

Blockchain Technology in Financial Accounting: Emerging Regulatory Issues

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Abstract: The aim of this paper is to analyze the impact of blockchain technology on the traditional financial accounting system both in the short-run and long-run. It is argued that blockchain technology can potentially disrupt the existing accounting system and practices. The decentralized nature of blockchain means that there is no need for a central authority to manage transactions or keep records. This could potentially make financial accounting more efficient and transparent, as well as reduce the risk of fraud.

The findings of this study will have implications for the policy-makers, regulators and interested parties to develop an understanding about how blockchain technology can be integrated in the existing financial reporting framework. The paper argues that though blockchain has potential to bring significant changes in the field of accounting and auditing, there are still a number of challenges which need to be addressed before its widespread adoption. These challenges include lack of standardization, scalability problems and privacy concerns.

Keywords: Financial accounting, blockchain, information quality, distributed ledger technology, triple entry system.

INTRODUCTION

The evolution of technology has continuously shaped various sectors of the global economy, and financial accounting is no exception. While the advent of the internet drastically transformed the way we exchange and transfer information, its impact on the exchange of value has been less profound (Warburg, 2016). This is where blockchain technology, originally conceived as the underlying technology for cryptocurrencies such as Bitcoin, steps in, offering potential solutions and applications in various industries, including supply chain management, healthcare, and notably, financial accounting. The power of blockchain technology (BT) – also known as distributed ledger technology (DLT) – has been steadily growing, and it is becoming increasingly clear that its use will have a continually transformative significance in the world of business and society at large. This is why it has drawn considerable attention from both academics and practitioners. Simply put, blockchain is defined as "a distributed database of records, or a public ledger of all transactions or digital events that have been executed and shared among participating parties" (Stanciu, 2017). In the open ledger, each transaction is confirmed by consensus from over half of the system's participants, and once registered, the information is permanent and cannot be deleted (Atlam et al.,

2018). Multiple copies of the ledger are managed and verified by those on the same network. These participants engage in transactions that are added to a sequential chain along with older validated transactions in the form of blocks. This process relies on the use of a hash, also known as a cryptographic signature.

In the BT architecture, each block is ordered numerically, and a verification process links the information of new transactions with previous ones (Buterin, 2014). The real power of BT lies in its decentralized nature. Data and records are distributed across multiple nodes rather than being stored in a single location (Bonsón and Bednárová, 2019). These records can be easily accessed by authorized individuals within the peer-to-peer network and are immutable. In essence, BT is a secure, transparent, efficient, and effective way to record and manage transactions. Importantly, these records remain unaltered and safe, much like an online ledger (Buterin, 2014).

Although initially recognized as the technology behind cryptocurrency, BT is now extensively used in the field of accounting. It enables transaction processing, voucher generation, inventory management, and contract execution. Leading accounting firms are gradually adopting BT to provide enhanced services to their clients in collaboration with major financial and professional institutions (Deloitte, Ernst & Young, PwC, and KPMG). Deloitte was the first to enter the blockchain space, launching its one-stop service platform "Rubix" in 2014, which offers blockchain application and consulting services. The firm established blockchain labs in

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Dublin in 2016 and New York in 2017 to develop projects and solutions using this technology. In August 2018, Deloitte partnered with the Monetary Authority of Singapore to work on applying blockchain to link fund transfers with security transfers (Cheng and Huang, 2020). Following Deloitte's lead, Ernst & Young introduced EY Ops Chain, and KPMG adopted blockchain-based prototype models to automate the reconciliation and cross-checking of client's financial data for the healthcare and financial services industries, as well as the public sector. These models are used to verify invoices, payment systems, inventory management, and digital contracts. Meanwhile, PricewaterhouseCoopers (PWC) utilizes De Novo in the supply chain.

Given the comprehensive assessment of blockchain technology and its current applications, it is evident that the landscape of financial accounting stands at the cusp of significant evolution. Blockchain's inherent characteristics of decentralization, transparency, and immutability present compelling advantages that could reshape the existing practices and systems. However, its integration into mainstream accounting is not without challenges. This study aims to address this research gap by discussing the ramifications of BT and delineating potential obstacles in the domain of financial accounting. The subsequent sections of this study are arranged to first provide an overview of blockchain technology and relevant literature, followed by a detailed description of the research methodology employed, which clarifies the process of literature selection and review. Subsequently, the analysis shifts focus towards the connection between blockchain and financial accounting, and later discusses the major contribution of blockchain in the accounting domain, particularly its facilitation of a shift from the traditional double-entry to the triple-entry system. The paper concludes by underscoring the transformative potential of blockchain technology in the realm of financial accounting, despite the existence of significant challenges that must be surmounted for its widespread adoption. This exploration aims to facilitate a nuanced understanding of the technology's role within the financial reporting framework and guide future actions towards its effective and secure adoption.

