auditors of companies that have adopted blockchain technology. We also expect that blockchains will create a range of multifaceted jobs for accounting practitioners. As

[6] Liu, Szalachowski, and Zhou (2021) inspected and provided empirical evidence that there was a (significant) price deviation by using price data extracted from various oracles, including AmpleForth, Synthetix, MakerDAO, and Compound.

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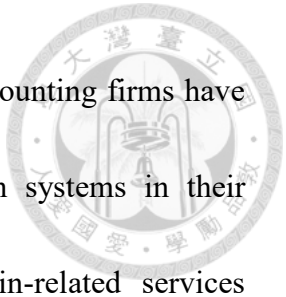

Dyball and Seethamraju (2021a) indicated, numerous Australian accounting firms have begun to engage with clients who have implemented blockchain systems in their businesses. Thus, studies should explore whether the blockchain-related services provided by accounting firms are beneficial and assess the results of companies adopting blockchains in their business operations.

RQ 1: How have accounting practitioners solved the problem of oracles in blockchain technology?

RQ 2: What audit procedures are necessary to reconcile on-chain and off-chain data?

RQ 3: What are the benefits of blockchain-related services for accounting firms?

RQ 4: How does adopting blockchain technology affect companies' business operations?

The use of smart contracts to develop automated audit procedures is a key topic for future research because smart contracts facilitate continuous auditing. In addition to authenticity and reliability of transaction data, studies should explore the quality of audit reports in relation to blockchains. Audit procedures must be reformulated to ensure the collection of relevant, sufficient and reliable evidence from clients in the context of blockchains. If auditors can obtain reliable information without error through blockchain-related applications, the quality of audit reports will be improved considerably.

RQ 5: Which audit procedures can be encoded into smart contracts?

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RQ 6: How do blockchains affect the quality of audit reports?

RQ 7: Which audit procedures should be reformulated to ensure the collection of reliable evidence in the context of blockchains?

Triple-entry AISs, as secure and distributed platforms, can increase the efficiency of bookkeeping and the quality of financial reporting through blockchains and smart contracts. McCallig, Robb and Rohde (2019) proposed a new model of an AIS to increase the reliability of financial reports and enable companies to secure their transaction data and share information with trading parties. How blockchains and smart contracts can be combined with traditional AISs to accomplish triple-entry bookkeeping is a critical topic that requires further investigation. Studies can explore this topic by investigating companies that use blockchains to create new AISs and by evaluating the effects of triple-entry bookkeeping.

RQ 8: How can blockchains and smart contracts be combined with traditional AISs?

RQ 9: Does triple-entry bookkeeping improve financial reports?

Blockchain technology is an energy-consuming and complicated technology that can increase operating and human resource costs for companies and related accounting firms. Whether accounting practitioners view blockchains as sustainable or disruptive remains unclear (Kend & Nguyen, 2020). Researchers should explore the sustainability of blockchains and investigate how accounting firms can limit operating and human

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resource costs by implementing blockchains.

RQ 10: How do companies and accounting firms control their operating and human resource costs by using blockchains?

5.2. Compelling Empirical Studies and Practical Case Studies

With a lack of empirical results regarding these topics, additional empirical studies should be conducted, especially given the large body of conceptual literature. The existing case studies, such as those in Gomaa et al. (2019), Kinory, Smith and Church (2020), Liu et al. (2021), can serve as resources to familiarize accounting students with blockchains and strengthen their technical skills. Additional case studies must be conducted to determine how blockchains can transform accounting and auditing (Garanina et al., 2021).

RQ 11: What are the effects of blockchains on accounting and auditing?

As Karajovic et al. (2019) and Kokina et al. (2017) have demonstrated, the Big 4 accounting firms have collaborated with companies to implement blockchains and provide new services; however, no study has analyzed the results of this process. Scholars should thus interview accountants, auditors, and business practitioners to understand their perspectives on blockchains and the results of this collaboration and thereby move toward a methodology based on empirical evidence.

RQ 12: What are the outcomes of collaboration between accounting firms and companies implementing blockchains in auditing?

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Because blockchains have developed rapidly, additional practical applications in business will likely emerge; studies should continue to investigate those applications' effects. The implementation of blockchain technology requires a balance between the transparency and privacy of transaction data (Herz & Pei, 2021). Studies should analyze how companies address this balance, how accounting firms help companies with blockchain-related services, and the advantages and disadvantages thereof.

