

Exploring blockchain in the accounting domain: a bibliometric analysis

Exploring
blockchain in
the accounting
domain

Alessandra Lardo

*Department of Business and Economics, University of Naples – Parthenope,
Napoli, Italy*

Katia Corsi

Economics and Business, Università degli Studi di Sassari, Sassari, Italy

Ashish Varma

Institute of Management Technology Ghaziabad, Ghaziabad, India, and

Daniela Mancini

Faculty of Law, University of Teramo, Teramo, Italy

Received 31 October 2020

Revised 5 July 2021

2 November 2021

Accepted 18 December 2021

Abstract

Purpose – Considering the growing interests in managerial and accounting issues related to blockchain technology (BT), the study aims at identifying the main research venues in this specific field. In particular, the purpose is to understand the spatial and temporal production and distribution of research documents, highlighting the most relevant topics, the most influential authors and research.

Design/methodology/approach – This research carries out a bibliometric analysis of 189 research documents in the business, management and accounting areas. Data collection and refining is carried out from the Scopus database. The data analysis is based on a hybrid literature review approach using a descriptive bibliometric method, data analysis visualization (through VOSViewer software) and thematic analysis.

Findings – Results indicate that research studies focused on BT and accounting have been growing exponentially over the last three years, with authors who previously focused on generalist themes, and are now facing more specific issues. Through cluster analysis, the authors propose the framework of accounting domain and blockchain technology (ADOB) to systematize and visualize the map of current studies about the BT in the accounting domain.

Research limitations/implications – The analysis highlights some aspects less investigated at the first research stage in the field of BT and accounting, such as the growing need of new accounting and control processes to address the practical issues of BT implementation and the need for education and training to stimulate a proper use of BT by accountants and practitioners.

Originality/value – This study is the first to adopt a bibliometric and thematic analysis to investigate BT in the accounting domain. The authors provide significant insights that could guide and foster the use of BT for accountants and practitioners, defining future research lines and a research agenda for academic researchers.

Keywords Blockchain technology, Accounting domain, Auditing and control processes, Bibliometric analysis, ADOB framework

Paper type Research paper

1. Introduction

In recent years, blockchain technology (BT) has increasingly attracted the interest of academics and practitioners, as one of the most disruptive and impactful technologies (Iansiti and Lakhani, 2017; Aste *et al.*, 2017; Tapscott and Tapscott, 2017a). BT is a multifaceted



technology studied by a wide variety of disciplines such as computer science, engineering, managerial, accounting, legal, etc.

Today, blockchain studies are moving away from primordial computer science and engineering interests, focusing on bitcoin and distributed database technology, toward managerial, economic and legal perspectives (Alkhudary *et al.*, 2020). In literature, new interests have emerged regarding smart contracts, financial services, intellectual property, cloud services, supply chain, etc.

BT was originally proposed by Nakamoto (2008). Today it is considered the technology behind the cryptocurrency bitcoin, which uses a peer-to-peer network to verify transactions (Garriga *et al.*, 2021). BT is constantly evolving (Swan, 2015; Miao and Yang, 2018; Xu *et al.*, 2019) and, in particular, Swan (2015) has categorized this evolving process of blockchain into three tiers. BT 1.0 focuses on bitcoin, as cryptocurrency used for digital payment relies on the cryptocurrency ecosystem. BT 2.0 regards new applications in the traditional transactions of financial areas (such as bonds, stocks and smart contracts), which requires high levels of security and data integrity. Finally, BT 3.0 spreads previous applications in new and different contexts such as government, health, science, culture and arts, helping to popularize this technology outside the areas of cryptocurrency and finance and allowing new answers to different needs of business and society (Swan, 2015).

BT is also known as distributed ledger technology (DLT) because the transaction records stored in blocks are maintained across several computers and allow reading and managing databases in a distributed way. The transactions are collectively validated through a cryptographic signature and are added in blocks to a chronological chain of previous blocks (Zhang *et al.*, 2019; Zhu *et al.*, 2019). All network participants maintain identical copies of the ledger and none of them can unilaterally modify the record because it is stored in multiple computers into the network and any single change of ledger is visible to everyone. The change can be made only following a consensus protocol (mathematical algorithms), which is distributed across all nodes of the network (public permissionless blockchain) or across only selected nodes (private or permissioned blockchain) (Lin and Liao, 2017; Niranjanamurthy *et al.*, 2018).

In the business, management and accounting area, studies underline that BT has relevant operational impacts because it reduces the information processing costs, excluding third-party involvement to verify transactions (unlike requested in traditional double-entry bookkeeping) (Faccia and Mosteanu, 2019; Cai, 2018). It enables the two parties to make the transactions with a triple-entry ledger system that provides independent verification and enhances trust in the system (Kiviat, 2015; Dai and Vasarhelyi, 2017; Yermack, 2017; O'Leary, 2017), thereby increasing the transactions speed and security. In this way, many informational opportunities are associated with BT: it makes data shared, accessible and distributed in the network, but also improves the quality of the information in terms of uniqueness, transparency and reliability (Tapscott and Tapscott, 2017b; Fanning and Centers, 2016; Wu *et al.*, 2019). In these terms, the BT shows relevant implications on the accounting and auditing process, "especially with regards to record-keeping processes, including the way transactions are initiated, processed, recorded, reconciled, audited and reported" (Schimtz and Leoni, 2019, p. 331). To confirm the impact of BT on the accounting area, recently, the Big 4 have paid particular attention to this technology (EY, 2017; CPA Canada, AICPA and UWCISA, 2017; Dai and Vasarhelyi, 2017). Some scholars (Alkhudary *et al.*, 2020; Bonsón and Bednárová, 2019) claim the opportunities linked to BT in improving the accounting information system in terms of more trustworthy and timelier information. Consequently, it impacts on the information quality as required by the IFRS (International Financial Reporting Standards) (Kokina *et al.*, 2017; Bonsón and Bednárová, 2019), such as: completeness (otherwise the information cannot be verified); clarity (each entry has predefined structure, with specific fields to fill in); relevancy (with differentiated availability); comparability (through the standardized information in specific fields); accuracy (as nodes

verify the information); timeliness (with an instant updating and continuous “on time” reporting); fairness (absence of manipulation because of the needed permissions and blocks cryptographically locked and immutable). Likely, all of these potential impacts of BT on the accounting area cannot fail to be reflected in the accounting and auditing professionals, changing their traditional practices and the status quo (Casey and Vigna, 2018; O’Leary, 2017; Yermack, 2017; Sinha, 2020).

To date, there are not many literature reviews on BT in the management area. A first systematic literature review is by Grover *et al.* (2018), in which the authors consider the contribution of BT to businesses concerning different stakeholders, such as consumers and government. This analysis highlights that BT will transform the way businesses are managed and organized because it facilitates the storing of records, improves transparency within the organization, flattens the hierarchy, helps the market disintermediation and the provenance tracking, builds mutual trust within a firm, stimulates rapid internationalization and improves the accounting function. Schimitz and Leoni (2019) focus on the accounting function and analyze both academic and professional literature, highlighting that the main themes emerging from accounting and auditing studies are: governance, transparency and trust; continuous audit; smart contracts; roles of auditors. Recently a systematic literature review (Kummer *et al.*, 2020) has shifted the focus from operational aspects to theoretical ones, identifying the most relevant organizational theories used in blockchain literature in the context of logistics and supply chain management. From literature six organizational theories (agency theory, information theory, institutional theory, network theory, the resource-based view and transaction cost analysis) emerge to help frame BT’s topic and facilitate future research.

Among the new lines of research, scholars are focusing on opportunities and changes of BT more for management (Mendling *et al.*, 2018; White, 2017) than for the accounting domain. The accounting blockchain domain should also include: future BT X.0, impact on accounting function and accountants profession, financial reporting for crypto assets and other aspects of recordkeeping processes (regarding the way transactions are authorized, recorded and reported a how data are stored) (Pimentel and Boulianne, 2020; CPA Canada, AICPA and UWCISA, 2017).

Considering the relevance and potential implementation of BT in the accounting area, it would be appropriate to do a literature analysis to prefigure the state of the art of this topic, understand its level of development in academic literature, and finally open up new paths for future research.

In conclusion, apart from the above-mentioned studies, which have provided some relevant insights, reporting mainly the research impacts and its directions, a systematic and objective analysis of literature on BT in the accounting area is still missing and limited primarily to the auditing field (Pimentel and Boulianne, 2020; Tiron-Tudor *et al.*, 2021; Maffei *et al.*, 2021).

This work aims to fill this gap, carrying out a bibliometric and a thematic analysis that, using mathematical and statistical methods, objectively highlights several aspects of literature (as shown in recent works, see Bruns *et al.*, 2020; Lamboglia *et al.*, 2020; Tiron-Tudor *et al.*, 2021). This study means to map the current state of the knowledge about BT applied in the accounting domain and to identify topics and interesting questions for future research. In fact, the bibliometric method is not only able to show the scholar’s activities, publications trends and countries and authors relations, but also to offer the information of growth of specific knowledge. Many advantages are attributed to bibliometric analysis: “(1) Authors are able to validate the centrality of their publication, exploration, and research; (2) Institutions are able to assess the publication and measure the quality and impact; (3) Scientists can foresee future research undertakings and the critical effect of research on specific domains; and (4) Analysts are able to assess the developing body of knowledge” (Firdaus *et al.*, 2019, p. 3).

This analysis can help discover productivities, spatial distribution (in terms of both countries and journals) and temporal distribution of publications, performances and connections of authors.

Specifically, this work aims to answer to following questions:

- RQ1. What is the trend of publications in blockchain studies throughout the accounting domain?
- RQ2. What do the papers on “intersection” of blockchain and accounting focus on? What are the most relevant topics?

The remainder of this paper is organized as follows: [Section 2](#) provides the methodology used. [Section 3](#) displays three descriptive bibliometric analyses. [Section 4](#) explains the keyword co-occurrence analysis and the main topics investigated in the data set, analyzing the different clusters identified. [Section 5](#) concludes the paper and suggests future research developments.

2. Research methodology

Our research is based on a hybrid literature review approach using a descriptive bibliometric method, data analysis visualization (through VOSViewer software) and thematic analysis to fully understand the content of studies on BT in the accounting domain.

We apply the bibliometric method to quantify research trends within publications and describe the phenomena of publications in a given field ([Ikpaahindi, 1985](#)). We conducted a bibliometric study of blockchain literature to reveal some valuable insights to scholars and practitioners in the accounting domain.

This paper followed the research cycle which involves the process of defining the blockchain relevant keywords, collecting data and performing analysis.

Actually, the bibliometric method combines performance analysis and science mapping procedures. Performance analysis provides data about the volume and impact of research using a wide range of techniques, including word frequency analysis, citation analysis and counting publications by a unit of analysis (e.g. authorship, country). Moreover, we also use science mapping, based on relational indicators that provide a spatial representation of how different elements relate to one another ([Jin et al., 2019](#)). To avoid errors related to the identification of the scientific products, a research protocol has been developed, as shown in the following [Figure 1](#).

2.1 Keywords selection and data collection

According to the research protocol adopted, the first phase consists of the data set setting. The first step of the data collection concerns the adoption of the Scopus database as the data source of this study, because it is the largest database which includes several types of papers, analysis tools, and it was introduced by Elsevier in November 2004 ([Aghaei Chadegani et al., 2013](#)). Thus, a systematic research on Scopus was conducted in September 2020 and data was collected in October 2020.