LITERATURE REVIEW

Blockchain is a distributed database that stores transaction records (blocks) in chronological order (chain). Each transaction is verified by consensus among participants in the network (nodes), and once verified, the transaction is added to the chain and becomes immutable (i.e., cannot be altered or deleted). Despite the predominant use of blockchain for cryptocurrency and trade transaction data, the technology can accommodate storage of any type of information. What separates blockchain from other ledgers or databases are three things: firstly, it does not need a middleman; secondly, it cannot be tampered with easily due to its decentralized nature; and thirdly the information stored on 'blocks' (i.e., units) is chained together using cryptographic hashes which creates an immutable record (Lewis, 2018, p. 235). A hash is a digital fingerprint of the data in each block. When a new block is created, it contains the hash of the previous block. If any information in a block changes, that will change the hash of that block and all subsequent blocks. This makes it very

difficult for anyone to tamper with data in a blockchain (Dinh et al., 2018).

The concept of blockchain was first presented in Satoshi Nakamoto's paper in 2008 as part of his work on Bitcoin (Nakamoto, 2008). Since then, blockchain has been gaining popularity and has been adopted by various industries such as real estate, healthcare, finance, and supply chain management. BT can potentially disrupt the existing accounting system and procedures. The decentralized nature of blockchain means that there is no need for a central authority to manage transactions or keep records. This could potentially make financial accounting more secure and transparent, as well as reduce the risk of fraud.

Although Bitcoin is the most well-known application of blockchain, the potential of blockchain extends far beyond it (Monrat et al., 2019). Both public and private entities should explore the benefits of decentralizing their information systems, and utilize accounting knowledge to enhance ledger design. Gietzmann and Grossetti (2021) suggest that cryptocurrency-free permissioned systems may offer greater value to businesses than systems that utilize cryptocurrencies. Permissionless blockchains, also known as public blockchains, are decentralized ledger systems accessible to anyone (Giannetti and Wang, 2016; Patil and Puranik, 2019). These systems, due to their openness to any participant, tend to be more secure and resistant to tampering compared to other types of ledgers.

To illustrate how blockchain operates, let's consider a basic transaction scenario: Party A wants to pay Party B. Prior to blockchain, Party A would transfer the money to an intermediary (such as a bank), which would then pass the funds to Party B. The transaction is settled once Party B receives the funds and confirms receipt. With blockchain, instead of using an intermediary, Party A can send the money directly to Party B's public key (an encryption method used to secure information). To verify the validity of the transaction, each node on the network compares the cryptographic signature against past transactions. If it is validated, each node adds the transaction to its individual copy of the transaction record (known as a "block"). This new block is then added to the chain after it has been verified by other nodes on the network.

Although BT is in its early stages (Ilbiz, 2020), several key features and advantages have already emerged. One significant benefit is the establishment of mutual trust in data: ensuring data integrity while offering transparency, traceability, and auditability of information is crucial in international trade contexts, where trust among parties can be scarce (Semerl, 2018). Nakashima (2018) claims that BT possesses the capacity to considerably automate numerous organizational functions, transforming the manner in which businesses manage their operations and leading to increased efficiency, cost-effectiveness, and transparency throughout various industry sectors. In accounting, blockchain's decentralized and transparent nature can significantly enhance the trustworthiness and accuracy of accounting records: by utilizing a distributed ledger system, every transaction is recorded across multiple nodes in the network, making it highly resistant to tampering or fraud (Kimani et al., 2020).

Another notable advantage of blockchain in accounting is the potential for cost savings and efficiency improvements (Chaney and Philipich, 2002). By automating many accounting processes and reducing the need for manual input, BT can streamline operations and reduce errors. This increased efficiency can lead to cost savings for both businesses and their clients, and ultimately contribute to a more frictionless financial market (Kimani et al., 2020).