RQ 13: Do blockchains ensure real-time monitoring, high transparency, and immutability?

RQ 14: How do companies balance the transparency and privacy of transaction data in blockchains?

5.3. Monitoring and Regulations

Cryptocurrency transactions remain shrouded in ambiguity and lack legally binding regulations (Vincent & Wilkins, 2020). This creates audit risk and other problems in accounting that should be considered during audits and interactions with clients. Several problems in accounting and auditing, such as those affecting asset classification, revenue recognition, and financial disclosure, remain to be solved (Vincent & Davenport, 2021).

AICPA (2022) has proposed guidelines for the accounting and auditing of digital assets, and PCAOB (2020) has released an advisory report that describes procedures for auditing certain cryptoassets; both provide nonbinding guidelines that help those

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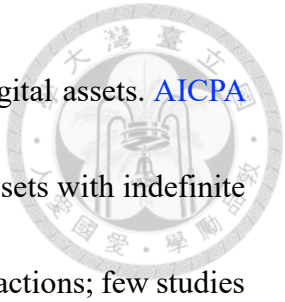

preparing financial statements and auditors account for and audit digital assets. AICPA (2022) indicated that digital assets should be considered intangible assets with indefinite lives and that auditors should determine a cutoff for digital asset transactions; few studies have explored these topics. The requirement for official regulations on digital assets for accountants and auditors remains, and studies should explore the process of their development by investigating, for example, whether audit risk is lower after official regulations on cryptoassets are established.

RQ 15: What official regulations on the accounting and auditing of digital assets have accounting authorities established?

Because cryptoassets are prevalent, accounting authorities such as the International Accounting Standards Board (IASB), FASB, and PCAOB should develop explicit guidelines and standards for accountants and auditors to report and inspect them accordingly. In addition, legal institutions, monitoring authorities, and regulators should develop legally binding regulations for companies and trading partners. Studies should track the development of such regulations and their effects.

RQ 16: What legally binding regulations on companies have regulators developed for the context of blockchains?

RQ 17: What guidelines have accounting authorities developed to manage auditing in the context of blockchains?

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5.4. Education

As the number of aspects of accounting affected by blockchain increases, scholars have begun to encourage adding blockchain technology to accounting curricula (Qasim & Kharbat, 2020). Stern and Reinstein (2021) described how blockchain technology should be taught in an independent course or added to existing courses. They designed a series of courses and materials for guided readings and group-based and individual assignments; furthermore, they recorded lectures and helped students apply what they learned. In addition, a questionnaire revealed that students rated the class 4.1 on a 5-point scale. Kaden, Lingwall and Shonhiwa (2021) demonstrated how coding exercises can deepen accounting students' understanding of blockchain technology. They introduced blockchain technology in a data analytics class and developed exercises to teach students how to write blockchain code in the R programming language. The results of the study were promising: 82% of students demonstrated that they understood the roles of transactions and blocks in blockchains, and 79% of them comprehended the concept of PoW after the lectures and coding exercises.

RQ 18: How can blockchain technology be introduced in accounting curricula?

RQ 19: What skills related to blockchain technology should accounting students develop?

Several scholars have used case studies on blockchain technology as instructional

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resources. Dunn et al. (2021) investigated the implications of Bitcoin and blockchains for auditing by having students audit an online retailer using Bitcoin. The study revealed that 95% of the students considered the learning experience positive. Ozlanski, Negangard and Fay (2020) illustrated the imminent transformation of auditing to students by demonstrating how an online lending company disrupted lending in nontraditional businesses. After the case study, the students rated the experience highly, with every item on a questionnaire receiving 4 points or more on a 5-point scale, and the students provided positive feedback.

Instructors and students have indicated that case studies help them understand blockchain and its effects on accounting and auditing. Therefore, accounting curricula should introduce blockchain-related case studies to equip students with new skills and prepare them for a future in which they work with blockchain technology. Studies should thus explore the effects of introducing blockchain technology to accounting curricula and the development of courses on blockchain technology.

RQ 20: What courses related to blockchain technology should accounting faculty create?