For our search, to select appropriate keywords, we have reviewed previous bibliometric studies and literature reviews on blockchain ([Firdaus et al., 2019](#); [Marrone and Hazelton, 2019](#); [Casino et al., 2019](#); [Miau and Yang, 2018](#)) and we have identified and selected the following keywords: “Blockchain”, “Cryptocurrency”, “Smart Contract”, “Initial Coin Offering”, “Bitcoin”. Then, we added “Account*” to answer the research questions and fit the call for papers that contributed to the development of knowledge in the accounting domain.

Then, we filtered the core document set considering published articles, articles in press, book chapters and conference proceedings to obtain a complete and updated data set.

Therefore, we did the query with TITLE-ABS-KEY with the following research string: ((“Blockchain” OR “Cryptocurrency” OR “Smart Contract” OR “Initial Coin Offering” OR “Bitcoin”) AND (“Account*”))

The query resulted in 1,062 documents, including articles, conference papers, book chapters and conference reviews.

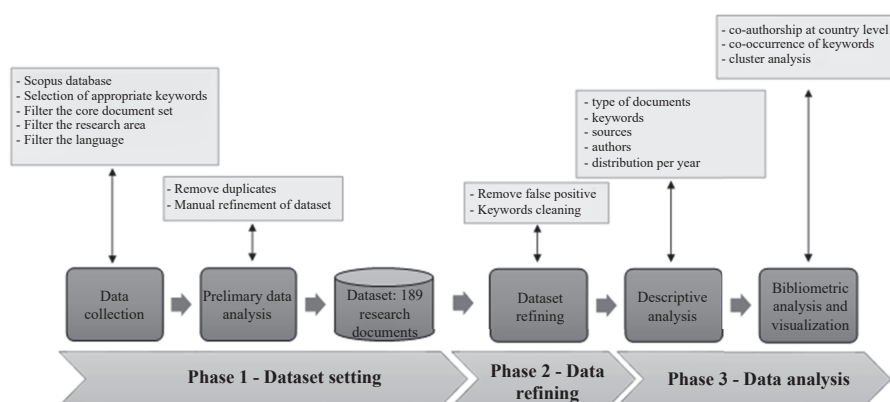


Figure 1.
Research protocol

In the next step, we have identified the exclusion criteria. We filtered the research area, only considering articles published in the Scopus subject area of business, management and accounting. This filter is needed for our analysis because we aim to develop new knowledge about BT's specific impact and relevance in the business, management and accounting scientific literature. Furthermore, we considered only papers written in the English language.

After retrieving raw data, we continued with the preliminary data analysis, removing duplicates and manually refining the data set.

Finally, this first phase of data set setting resulted in 189 relevant scientific products consistent with prior samples used in bibliometric studies. Our analysis covers a period of 5 years, from 2015 until 2020, because the number of publications related to BT has been growing continuously since proposing Nakamoto's paper in 2008. However, only from 2015, we can see a significant change in publication trends where BT has started to receive more attention from researchers than other topics (Dabbagh *et al.*, 2019).

2.2 Dataset refining and data analysis

The second phase of the research protocol removes false positives, cleans keywords, and standardizes the content of some fields in the corpus. Specifically, keywords are refined by merging the plural and singular form of the same concept and unifying the writing of certain words; in example, we merged singular and plural forms of "bitcoin/s", "smart contract/s", "cryptocurrency/cryptocurrencies/crypto-currency/crypto-currencies" and we also uniformed the keywords "block chain/blockchain", "data mining/data-mining". Then, the data analysis involved two steps: the analysis of descriptive bibliometric indicators and the main topics investigated in our data set. In particular, to understand the extent of literature and answer the first research question guiding our study, the statistical examination was conducted via different characters from spatial and time dimensions. As a tool to calculate these indicators, we used VOSViewer (van Eck and Waltman, 2010), a software capable of supporting the design and visualization of bibliometric networks. VOSviewer provides three visualizations of a map: the network visualization, the overlay visualization and the density visualization (van Eck and Waltman, 2018). Moreover, it is possible to zoom and scroll in these visualizations to allow researchers to explore the investigated subject in full detail. Therefore, the refining of the data set is conducted at the software level to come up with the network, overlay and density map. In the network visualization, items are represented by their label and by default also by a circle. The weight of the item determines the size of the label and the circle of an item. The color of an item is determined by the cluster to which the

item belongs. In the overlay visualization, we consider the temporal distribution of bibliometric indicators. Then, in our study, we analyze the two variants of the density visualization: item density visualization and cluster density visualization.

Finally, to answer the second research question by exploring the main topics on our data set, we use the co-occurrence of keywords adopting a full counting method and the cluster analysis developed matching authors and index keywords with the list of the most prominent keywords of the data set. Therefore, a thematic analysis is conducted to analyze the content of the papers belonging to each cluster. To attribute the research paper to each cluster, we adopt the following process: we associate papers with each keyword we group the papers containing keywords included in the different clusters, and manually check that each cluster contains all the papers associated with the respective keywords.

3. Descriptive bibliometric analysis

The descriptive analysis aims to show the main features of our data set, focusing on five aspects that should define scholars' interest in the blockchain issue in the accounting field and an accurate picture of the scientific production of this theme. These aspects are: (1) the trend of publications; (2) the most cited papers and citations by year; (3) the authors, considering their productivity and co-authorship; (4) the types of documents and journals; (5) publishing activity by country.

3.1 Publications by year

The blockchain is a novel theme, which in more recent years, starting from 2015, drew the attention of accounting scholars. The trend of publications on BT in management and accounting areas has significantly increased in the last 3 years as shown in [Figure 2](#), where more than 91% of the papers of our data set are concentrated. This paper's number trend shows the increasing interest of scientific research on this topic and is a first call for our work. The decline of the trend of [Figure 2](#) in 2020 is not significant as we collected the data in September 2020, and the data set does not include the entire scientific production of the year on this topic.

3.2 Citations by year and most cited documents

By analyzing the number of citations, one can achieve a picture of the documents' relevance in a specific field of study ([Baier-Fuentes et al., 2019](#)). [Figure 3](#) shows the total citation per article per

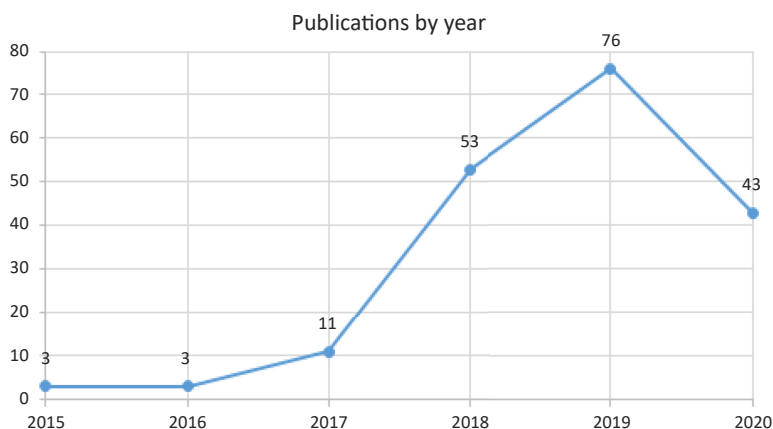


Figure 2.
Publications by year

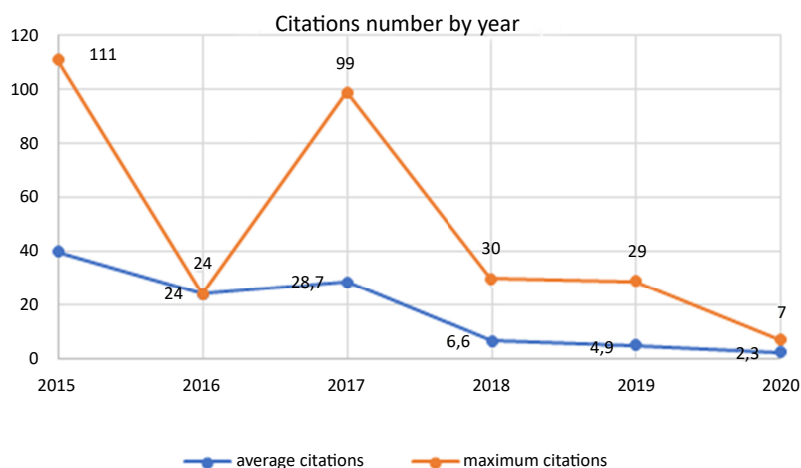


Figure 3.
Research citations
by year

year, considering the maximum and the average number of total citations. In particular, this figure highlights both the year in which the documents are on average more cited and the most cited paper per year. In this way, limitedly to available citations in our data set, this analysis helps us to understand in which years the average is representative of the impact of the papers and when instead it is distorted by the presence of a single paper which has many citations, but other documents join it with very few citations. This happened in the year 2015 and 2017, in which are the two most cited papers with a number of citations much higher than average.

In [Table 1](#), about the top 10 cited papers, the first paper ([Yermack, 2015](#)), although first published, has 111 citations. It focuses on bitcoin and only marginally deals with the accounting issue. The second paper (with 99 citations) is [Dai and Vasarhelyi \(2017\)](#), which represents the primordial work about the application of BT to accounting and assurance and today continues to be the most relevant work as a reference point for all studies in this field. It highlights the contribution of BT to the accounting system, making it more real-time, verifiable and transparent but also transforming the auditing practices. The other most cited papers, in [Table 1](#), have fewer citations (from 25 to 44). Among these, we can distinguish three principal types of interest. The first group of documents ([O'Leary, 2017](#); [Holub and Johnson, 2018](#)) deals with different blockchain architecture across many disciplines (including accounting), considering BT's ability to process several types of transaction information in several fields. The second cluster considers the blockchain as a technology that offers new opportunities in financial perspective as digital finance technology ([Larios-Hernández, 2017](#); [Cai, 2018](#)) to support financial services such as crowdfunding but also in a business process re-engineering perspective, supporting supply chain design and development ([Chang et al., 2019](#)). The final cluster ([Kokina et al., 2017](#); [Wang and Kogan, 2018](#); [Coyne and McMickle, 2017](#)) focuses on the functionality of BT to transform the accounting practice, impacting real-time accounting, continuous monitoring and fraud prevention.

3.3 Authors and their productivity

[Table 2](#) shows that the authors of the examined documents are numerous, equal to 494. Furthermore, we find that the number of single authors per article is very far from the number of authors of multi-authored articles, which could confirm the importance of network analysis. There are three papers with 9 ([Raman et al., 2019](#)), 10 ([Lytvyn et al., 2019](#)) and 13 ([Thomason et al., 2018](#)) authors.

