

Blockchain in accounting practice and research: systematic literature review

Blockchain in
accounting

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Abstract

Purpose – This study aims to review the academic literature on the utilization of blockchain in accounting practice and research to identify potential opportunities for further scientific investigation and to provide a framework for how accounting practices are impacted by blockchain.

Design/methodology/approach – This study is based on a systematic literature review (SLR) of 346 research products available on Scopus, which were mapped with bibliometric analyses and critically discussed in relation to three main topics: the impact of blockchain on accounting and auditing, cryptoassets and finance, business models and supply chain management.

Findings – Blockchain has many potential implications for accounting practice and research. In addition to providing the state-of-the-art of accounting research on blockchain and additional avenues for further studies, this study discusses why practitioners are interested in this technology: triple-entry bookkeeping, the inalterability of transactions, the automation of repetitive tasks that do not require discretionary choices, the representation of cryptocurrencies in financial statements, value-chain management, social and environmental auditing and reporting and business model innovation.

Originality/value – The novel contribution of this study is integrated and threefold. First, this SLR provides a clear picture of the state of the accounting research on blockchain using bibliographic and narrative analyses. Second, it investigates how accounting and auditing practices are impacted by blockchain.

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Although the paper is the result of a team effort, Marco Bellucci can be considered the author of Sections 1 and 2; Damiano Cesa Bianchi, Section 3; and Giacomo Manetti, Section 4.



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Third, it contributes to the accounting literature with its discussion of the potential future research trends related to blockchain for accounting.

Keywords Blockchain, Systematic literature review, Bibliometric, Accounting, Auditing, Cryptoassets, Triple-entry bookkeeping, Smart contracts

Paper type Literature review

1. Introduction

New technologies and digital innovations are gradually reshaping the contours of accounting, auditing and reporting (Bonsón and Bednárová, 2019; Dai and Vasarhelyi, 2017; Lombardi and Secundo, 2020; Mancini *et al.*, 2021; Marrone and Hazelton, 2019). Over the past 20 years, a multitude of academic studies has focused on the implications of new technological paradigms such as automation (Kokina and Davenport, 2017; Susskind and Susskind, 2015), big data (Cockcroft and Russell, 2018; Vasarhelyi *et al.*, 2015), cloud computing (Choudhary and Vithayathil, 2013; Cleary and Quinn, 2016), social media (Arnaboldi *et al.*, 2017; Manetti and Bellucci, 2016; Ramassa and Di Fabio, 2016) and artificial intelligence (Issa *et al.*, 2016; Moşteanu and Faccia, 2020; Sutton *et al.*, 2016) for accountancy research and practice. Among the emerging technologies able to revolutionize business models and consequently change the processes underlying management control, accounting, auditing and reporting is blockchain (Schmitz and Leoni, 2019). A blockchain is a distributed digital ledger shared by several peers in a network that facilitates transaction recording and property tracking for tangible and intangible assets. Approved transactions take the form of blocks added to a chronological chain of previously validated blocks through the use of cryptographic signatures (Bonsón and Bednárová, 2019). Each new block is marked chronologically and contains information that refers to the block that preceded it, and this ensures that any attempt to adulterate the blockchain would require an adulteration of each previously created block, which is almost impossible given the decentralized nature of the ledger (Bonsón and Bednárová, 2019; Buterin, 2014).

Although the popularity of blockchain is usually linked to its status as the foundation of Bitcoin and other cryptoassets (Buterin, 2014; Nakamoto, 2008), public and institutional attention is now extending to the technology itself and its potentially disruptive applications unrelated to digital currencies. For example, blockchain could be applied to decentralized finance (Chen and Bellavitis, 2020), nonfungible tokens (NFTs) (Regner *et al.*, 2019) and, most notably, smart contracts (Buterin, 2014; Cong and He, 2019; Hughes *et al.*, 2019; Rozario and Vasarhelyi, 2018), which are systems that automatically control digital assets according to arbitrary prespecified rules (Buterin, 2014).

Recent reports elaborated by the Big Four audit firms (Deloitte, 2020; KPMG, 2018; PwC, 2020; EY, 2020) suggest that accountants, auditors and regulators will be significantly affected by blockchain innovations, especially with regard to processes related to the ways in which transactions are initiated, processed, recorded, reconciled, audited and reported (Coyne and McMickle, 2017; Ferri *et al.*, 2020; Schmitz and Leoni, 2019).

Despite the growing discussion on the potential of this technology for business (Coyne and McMickle, 2017; Dai and Vasarhelyi, 2017; Kokina *et al.*, 2017; Schmitz and Leoni, 2019), the implications of blockchain technology and its applications still represent an emerging research theme that is underinvestigated in the contexts of accounting, auditing and reporting. We believe it is urgent to fill this gap with systematic insights into the potential of and challenges facing blockchain technologies in accounting practice and research.

Against this background, the present study is timely, as it aims to review the existing literature on the use of blockchain in accounting practice and research and to define potential opportunities for further investigation. Despite the existence of other literature reviews on the implications of blockchain in accounting and auditing (Schmitz and Leoni, 2019; Bonsón and Bednárová, 2019; Lombardi *et al.*, 2021; Secinaro *et al.*, 2021), to our knowledge, this is one of the very first studies that specifically resorts to a systematic literature review (SLR) combined with bibliometric analyses while encompassing a comprehensive perspective and including a wide range of research products (books and recent conference proceedings included) on accounting, auditing and reporting.

The contribution of this study is threefold. First, this SLR provides a clear picture of the state of accounting research on blockchain. The engagement of academics and practitioners with the potential of blockchain and technological advancements is growing but limited (Schmitz and Leoni, 2019). At this crucial moment for the distribution and development of blockchain technology – when large companies, institutions and major audit firms have already become convinced adopters (EY, 2020; PwC, 2020) – our study provides an up-to-date, comprehensive SLR of 346 research products indexed on Scopus.

Second, this study investigates how accounting practice will be impacted by blockchain. Blockchain can improve information timelines and accounting reliability because of its decentralization and transparency, but it will also require new competencies, attention to scalability and accounting standard reconciliation.

Third, our study contributes to the accounting literature with a discussion of the potential future research trends related to blockchain for accounting. We believe that this study will be a helpful resource for present and future scholars interested in addressing the most meaningful connections between accounting and disruptive applications based on blockchain.

The present article is structured as follows. Following this introduction, the second section presents the details of our SLR methodology and introduces bibliometric visualizations of the 346 included research products. The next section discusses the primary and most impactful contributions on the links between blockchain and accounting and auditing (Section 3.1), finance innovations and the representation of cryptoassets (Section 3.2) and business model innovation and supply chain management (Section 3.3). Finally, the Conclusion highlights our threefold contribution and provides an agenda for future impactful research on blockchain for accounting and auditing.