Table 2

A Summary of the RQs for Future Research

Category	RQs

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Opportunities and challenges for accounting practitioners	1. How have accounting practitioners solved the problem of oracles in blockchain technology? 2. What audit procedures are necessary to reconcile on-chain and off-chain data? 3. What are the benefits of blockchain-related services for accounting firms? 4. How does adopting blockchain technology affect companies' business operations? 5. Which audit procedures can be encoded into smart contracts? 6. How does blockchain technology affect the quality of audit reports? 7. Which audit procedures should be reformulated to ensure the collection of reliable evidence in the context of blockchain technology? 8. How can blockchain technology and smart contracts be combined with traditional AISs? 9. Does triple-entry bookkeeping improve financial reports? 10. How do companies and accounting firms control their operating and human resource costs by using blockchain technology?
Compelling empirical studies and practical case studies	11. What are the effects of blockchain technology on accounting and auditing? 12. What are the outcomes of collaboration between accounting firms and companies implementing blockchain technology in auditing? 13. Does blockchain technology ensure real-time monitoring, high transparency, and immutability? 14. How do companies balance the transparency and privacy of transaction data in blockchain technology?
Monitoring and Regulations	15. What official regulations on the accounting and auditing of digital assets have accounting authorities established? 16. What legally binding regulations on companies have regulators developed for the context of

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	blockchain technology? 17. What guidelines have accounting authorities developed to manage auditing in the context of blockchain technology?
Education	18. How can blockchain technology be introduced in accounting curricula? 19. What skills related to blockchain technology should accounting students develop? 20. What courses related to blockchain technology should accounting faculty create?

6. Conclusion

This study investigated how blockchain technology can affect accounting and auditing, especially in terms of practice. It also explored how blockchain technology has evolved in accounting by reviewing 80 studies from 2016 to 2021 selected from the top 60 international accounting journals. In addition, this study provides a survey of the literature on blockchain technology in accounting and auditing. The number of studies has increased considerably, and most studies have been conceptual in nature (See Fig. 2), whereas few have been empirical. This may be ascribed to blockchain technology not being mature and widely adopted, resulting in a lack of data indicating the effects of blockchain technology on accounting. Given that blockchain technology could serve as a disruptive AIS and transforms audit procedures drastically, the AIS and auditing in which the final 80 studies are involved. Instructors and practitioners have increasingly expressed that introducing blockchain technology to accounting courses can help equip students

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with the necessary skills for their future careers. Some studies have indicated that blockchain technology will replace accountants and auditors. However, most studies have noted that these professions will change rather than be fully automated and that a demand for accounting practitioners' professional judgment will remain (Garanina et al., 2021).

This literature review explored several key concepts related to blockchains in accounting and auditing, namely triple-entry bookkeeping, smart contracts, continuous auditing, and accountability and governance. Triple-entry bookkeeping is a new method of representing transaction flows through tokens in which accounts in blockchain ledgers function as layered aggregations of data. Smart contracts can be embedded into triple-entry AISs to automatically record transaction data. Triple-entry AISs can benefit companies and auditors by increasing the efficiency of their operational procedures. Smart contracts encode contractual provisions and specific procedures to ensure that tasks are accomplished in accordance with preestablished rules, standards, procedures, and routines. The use of smart contracts to automatically execute audits and processes can help reduce human error and improve auditing. Auditors can continuously acquire transaction data from clients in real time by using shared blockchain databases. This also enables auditors to extract data on entire populations rather than selected samples. This continuous auditing helps auditors collect evidence from their clients to make informed decisions regarding financial reports. In addition, the decentralized nature of blockchains

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eliminates the need for intermediaries and trusted third parties, and accountability is distributed to each node in a blockchain system. As Tyma et al. (2022) described, each blockchain system should use a mechanism of accountability that suits the operating model. Therefore, accountants and auditors should investigate how various entities use accountability mechanisms and establish new corporate governance systems by using blockchains. They should also maintain their professionalism, sense of responsibility, and neutrality as they address the transformations caused by blockchain technology.

This literature review can help researchers understand key resources and topics related to blockchain technology in accounting and auditing. The results can also help accountants, auditors, and business practitioners understand the effects of blockchain technology, the opportunities it has created, its key characteristics, and its practical applications. However, this review has several limitations. For example, the data set only comprises studies from the top 60 international accounting journals identified in Chin et al. (2012); several other journals were not considered. In addition, the validity of the results depends on the timing of this study. Additional studies should be conducted to provide new insight into blockchain technology in accounting and auditing.