Title	Authors	Institute (first)	Country (first)	Source	Year	Citation frequency
Is Bitcoin a Real Currency? An Economic Appraisal	Yermack D.	University Stern School of Business, New York	USA	Handbook of Digital Currency: Bitcoin, Innovation, Financial Instruments, and Big Data	2015	111
Toward Blockchain Based Accounting and Assurance	Dai J. and Vasarhelyi M.A.	Newark Southwestern University of Finance and Economics	China USA	Journal of Information Systems, 31(3)	2017	99
Configuring Blockchain Architectures for Transaction Information in Blockchain Consortiums: The Case of Accounting And Supply Chain Systems	O'leary D.E.	University of Southern California	USA	Intelligent Systems in Accounting, Finance and Management	2017	44
Blockchain Entrepreneurship Opportunity in the Practices of the Unbanked	Larios–Hernández G.J.	Universidad Anáhuac	Mexico	Business Horizons, 60(6)	2017	41
Blockchain: Emergent Industry Adoption and Implications for Accounting	Kokina J, Mancha R. and Pachamanova D.	Babson College	USA	Journal of Emerging Technologies in Accounting, 14(2)	2017	34
Designing Confidentiality-Preserving Blockchain Based Transaction Processing Systems	Wang Y. and Kogan A.	Southwestern University of Finance and Economics	China	International Journal of Accounting Information Systems, 30	2018	30
Can Blockchains Serve an Accounting Purpose?	Coyne J.G. and McMickle P. L.	The University of Memphis	USA	Journal of Emerging Technologies in Accounting, 14(2)	2017	30
Supply Chain Re-Engineering Using Blockchain Technology: A Case of Smart Contract Based Tracking Process	Chang S.E., Chen Y.-C. and Lu M.	National Chung Hsing University	Taiwan	Technological Forecasting and Social Change, 144	2019	29

Table 1.
Top 10 cited papers

(continued)

Title	Authors	Institute (first)	Country (first)	Source	Year	Citation frequency
Bitcoin Research Across Disciplines	Holub M. and Johnson J.	Business School, University Western Australia	Australia	Information Society, 34(2)	2018	26
Disruption of Financial Intermediation by Fintech: A Review on Crowdfunding and Blockchain	Cai C.W.	Australia Charles Sturt University Melbourne Study Group Center	Australia	Accounting and Finance, 58(4)	2018	25

Table 1.

Authors	The authors' frequency distribution	494
Authors appearances	The number of author appearances	522
Authors of single authored articles	The number of single author per article	48
Authors of multi authored articles	The number of authors of multi authored articles	446
Authors per article	Average number of authors in each article	2.769
Co-authors per articles	Average number of co-authors in each article	3.378

Table 2.
Authors productivity

The most productive authors are shown in [Table 3](#). Smith S.S. is the most productive author with four papers co-authored and recently published (two in 2020, one in 2019 and one in 2018). In all his 4 papers (“Implications of next step blockchain applications for accounting and legal practitioners: a case study”, 2018; “Blockchain and cryptocurrencies – considerations for treatment and reporting for financial services professionals”, 2019; “Blockchain and accounting governance: emerging issues and considerations for accounting and assurance professionals” [sic], 2020; Exploring the playground: blockchain prototype use cases with hyperledger composer), Smith S.S. studies the impact of BT on financial, legal and accounting fields. It can be significant to highlight that Smith SS, in his last research, emphasizes the role of education and training to teach how to use and familiarize with blockchain in order to allow future practitioners to be oriented in the current working environment.

However, he is not the most cited; in fact, he collects fewer citations than others. Excluded Dai, which (as shown before) has one paper among the most cited ([Dai and Vasarhelyi, 2017](#)),

Author	No of documents
Smith S.S.	4
O’Leary D.E.	3
Cai C.W.	2
Chen Y.	2
Dai J.	2
Elshin L.A.	2
Erlina, Fachrudin K.A.	2
Gilmanov A.M.	2
Gupta R.	2
Ilham R.N.	2
Kuchkovskiy V.	2
Kumar A.	2

Table 3.
List of the most
productive authors

the authors most cited is O'Leary, who with his two papers collects 51 citations and Kuchkovskiy, which collects 40 citations with two works.

3.4 Type of documents and sources

Considering the publishing activity, we find that only 23 sources contain more than one paper, and that our data set of 189 papers is dispersed in a high number of sources (114): these evidences confirm the need for an analysis of the structure of the body of knowledge.

The examined documents are of different types, although the paper in scientific journals prevails by far (see [Table 4](#)).

We can see that articles carried a total of 120 documents, followed at a much lower frequency by conference papers with 39 documents. Other literature analysis on blockchain in general ([Firdaus et al., 2019](#)), highlights an evident prevalence of conference papers, showing a greater vitality of conference activities for the blockchain considered in technical, engineering and information technology terms. The contextualization of BT in the management and accounting area is a niche issue that does not stimulate many conferences, although it attracts many scholars, as shown previously in [Table 1](#).

The studies that analyze the BT in the accounting area have a varied editorial position: 91 sources out of 114 have only one document. Among the sources which have at least two documents prevailing by far, as already highlighted, the scientific journal. The most prolific journal is "Journal of Emerging Technologies in Accounting" (see [Table 5](#)), strongly focused on the subject matter of our work, with 10 articles (83% of articles published in scientific journals). 7 documents are collected in a book edited by Alastai Marke in 2018 "Transforming Climate Finance and Green Investment with Blockchains", which could testify that the issue of BT in the accounting area is also conveyed on the current problems linked to sustainability.

3.5 Publishing activity by country

The topic of BT in the accounting field seems to be discussed worldwide. Considering the first author's affiliation in our data set, the research on this theme was conducted in 43 countries. These countries have a different number of papers. The most productive countries, with at least two articles are shown in [Figure 4](#). The USA represents the most productive country by far, with a continuity starting from the most distant years. Already in 2015, it had two papers, which represent primordial works.

3.6 Co-authorship at country level

To improve results about productivity by country, we use the bibliometric co-authorship indicator at the country level: it reflects the geographic collaboration and spatial distribution ([Perianes-Rodriguez et al., 2016](#)).

From the VOSViewer software elaboration, it is possible to identify the United States as the most active country to take forward the blockchain publication in the accounting domain, with UK, Australia and China following closely behind ([Figure 5](#)). Even if this result could be influenced by our language filter in data collection, we can assert that this result was expected

Document type	No of documents
Articles	120
Book chapters	28
Conference papers	39
Conference reviews	2
Total	189

Table 4.
Distribution by
document type

Editorial collocation	No. papers
Journal of Emerging Technologies in Accounting	10
Lecture Notes in Business Information Processing	9
Transforming Climate Finance and Green Investment with Blockchains	7
Australian Accounting Review	5
Academy of Accounting and Financial Studies Journal	4
Quality – Access to Success	4
Accounting and Finance	4
Contributions to Management Science	4
International Journal of Supply Chain Management	4
Intelligent Systems in Accounting, Finance and Management	4
International Journal of Accounting Information Systems	3
International Journal of Digital Accounting Research	3
Current Issues in Auditing	3
Computer Law and Security Review	3
Journal of Payments Strategy and Systems	3
Research in International Business and Finance	2
Meditari Accountancy Research	2
Managerial Finance	2
International Journal of Recent Technology and Engineering	2
Proceedings – 2019 Crypto Valley Conference on Blockchain Technology, CVCBT 2019	2
Crypto Uncovered: The Evolution of Bitcoin and the Crypto Currency Marketplace	2
Proceedings of the 33rd International Business Information Management Association Conference, IBIMA 2019: Education Excellence and Innovation Management through Vision 2020	2
Handbook of Digital Currency: Bitcoin, Innovation, Financial Instruments, and Big Data	2

Table 5.
Editorial collocation of documents

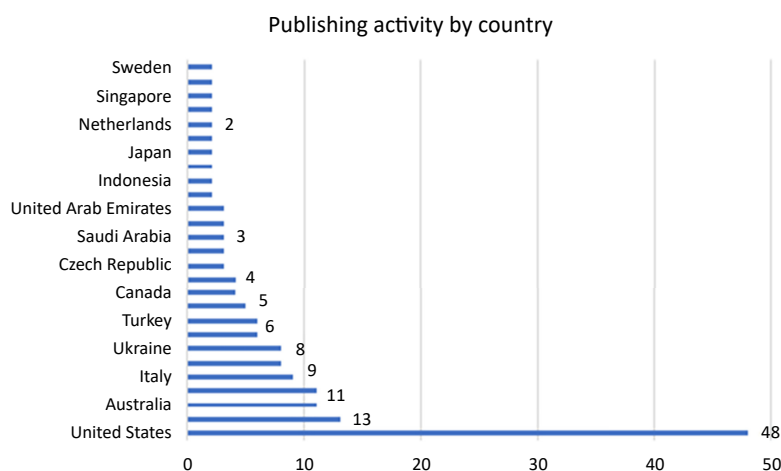
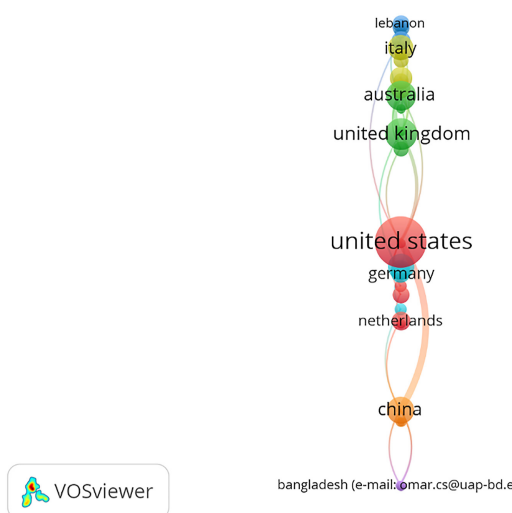


Figure 4.
Publishing activity by country

because the USA can be seen as the technical torch bearer for the world, having come up with some of the most advanced and brilliant technical innovations of the century.

Apart from the dominant cluster of the USA, there were other relevant clusters as the UK, China and Italy, and other small but significant clusters that were identified are Canada, Indonesia and Ukraine.

Figure 5.
Country network
visualization of
co-authorship at
country level



Considering the network analysis, we can identify other countries that share similar research papers. For example, on the one hand, Germany, Switzerland and Russian Federation; and on the other hand, Lithuania and Czech Republic along with Belgium, Netherlands and Hungary. The same happens with China, Hong Kong and Norway that share similar papers, as well as Bangladesh, Japan and the UK. The USA, Italy, India, Australia and the UK share similar topic papers in the other corner. It is to be noted that the most significant contribution on the topic can be assumed by the nations.

As shown in [Table 6](#), regarding the scientific collaboration at country level, the USA is definitely the country most open to collaboration with 54 co-authorships between USA authors and other authors from any of the other countries listed, followed by the UK, Australia, China, Russian and Italy which have a much lower number of co-authorship frequency. The most numerous authorships of the USA are with China: they are the most strongly linked countries, as shown by the lines in [Figure 5](#).

In a temporal dimension ([Figure 6](#)), these co-authorships are very recent: the most recent publications are from Australia (with 2019 as the average publication year) followed by the average publication year of 2018, 7 for the UK and year 2018, 5 for the USA.

Country	Co-authorship frequency
United States of America	54
United Kingdom	17
Australia	15
China	12
Russian Federation	11
Italy	10
India	8
Ukraine	8
Germany	6
Switzerland	6

Table 6.
Co-authorship
frequency by country

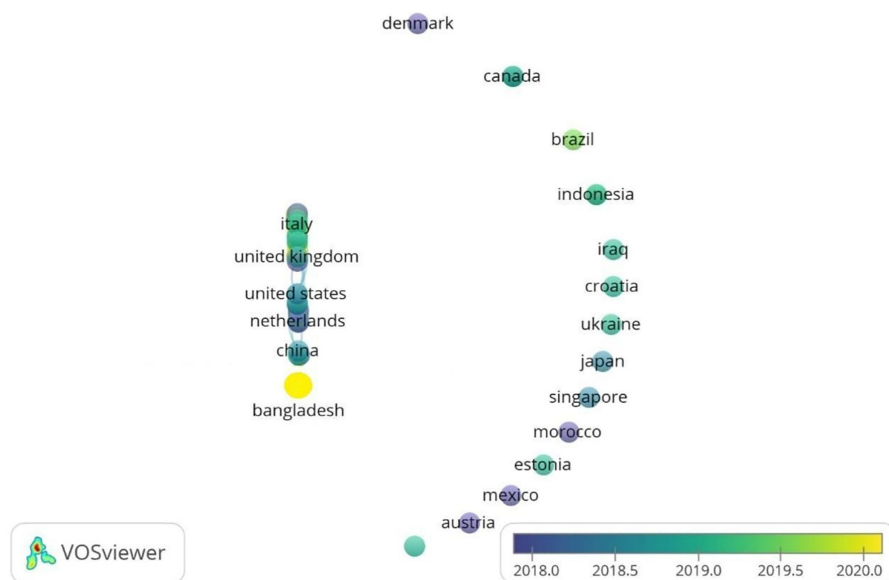


Figure 6.
Network visualization
of co-authorship by
country

4. Bibliometric analyses of the main topics investigated in the data set

This section aims to explore the most relevant topics discussed in our dataset. We analyzed the most recurring keywords used by authors. The keywords analysis provides some insights regarding the content and the main issues on blockchain in the accounting domain discussed in the 189 papers.