RESEARCH METHODOLOGY

The research methodology employed in this present work involved a comprehensive and detailed literature search to gather relevant academic papers from well-known databases. The databases used for the literature search included Wiley, Emerald, Springer Nature, Taylor and Francis, and the American Accounting Association. To ensure a thorough exploration of the topic, specific search terms such as 'Blockchain in Accounting', 'Triple Entry System', and 'Artificial Intelligence in Accounting' were utilized. The initial search generated a total of 58 papers. Each paper was carefully evaluated for its relevance to the topic and its contribution to the field of accounting and blockchain technology. The evaluation process considered factors such as the research focus, methodology, and findings. After a detailed review, 46 papers were selected based on their significance and alignment with the research objectives of this study. The selected papers formed a substantial and diverse collection of scholarly work, providing a comprehensive range of insights and perspectives on the topic. By analyzing these papers, a detailed synthesis of the existing literature was conducted, allowing for a comprehensive exploration of the impact of blockchain technology on financial accounting.

It is important to note that the research methodology employed in this study aimed to ensure the inclusion of relevant and high-quality sources that contribute to the depth and breadth of the research. By utilizing multiple databases and employing specific search terms, a systematic approach was adopted to gather a comprehensive body of literature. This methodology provides a solid foundation for the subsequent analysis and discussion of the findings, enabling a thorough examination of the emerging regulatory issues surrounding blockchain technology in financial accounting.

THE BLOCKCHAIN EVOLUTION AND REVOLUTION OF ACCOUNTING

The goal of traditional accounting and auditing is to establish mutual confidence and protect the interests of investors by developing necessary mechanisms. The history of modern accounting can be traced back to trading activities in 13th-century Italy. To increase accountants' precision, traders developed the double-entry bookkeeping method, which has been widely accepted since it was summarized by Luca Pacioli in his *Mathematics* textbook published in Venice in 1494 (Basu and Waymire, 2008). This method requires every financial transaction to be recorded in at least two accounts. The purpose of double-entry bookkeeping is to prevent errors and provide a system of checks and balances. The system helps ensure that all transactions are recorded and that each transaction is recorded in the correct account. The continuous growth of firms' activities, the need for financial in-

formation, and external factors like stock market regulations, among others, have motivated the development of larger and more sophisticated accounting systems over the centuries.

Although accounting systems have become more sophisticated and integrated over the years, their primary goal remains to deliver high-quality and accurate financial statements to companies' shareholders. Typically, regulated firms are required by law to provide accurate and timely financial information, including forecasted balance sheets, profit and loss accounts, and standard financial ratios. Similarly, accounting procedures have evolved as reporting requirements have expanded beyond financial statements to encompass disclosure of quantitative and qualitative information related to valuation, risk, and other matters (Chowdhury, 2019; Christensen et al., 2017; Fedyk and Hodson, 2019).

Despite efforts to improve the auditing process, discrepancies can still occur, eroding investor trust and hindering the normal functioning of capital markets (Wang and Wang, 2022). As a result, the audit profession has come under intense scrutiny, with many organizations and government agencies calling for reforms. The Sarbanes-Oxley Act (SOX) of 2002 was enacted in response to a series of high-profile corporate and accounting scandals, such as those involving Enron, WorldCom, and other prominent companies. The legislation aimed to restore public trust in financial markets by implementing enhanced standards for all U.S. corporate boards, executive management, and public accounting firms (Xia et al., 2014). These new regulations were designed to promote greater transparency, accountability, and corporate governance within the business world. SOX requires that the auditor's opinion on the financial statements be accompanied by a detailed report on the auditor's findings. SOX also mandates that the auditor's report on internal control over financial reporting (ICFR) includes a statement identifying the scope of the auditor's tests of ICFR and a statement that the auditor has obtained reasonable assurance about whether ICFR is effective in all material respects. These measures promote the role of audits as third-party control mechanisms and can effectively serve as tools for reducing fraud and error in firms' disclosures. However, they do not guarantee that all fraud and error will be prevented or detected.