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Appendix

Appendix A. Top 60 International Accounting Journals

Ranking	International Accounting Journals
1	The Accounting Review
2	Journal of Accounting and Economics
3	Journal of Accounting Research
4	Review of Accounting Studies
5	Accounting, Organizations and Society
6	Contemporary Accounting Research
7	Auditing: A Journal of Practice and Theory
8	Journal of Management Accounting Research
9	Journal of Accounting and Public Policy
10	Journal of the American Taxation Association
11	Journal of Accounting, Auditing and Finance
12	Journal of Business Finance and Accounting
13	Accounting Horizons
14	European Accounting Review
15	National Tax Journal
16	Accounting and Business Research
17	Behavioral Research in Accounting
18	Abacus
19	Journal of Accounting Literature
20	International Journal of Accounting
21	Review of Quantitative Finance and Accounting
22	Journal of Information Systems
23	Asia Pacific Journal of Accounting and Economics
24	Management Accounting Research
25	Issues in Accounting Education
26	British Accounting Review
27	Advances in Accounting
28	Accounting and Finance
29	Journal of Contemporary Accounting & Economics
30	Journal of International Accounting Research
31	International Journal of Accounting Information Systems
32	Critical Perspectives on Accounting
33	Journal of Accounting Education

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34	Accounting, Auditing & Accountability Journal
35	Financial Accountability and Management in Governments, Public Services & Charities
36	International Journal of Auditing
37	Accounting and the Public Interest
38	Advances in Quantitative Analysis of Finance and Accounting
39	Journal of International Financial Management and Accounting
40	Research on Accounting Ethics
41	Pacific Accounting Review
42	Research in Governmental and Non-profit Accounting
43	Advances in Public Interest Accounting
44	Accounting Historians
45	Journal of International Accounting, Auditing and Taxation
46	Advances in Management Accounting
47	Journal of Taxation
48	The ATA Journal of Legal Tax Research
49	Journal of Forensic Accounting
50	Australian Accounting Review
51	Research in Accounting Regulation
52	Accounting Educators' Journal
53	Current Issues in Auditing
54	Journal of Emerging Technologies in Accounting
55	Accounting in Europe
56	Accounting Enquiries
57	The Government Accountants Journal
58	Qualitative Research in Accounting & Management
59	Accounting Forum
60	Accounting, Business and Financial History

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Appendix B. Overview of Selected Articles

Accounting Journals	Authors	Year	Articles	Main Research Method	Accounting Areas
Journal of Accounting and Public Policy	Miles Gietzmann Francesco Grossetti	2021	Blockchain and other distributed ledger technologies: Where is the accounting?	Conceptual	AIS
	Ashley A. Austin L. Tyler Williams	2021	Evaluating company adoptions of blockchain technology: How do management and auditor communications affect nonprofessional investor judgments?	Empirical	Audit
Journal of Accounting, Auditing and Finance	Eyal Beigman Gerard Brennan Sheng-Feng Hsieh Alexander J. Sannella	2021	Dynamic Principal Market Determination: Fair Value Measurement of Cryptocurrency	Analytical	FA
Accounting Horizons	Deniz Appelbaum D. Scott Showalter Ting Sun Miklos A. Vasarhelyi	2021	A Framework for Auditor Data Literacy: A Normative Position	Conceptual	Audit AIS
	Vernon J. Richardson Marcia Weidenmier Watson	2021	Act or Be Acted Upon: Revolutionizing Accounting Curriculums with Data Analytics	Conceptual	Audit

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Accounting Horizons	Nikola Kostić Tomaz Sedej	2021	Blockchain technology, inter-organizational relationships and management accounting: A synthesis and a research agenda*	Literature Review	MA
	Theophanis C. Stratopoulos Victor Xiaoqi Wang Hua (Jonathan) Ye	2021	Use of Corporate Disclosures to Identify the Stage of Blockchain Adoption*	Analytical	Audit
Journal of Information Systems	Feng Guo Stephanie Walton Patrick R. Wheeler Yiyang (Ian) Zhang	2021	Early Disruptors: Examining the Determinants and Consequences of Blockchain Early Adoption	Empirical	MA
	Abdullah Albizri Deniz Appelbaum	2021	Trust but Verify：The Oracle Paradox of Blockchain Smart Contract	DSR	Audit AIS
	Erica Pimentel Emilio Boulianne Shayan Eskandari Jeremy Clark	2021	Systemizing the Challenges of Auditing Blockchain-Based Assets	Interviews	FA Audit AIS
	Mark D. Sheldon	2021	Auditing the Blockchain Oracle Problem	Conceptual	Audit AIS
	Deniz Appelbaum Robert A. Nehmer	2020	Auditing Cloud-Based Blockchain Accounting Systems	DSR	Audit AIS
	Jun Dai Miklos A. Vasarhelyi	2017	Toward Blockchain-Based Accounting and Assurance	Conceptual	Audit AIS