2. Methodology

This study adopted a systematic approach to conduct a literature review to minimize bias and lend scientific value to its results. To ensure the robustness of our protocol, we built on other literature reviews regarding accounting (Bartolacci *et al.*, 2020; Fragoso *et al.*, 2020; Lombardi and Secundo, 2020; Massaro *et al.*, 2016) and followed Denyer and Tranfield's (2009) transparent, inclusive, explanatory and heuristic principles. Finally, we present our analysis steps using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), which assists authors in improving the reporting of systematic reviews. PRISMA is a protocol for reporting on systematic reviews consisting of a checklist and a flow diagram, which was developed in the life science field to increase the transparency and accuracy of literature reviews (Page *et al.*, 2021). We chose PRISMA over other existing protocols because of its comprehensiveness, its use in several disciplines worldwide and its potential to increase consistency across reviews (Liberati *et al.*, 2009; Pahlevan-Sharif *et al.*, 2019).

2.1 *Design the plan*

In this research, we also followed the protocol of [Jesson et al. \(2011, p. 12\)](#), which involves the following steps:

- define a research question;
- design a plan;
- search for the literature;
- apply exclusion and inclusion criteria;
- conduct a quality assessment; and
- discuss the results.

2.2 *Define the research question*

A systematic review process is led by research questions that define the subject, object and scope of the research ([Booth et al., 2012](#)). Accordingly, we identified the following research questions:

RQ1. What is the academic state-of-the-art of the research on blockchain for accounting?

RQ2. How will blockchain change accounting and business practices?

RQ3. What are the future research trends related to blockchain for accounting?

RQ1 and *RQ3* declare the main goals of the systematic review process related to research, while *RQ2* clarifies our additional intention to investigate practical and managerial implications.

2.3 *Search for the literature*

We selected Scopus as our primary source of information to assure both scientific robustness and inclusivity. We identified a preliminary set of keywords related to our topic: blockchain, cryptocurrencies or cryptoassets (crypto*), accounting, accountability, accountant (account*), auditing, auditor, audit (audit*), reporting and report (report*). The research string was validated through an online survey administered to five experts in the fields of accounting, law and blockchain technology and two SLR experts in the field of business and management. This group of experts rated the significance of the keywords to be included in the research string and suggested variations that refined the perimeter of our literature review. We selected the following source types: article, conference paper, book chapter and book. We included only those papers belonging to the category “business, management and accounting.” Moreover, we excluded articles written in languages other than English to avoid comprehension issues and improve the replicability of this research for the international community. No time filter was applied. The Scopus research string was, thus, defined as follows:

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((TITLE-ABS-KEY (blockchain OR crypto*) ) AND (TITLE-ABS-KEY (account* OR audit* OR report*) ) AND (LIMIT-TO (SUBJAREA, "BUSI") ) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ch") OR LIMIT-TO (DOCTYPE, "bk") ) AND (LIMIT-TO (LANGUAGE, "English") )
```

We extracted data from the database on January 1, 2022, and 662 documents were retrieved. Of them, 6 were duplicate items, so the final number of retrieved documents was 656.

2.4 Apply exclusion and inclusion criteria

To determine which articles should be excluded because of irrelevance, we manually analyzed the titles; abstracts; keywords; and, if necessary, the full text of the articles (Booth *et al.*, 2012, p. 99). To do so, we clustered the articles into the categories shown in Table 1, and we excluded those not pertinent to our research questions that had been erroneously captured by our research string.

After this process, 346 articles were considered relevant, as our content analysis confirmed that they were linked to our research questions. To further refine which studies were the most relevant and worth deep analysis of their full texts, we manually assessed the relevance of each product, considering the following: the type of work (scientific article, conference proceeding, book, chapter, etc.); total citations, citations per year (CPY) and normalized citations; the AJG2021 journal rank for scientific articles; and the pertinence of the title, keywords and abstracts in terms of our research questions. No rigid quantitative rules were applied, but we considered the relative impact within their specific research topics/areas. Ultimately, 199 studies were considered less relevant, and 147 full-text items were sought for retrieval. In all, 5 papers were not retrieved because they were not available from our institution, so 142 full-text items were thoroughly analyzed for this review.

Figure 1 shows the distribution over time of the included research products. The blue line includes all 346 research products assessed for discussion. The green line represents all 127 research products that belong to the “Accounting and Auditing” topic. The yellow line depicts articles published in journals ranked as “ACCOUNT” by the ABS AJG2021 journal ranking. Figure 1 shows a considerable increase in interest since 2016, in which year accountants and practitioners began to seriously consider blockchain as an accounting tool (Kokina *et al.*, 2017).

2.5 Conduct a quality assessment

We opted not to exclude papers that were published in journals with moderate- to low-impact factors. Moreover, as blockchain is a recent topic, we decided to include conference papers and book chapters.

2.6 PRISMA diagram

Figure 2 represents our steps using a PRISMA diagram (Page *et al.*, 2021), which we adjusted to enhance its fit for a qualitative systematic review. The PRISMA flow diagram depicts the flow of information through the different phases of a systematic review. It maps the number of records identified, included and excluded and the reasons for exclusions.

Topics	Total number	First year of publication	Last year of publication	Included
Accounting and auditing	127	1980	2021	Yes
Cryptoassets accounting and finance	102	2000	2021	Yes
Business models and supply chain	117	2004	2021	Yes
Industrial engineering	46	2006	2021	No
Information Technology (IT) and computer science	207	1996	2022	No
Law	34	1991	2021	No
Medicine and physics	4	2004	2016	No
Political science	19	2008	2021	No
Total	656	1980	2022	

Table 1.
Research product
distribution by topic

Figure 1.
Research product
distribution over time

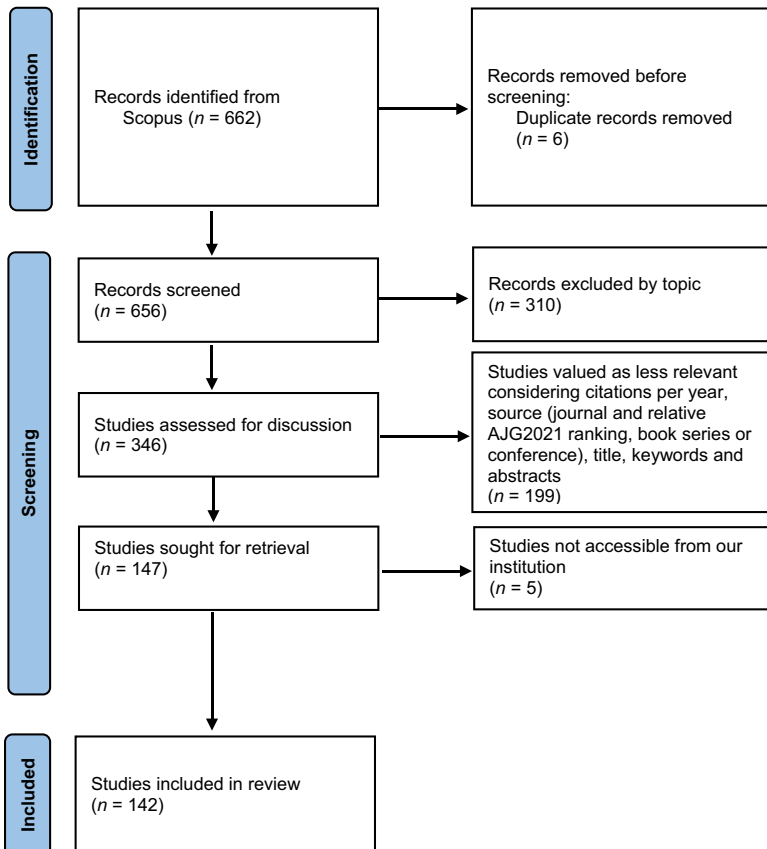
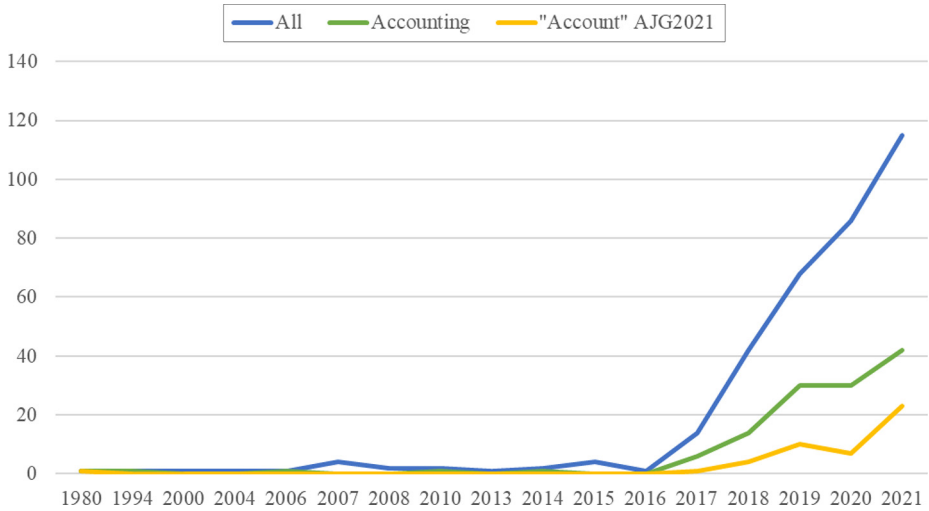


Figure 2.
PRISMA flow
diagram

2.7 Bibliometric mapping/visualization

Figure 3 shows the bibliometric subnetwork containing the research products included in our study that were most connected (263). This network analysis is based on the connections formed by the literature citations. In our analysis of the citations of the examined publications, we used bibliographic coupling using VOSviewer software. Bibliographic coupling involves measuring the similarity between two publications by identifying the number of references that they share (Manetti *et al.*, 2021). The sizes of the dots associated with each node represent weights defined by the number of citations made by each publication. This method is useful for highlighting seminal, frequently cited research products. The overlay colors in Figure 3 provide a visualization based on the publication year for each document.

Figure 4 shows a visualization of our cooccurrence analysis. In a cooccurrence analysis of keywords, the relatedness of the entries is based on the number of documents in which the keywords occur together. This analysis included any author keywords that were used in at least five publications. We used a thesaurus file to merge similar keywords (e.g. “audit” and “auditing,” “cryptocurrencies” and “cryptocurrency”). The keywords were grouped into clusters, namely, sets of closely related nodes within a bibliometric network. To create this form of bibliometric network visualization, VOSviewer uses colors to indicate the cluster to which each node has been assigned considering the cooccurrence relations. The clustering technique used by VOSviewer is discussed by Waltman *et al.* (2010). The weight of a node is based on the number of occurrences of the corresponding keyword.

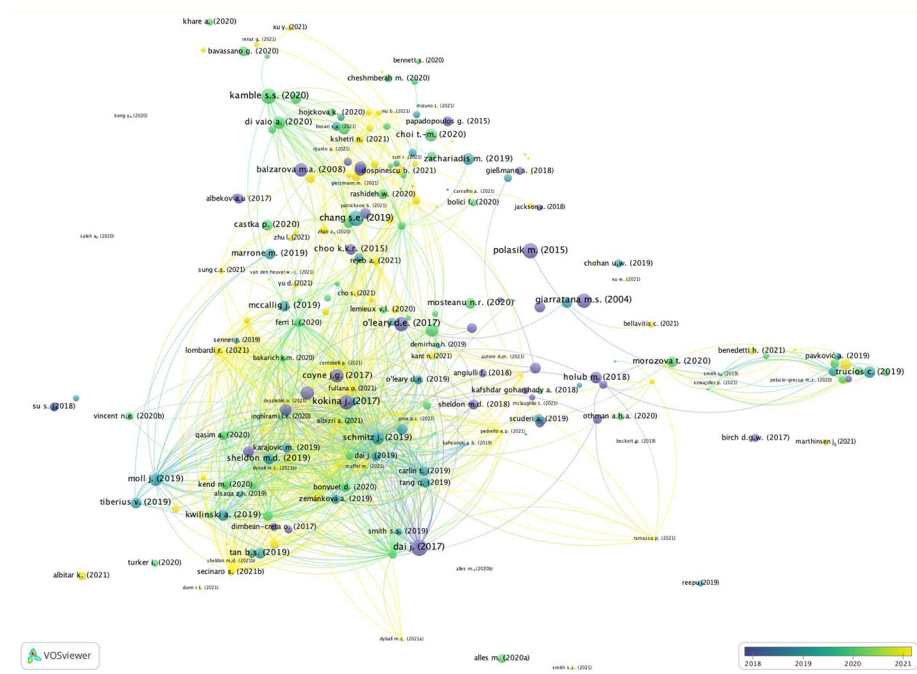


Figure 3.
Bibliometric network
of included
publications

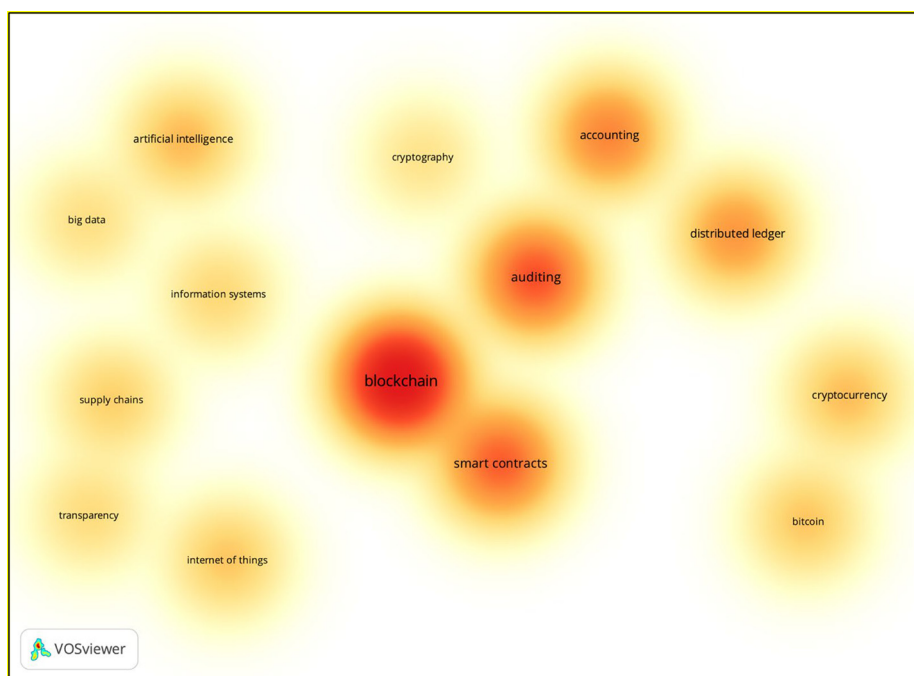


Figure 5.
Cooccurrence
heatmap of the
authors' keywords in
the "Blockchain for
accounting and
auditing" cluster

3.1.1 Area 1: understanding blockchain technology. As blockchain is a new technology, the first research area aims to discover which accounting and auditing problems blockchain can solve and whether accountants see it as an opportunity to leverage their capabilities or a threat that can make their job obsolete.

Immutability is a desirable feature for accounting systems because it prevents manipulation, but the way that blockchain achieves this goal is subject to criticism. Indeed, [Coyne and McMickle \(2017\)](#) note that a public accounting blockchain cannot be created because entities do not want to make all their accounting entries public and a private blockchain would not increase assurance because it would not be immutable ([O'Leary, 2017](#)).