AUDITING WITH SMART CONTRACTS

The rise of digital transformations and the abundance of data have compelled businesses to adapt and modify their practices. Disruptive technologies like deep learning and Big Data have reshaped the collection, analysis, and dissemination of information, with applications ranging from predicting reputational risk through social media data to the transformative potential of blockchain-enabled smart contracts in supply chains and the financial industry (Rozario and Vasarhelyi, 2018). With its cryptographic and consensus mechanisms that secure the integrity of transactions, BT can potentially transform the accounting, auditing and accountability fields by creating a more efficient and innovative way to track and verify transactions (Vasarhelyi et al., 2015). This could lead to reduced costs and improved accuracy. In addition, blockchain could help to improve transparency and accountability in accounting by providing a tamper-proof record of transactions. Smart contracts, often described as programmed hu-

man actions, encode essential terms into a blockchain and autonomously execute when predetermined conditions are fulfilled (Schmitz and Leoni, 2019; Coyne and McMickle, 2017). They represent a powerful application of BT, enabling the autonomous facilitation, verification, control, and enforcement of transactions. In doing so, they extend the utility of blockchain beyond simple record-keeping to the automatic implementation of multiparty agreements' terms (Deloitte, 2019). This transparency helps to build trust between firms and their stakeholders. As Gietzmann and Grossetti (2021) note "This new way of resolving contracts is potentially disruptive. Besides the inherent ability to eliminate unnecessary parties in the process, smart contracts provide a well-defined and robust language which is not subject to human interpretation and does not suffer from the presence of unintuitive legal vocabulary."

To adapt to the modern digital economy, the traditional audit model must evolve due to the increasing automation and predictive nature of financial statement audits: external auditors must acknowledge the impact of sophisticated audit analytics, smart contracts, and blockchain in order to remain relevant and deliver high-quality audits in a complex business environment (Rozario and Vasarhelyi, 2018). This is particularly important as databases storing daily transactions face cybersecurity threats. By embracing these technologies and considering the challenges they present, auditors can navigate the landscape of cybersecurity attacks and leverage the opportunities provided by blockchain and smart contracts for enhanced operational efficiencies (Rozario and Vasarhelyi, 2018). More precisely, blockchain could help to improve transparency and accountability in auditing by providing a tamper-proof record of transactions: firms can use BT to create audit trails that can be used to assess the accuracy of financial statements. Despite having to adhere to accounting principles for documentation, presentation, and disclosure in traditional accounting, firms are able to control some accounting methods such as accounting policies, accounting estimates and judgements (Yu et al., 2018). Normally, companies do not disclose the accounting processes used in preparing the reports rather only provide the regular financial statements to the outside users. By doing so, companies can keep their information confidential; however, this comes with a few disadvantages. One issue is that whether a company uses a paper-based or electronic-based ledger, there is a possibility of tampering with and damaging transactions. Another concern is that, to maximize personal interests, managers or controlling shareholders may create false accounts and manipulate the accounts. As a consequence, it becomes increasingly challenging for external stakeholders, including investors and regulators, to identify potential issues or discrepancies due to the complex nature of traditional accounting processes. The introduction of BT can minimize errors in the accounting fields.

In addition, BT could also be used to create digital ledger systems that track all transactions made within a particular network. This could potentially revolutionize the way financial statements are prepared as all transaction data would be readily available and updated in real-time. Ledgers built on BT would provide greater transparency as they would be tamper resistant due rigorous security protocols: using blockchain in financial accounting ensures that once it is

posted on the public blockchain, there will be thousands of backups available and all transactions will be transparent to all network members (Cai, 2021; Yermack, 2017). In auditing, it would ensure tests of existence can be conducted quickly and efficiently using smart contracts to reconfigure the data that has been previously validated. The technology could enhance risk management practices as well by identifying any events or conditions early on through predictive analytics. For instance, if a certain pattern in purchase orders emerged which had not been identified before and was deemed potentially fraudulent, further analysis could fully understand what is going on behind such behaviour prior to them causing serious financial loss within an organisation (Bonyuet, 2020). In this way audit firms may need larger teams with different skillsets including IT experts familiar with coding languages for developing blockchain applications suitable for their clients specific needs (He et al. 2016).

SMART AUDIT PROCEDURES: CHALLENGES AND OPPORTUNITIES

BT's application in the accounting, auditing and accountability fields remains in the initial stages, and numerous obstacles must be overcome before it can achieve widespread adoption. One issue is that current BT cannot handle the vast accounting data of a company, and incorporating blockchain requires significant financial investment. Another concern is the unrestricted access and use of information due to the transparent nature of the technical framework, which could result in substantial losses for firms needing to protect trade secrets (Cernea et al., 2022). Moreover, the lack of standardization in blockchain applications poses issues, as it would require all audit firms to use the same platform, which is currently impractical. Overcoming these obstacles necessitates agreement among various stakeholders and the establishment of common standards and practices.