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Journal of Information Systems	Kimberly Swanson Church Pamela J. SchmidtKemi Ajayi	2020	Forecast Cloudy—Fair or Stormy Weather: Cloud Computing Insights and Issues	Conceptual	AIS
	Chi-Chun Chou Nen-Chen Richard Hwang Gary P. Schneider Tawei Wang Chang-Wei Li William Wei	2021	Using Smart Contracts to Establish Decentralized Accounting Contracts: An Example of Revenue Recognition	Conceptual	FA Audit AIS
Issues in Accounting Education	Stacey R. Kaden Jeff W. Lingwall Trevor T. Shonhiwa	2021	Teaching Blockchain through Coding: Educating the Future Accounting Professional	Conceptual	AIS
	Ryan T. Dunn J. Gregory Jenkins Mark D. Sheldon	2021	Bitcoin and Blockchain: Audit Implications of the Killer Bs	Case Study	FA Audit AIS
	Kerry K. Inger Mollie Mathis	2021	Taxes: Taking a Bite out of Bitcoin	Case Study	Taxation
	Michael E. Ozlanski Eric M. Negangard Rebecca G. Fay	2020	Kabbage: A Fresh Approach to Understanding Fundamental Auditing Concepts and the Effects of Disruptive Technology	Case Study	FA Audit AIS
British Accounting Review	Jodie Moll Ogan Yigitbasioglu	2019	The role of internet-related technologies in shaping the work of accountants: New	Literature Review	FA MA

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British Accounting Review			directions for accounting research		Audit AIS
	Niamh M. Brennan Nava Subramaniam Chris J. van Staden	2019	Corporate governance implications of disruptive technology: An overview	Commentary	FA MA Audit AIS
Accounting and Finance	Cynthia Weiyi Cai	2021	Triple-entry accounting with blockchain: How far have we come?	Case Study	Audit AIS
	Cynthia Weiyi Cai	2018	Disruption of financial intermediation by FinTech: a review on crowdfunding and blockchain	Literature Review	FA MA AIS
International Journal of Accounting Information Systems	Jonas Sveistrup Søgaard	2021	A Blockchain-enabled Platform for VAT settlement	DSR	AIS Taxation
	Ju-Chun Yen Tawei Wang	2021	Stock price relevance of voluntary disclosures about blockchain technology and cryptocurrencies	Empirical	FA
	Yunsen Wang Alexander Kogan	2018	Designing confidentiality-preserving Blockchain-based transaction processing systems	Conceptual	Audit AIS
	John McCallig Alastair Robb Fiona Rohde	2019	Establishing the representational faithfulness of financial accounting information using multiparty security, network analysis and a blockchain	Conceptual	FA Audit AIS
	Nishani Edirisinghe Vincent	2020	Blockchain architecture: A design that	Conceptual	Audit

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International Journal of Accounting Information Systems	Anthony Skjellum Sai Medury		helps CPA firms leverage the technology		AIS
	Michael Alles Glen L. Gray	2020	"The first mile problem": Deriving an endogenous demand for auditing in blockchain-based business processes	Conceptual	Audit AIS
	David Kocsis	2019	A conceptual foundation of design and implementation research in accounting information systems	Literature Review	AIS
Journal of Accounting Education	Myles Stern Alan Reinstein	2021	A blockchain course for accounting and other business students	Conceptual	FA MA Audit AIS Taxation
Accounting, Auditing & Accountability Journal	Bridget Tyma Rina Dhillon Prabhu Sivabalan Bernhard Wieder	2021	Understanding accountability in blockchain systems	Interviews	MA Audit AIS
	Piera Centobelli Roberto Cerchione Pasquale Del Vecchio Eugenio Oropallo Giustina Secundo	2021	Blockchain technology design in accounting: Game changer to tackle fraud or technological fairy tale?	DSR	MA Audit AIS
	Heather Carrasco Andrea M. Romi	2021	Toward an omniopticon: the potential of blockchain technology toward influencing	Conceptual	MA Audit