4.1 Keywords co-occurrence

Co-occurrence of keywords analysis uses the author's provided keywords to investigate the connections among the main topics in the domain analyzed (Ji *et al.*, 2018).

Table 7 provides the information to uncover which fields were related to blockchain research in the accounting domain. It establishes the keyword co-occurrences of the network. Moreover, we consider only keywords that appear at least five times within the list. The singular and plural forms ("cryptocurrency" and "cryptocurrencies"; "bitcoin" and "bitcoins"; "smart contract" and "smart contracts") and synonyms ("data-mining" and "data mining"; "block chain" and "blockchain") were properly processed by manual in phase 2 of our research protocol.

Sr. no.	Keyword	Occurrence
1	Blockchain	111
2	Cryptocurrency	37
3	Bitcoin	35
4	Smart contract	24
5	Internet of things	18
6	Green computing	13
7	Ethereum	8
8	Accounting	8
9	Blockchain technology	8
10	Machine learning	7

Table 7.
Top ten keywords
co-occurrence

Blockchain is the most prominent keyword with strong links with the keywords smart contract, cryptocurrency, bitcoin and Internet of Things (IoT).

The strongest links are found between the keyword pairs blockchain and smart contract; blockchain and Internet of Things; blockchain and cryptocurrency; cryptocurrency and bitcoin as in the network map of keywords co-occurrence (Figure 7).

Smart contract is linked strongly with blockchain while cryptocurrency is linked strongly with bitcoin. There is also a strong link between blockchain and the IoT and green computing. These are the areas where blockchain has a very direct, technological approach and applications.

Some keywords pertain to very specific applications of the concept of blockchain and accounting. They are the keywords located at the outer periphery of the density map (Figure 8), such as: communication channels; decentralized depository receipts; 21st century skills; accounting competences.

This co-occurrence of keywords is of great relevance for our research aims. Actually, keywords such as accounting competencies and 21st century skills demonstrate that research studies are involved in analyzing the future trends of accounting capabilities and skills that nowadays practitioners, accountants and auditors need to face in the new digital environment and to use BT.

The distribution of authors' keywords can help us to investigate popular research topics among researchers and have proved to play an important role in science development (Li *et al.*, 2009).

Considering the network map, blockchain was the most prominent keyword which had strong links with the keywords bitcoin, smart contracts, IoT, green computing and accounting.

The most strongly associated keyword, IoT, was most strongly linked with green computing and the trio, blockchain, IoT and green computing formed the most strongly linked keywords of all. "Smart contracts" is a keyword linked strongly with accounting and

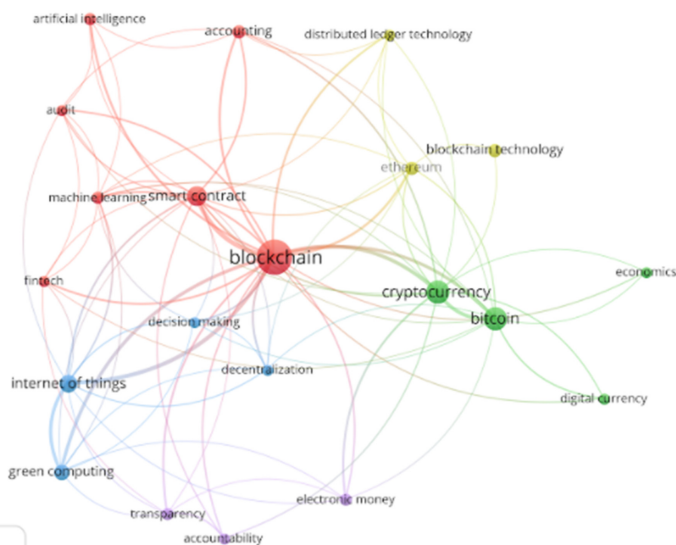


Figure 7.
Network visualization
of keywords
co-occurrence

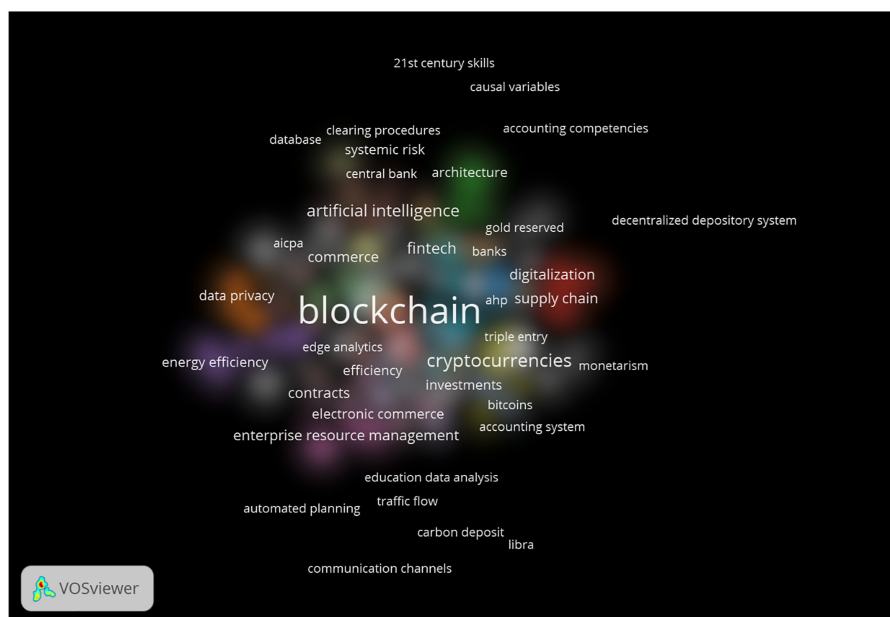


Figure 8.
Cluster density
visualization of
keywords
co-occurrence

the IoT. Some of the most significant keywords include blockchain, smart contracts, cryptocurrency as well as accounting, as observed from network visualization (Figure 7).

The most striking keywords based on the network visualization were blockchain, cryptocurrency(ies), auditing, IoT, laws and legislation, digital storage and bitcoin.

4.2 Cluster analysis

Analyzing the keywords co-occurrence on the basis of their connections, according to Figure 7, it is possible to recognize four main clusters marked by different colors.

- (1) The green cluster includes the following keywords: cryptocurrencies and bitcoin. These keywords suggest that the main topic of this cluster could be the investigation of the relationship between accounting and using cryptocurrency as a currency to settle secure money transactions. It includes 20 articles.
- (2) The yellow cluster includes the following keywords: BT, DLT and Ethereum issues. These keywords suggest that the main topic of this cluster could relate to the feature of the distributed ledger of BT, Ethereum, and the accounting processes and activities. This cluster includes 17 papers.
- (3) The red cluster includes the following keywords: blockchain, accounting, audit, machine learning, artificial intelligence and smart contracts. These keywords suggest that the main topic of this cluster could be the combination of BT and other technologies, especially artificial intelligence applied in the accounting and auditing function/fields. It contains 37 papers and is the most numerous of the four clusters, so it could be considered the most investigated topic.
- (4) The blue cluster includes the following keywords: BT, IoT, green computing and decentralization. Considering the keywords of the cluster, we could identify that the

main topic could be related to the combination of BT with other technologies, as the IoT and the decentralization of the system in the accounting field. It includes 20 papers.

Starting from the above mentioned cluster analysis, we read the papers of each cluster to analyze more in depth the content of the papers and deduce more specific considerations about topics, their relevance and derive underdeveloped streams of research.

4.2.1 The green cluster: accounting of cryptocurrency. The papers collected in this cluster focused on bitcoin, which, although it is the most known, is not the only example of cryptocurrencies (there are Monero, Ethereum, Zcash, etc.). In this cluster, the blockchain is instrumental in using cryptocurrencies and indirectly ensures their efficacy in terms of timeliness, reliability, security of transactions and related information.

Many studies deal with e-commerce transactions through bitcoin, but there is little academic research on the implications of bitcoin for governance and accountability.

In this cluster, we can find two streams of research. The first is related to enhancing the use of bitcoin. One paper ([Holub and Johnson, 2018](#)) is a literature review to show the poliedric issue of the bitcoin, considering it “across disciplines”: among different categories (such as technology, economics, finance, accounting, tax and regulation), the accounting collected only 1.1% of papers examined by authors. In this paper, the blockchain is considered in its original use as a permanent record of transactions, as bitcoin protocol and the leading financial innovation enabled by bitcoin are associated with BT. [Broadhead \(2018\)](#) deals with cybercrime in a broader sense as “any illegal behaviour committed by means of, or in relation to, a computer system or network, including such crimes as possession, offering or distributing information using a computer system or network”. The use of bitcoin linked to the darknet, as private blockchain can generate several illicit activities.

The second stream of research is more specific. It regards the recognition and measurement of Bitcoin in the financial statement, highlighting the need to have an accounting standard for a generally accepted accounting treatment.

[Ram et al. \(2016\)](#), adopting the theories of neoliberalism and stewardship, offer a possible basis for developing accounting policies when a transaction or event is not the object of an existing international financial reporting standard, as the bitcoin. Cost and fair value may be different methods to communicate the economic rationale for holding bitcoin. Through interviews with experts, the authors show that where the bitcoin is used speculatively, the respondents favored measurement at fair value, which allows communicating best the volatility of the value and the bitcoin nature as a financial resource; when the bitcoin is used in the production or supply of goods or services the respondents prefer the cost model, which offers more appropriate information to communicate the allocation of bitcoin cost to cost objects.

In line with the previous article, [Procházka \(2018\)](#) assesses and compares different models of accounting treatment of cryptocurrency, performing a literature review and an empirical analysis. The author derived that, as IASB (International Accounting Standards Board) has not assumed a position about cryptocurrency accounting, it may be treated according to the existing standards considering the purpose of the company’s acquisition of cryptocurrency. Furthermore, the author underlines the need for empirical research on companies practices to compare different models of accounting treatments on an empirical basis and collect insight on voluntary reporting practices.

Similarly, [Morozova et al. \(2020\)](#) consider the procedure for a fair evaluation of crypto assets, proposing a model based on the existing practices for managing the value of this asset. These authors recognize that crypto assets have all attributes of a general asset complaint with the conceptual framework of IFRS, such as right, control and expected economic benefit and propose a comprehensive approach to different crypto assets set to continue or to be sold. The authors hope for a new accounting standard from IASB, which regulates the disclosure

on operations with cryptographic assets regarding the formation of their cost, classification and revaluation after recognition.