Furthermore, a blockchain cannot ensure that recorded transactions happened in the real world ([Coyne and McMickle, 2017](#); [Alles and Gray, 2020](#); [Sheldon, 2021](#)). Possible solutions for this issue include establishing conflicting interests between involved parties by design ([McAliney and Ang, 2019](#)) or providing digital IDs of real-world objects ([Alles and Gray, 2020](#)). The latter suggests the complementarity between blockchain and Internet of Things (IoT)/radio-frequency identification (RFID) technology ([Sheldon, 2019](#)).

Other expected benefits of a blockchain accounting system include the reduction of repetitive tasks, the elimination of the need for reconciliation, the ability to perform real-time accounting and continuous audits, the capability to test an entire database instead of a sample and the reduction of manual errors ([Sheldon, 2019](#); [Turker and Bicer, 2020](#)). Moreover, some of the relevant minor issues are related to latency, scalability and energy consumption ([O'Leary, 2019](#)).

According to [McAliney and Ang \(2019, p.171\)](#), blockchain can be a solution only if there is a need for a common shared database, multiple parties are involved, the parties have

Table 2.
Five most-cited studies in the “blockchain for accounting and auditing” topic ordered by citations per year

Authors	Title	Year	Source title	Cited by	CPY
Dai J., Vasarhelyi M.A.	Toward blockchain-based accounting and assurance	2017	<i>Journal of Information Systems</i>	195	39.00
Schmitz J., Leoni G.	Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda	2019	<i>Australian Accounting Review</i>	61	20.33
Moll J., Yigitbasioglu O.	The role of internet-related technologies in shaping the work of accountants: New directions for accounting research	2019	<i>British Accounting Review</i>	55	18.33
O’Leary D.E.	Configuring blockchain architectures for transaction information in blockchain consortiums: The case of accounting and supply chain systems	2017	<i>Intelligent Systems in Accounting, Finance and Management</i>	91	18.20
Kokina J., Mancha R., Pachamanova D.	Blockchain: Emergent industry adoption and implications for accounting	2017	<i>Journal of Emerging Technologies in Accounting</i>	89	17.80

conflicting incentives and/or are not trusted, the rules among the participants are uniform, there is a need for an objective, immutable log and the transaction rules do not frequently change.

The purpose of blockchain, namely, to facilitate trust without intermediaries, has raised concerns about the future of auditors and their role in society. However, thus far, these worries are not justified because some aspects of the auditing process still require professional judgment (Turker and Bicer, 2020). Some audit procedures, such as sampling, confirmation letters, payroll examinations, invoice evaluations and reconciliation, will become less expensive or obsolete (Turker and Bicer, 2020). Others, such as systemic evaluation, risk assessments, predictive audits and fraud detection, will attract new and significant interest (Bonyuet, 2020).

Auditors could extend their services to work as accounting blockchain information systems administrators or advisors (Bonyuet, 2020). Auditing procedures and standards will need to keep pace with the new IT environment (Gauthier and Brender, 2021), as new accounting systems will be subject to control testing (Sheldon, 2019).

Tiberius and Hirth (2019) confirm that auditors’ expectations align with those of academics, who believe that the role of auditors will not be filled by blockchain technology. Ferri et al. (2020) found that performance expectancy and social influence generally lead to blockchain adoption intentions. Kend and Nguyen (2020) found that auditors are skeptical of the usefulness of blockchain for auditing. Dyball and Seethamraju (2021) highlight that

auditors consider clients that use blockchain applications as riskier because there is no accounting consensus about how to address their needs. Therefore, the essential benefits perceived by practitioners are unclear but seem to include reductions in time-consuming activities and the need for additional opinions.

A promising accounting context in which blockchain could quickly become part of the status quo is sustainability reporting because there is a need to improve the transparency and assurance of the information that entities disclose to prevent green-washing policies and practices (Bakarich *et al.*, 2020).

Many research products have already contributed to highlighting the essential features and critical elements of blockchain in the context of accounting. Therefore, we agree with Pimentel and Boulianne (2020, p. 342) that we do not need more research “on what a blockchain is or high-level ruminations over how it could be used or abused.”

3.1.2 Area 2: designing accounting blockchain applications. In this area, researchers study how to apply blockchain to accounting and design data flows and architectural features.

The most frequently cited paper in this area is that of Dai and Vasarhelyi (2017), which entered triple-entry bookkeeping into the academic discussion on blockchain and accounting. Their idea comes from Grigg (2005), who proposed a third entry recorded by a trusted third party that stores a receipt to which both parties involved in a transaction agree and digitally sign.

Wang and Kogan (2018) extend the aim of Dai and Vasarhelyi (2017) to solve the trade-off between confidentiality and transparency and propose the use of zk-SNARK (zero-knowledge verification) schemes and homomorphic encryption. In this way, the data stored in a blockchain can be validated and summed without revealing any details. McCallig *et al.* (2019) propose a blockchain system that overcomes the privacy issues the use of multiparty security and modular arithmetic. However, their system requires communication between all involved entity customers or suppliers.

Rozario and Thomas (2019) suggest the creation of a second blockchain owned by an auditor and connected to the accounting blockchain of the first client in a network. In this way, auditors could extract data from firms' blockchains and perform smart audit procedures within these blockchains. Fatz *et al.* (2019) use blockchain technology to create a system that issues certificates of arrival for goods, which are relevant in the VAT context for transactions between two businesses located in different EU countries.

Although there are some proposals for the use of blockchain in accounting, thus far, none have been commonly accepted. Interesting projects may arise from further action research.