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Accounting, Auditing & Accountability Journal			vulnerable populations in contested markets		AIS
	Tatiana Garanina Mikko Ranta John Dumay	2021	Blockchain in accounting research: current trends and emerging topics	Literature Review	FA MA Audit AIS
	Maria Cadiz Dyball Ravi Seethamraju	2021	Client use of blockchain technology: exploring its (potential) impact on financial statement audits of Australian accounting firms	Interviews	Audit AIS
	Silvana Secinaro Francesca Dal Mas Valerio Brescia Davide Calandra	2021	Blockchain in the accounting, auditing and accountability fields: a bibliometric and coding analysis	Literature Review	FA MA Audit AIS
	Rosa Lombardi Charl de Villiers Nicola Moscariello Michele Pizzo	2021	The disruption of blockchain in auditing – a systematic literature review and an agenda for future research	Literature Review	FA MA Audit AIS
	Paola Ramassa Giulia Leoni	2021	Standard setting in times of technological change: accounting for cryptocurrency holdings	Conceptual	FA
International Journal of Auditing	Maria Cadiz Dyball Ravi Seethamraju	2021	The impact of client use of blockchain technology on audit risk and audit approach—An exploratory study	Interviews	Audit AIS

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Journal of International Accounting, Auditing and Taxation	Victor Tiberiusa Stefanie Hirth	2019	Impacts of digitization on auditing: A Delphi study for Germany	Interviews	Audit AIS
The ATA Journal of Legal Tax Research	William D. Terando Bryan Cataldi	2017	Impact of the IRC Section 475 Mark-to-Market Election on Bitcoin Taxation	Conceptual	Taxation
	Mollie T. Adams William A. Bailey	2021	Emerging Cryptocurrencies and IRS Summons Power: Striking the Proper Balance between IRS Audit Authority and Taxpayer Privacy	Conceptual	Taxation
Australian Accounting Review	Michael Kend Lan Anh Nguyen	2020	Big Data Analytics and Other Emerging Technologies: The Impact on the Australian Audit and Assurance Profession	Interviews	Audit AIS
	Jana Schmitz Giulia Leoni	2019	Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda	Literature Review	MA Audit AIS
	Maria Karajovic Marek Laskowski Henry M. Kim	2019	Thinking Outside the Block: Projected Phases of Blockchain Integration in the Accounting Industry	Conceptual	MA Audit AIS
	Boon Seng Tan Kin Yew Low	2019	Blockchain as the Database Engine in the Accounting System	Conceptual	Audit AIS
	Tyrone Carlin	2019	Blockchain and the Journey Beyond Double Entry	Conceptual	AIS

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Australian Accounting Review	Filip Hampl Lucie Gyönyörová	2021	Can Fiat-backed Stablecoins Be Considered Cash or Cash Equivalents Under International Financial Reporting Standards Rules?	Conceptual	FA
Accounting Educators' Journal	Elizabeth A. Felski Tyson B. Empey	2020	Should Blockchain be added to the Accounting Curriculum? Evidence from a Survey of Students, Professionals and Academics	Survey	Audit AIS
Current Issues in Auditing	Nishani Edirisinghe Vincent Reza Barkhi	2021	Evaluating Blockchain Using COSO	Conceptual	MA Audit AIS
	Manlu Liu Kean Wu Jennifer Jie Xu	2019	How Will Blockchain Technology Impact Auditing and Accounting: Permissionless versus Permissioned Blockchain	Conceptual	MA Audit AIS
	Mark D. Sheldon	2019	A Primer for Information Technology General Control Considerations on a Private and Permissioned Blockchain Audit	Conceptual	Audit AIS
	Mark D. Sheldon	2018	Using Blockchain to Aggregate and Share Misconduct Issues across the Accounting Profession	Conceptual	Audit
	Nishani Edirisinghe Vincent Anne M. Wilkins	2020	Challenges when Auditing Cryptocurrencies	Conceptual	FA Audit