The papers included in the green cluster are essentially linked to the first tier of BT as categorized by [Swan \(2015\)](#), in fact they discuss the implications of cryptocurrency seen as a means to manage money transfer and digital payments. Furthermore, studies in the green cluster adopt a comprehensive orientation to BT considering both technology and accounting issues to develop the investigation and deepen the implications of BT in terms of cybercrime and darknet, accounting principles of cryptocurrency and fair value of crypto assets.

4.2.2 The yellow cluster: accounting for transactions with distributed ledger. Yellow cluster focuses on BT's technical characteristics and potential, emphasizing how it can encourage the efficient and effective management of transactions. Since the BT does not allow third-parties to intervene in the transaction, on the one hand, it reduces agency conflict and information asymmetry, creating trust between the parts; on the other hand, it ensures the transparency and integrity of data because they cannot be manipulated and the public ledger can be accessed by anyone and anywhere.

In this cluster, three papers highlight the impacts of BT on the management of operational processes and finance/accounting transactions, reflecting on the business model too. [Rashideh \(2020\)](#) shows the effects of BT in the tourism industry. It traditionally has a relevant number of stakeholders and intermediaries (such as tour operators, travel agencies, insurance firms, etc.), but BT adoption opens the door for direct communication among parties and reduces the number of mediators, leading to the cost reduction and increasing security of payment. These aspects also require a redefinition of the business model: BT use in the tourism industry increases its level of disintermediation and reduces the number of new entrants. Finally, this reflects on more efficiency, reduction of time and costs for travelers. [Afanasyev et al. \(2020\)](#) reach a similar conclusion in Russian's electric energy market: in this context BT allows to improve network efficiency, billing processes, supply chain and enables new sources of innovation that reflect on review of business model. In particular, BT can support the programs for producing and installing modern meters to account for the expenditure of electric energy consumed by companies and individuals. [Lakshmi and Sricharan \(2019\)](#) study the relevance of BT in the shared service industry and show the potential of BT in rewriting the foundation of business. The findings confirm that the two functions in which the BT can offer more advantages are the finance and accounting function, based on trust and audit trail, and supply chain management, where procurement, invoicing and payment can be blockchain-enabled for quick transactions and automatic reconciliations. In fact, the BT changes how finance and accounting transactions are saved, processed and retrieved and allow processing decentralized transactions at a higher speed and lower cost.

Finally, [Rien and Susilowati \(2019\)](#) highlight the advantages of BT to prevent corruption in Indonesian public procurement, in which fraudulent behaviors are widespread and highly impacting. They can impact in different areas: financial; health; human's safety; innovation. The authors emphasize the pivotal role of BT to prevent corruption and data manipulation and so ensure trust and efficiency in public procurement.

The papers included in the yellow cluster are essentially linked to the second tier of BT as categorized by [Swan \(2015\)](#), in fact they discuss DLT to manage several types of transactions in the financial area, not simple cash transactions. BT is seen as a means of trust and integrity of business transactions which can effectively support them. Furthermore, studies in the green cluster adopt a moderate orientation toward technology and accounting issues, focusing more on implications of BT in terms of efficiency, cost reduction, reliability and timeliness of operational and financial processes.

4.2.3 The red cluster: accounting and auditing in a blockchain context. The red cluster includes papers that analyze blockchain as a technology applied to manage a wide range of transactions, not limited to the transfer of digital money and to the application of smart

contracts. These articles discuss benefits and challenges that BT could bring into the accounting domain and they could be divided into three sub-areas of topics:

- (1) accounting;
- (2) audit profession;
- (3) accountability.

In the literature examined, BT mainly intercepts accounting in two meanings: accounting information system and accounting profession.

Under the first stream of research, considering the accounting topic in a narrow sense, [Dai and Vasarhelyi \(2017\)](#) explore the potential of blockchain applications to accounting and audit, contributing to constitute a “New accounting ecosystem”. Considering the specific accounting theme analyzed, this paper proposes a blockchain-enabled, real-time, verifiable and transparent accounting ecosystem. In the ecosystem, blockchain would play the role of the accounting information system, which distributes the power of transaction verification, storage and management to a group of computers in order to prevent any unauthorized data changes, enabling the automated recording and measurement of business performance.

Additionally, the authors link ERP (Enterprise Resource Planning) systems and the use of BT; indeed, large organizations operating multiple ERPs may have to invest valuable resources to integrate blockchain applications with each system. The acceptance and use of ERP systems have proven to be significantly influenced by regulator pressure. Therefore, regulators are expected to play an essential role in the adoption stage of blockchain within the accounting sphere. Regulators should have a deep understanding of the technology and its impact on businesses, and provide appropriate guidance and supervision to prevent misuse and abuse of blockchain and smart contracts.

Moreover, they also argue that, because of the nature of blockchain, once an accounting entry is confirmed and added to the chain, it can hardly be altered or destroyed. Moreover, smart contract technology could enable rapid verification of transaction records following accounting standards or pre-specified business rules. By encoding the third accounting entry into blockchain, a transparent, cryptographically secure and self-verifying accounting information system can be generated, which could facilitate reliable data sharing between business parties and continuous reporting for shareholders.

According to [Moll and Yigitbasioglu \(2019\)](#) the development of a new accounting ecosystem allows the widespread adoption of “transactional reporting”, where stakeholders will decide how to aggregate data in information and visualize them in reports and financial statements. Furthermore, the authors suggest that the increasing transparency of data and information could justify revising the accounting standard. Also [Dai and Vasarhelyi \(2017\)](#) argue about how the existing accounting standards can be adapted to the increasingly verifiable and transparent accounting ecosystem.

Moreover, as explained by [Kokina et al. \(2017\)](#), numerous initiatives are implemented by the Big 4 accounting firms (Deloitte, PricewaterhouseCoopers, Ernst and Young, and KPMG) for the foundation of a distributed ledger consortium for the accounting industry, and they create five working groups to work with the standard setters and assist in developing accounting standards to regulate blockchain use. They also aim to develop assurance and advisory needs because this technology enters the accounting profession.

Considering the advantages and obstacles of using BT in the accounting domain, many authors argue that BT brings lower costs of information to be recorded and reported ([Gökalp et al., 2018](#); [Dai and Vasarhelyi, 2017](#)) but currently BT has some drawbacks as high electricity consumption, large amount of storage space, risks in losing access to the network ([Kwilinski, 2019](#)). By studying the implementation of BT to manage financial accounting and

accounting processes more in-depth, some studies investigate the pros and cons of this new technology compared to the traditional ones (enterprise resource planning, electronic data interchange, data warehouse, etc.). O'Leary (2017) discusses how different configurations of BT (centralized vs. decentralized; public vs. private, peer-to-peer vs. cloud-based) could fit different needs in the accounting information processes, and he wonders if BT "can do those things cheaper, better or faster" than the traditional technologies (p. 145). Furthermore, Coyne and McMickle (2017) consider the implementation of BT to substitute the current accounting ledgers; they underline that even if BT could offer an opportunity of innovation in accounting there are some issues needed to solve. They wonder how to guarantee the same level of reliability of public blockchain in a private one and, in general, how BT can be flexible to comply with current accounting needs. Kwilinski (2019) classifies BT advantages in managing accounting procedures in five categories: organizational, economical, professional, qualitative and technological.

O'Leary (2017) demands for more research to investigate costs and benefits of blockchain and hybrid systems in accounting, developing case study analysis which questioning automation vs. re-engineering of processes, while Coyne and McMickle (2017) identify as possible issue to address "how accounting might change to take advantage of the benefits of the blockchain" (p. 111).

The second line of research of the articles in the red cluster links the BT with the accountants' skills and reputation. The growing implementation of BT technology in accounting information systems may require some new skills (Henage, 2020) that accounting professionals have to acquire through university programs. In particular, Qasim and Kharbat (2020) suggest to include a course on the introduction to business technologies, and to substitute the course of accounting information systems with digital accounting, in order to give a complete overview and knowledge on modern technologies for accounting (XBRL, big data analytics, artificial intelligence, blockchain).

An interesting view on BT is also found in Sheldon (2018) who proposes BT as a tool to collect and share information regarding accounting professional misconduct. This type of application of BT is relevant to enhance transparency and accountability for accounting professional activities and is also an example of the employment of BT to alleviate issues related to professional and quality transactions to assure an objective measurement of reputation and to manage a system of incentives and punishment. Even if some key questions have to be face yet, as for example who manage the system, who define incentives and punishment, who pay for the development of the system and so on, this way to apply BT could be very powerful for the accounting profession "as the technology matures and as a broader audience becomes familiar with the functionality and potential of the tool".

Other papers of the red cluster deal with the audit topic, analyzed under different perspectives.

Most studies deal with the topic of automated assurance and continuous audit (Rodríguez-Espíndola *et al.*, 2020; Rozario and Thomas, 2019; Dai and Vasarhelyi, 2017; Kokina *et al.*, 2017).

They argue that BT could also serve as a foundation to enable automatic assurance and help the current auditing paradigm become more agile and precise. According to Dai and Vasarhelyi (2017), the new audit paradigm would consist of two components: (1) a physical world and (2) a mirror world, which is a virtual model that reflects business activities and conditions of objects in the physical world. Each physical object would have a virtual representation in the mirror world, with the conditions, locations, surrounding environment, history and activities continuously transmitted via IoT or other information and communication technology. The mirror world is composed of three layers: blockchain, smart control and payment. Moreover, the auditors' role in the new accounting system should be rethought, and the current audit paradigm may need reengineering.

Moreover, [Kokina et al. \(2017\)](#) state that accounting researchers should examine in the context of auditing how to develop a triple-entry accounting system that enables BT to be an intermediary that automates transaction storage and verification. Auditing researchers should also examine ways to develop internal controls for blockchain applications, understand their auditability and incorporate internal control protocols into smart contracts, called “smart controls”.

A relevant contribution to the topic is offered by [Birch and Parulava \(2018\)](#); they discuss about the possibility provided by BT to maintain a transaction ledger across multiple organizations and about the so called “Glass organizations”, where anyone could run software to check their accounts without actually being able to read every item of data in them. For financial markets this kind of controlled transparency will be a competitive advantage for both permissioned and permissionless ledgers: as an investor, as a customer, as a citizen. This brings to the era of ambient accountability, where the technological architecture means constant verification and validation. In other words, the ability to constantly monitor the ledgers (albeit in an encrypted form) and we will no longer need to wait until the end of the reporting period to conduct an audit and produce the results with the help of skilled financial professionals.

Regarding financial information, [Roszkowska \(2021\)](#) considers if FinTech can overcome or mitigate financial reporting and auditing problems, improving the reliability of financial information and increasing auditing quality. The authors consider two big scandals linked to financial statements fraud, such as Enron and its auditor Arthur Andersen, to reach this aim. In particular, the blockchain has a pivotal role because it can be used for recordkeeping processes. Compared to traditional accounting software it allows for keeping well structured, stored, easily accessible each time. If Enron had recorded all transactions on the blockchain, they would have been linked to Enron and not to SPEs and the records have been immutable, undelete and unchangeable, representing a great platform for the external auditor’s work and allowing investors to realize the company’s results sooner.