3.1.3 Area 3: building theory. Researchers have worked to build a theory to explain how blockchain will change accounting. Some research products have used general frameworks such as the technology–organization–environment framework (Dai and Vasarhelyi, 2017) and the unified theory of acceptance and use of technology (Ferri *et al.*, 2020). Many others do not refer to a theoretical framework in their analysis of this phenomenon because they provide general overviews of the possible uses, benefits and limitations of blockchain in the context of accounting (Pimentel and Boulianne, 2020).

We believe that a specific theory to explain accounting blockchains could be drawn from the papers of Cai (2021) and Carlin (2019). They note that blockchain could induce a radical change in the field of accounting, namely, a shift to triple-entry bookkeeping. The advantages of triple-entry bookkeeping are that it increases transparency, reduces the time lag between fact and reporting, facilitates real-time accounting, reduces the possibility of manipulation and allows complete audits of whole recorded populations (Carlin, 2019).

Two distinct concepts of triple-entry accounting exist (Cai, 2021). The first is proposed by Ijiri (1986), who suggests the use of a third layer to measure momentum income. The second idea, which refers to accounting blockchain, is that of Grigg (2005). Furthermore, a blockchain accounting system that is integrated with smart contracts “can self-execute or self-enforce the agreements signed by two parties” (Cai, 2021, p. 9).

3.1.4 Area 4: test blockchain accounting information systems and their implications. The authors in the fourth area engage with empirical evidence and analyses, aiming to test how and why blockchain is implemented.

Calderón and Stratopoulos (2020) show how the blockchain of the Listerine® supply chain works; this product is a mouthwash produced by J&J, a multinational pharmaceutical company. Listerine managers use blockchain to assure the provenance of input and to facilitate better coordination and trust between members. Notably, although every peer maintains a copy of the chain (hence, it is decentralized), it also entails an element of centralization because of its identity provider and ordering node.

Cai (2021) cites three blockchain systems, but these cases were studied when they were within initial commercial rather than working phases. They are LucaTM by Ledgerium, which is a third ledger records payment transactions between business parties; zkLedgerTM by the MIT Media Lab, the USA, which is privacy-preserving auditing for a distributed ledger; and PacioTM Solution, which is a blockchain ecosystem with triple-entry accounting.

This area is undeveloped because blockchain is a recent technology, and there are few use cases to study (Pimentel and Boulianne, 2020). According to Karajovic *et al.* (2019), blockchain for accounting information systems will reach a critical adoption mass within the next three years and will become mainstream in 2025.

3.2 Finance and cryptoassets: a novelty to account for

This topic includes 36 research products published between 2000 and 2021. Figure 6 shows a cooccurrence heatmap of the main authors’ keywords (more than five occurrences) in this cluster. Table 3 provides some quantitative data (total citation and CPY) regarding the studies with the highest impact on this topic.

The realm of finance has been impacted by blockchain. This impact has raised questions about the nature of cryptos, their function as payment systems, their performance and the role of central banks. Smart contracts have also created new ways to collect capital. As blockchain is an innovation, the financial market also had to learn to value companies that announced that they were pursuing investment in this new technology. The research questions in this area are related to the cryptoassets innovations in finance, whether and how cryptoassets should be reported in financial statements and whether they represent taxable events (Trucíos, 2019; Ram *et al.*, 2016; Ram, 2018).

3.2.1 Area 1: financial innovation. Polasik *et al.* (2015) highlight that in countries with large shadow economies and low gross domestic product per capita, Bitcoin can work as a substitute for PayPal, payment cards and cash on delivery. However, according to Senner and Sornette (2019), cryptocurrencies cannot replace fiat currencies because they do not entirely address the complexity of monetary politics. Furthermore, decentralized systems entail governance issues that pose challenges when urgent decisions are needed (Zachariadis *et al.*, 2019).

Another part of this research topic focuses on studying the financial performance of cryptocurrencies (Trucíos, 2019; Le *et al.*, 2021). Alfieri *et al.* (2019) argue that Bitcoin is similar to common stock, has an excellent risk–return profile and represents an opportunity for portfolio diversification. Benedetti and Nikbakht (2021) study the effect of cross-listing.

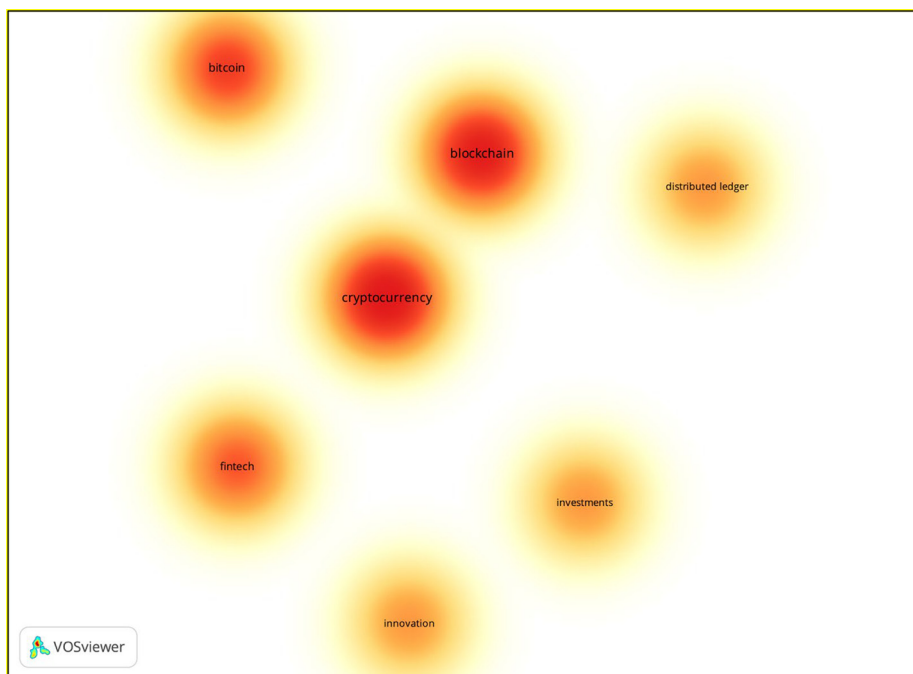


Figure 6.
Cooccurrence
heatmap of the
authors' keywords in
the "Finance and
cryptoassets" cluster

Polasik *et al.* (2015) find that the price of Bitcoin is influenced by the number and tone of related newspaper articles and Google searches.

The advent of cryptocurrencies has also raised questions about the role of central banks. Currently, central banks continue to supply money, both virtually and physically. However, while physical money (cash) is accessible to anyone, virtual central bank money is restricted to a few financial intermediaries. Berentsen and Schär (2018) suggest that central banks should not create new cryptocurrencies but should allow anyone to open an account with them.

Through smart contracts, blockchain offers a new way to collect capital from the public without intermediaries that screen projects and mandatory professional entities that evaluate corporate governance practices before fundraising can begin (Subramanian, 2020). However, in the absence of these forms of investor guarantees (involved intermediaries), Giudici and Adhami (2019) found that fundraising success depends on a project's team and the advisory committee's reputational capital at stake. According to Gan *et al.* (2021), the critical success factors in this context are the existence of a liquid secondary market, a minimum price-cost ratio of 2, a critical mass condition and the establishment of a maximum number of tokens. Gonzalez (2020) shows that peer-to-peer (P2P) lending decisions are influenced by the gender of borrowers and herding behavior.