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Current Issues in Auditing	Mark D. Sheldon	2021	Preparing Auditors for the Blockchain Oracle Problem	Commentary	Audit AIS
	Steven A. Harrast Debra Mcgilsky Yan (Tricia) Sun	2021	Determining the Inherent Risks of Cryptocurrency: A Survey Analysis*	Survey	FA Audit
Journal of Emerging Technologies in Accounting	Stanton Heister Matthew Kaufman Kristi Yuthas	2021	Blockchain and the Future of Business Data Analytics	Case Study	Audit AIS
	Kimberly Swanson Church Sean Stein Smith Ethan Kinory	2021	Accounting Implications of Blockchain: A Hyperledger Composer Use Case for Intangible Assets	Case Study	MA Audit AIS
	Jose Victor Lineros	2021	IT Governance Considerations for Permissioned Blockchains	Conceptual	MA Audit AIS
	Theophanis C. Stratopoulos	2020	Teaching Blockchain to Accounting Students	Conceptual	Audit AIS
	Sean Stein Smith John ‘‘Jack’’ Castonguay	2020	Blockchain and Accounting Governance: Emerging Issues and Considerations for Accounting and Assurance Professionals	Conceptual	MA Audit AIS
	Ethan Kinory Sean Stein Smith Kimberly Swanson Church	2020	Exploring the Playground: Blockchain Prototype Use Cases with Hyperledger Composer	Case Study	AIS

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Journal of Emerging Technologies in Accounting	Amer Qasim Faten F. Kharbat	2020	Blockchain Technology, Business Data Analytics, and Artificial Intelligence: Use in the Accounting Profession and Ideas for Inclusion into the Accounting Curriculum	Conceptual	FA MA Audit AIS
	Irfan Bora Huijue Kelly Duan Miklos A. Vasarhelyi Chanyuan (Abigail) Zhang Jun Dai	2021	The Transformation of Government Accountability and Reporting	Commentary	MA Audit AIS
	Andrea M. Rozario Chanta Thomas	2019	Reengineering the Audit with Blockchain and Smart Contracts	DSR	Audit AIS
	Ahmed A. Gomaa Mohamed I. Gomaa Ashley Stampone	2019	A Transaction on the Blockchain: An AIS Perspective, Intro Case to Explain Transactions on the ERP and the Role of the Internal and External Auditor	Case Study	Audit AIS
	Jun Dai Na He Haizong Yu	2019	Utilizing Blockchain and Smart Contracts to Enable Audit 4.0: From the Perspective of Accountability Audit of Air Pollution Control in China	Conceptual	MA Audit AIS
	Julia Kokina Ruben Mancha Dessislava Pachamanova	2017	Blockchain: Emergent Industry Adoption and Implications for Accounting	Conceptual	MA Audit AIS
	Joshua G. Coyne	2017	Can Blockchains Serve an Accounting	Conceptual	Audit

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Journal of Emerging Technologies in Accounting	Peter L. McMickle Lazarus Elad Fotoh Johan Ingemar Lorentzon		Purpose?		AIS
		2021	The Impact of Digitalization on Future Audits	Literature Review	Audit
	Robert H. Herz Duo Pei	2021	Advancing Financial Reporting in the Age of Technology: An Interview with Robert H. Herz	Interviews	Audit AIS
	Soohyun Cho Miklos A. Vasarhelyi Chanyuan (Abigail) Zhang	2019	The Forthcoming Data Ecosystem for Business Measurement and Assurance	Commentary	Audit AIS
	Yu Cong Hui Du Miklos A. Vasarhelyi	2018	Technological Disruption in Accounting and Auditing	Commentary	Audit AIS
	Qingliang Tang Lie Ming Tang	2019	Toward a Distributed Carbon Ledger for Carbon Emissions Trading and Accounting for Corporate Carbon Management	Conceptual	MA Audit AIS
	Michael G. Alles Jun Dai Miklos A. Vasarhelyi	2021	Reporting 4.0: Business Reporting for the Age of Mass Customization	Commentary	Audit AIS
	Li Zhang Duo Pei Miklos A. Vasarhelyi	2017	Toward a New Business Reporting Model	Commentary	Audit AIS

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Journal of Emerging Technologies in Accounting	Manlu Liu Ashok Robin Kean Wu Jennifer Xu	2021	Blockchain's Impact on Accounting and Auditing: A Use Case on Supply Chain Traceability*	Case Study	MA Audit AIS
	Lorraine S. Lee Deniz Appelbaum Richard D. Mautz III	2021	Blockchains: An Experiential Accounting Learning Activity*	Conceptual	Audit AIS
	Nishani Edirisinghe Vincent Stephan A. Davenport	2021	Accounting Research Opportunities for Cryptocurrencies*	Conceptual	FA MA Audit AIS Taxation

* Online early paper

** AIS: accounting information system; MA: management accounting; FA: financial accounting

***The sorting criteria are followed by the ranking of international accounting journals

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