The final strand of research that we can identify in the red cluster concerns accountability, studied in different industries with many case studies related to food supply chain ([Kumar et al., 2020](#)), to humanitarian supply chain during disaster management (financial and logistic flows) ([Rodríguez-Espíndola et al., 2020](#)). Then, there are other studies dealing with powering the poor in developing countries considering renewable energy projects and real time auditing of the entire industry of renewable ([Thomason et al., 2018](#); [Duchenne, 2018](#)), inspect climate finance flows from government budgets and capital markets ([Duchenne, 2018](#)). BT represents an interesting opportunity also in the field of sustainability and a boost to reduce greenhouse gas emissions. [Zhang et al. \(2018\)](#) ponder the application of such a type of technology to measure and account green investment return and to create a transparent and reliable system for emission trading and tracking the investment of green financial resources.

The papers included in the red cluster are also linked to the second tier of BT as categorized by [Swan \(2015\)](#), in fact they discuss BT seen as a means of reinventing accounting and auditing domains. Furthermore, studies in the red cluster strongly focus on discovering new pathways of accounting and auditing enabled by BT as the reconfiguration of accounting ecosystems, skills, continuous auditing and accountability.

4.2.4 The blue cluster: decentralization framework for accounting. The papers belonging to the blue cluster consider BT as a service because of the opportunity to use several applications based on this technology for all kinds of transactions and simplify human-machine interaction. Many researchers ([Kumar and Mallick, 2018](#); [Desai et al., 2018](#)) tries to apply BT and smart contracts to find a novel alternative for tracking, managing data sharing agreements, in particular related to medical service record, insurance payment and insurance agreements within the distribute immutable ledger ([He et al., 2018](#)). Indeed, decentralized networks strive to reduce the level of trust that participants must place in one another, and deter their ability to exert authority or control over one another in ways that degrade the functionality of the network.

The papers included in the blue cluster are linked to the third tier of BT as categorized by Swan (2015); in fact they discuss BT seen as a service to answer to the needs of society, translating traditional BT applications to new contexts such as health, government, etc. Furthermore, studies in the blue cluster strongly focus on discovering technological solutions and systems to extend BT in social and human problems, while accounting and accountability orientation is not fully considered. Therefore, there is a need to explore these issues further paving the way to new approaches to the tracking and managing of data sharing through the lens of the accounting domain.

Figure 9 shows the matrix of the accounting domain and blockchain technology (ADOB). This matrix represents a framework to systematize and visualize the map of current studies about the BT in the accounting domain. Starting from the systematic analysis of the four clusters and on the three tiers of BT, current research pathways can be represented according to the accounting domain and the BT domain. The first dimension highlights how much research deals in depth with the evolution of the accounting domain through the BT, considering the technology domain as a context factor. The second one underlines the extent to which research addresses issues more or less focused on technical aspects of BT, considering the accounting domain only as a background.

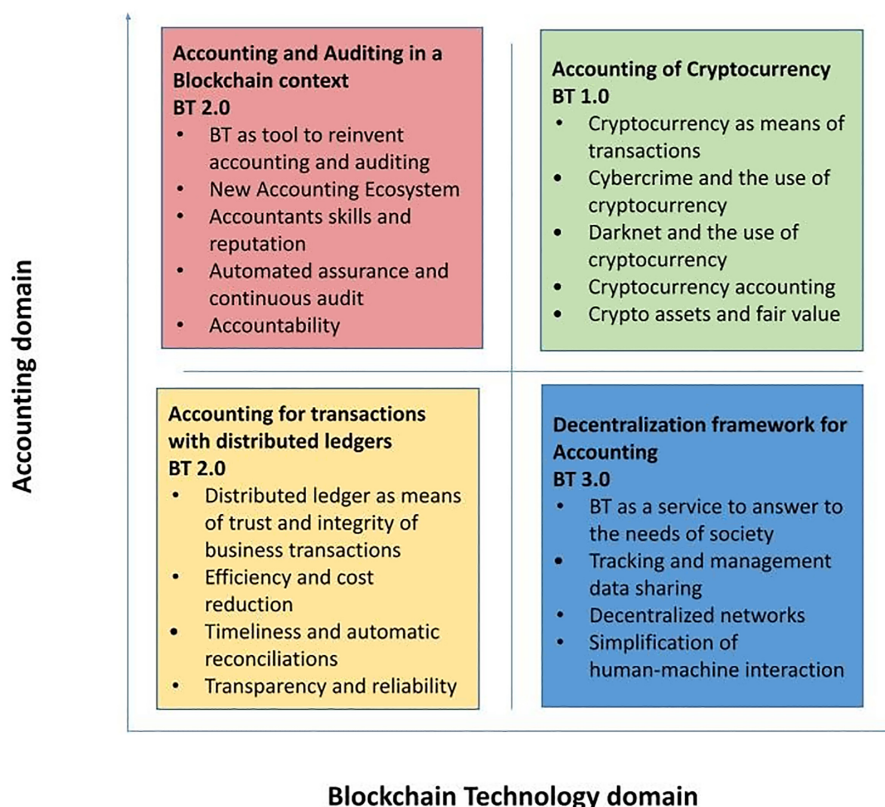


Figure 9.
The ADOB framework

5. Conclusions

BT is one of the most important capabilities of Industry 4.0 (Lardo *et al.*, 2020). Starting from its initial appearance in the field of bitcoins for online financial transactions, it has gained the role of technology infrastructure for trustworthy and reliable transactions among companies and other economic players (smart contracts). It is currently being considered relevant support for effective and timely management and recording transactions inside companies (triple ledger accounting).

On a practical level, BT has become a key issue for companies that need to understand the real potential of this technology in the current frontier of accounting (EY, 2017; PwC, 2017). Furthermore, in investigating BT, scientific research is moving from an initial technology and engineering perspective to a wide interest from other academic fields such as law, economics, public management, health, auditing and accounting (Alkhudary *et al.*, 2020). Particularly, in the accounting domain many scholars (Bonsón and Bednárová, 2019; Tiron-Tudor *et al.*, 2021; Maffei *et al.*, 2021) request for more investigations regarding how BT affects accounting and auditing processes and jobs, how BT can be applied in a real ecosystem, and how awareness and consensus could be stimulated in stakeholders and other actors of the ecosystem, such as regulators, auditors and public administrators. Furthermore, Schimtz and Leoni (2019), foreseeing potential to revolutionize the profession ecosystem, ask for future investigation on BT in accounting and auditing to explore BT applications.

Starting from these observations, this study has performed an investigation of the existing literature linking blockchain and accounting research through a bibliometric analysis performed through the Scopus database and a data set of 189 research documents. The main goal of this study is to map the current state of the knowledge about BT applied in the accounting domain and to identify topics and interesting questions for future research. In particular, we aim at identifying the main research venues in the intersection between BT and accounting.

Trying to answer the first research question guiding our study, we can state that the production and temporal distribution of scientific documents from 2015 reveals a growing interest on this topic in the last three years, in fact the number of scientific documents is increasing. Equally, our results demonstrate growing interconnected research due to the increased number of documents co-authored during the years.

We investigated the spatial distribution of BT research in the accounting domain considering sources and countries. Among the journals with a greater number of documents, are prevailing those with computer and technological orientation. Considering the geographical distribution of scientific documents, the USA is the most important country in terms of publications and co-authorships. On the one hand, it is followed by other Anglo-Saxon countries such as the UK and Australia and, on the other hand, from Germany, Netherlands and China. In this field of research, it is relevant to notice that the main countries that emerged as co-authorship have been the pioneers of Industry 4.0, and that USA and China are the most prolific and the most linked. Furthermore, these two main global economic powers are also the main countries in the top 10 cited documents and authors. All this evidence demonstrates that their research institutions and affiliated researchers are the most influential contributors to the body of knowledge regarding BT and accounting.

Considering the temporal structure of the studies on BT and accounting body of knowledge, the bibliometric analysis shows that most research documents were published between 2015 and 2017. The year that we can consider the most relevant is 2018, because the publications of that year probably have stimulated the research on BT and accounting published in 2020.

To address the second research question, we investigate the co-occurrence of keywords and analyze the clusters identified. Current studies on BT in the accounting domain are built around applying this technology to accounting, accounting information systems, auditing and assurance. The keywords closely associated with blockchain are bitcoin, cryptocurrency(ies), IoT and smart contracts. These are the areas with which blockchain is

traditionally linked from a technological point of view. Instead, keywords that pertain to very specific concepts, linked to the application of BT, are communication channels, decentralized depository receipts, 21st century skills and accounting competences.

From the cluster analysis, it is possible to carry out the thematic analysis, which involves numerous aspects on the different tiers of BT.

The theme still much investigated concerns the primordial aspect linked to cryptocurrencies with particular reference to bitcoin, as for the BT 1.0 tier. In this perspective, BT allows a different transactions' management, which, on the one hand, relates more to management accounting and, on the other, to financial accounting. The first is linked to the reduction in intermediation level that impacts a different management of processes and a redefinition of business models. The second one has a direct impact on the financial statements because it is needed to introduce new ways of evaluating transactions with cryptocurrencies: in fact, there have been many calls for the issuance by the IASB of a specific standard that adapts the old accounting models to the new transactions.

The second theme, associated with the BT 2.0 tier, is related to the characteristics of the new technology and its impact on the conditions of effectiveness of the information system that affects the accounting domain linked to bookkeeping recording. This makes it possible to increase the security, transparency and controllability of information, which are the characteristics that most impact auditing. In fact, in the context of our analysis on the accounting domain, auditing seems to be the theme that first attracted the interest of scholars. The radical change in the information system opens up the problem of the education of accountants' skills which represents another interesting theme that attracts the interest of scholars albeit it is still extremely fragmented (Tiron-Tudor *et al.*, 2021). Indeed, also considering indications coming from the keywords analysis, our results show that the study of accounting competences and 21st century skills is yet marginal and calls for further research on the role of education and training to allow future practitioners to be oriented in the current working environment.

Moreover, themes yet to be fully developed that are associated with more recent and future BT applications (BT 3.0) and can offer benefits to accounting for a wide range of issues and benefit society as a whole to support human-machine interaction. Such studies (Kumar and Mallick, 2018; Desai *et al.*, 2018) try to find a novel alternative for tracking and managing data sharing agreements, particularly related to specific applications in different industries. It is noteworthy that these studies analyze these issues across sectors: medical service record, insurance payment and insurance agreements within the distributed immutable ledger (He *et al.*, 2018); tourism reducing the role of intermediaries (Rashideh, 2020); the public sector to reduce costs and allow resources to be diverted from ancillary activities on core activities; multi-utilities management also for reliable accounting of energy services (Afanasyev *et al.*, 2019) and shared services (Lakshmi and Sricharan, 2019).

Finally, results of our study demonstrate that the current state of knowledge does not include topics such as awareness and consensus around the BT and engagement of regulators, auditors and public administrators to develop and use the potential of BT, therefore further research is needed in these directions.

According to our bibliometric analysis discussion, we outline a final Table 8 that synthesizes the main future lines of research and correlated research agenda of BT tiers in the accounting domain that can guide academic researchers.

The study also has some limitations. The first is that we only consider the Scopus database, so it probably does not cover all the literature on BT and accounting. The second limit of our analysis to the business, management and accounting field, excluding other related areas such as computer science, information systems, and engineering.