Moreover, Autore *et al.* (2020) found that a firm announcement regarding its investment in blockchain leads to an increase in its stock price. However, these findings contrast with Austin and Williams (2021), who state that there is no evidence that disclosing information about blockchain investments positively affects investor judgments.

Table 3.
Five most-cited
studies in the
“finance and
cryptoassets” topic
ordered by citations
per year

Authors	Title	Year	Source title	Cited by	CPY
Le T.N.-L., Abakah E.J.A., Tiwari A.K.	Time and frequency domain connectedness and spill-over among fintech, green bonds and cryptocurrencies in the age of the fourth industrial revolution	2021	Technological Forecasting and Social Change	22	22.00
Polasik M., Piotrowska A.I., Wisniewski T.P., Kotkowski R., Lightfoot G.	Price fluctuations and the use of bitcoin: An empirical inquiry	2015	<i>International Journal of Electronic Commerce</i>	146	20.86
Zachariadis M., Hileman G., Scott S.V.	Governance and control in distributed ledgers: Understanding the challenges facing blockchain technology in financial services	2019	<i>Information and Organization</i>	39	13.00
Trucios C.	Forecasting Bitcoin risk measures: A robust approach	2019	<i>International Journal of Forecasting</i>	32	10.67
Morozova T., Akhmadeev R., Lehoux L., Yumashev A., Meshkova G., Lukiyanova M.	Crypto asset assessment models in financial reporting content typologies	2020	<i>Entrepreneurship and Sustainability Issues</i>	25	12.50

3.2.2 *Area 2: cryptoassets.* From an accounting perspective, cryptocurrencies fulfill the asset definition given by the conceptual framework of international financial reporting standards (IFRS) (Morozova *et al.*, 2020; Ram *et al.*, 2016).

Accounting for cryptocurrencies as cash falls under IAS21 “The Effects of Changes in Foreign Exchange Rates” if one adopts a broad definition of cash that goes beyond legal tender status (Procházka, 2018; Hampl and Gyönyörová, 2021).

We could consider accounting for cryptos as financial instruments, taking into account the speculative nature of the motivation underlying companies’ decisions to buy and sell these items. According to IFRS9, this classification would allow valuation at fair value. However, cryptocurrencies do not meet the financial asset definition provided by IAS32 (Procházka, 2018; Morozova *et al.*, 2020).

If buying and selling cryptocurrencies was part of the ordinary business of an entity, then it would be possible to account for cryptocurrencies as inventory. IAS2 par. 9 states, “Inventories shall be measured at the lower of cost and net realizable value,” and if a company is a broker-trader, then it can value cryptos at fair value less cost to sell (Procházka, 2018; Morozova *et al.*, 2020).

Finally, because cryptos fulfill the asset definition but are not tangible or a type of asset included within the scope of principles other than IAS38, they can be considered intangible assets. Thus, cryptos fall under the accounting rules for “Intangible assets with indefinite useful lives” (IAS 38.107), so they cannot be amortized but only impaired. Furthermore, if an active market exists, then intangible assets can be valued at fair value (IAS 38.75) (Procházka, 2018; Morozova *et al.*, 2020; Beigman *et al.*, 2021).

The official interpretation was issued by the IFRS [Interpretations Committee, (2019)], which stated that the only way to comply with the IFRS principles was to account for cryptocurrencies as intangible assets (IAS38) or inventory (IAS2). However, as the IFRS Interpretations Committee (2019) left an opening, in the future, accounting recommendations could change if some countries adopt certain cryptocurrencies as legally tender or entities adopt them as the basis for their transactions.

Having companies with cryptocurrencies on their balance sheets also presents some auditing issues because there is not a third party and transactions are pseudoanonymous in some cases. Therefore, the whole auditing process relies on companies’ internal control (Vincent and Wilkins, 2020).

Another similar issue is presented by taxation. There are two different situations that represent taxable events involving cryptoassets: mining activity and exchanges (Volosovych and Baraniuk, 2018; Ram, 2018). Mining activity refers to the business of producing and selling cryptoassets. Such activity represents a production event that “should be taxed with general taxes” (Volosovych and Baraniuk, 2018 p.103). The second situation includes any transaction that is a simple exchange of cryptocurrency. In the latter case, no special fee should be imposed, and the transaction is taxed like any other event that involves foreign currency (Volosovych and Baraniuk, 2018).

To enforce tax compliance in relation to exchanges of cryptocurrencies, authorities could regulate these exchanges in the same way as they do the banking system and give to the central banks law enforcement power (Volosovych and Baraniuk, 2018).

Regarding taxation, two nonacademic documents have attracted attention. The Court of Justice of the European Union (2015) decided that exchanges of cryptocurrencies are VAT exempt under the provision that exempts means of payment. The IRS (2014) of the USA declared that virtual currencies must be treated as property.

Although there was some doubt on the matter before an official interpretation was provided by the IFRS Interpretations Committee in June 2019, cryptoassets should currently

be accounted for as intangible assets (IAS38) or inventory (IAS2). Regarding taxation, cryptocurrencies should be VAT exempt, and when they are directly taxed, transactions should be treated as production events for miners or as exchanges of foreign currencies in all other situations.

3.3 Blockchain potential in business models and supply chain

This topic includes 42 products published from 2004 to 2021. Figure 7 shows a cooccurrence heatmap of the main authors' keywords (more than five occurrences) in this cluster. Table 4 provides some quantitative data (total citation and CPY) regarding the studies with the highest impact on this topic.

The success of cryptocurrencies has enticed entrepreneurs, academics and practitioners to study their innovative underlying technology, the blockchain and its opportunities in many different sectors. Hence, blockchain became a tool to innovate and could disrupt and create new business models. Supply chain processes seem particularly prone to benefit from this technology.

3.3.1 Area 1: business model innovations. Blockchain could have use cases and drive innovation in many sectors, such as those of banking, financial markets, retail, supply chains, healthcare, manufacturing, governance and insurance (Gaur, 2020). In financial sectors, in addition to supporting cryptocurrencies, it offers an opportunity for entrepreneurs who want to create value-reducing financial exclusion (Larios-Hernández, 2017).