However, despite these challenges, accounting stands to benefit greatly from DLT like blockchain, primarily due to its enhanced transparency and security features. The use of blockchain enables the creation of a distributed ledger that records and stores all transactions in a public database accessible to anyone with an internet connection. The permanence of data within the blockchain ensures that it cannot be altered or deleted once entered, ensuring greater transparency and information security compared to traditional accounting systems (Cai, 2021; Yermack, 2017). The use of smart contracts would also automate many tasks that are currently done manually such as invoicing and payments which would lead to reduced processing time and costs. In addition, audit processes could be automated and made more efficient through the use of smart contracts which would verify transactions against pre-determined conditions before they are executed.

The technical qualities of blockchain, such as its heightened transparency, effortless traceability, and resistance to tampering, offer an attractive avenue for companies aiming to reduce the information gap between them and their investors (Healy and Wahlen, 1999). By employing blockchain in the short term, businesses can selectively disclose advantageous information that is not legally mandated, such as projected earnings and Corporate Social Responsibility (CSR) initiatives. This proactive sharing of information allows investors

to make better-informed decisions and acquire a more profound understanding of the organization in question (Cernea et al., 2022).

Moreover, there are numerous positive outcomes associated with leveraging BT to disseminate public information. For example, having access to historical records enables investors to validate and evaluate present data, which is particularly beneficial when encountering significant uncertainties. Furthermore, distributing public data through authorized channels can significantly impact the choices made by investors, potentially leading to more accurate assessments of a company's performance and prospects (Yu et al., 2018).

Over time, as an increasing number of companies and investors recognize the value of voluntary disclosure as an effective signaling mechanism for reducing trust-related costs, they will be more likely to engage in this practice. The use of BT in the accounting, auditing and accountability fields, in turn, would bring benefits such as improved efficiency, accuracy and transparency of financial reporting which would instil greater confidence in the users of the reports. There would also be reduced reliance on intermediaries as well as increased security due to tamper-proof ledgers.

Implementing BT could significantly decrease or even eradicate fraudulent activities, as every transaction would be recorded and visible to all network participants. This would lead to cost savings for organizations, as they would no longer need to carry out costly audits to identify and investigate fraud (Yermack, 2017). By thoughtfully assessing the pros and cons of such disclosures, businesses can make well-informed decisions about the information they opt to share. In the process, they not only display their dedication to transparency and ethical practices but also nurture stronger relationships with investors, who value the additional insights into the company's operations and financial well-being.

In terms of cost-savings, the use of blockchain could lead to reduced fees for auditors as well as accountants as their services might not be required on a regular basis if the records are maintained on a secure and tamper-proof ledger. The time taken to prepare financial statements could also be greatly reduced due to automation (Cai, 2021).

Apart from this, companies should also reveal common contents including CSR reports, business reviews, earning forecasts on the blockchain which they would like to voluntarily reveal in the short run. The frequency of disclosure should be determined by the firm's discretion and firms would have the incentive to reveal non-confidential information in a timely manner if they want to make a good impression on the market (Fullana and Ruiz, 2021).

SHIFTING FROM DOUBLE ENTRY TO TRIPLE ENTRY

Triple entry accounting, initially introduced by Grigg (2005), necessitates the involvement of a third party, such as a notary or bank, to validate journal entries. Transitioning from the prevalent double entry system to triple entry accounting entails addressing several assumptions about blockchain technology. First, data integrity issues need to be resolved using cryptographic hashing functions and digital signatures (Dai

and Vasarhelyi, 2017). Second, blockchain must incorporate embedded timestamping to record the details of each transaction's journal entries, including debits, credits, and involved parties (Dai and Vasarhelyi, 2017). Lastly, smart contracts should be advanced enough to enable accountants to seamlessly integrate them into clients' computer systems, generating primary source documentation akin to current enterprise resource planning software modules. This may require new job roles with IT audit expertise and coding language proficiency (Drake et al., 2019; Hail et al., 2017).