The results of this research have some implications from a theoretical and practical level. It constitutes the first attempt to conceptualize the structure of knowledge developed in the

Table 8.
Main future research lines and a research agenda for academic researchers

BT tiers in accounting domain	Future research lines	Research agenda
BT 1.0	<ul style="list-style-type: none"> - Cryptocurrency accounting and Crypto assets valuation 	<ul style="list-style-type: none"> • How do traditional accounting standards fit the recognition of cryptocurrencies in financial statements?
BT 2.0	<ul style="list-style-type: none"> - Cryptocurrency and Crypto assets in financial reporting - Performance Measurement and Control of BT impacts - Potentialities and risks of BT in automating financial and administrative processes in several organizations 	<ul style="list-style-type: none"> • What information do companies disclose in their financial reporting? • Which is the relationship between BT and XBRL in financial reporting? • To what extent traditional managerial accounting techniques apply to BT? • Which are key-indicators useful for evaluating BT sustainability? • How can we use BT for green accounting and auditing? • How BT features meet Chief Financial Officer's needs? • Can a BT accounting information system improve the reliability of financial information?
BT3.0	<ul style="list-style-type: none"> - BT and Education - Continuous auditing, Smart controls and "glass organizations" - Decentralized networks for accounting, control and auditing - Potentialities of BT for tracking and managing data sharing 	<ul style="list-style-type: none"> • Risks and barriers to the use of blockchain in financial and administrative areas? • How can university programs enable the acceptance of BT in the accounting domain? • What are the pivotal capabilities for accountants' readiness to embrace smart technologies? • How can universities play a pivotal role in the New BT accounting ecosystem? • How can firms become glass organizations integrating smart controls? • How the use of BT can prevent financial statements fraud? • What are the new pathways of the dichotomy between trust and control in BT context? • How can the growing use of decentralized networks increase trust? • What are effective and new control mechanisms in trusted decentralized networks? • Which is the strength of BT use for data sharing in accounting and auditing processes? • What new services can emerge for accounting and auditing leveraging BT potential of tracking and managing data sharing?

accounting fields related to BT; this analysis helps researchers to identify future avenues of investigations to meet the growing need of companies to address the practical issues of BT implementation. We notice that the application of BT for management control and cost accounting is poorly investigated although it would be a relevant use within the accounting domain. Different studies focus on process management and supply-chain; instead, little attention is paid to measure internal transactions. After this analysis, we believe that potential research lines are related to using management accounting techniques to identify and assess, among several BT applications, the more proper technology to be implemented in companies.

Secondly, our research highlights the need for a prominent effort for international political and professional institutions to collaborate between countries and research centers to stimulate BT's adoption to assure trustworthy, effective, timely and efficient transactions in the new economic ecosystem. In this perspective, it would be useful to develop case studies about the application of BT in multinational companies or business networks to assess and report transactions, to foster its adoption.

References

- Afanasyev, V.Y., Lyubimova, N.G., Ukolov, V.F. and Shayakhmetov, S.R. (2019), "Digitalization of energy manufacture: infrastructure, supply chain strategy and communication", *International Journal of Supply Chain Management*, Vol. 8 No. 4, pp. 601-609.
- Afanasyev, V. Y., Lyubimova, N. G., Ukolov, V. F. and Shayakhmetov, S. R. (2020), "Impact of blockchain technology for modification of the supply chain management in energy markets", *International Journal of Supply Chain Management*, Vol. 9 No. 3, pp. 757-762.
- Aghaei Chadehgan, A., Salehi, H., Yunus, M., Farhadi, H., Fooladi, M., Farhadi, M. and Ale Ebrahim, N. (2013), "A comparison between two main academic literature collections: web of science and Scopus databases", *Asian Social Science*, Vol. 9 No. 5, pp. 18-26.
- Alkhudary, R., Brusset, X. and Fenies, P. (2020), "Blockchain in general management and economics: a systematic literature review", *European Business Review*, Vol. 32 No. 4, pp. 765-783.
- Aste, T., Tasca, P. and Di Matteo, T. (2017), "Blockchain technologies: the foreseeable impact on society and industry", *Computer*, Vol. 50 No. 9, pp. 18-28.
- Baier-Fuentes, H., Merigó, J.M., Amorós, J.E. and Gaviria-Marín, M. (2019), "International entrepreneurship: a bibliometric overview", *International Entrepreneurship and Management Journal*, Vol. 15 No. 2, pp. 385-429.
- Birch, D.G. and Parulava, S. (2018), "Ambient accountability: shared ledger technology and radical transparency for next generation digital financial services", in *Handbook of Blockchain, Digital Finance, and Inclusion*, Academic Press, Vol. 1, pp. 375-387.
- Bonsón, E. and Bednárová, M. (2019), "Blockchain and its implications for accounting and auditing", *Meditari Accountancy Research*, Vol. 27 No. 5, pp. 725-740.
- Broadhead, S. (2018), "The contemporary cybercrime ecosystem: a multi-disciplinary overview of the state of affairs and developments", *Computer Law and Security Review*, Vol. 34 No. 6, pp. 1180-1196.
- Bruns, H.-J., Christensen, M. and Pilkington, A. (2020), "Intellectual heritages of post-1990 public sector accounting research: an exploration", *Accounting, Auditing & Accountability Journal*, Vol. 33 No. 8, pp. 2077-2110.
- Cai, C.W. (2018), "Disruption of financial intermediation by FinTech: a review on crowdfunding and blockchain", *Accounting and Finance*, Vol. 58 No. 4, pp. 965-992.
- Casey, M. and Vigna, P. (2018), *The Truth Machine: The Blockchain and the Future of Everything*, Harper Collins, New York.
- Casino, F., Dasaklis, T.K. and Patsakis, C. (2019), "A systematic literature review of blockchain-based applications: current status, classification and open issues", *Telematics and Informatics*, Vol. 36, pp. 55-81.

-
- Chang, S.E., Chen, Y.C. and Lu, M.F. (2019), "Supply chain re-engineering using blockchain technology: a case of smart contract based tracking process", *Technological Forecasting and Social Change*, Vol. 144, pp. 1-11.
- Coyne, J.G. and McMickle, P.L. (2017), "Can blockchains serve an accounting purpose?", *Journal of Emerging Technologies in Accounting*, Vol. 14 No. 2, pp. 101-111.
- CPA Canada, AICPA and UWCISA (2017), "Blockchain technology and its potential impact on the audit and assurance profession", available at: www2.deloitte.com/content/dam/Deloitte/us/Documents/audit/us-audit-blockchain-technology-and-its-potential-impact-on-the-audit-and-assurance-profession.pdf (accessed 6 September 2019).
- Dabbagh, M., Sookhak, M. and Safa, N.S. (2019), "The evolution of blockchain: a bibliometric study", *IEEE Access*, Vol. 7, pp. 19212-19221.
- Dai, J. and Vasarhelyi, M.A. (2017), "Toward blockchain-based accounting and assurance", *Journal of Information Systems: Fall*, Vol. 31 No. 3, pp. 5-21.
- Desai, H., Liu, K., Kantarcioglu, M. and Kagal, L. (2018), "Adjudicating violations in data sharing agreements using smart contracts", *2018 IEEE International Conference on Internet of Things (iThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData)*, IEEE, pp. 1553-1560.
- Duchenne, J. (2018), "Blockchain and smart contracts: complementing climate finance, legislative frameworks, and renewable energy projects", in *Transforming Climate Finance and Green Investment with Blockchains*, Academic Press, pp. 303-317.
- EY (2017), "How blockchain will revolutionize finance and auditing", available at: <https://betterworkingworld.ey.com/digital/blockchain-why-finance-and-auditing-willnever-be-the-same>.
- Faccia, A. and Mosteanu, N.R. (2019), "Accounting and blockchain technology: from double-entry to triple-entry", *Business and Management Review*, Vol. 10 No. 2, pp. 108-116.
- Fanning, K. and Centers, D.P. (2016), "Blockchain and its coming impact on financial services", *Journal of Corporate Accounting and Finance*, Vol. 27 No. 5, pp. 53-55.
- Firdaus, A., Razak, M.F.A. and Feizollah, A. (2019), "The rise of 'blockchain': bibliometric analysis of blockchain study", *Scientometrics*, Vol. 120, pp. 1289-1331.
- Garriga, M., Dalla Palma, S., Arias, M., De Renzis, A., Pareschi, R. and Andrew Tamburri, D. (2021), "Blockchain and cryptocurrencies: A classification and comparison of architecture drivers", *Concurrency and Computation: Practice and Experience*, Vol. 33 No. 8, pp. 1-21.
- Gökalp, E., Gökalp, M.O., Çoban, S. and Eren, P.E. (2018), "Analyzing opportunities and challenges of integrated blockchain technologies in healthcare", in *Eurosymposium on Systems Analysis and Design*, Springer, Cham, pp. 174-183.
- Grover, P., Kari, A.K. and Ilavarasan, P.V. (2018), "Blockchain for businesses: a systematic literature review", in Al-Sharhan, S.A., Simintiras, A.C., Dwivedi, Y.K., Janssen, M., Mäntymäki, M., Tahat, L., Moughrabi, I., Ali, T.M. and Rana, N.P. (Eds), *Challenges and Opportunities in the Digital era, Conference on e-Business, e-Services, and e-Society, I3E 2018*, Kuwait City, 30 October–1 November, 2018, pp. 325-336.
- He, X., Alqahtani, S. and Gamble, R. (2018), "Toward privacy-assured health insurance claims", *2018 IEEE International Conference on Internet of Things (iThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData)*, IEEE, pp. 1634-1641.
- Henage, R. (2020), "KPMG Spark: bringing cutting-edge technology to SME clients", *Academy of Accounting and Financial Studies Journal*, Vol. 24 No. 3, pp. 1-7.
- Holub, M. and Johnson, J. (2018), "Bitcoin research across disciplines", *The Information Society*, Vol. 34 No. 2, pp. 114-126.
- Iansiti, M. and Lakhani, K.R. (2017), "The truth about blockchain", *Harvard Business Review*, Vol. 95 No. 1, pp. 118-127.