Bolici et al. (2020) analyze discussions about blockchain and tourism on Twitter. They highlight that the public interest in this specific topic is strong and positive. In the long term,

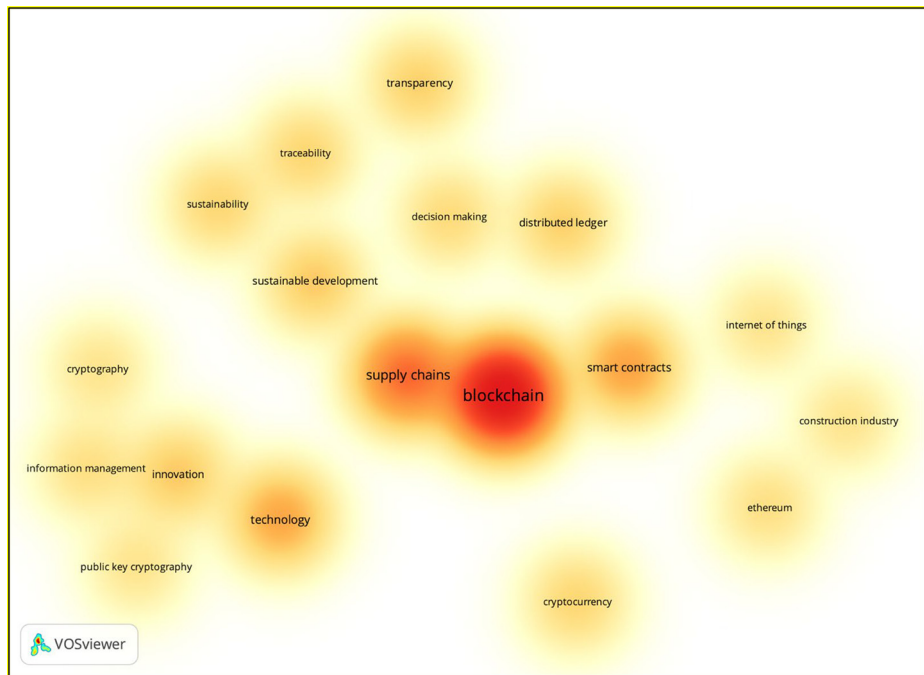


Figure 7.
Cooccurrence
heatmap of the
authors' keywords
in the "Blockchain in
business models and
supply chain" cluster

Authors	Title	Year	Source title	Cited by	CPY
Kamble S.S., Gunasekaran A., Sharma R.	Modeling the blockchain enabled traceability in agriculture supply chain	2020	<i>International Journal of Information Management</i>	146	73.00
Chang S.E., Chen Y.-C., Lu M.-F.	Supply chain re-engineering using blockchain technology: A case of smart contract-based tracking process	2019	<i>Technological Forecasting and Social Change</i>	132	44.00
Choi T.-M., Feng L., Li R.	Information disclosure structure in supply chains with rental service platforms in the blockchain technology era	2020	<i>International Journal of Production Economics</i>	59	29.50
Kumar A., Liu R., Shan Z.	Is Blockchain a Silver Bullet for Supply Chain Management? Technical Challenges and Research Opportunities	2020	<i>Decision Sciences</i>	56	28.00
Rodríguez-Espindola O., Chowdhury S., Beltagui A., Albores P.	The potential of emergent disruptive technologies for humanitarian supply chains: the integration of blockchain, Artificial Intelligence and 3D printing	2020	<i>International Journal of Production Research</i>	36	18.00

Table 4. Five most-cited studies in the “blockchain in business models and supply chain” topic ordered by citations per year

blockchain could increase disintermediation, reducing the power of companies such as Uber, Lyft and Airbnb, which currently create value by ensuring the reliability of their drivers or apartment owners (Rashideh, 2020).

Blockchain might be helpful in terms of accounting for renewable energy and carbon credits, which are intangible tradable items created to provide additional financial incentives to clean energy producers (Ashley and Johnson, 2018; Tang and Tang, 2019). Hojckova *et al.* (2020) study the success factors of blockchain-based P2P electricity trading.

Christ and V Helliari (2021) show that blockchain also makes it possible to monitor workers' rights, but there are some privacy concerns that must be addressed.

Tiscini *et al.* (2020) explore blockchain adoption as a sustainable business model innovation in the agrifood industry. Bavassano *et al.* (2020) focus on the shipping industry, where blockchain can be used to improve international administrative procedures, but a lack

of standards, particularly those imposed by regulation, represent the highest barriers in this context.

3.3.2 *Area 2: supply chain management.* [Chang et al. \(2019\)](#) find that a blockchain-based supply chain process could enable instant tracking, reduce costs related to updating information, improve cash liquidity, enable automatic payments and, in general, improve automation. [Choi et al. \(2020\)](#) argue that blockchain can reduce information auditing costs, increase the proportion of information-sensitive consumers and reduce demand volatility. [Rodríguez-Espíndola et al. \(2020\)](#) affirm that blockchain could enhance the information flows in the humanitarian supply chain, facilitating real-time sharing of secure information, boosting accountability related to the use of financial resources, preventing the duplication of databases and increasing the traceability of resource usage. In the agricultural supply chain, blockchain could increase traceability, auditability, immutability and provenance ([Kamble et al., 2020](#)). [Parmentola et al. \(2022\)](#) conclude that blockchain could create a more sustainable supply chain in line with the sustainable development goals.

[Van Hoek \(2019\)](#) notes that a need for transparency and visibility motivates blockchain implementation and that the main barrier facing such an implementation is a lack of understanding of how to integrate and leverage blockchain investments.

[Kumar et al. \(2020\)](#) highlight certain challenges in blockchain adoption: some contractual clauses are difficult to translate to computer programs, and assuring that every smart contract is bug-free is difficult. In the context of international business, there is a need to determine which jurisdiction will be used to solve disputes; redundancy and consensus protocols increase storage and processing data costs; and finally, secrecy and privacy issues may arise.

Some authors ([Chang et al., 2019](#); [Kumar et al., 2020](#)) suggest that future supply chain systems will be formed through integrations of blockchain into current systems, and a hybrid system with public on-chain data and private off-chain data will be used. Furthermore, major complementarities emerge between blockchain and RFID ([van Hoek, 2019](#)), IoT and ERP ([Kayikci et al., 2022](#)).

4. Discussion and conclusions

The main aim of the present study is to review the literature on the use of blockchain in accounting practice and research and to define potential opportunities for further investigation.

As indicated in [Figure 3](#) (bibliometric network of included publications), after some precursors in the years before 2018, in the period immediately following, new publications exploded, gradually creating a new “constellation” of this line of research, in which each publication is connected with others by bibliographic coupling.

[Figure 4](#) (cooccurrence analysis of the authors’ keywords) and, with more details, [Figures 5–7](#) (cooccurrence heatmaps of the authors’ keywords by cluster) confirm the reliability of not only the keywords chosen for the SLR but also the three clusters, which are consistent with the words most used in the analyzed papers.

The main findings related to accounting and auditing (first cluster) are that blockchain immutability is certainly desirable for accountants and auditors and should contribute to the prevention of earnings manipulation and the assurance of information and data. Nonetheless, many other advantages can emerge from blockchain technology, such as the reduction of repetitive tasks, the elimination of the need for reconciliation, the ability to perform real-time accounting and continuous auditing, the capability to test an entire database instead of a sample and the reduction of manual errors ([Sheldon, 2019](#); [Turker and Bicer, 2020](#)). Another possible application is triple-entry bookkeeping, with third entries

recorded on a chain (Dai and Vasarhelyi, 2017; Wang and Kogan, 2018), despite certain issues related to confidentiality and transparency that must be addressed and resolved. While blockchain cannot completely substitute for the roles of auditors and assurance providers, it could play a relatively central role in the context of social and environmental accounting and reporting.

However, the recent past and the near future of blockchain are firmly anchored to the development of financial instruments and cryptoassets (second cluster). While the problem of the representation and valuation of cryptocurrencies in financial statements can be considered clarified following the IFRS interpretations commission, significant audit and taxation issues remain, especially in cases where there is a need for a financial intermediary to provide external confirmation. Moreover, because of the existence of very different national regulations, it is unlikely that cryptocurrencies will be able to completely replace fiat currencies (Semner and Sornette, 2019; Polasik *et al.*, 2015), but the former are undoubtedly important forms of wealth investment for portfolio diversification (Alferi *et al.*, 2019).

In relation to business models innovation and supply chain management (third cluster), blockchain technology holds potential for innovating business models in many diverse sectors (Gaur, 2020), especially in socially or environmentally sensitive sectors or those involving particularly complicated supply chain management (Tiscini *et al.*, 2020; Bavassano *et al.*, 2020; Hojckova *et al.*, 2020). A blockchain-based supply chain process could facilitate instant tracking, preserve privacy through a private chain with preauthorization, reduce costs related to updating information, enable automatic payments and, in general, improve automation (Chang *et al.*, 2019). This is particularly interesting in the context of the energy sector, where renewable energy and carbon credits are intangible tradable items. The application of blockchain to supply chain management is particularly intriguing in relation to the monitoring of workers' rights, slavery and unethical behaviors because it contributes to tracking and assuring the entire process.

Moreover, our SLR allows us to highlight potential future developments related to the use of blockchain for accounting and, more broadly, blockchain in business studies.

First, in line with Garanina *et al.* (2021), Mancini *et al.* (2021), Lombardi *et al.* (2021) and Secinaro *et al.* (2021), the research on blockchain in accounting studies is primarily qualitative. Contrary to other studies, our SLR was updated at the beginning of 2022; therefore, it includes the most recent literature reviews published on the topic. Furthermore, although it is based on a "manual" and qualitative evaluation of each piece of research, it uses the PRISMA protocol and bibliometric software, both of which were extremely useful in supporting the research team in setting up the SRL, in the bibliometric visualizations and in analyzing and discussing each contribution. Compared to other SLRs recently published, this study has the twin peculiarities of focusing on the role of blockchain in accounting studies and of recurring to a mixed methodological approach, rather than addressing the more general issue of the role of smart technologies (Mancini *et al.*, 2021), focusing only on auditing (Lombardi *et al.*, 2021) or using different methodologies such as citation analysis and machine learning for topic modeling (Garanina *et al.*, 2021) or bibliometric and open-coding analysis (Secinaro *et al.*, 2021). However, especially in light of other SLRs on similar topics, we see an opportunity to perform future in-depth analyses to test new methods, including empirical and quantitative methods.

Second, the impact of blockchain on business models – in particular, those related to the management and control of business sustainability – and supply chain management may be particularly significant: researchers may consider filling this gap in the future.

Third, an application of blockchain that is growing in importance concerns smart contracts (particularly in the event, cultural and tourism sectors) and NFTs (especially in the world of art, thanks to high-value digital reproductions that are completely unique), as this technology not only constitutes an automation and speeds up processes in these contexts but also represents a standard of security and of the verifiability and authenticity of data.

Fourth, in our SLR, we underline that the impact of this technology on accountability remains relatively unexplored. In particular, the impact of blockchain on the broader concept of accountability, which includes financial, social and environmental data, is overlooked. Therefore, the issue of accountability based on blockchain represents a tremendous opportunity for future research.

As does all research, this study presents limitations. For instance, we do not consider technical, legal or ethical issues, such as the security and privacy of data or the reliability of information entered in the blockchain. Methodologically, the use of the Scopus database does not allow the analysis of a large number of books or book chapters or non-peer-reviewed studies published on the topic of blockchain in accounting.

Among the possible developments of this study in terms of the practical and theoretical applications of blockchain technology to accounting, we mention the possibility of overcoming the problem of data privacy through the use of public blockchains. Today, and to a greater extent in future years, ledgers managed by private blockchain monopolists can be replaced with public blockchain systems to offer a better choice to enterprise users and allow companies to use blockchains while maintaining complete data privacy.

However, to be affordable for everyone, blockchain solutions need to be scalable to operate efficiently on a large scale. From this perspective, it is essential that blockchain solutions are integrated into ERP systems and with RFID, IoT and AI technologies to create fast, reliable and repeatable processes. If blockchains integrate information and processes within and across company boundaries and are in synergy with emerging technologies, then it will be possible to simplify and accelerate business processes, increase cybersecurity protection and reduce or eliminate the roles of intermediaries.

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