- Ikpaaahindi, L. (1985), "An overview of bibliometrics: its measurements, laws and their applications", *Libri*, Vol. 35 No. 2, pp. 163-177.
- Ji, L., Liu, C., Huang, L. and Huang, G. (2018), "The evolution of resources conservation and recycling over the past 30 years: a bibliometric overview", *Resources, Conservation and Recycling*, Vol. 134, pp. 34-43.
- Jin, R., Yuan, H. and Chen, Q. (2019), "Science mapping approach to assisting the review of construction and demolition waste management research published between 2009 and 2018", *Resources, Conservation and Recycling*, Vol. 140, pp. 175-188.
- Kiviat, T.I. (2015), "Beyond bitcoin: issues in regulating blockchain transactions", *Duke Law Journal*, Vol. 65, pp. 569-608.
- Kokina, J., Mancha, R. and Pachamanova, D. (2017), "Blockchain: emergent industry adoption and implications for accounting", *Journal of Emerging Technologies in Accounting*, Vol. 14 No. 2, pp. 91-100.
- Kumar, A., Jha, G., Sharma, L. and Khatri, S.K. (2019), "Challenges potential and future of internet of things integrated with blockchain", *International Journal of Recent Technology and Engineering*, Vol. 8 No. 2s7, pp. 530-536.
- Kumar, A., Liu, R. and Shan, Z. (2020), "Is blockchain a silver bullet for supply chain management? Technical challenges and research opportunities", *Decision Sciences*, Vol. 51 No. 1, pp. 8-37.
- Kumar, N.M. and Mallick, P.K. (2018), "Blockchain technology for security issues and challenges in IoT", *Procedia Computer Science*, Vol. 132, pp. 1815-1823.
- Kummer, S., Herold, M., Dobrovnik, M., Mikl, J. and Schäfer, N. (2020), "A systematic review of blockchain literature in logistics and supply chain management: identifying research questions and future directions", *Future Internet*, Vol. 12 No. 3, pp. 1-15.
- Kwilinski, A. (2019), "Implementation of blockchain technology in accounting sphere", *Academy of Accounting and Financial Studies Journal*, Vol. 23, pp. 1-6.
- Lakshmi, N. and Sricharan, S. (2019), "Blockchain: single source of truth in shared services? An empirical paper on the relevance of blockchain for shared services", *International Journal of Recent Technology and Engineering*, Vol. 7, pp. 1783-1788.
- Lamboglia, R., Lavorato, D., Scornavacca, E. and Za, S. (2020), "Exploring the relationship between audit and technology. A bibliometric analysis", *Meditari Accountancy Research*, Vol. 29 No. 5.
- Lardo, A., Mancini, D., Paoloni, N. and Russo, G. (2020), "The perspective of capability providers in creating a sustainable 14.0 environment", *Management Decision*, Vol. 58 No. 8, pp. 1759-1777.
- Larios-Hernández, G.J. (2017), "Blockchain entrepreneurship opportunity in the practices of the unbanked", *Business Horizons*, Vol. 60 No. 6, pp. 865-874.
- Li, L.-L., Ding, G., Feng, N., Wang, M.-H. and Ho, Y.-S. (2009), "Global stem cell research trend: bibliometric analysis as a tool for mapping of trends from 1991 to 2006", *Scientometrics*, Vol. 80 No. 1, pp. 39-58, doi: [10.1007/s11192-008-1939-5](https://doi.org/10.1007/s11192-008-1939-5).
- Lin, I.C. and Liao, T.C. (2017), "A survey of blockchain security issues and challenges", *International Journal of Network Security*, Vol. 19 No. 5, pp. 653-659.
- Lytvyn, V., Vysotska, V., Kuchkovskiy, V., Bobyk, I., Malanchuk, O., Ryshkovets, Y., Pelekh, I., Brodyak, O., Bobrivetc, V. and Panasyuk, V. (2019), "Development of the system to integrate and generate content considering the cryptocurrent needs of users", *Eastern-European Journal of Enterprise Technologies*, Vol. 1, pp. 18-39.
- Maffei, M., Casciello, R. and Meucci, F. (2021), "Blockchain technology: uninvestigated issues emerging from an integrated view within accounting and auditing practices", *Journal of Organizational Change Management*, Vol. 34 No. 2, pp. 462-476.
- Marrone, M. and Hazelton, J. (2019), "The disruptive and transformative potential of new technologies for accounting, accountants and accountability. A review of current literature and a call for further research", *Meditari Accountancy Research*, Vol. 27 No. 5, pp. 677-694.

-
- Mendingling, J., Weber, I., Aalst, W.V.D., Brocke, J.V., Cabanillas, C., Daniel, F., Debois, S., Ciccio, C.D., Dumas, M., Dustdar, S. and Gal, A. (2018), "Blockchains for business process management-challenges and opportunities", *ACM Transaction of Management Information Systems*, Vol. 9 No. 1, pp. 1-16.
- Miau, S. and Yang, J.-M. (2018), "Bibliometrics-based evaluation of the blockchain research trend: 2008 – March 2017", *Technology Analysis and Strategic Management*, Vol. 30 No. 9, pp. 1029-1045.
- Moll, J. and Yigitbasioglu, O. (2019), "The role of internet-related technologies in shaping the work of accountants: new directions for accounting research", *The British Accounting Review*, Vol. 51 No. 6, 100833.
- Morozova, T., Akhmadeev, R., Lehoux, L., Yumashev, A.V., Meshkova, G.V. and Lukiyanova, M. (2020), "Crypto asset assessment models in financial reporting content typologies", *Entrepreneurship and Sustainability Issues*, Vol. 7 No. 3, pp. 2196-2212.
- Nakamoto, S. (2008), "Bitcoin: a peer-to-peer electronic cash system", available at: <https://bitcoin.org/bitcoin.pdf>.
- Niranjanamurthy, M., Nithya, B.N. and Jagannatha, S. (2018), "Analysis of blockchain technology: pros, cons and SWOT", *Cluster Computing*, Vol. 22 No. 6, pp. 14743-14757.
- O'Leary, D.E. (2017), "Configuring blockchain architectures for transaction information in blockchain consortiums: the case of accounting and supply chain systems intelligent systems", *Accounting, Finance And Management Systems*, Vol. 24, pp. 138-147.
- Perianes-Rodríguez, A., Waltman, L. and Eck, N.J. (2016), "Constructing bibliometric networks: a comparison between full and fractional counting", *Journal of Informetrics*, Vol. 10 No. 4, pp. 1178-1195.
- Pimentel, E. and Boulianne, E. (2020), "Blockchain in accounting research and practice: current trends and future opportunities", *Accounting Perspectives*, Vol. 19 No. 4, pp. 325-361.
- Procházka, D. (2018), "Accounting for bitcoin and other cryptocurrencies under IFRS: a comparison and assessment of competing models", *The International Journal of Digital Accounting Research*, Vol. 18 No. 24, pp. 161-188.
- PwC (2017), "Auditing blockchain: a new frontier", available at: <https://www.pwc.com/us/en/industries/financial-services/research-institute/blog/blockchain-audit-a-michael-smith.html>.
- Qasim, A. and Kharbat, F.F. (2020), "Blockchain technology, business data analytics, and artificial intelligence: use in the accounting profession and ideas for inclusion into the accounting curriculum", *Journal of Emerging Technologies in Accounting*, Vol. 17 No. 1, pp. 107-117.
- Ram, A., Maroun, W. and Garnett, R. (2016), "Accounting for the bitcoin: accountability, neoliberalism and a correspondence analysis", *Meditari Accountancy Research*, Vol. 24 No. 1, pp. 2-35.
- Raman, R.K., Vaculin, R., Hind, M., Remy, S.L., Pissadaki, E.K., Bore, N.K., . . . & Varshney, K.R. (2019, May). "A scalable blockchain approach for trusted computation and verifiable simulation in multi-party collaborations", In *2019 IEEE International Conference on Blockchain and Cryptocurrency (ICBC)*, pp. 277–284.
- Rashideh, W. (2020), "Blockchain technology framework: current and future perspectives for the tourism industry", *Tourism Management*, Vol. 80, pp. 104-125.
- Rien, A.F. and Susilowati, D. (2019), "Preventing corruption with blockchain technology (case study of Indonesian public procurement)", *International Journal of Scientific and Technological Research*, Vol. 8 No. 9, pp. 2377-2383.
- Rodríguez-Espíndola, O., Chowdhury, S., Beltagui, A. and Albores, P. (2020), "The potential of emergent disruptive technologies for humanitarian supply chains: the integration of blockchain, artificial intelligence and 3D printing", *International Journal of Production Research*, Vol. 58 No. 15, pp. 4610-4630.
- Roszkowska, P. (2021), "Fintech in financial reporting and audit for fraud prevention and safeguarding equity investments", *Journal of Accounting and Organizational Change*, Vol. 17 No. 2, pp. 164-196.

- Rozario, A.M. and Thomas, C. (2019), "Reengineering the audit with blockchain and smart contracts", *Journal of Emerging Technologies in Accounting*, Vol. 16 No. 1, pp. 21-35.
- Schmitz, J. and Leoni, G. (2019), "Accounting and auditing at the time of blockchain technology: a research agenda", *Australian Accounting Review*, Vol. 29, pp. 331-342.
- Sheldon, M.D. (2018), "Using blockchain to aggregate and share misconduct issues across the accounting profession", *Current Issues in Auditing*, Vol. 12 No. 2, pp. 27-35.
- Sinha, S. (2020), "Blockchain – opportunities and challenges for accounting professionals", *Journal of Corporate Accounting and Finance*, Vol. 31, pp. 65-67.
- Swan, M. (2015), *Blockchain: Blueprint for a New Economy*, O'Reilly Media, Sebastopol, California.
- Tapscott, D. and Tapscott, A. (2017a), "How blockchain will change organizations", *MIT Sloan Management Review*, Vol. 58 No. 2, pp. 9-13.
- Tapscott, A. and Tapscott, D. (2017b), "How blockchain is changing finance", *Harvard Business Review*, Vol. 1 No. 9, pp. 2-5.
- Thomason, J., Ahmad, M., Bronder, P., Hoyt, E., Pocock, S., Bouteloupe, J. and Shrier, D. (2018), "Blockchain – powering and empowering the poor in developing countries", in *Transforming Climate Finance and Green Investment with Blockchains*, Academic Press, pp. 137-152.
- Tiron-Tudor, A., Deliu, D., Farcane, N. and Dontu, A. (2021), "Managing change with and through blockchain in accountancy organizations: a systematic literature review", *Journal of Organizational Change Management*, Vol. 34 No. 2, pp. 477-506.
- van Eck, N.J. and Waltman, L. (2010), "Software survey: VOSviewer, a computer program for bibliometric mapping", *Scientometrics*, Vol. 84 No. 2, pp. 523-538.
- van Eck, N.J. and Waltman, L. (2018), *VOSviewer Manual Version 1.6.8*, Universteit Leiden, Leiden, Vol. 1 No. 1, pp. 1-53.
- Wang, Y. and Kogan, A. (2018), "Designing confidentiality-preserving blockchain-based transaction processing systems", *International Journal of Accounting Information Systems*, Vol. 30, pp. 1-18.
- White, G.R.T. (2017), "Future applications of blockchain in business and management: a Delphi study", *Strategic Change*, Vol. 26 No. 5, pp. 439-451.
- Wu, J., Xiong, F. and Li, C. (2019), "Application of Internet of Things and blockchain technologies to improve accounting", *IEEE Access*, Vol. 20, pp. 1-10.
- Xu, M., Chen, X. and Kou, G. (2019), "A systematic review of blockchain", *Financial Innovation*, Vol. 5 No. 1, pp. 5-27.
- Yermack, D. (2015), "Is bitcoin a real currency? An economic appraisal", in *Handbook of Digital Currency*, Academic Press, pp. 31-43.
- Yermack, D. (2017), "Corporate governance and blockchains", *Review of Finance*, Vol. 21 No. 1, pp. 7-31.
- Zhang, X., Aranguiz, M., Xu, D., Zhang, X. and Xu, X. (2018), "Utilizing blockchain for better enforcement of green finance law and regulations", in *Transforming Climate Finance and Green Investment with Blockchains*, Academic Press, pp. 289-301.
- Zhang, R., Xue, R. and Liu, L. (2019), "Security and privacy on blockchain", *ACM Computing Surveys*, Vol. 52 No. 3, pp. 1-34.
- Zhu, Q., Loke, S.W., Trujillo-Rasua, R., Jiang, F. and Xiang, Y. (2019), "Applications of distributed ledger technologies to the internet of things: a survey", *ACM Computing Surveys*, Vol. 52 No. 6, pp. 1-34.

Further reading

- Braam, R.R., Moed, H.F. and van Raan, A.F.J. (1991), "Mapping science by combined co-citation and word analysis 1: structural aspects", *Journal of the American Society for Information Science*, Vol. 42 No. 4, pp. 233-251.
- Ferreira, F.A. (2018), "Mapping the field of arts-based management: bibliographic coupling and co-citation analyses", *Journal of Business Research*, Vol. 85, pp. 348-357.

AAAJ

Zhao, D. and Strotmann, A. (2008), "Information science in the first decade of the web: an enriched author cocitation analysis", *Journal of the American Society for Information Science and Technology*, Vol. 59 No. 6, pp. 916-937.

Corresponding author

Alessandra Lardo can be contacted at: alessandra.lardo@uniparthenope.it

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgroupublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com