Various proposals have been put forth to promote the adoption of triple-entry accounting. Schmitz and Leoni (2019) suggest that the implementation of blockchain technology in accounting and auditing requires a significant shift in current practices, including the development of new auditing standards and frameworks. As BT allows for real-time verification and access to information, there is a need to rethink the role of auditors and the types of evidence they rely on to ensure the integrity of financial reporting. The authors propose that future research should focus on exploring the implications of BT on auditing, including the development of new audit procedures and the identification of potential risks and opportunities associated with the technology. Furthermore, they highlight the need for auditors to possess a deep understanding of blockchain technology and its associated risks to provide effective assurance to stakeholders.

An alternative proposal suggested using cryptographic hashes to create unique fingerprints for each transaction, eliminating intermediaries but raising concerns about data integrity and scalability (Dai and Vasarhelyi, 2017). To address these issues, a more recent proposal introduced incorporating a 'state' element, defined as the set comprising all commitments made so far within some specified jurisdiction at some point up until now. This state can be verified through digital signatures from authorized entities such as banks or financial institutions, maintaining decentralization while addressing data integrity concerns. The state could become an integral part of each ledger entry, complete with caption, timestamp, comment history, and links to the original primary source documentation available in the public domain, provided access is granted by the relevant authority.

CONCLUSION

Blockchain is a distributed, shared database that securely processes transactions without need for intermediaries like banks or governments by implementing cryptographic techniques to sequentially link each transaction record together creating an immutable ledger which can be verified by all participants who do not require any centralised authority. As it stores data chronologically as "blocks" connected through digital signatures called hashes, this allows for tamperproof immutable ledgers enabling trustless peer-to-peer interactions between network members thus disintermediating third parties such as auditors. More precisely, the decentralized and transparent nature of blockchain offers opportunities for enhanced efficiency, transparency, and security in financial reporting. By eliminating the need for intermediaries and introducing a distributed ledger system, blockchain has the potential to revolutionize traditional accounting practices and mitigate the risk of fraud.

The adoption of blockchain technology in financial accounting, however, is not without challenges. Standardization, scalability, and privacy concerns need to be addressed to ensure seamless integration and widespread acceptance of blockchain systems. In order to fully realize the benefits of BT in financial accounting, it is crucial for professionals in the field to develop a profound understanding of blockchain and its intricate implications. Furthermore, regulatory frameworks and governance mechanisms must be developed to provide guidance, compliance, and protection of stakeholders' interests.

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AUTHORS CONTRIBUTION

Correspondence author confirm contribution to the paper as follows: study conception and design, data collection and manuscript preparation: Emon Kalyan Chowdhury; Corresponding author, legal analysis on smart contracts and legal issues: Alessandro Stasi; Research methodology, form revision, proofreading, references, and conclusion: Alfonso Pellegriano.

REFERENCES

- Atlam, H. F., Alenezi, A., Alassafi, M. O., & Wills, G. (2018). Blockchain with internet of things: Benefits, challenges, and future directions. *International Journal of Intelligent Systems and Applications*, 10(6), 40-48.
- Basu, S., & Waymire, G. (2008). Has the importance of intangibles really grown? And if so, why?. *Accounting and business research*, 38(3), 171-190.
- Bonsón, E., & Bednárová, M. (2019). Blockchain and its implications for accounting and auditing. *Meditari Accountancy Research*, 27(5), 725-740.
- Bonyuet, D. (2020). Overview and impact of blockchain on auditing. *Int. J. Digit. Account. Res.*, 31-43.
- Buterin, V. (2014). A next-generation smart contract and decentralized application platform. *white paper*, 3(37), 2-1.
- Cai, C. W. (2021). Triple-entry accounting with blockchain: How far have we come?. *Accounting & Finance*, 61(1), 71-93.
- Cernea, M. S., Ene, O. C. B., Monac, C. M., & VrĂ, A. (2022). The Perspective Of The Implementation Of The Blockchain Within Romanian Companies. *Social-Economic Debates*, 11(1), 1-6.
- Semerl, K. (2018). Blockchain—A potential technological revolution for increasing efficiency in cross-border trade processes? [Working paper]. *Blockchain Research Accelerator*.
- Chaney, P. K., & Philipich, K. L. (2002). Shredded reputation: The cost of audit failure. *Journal of accounting research*, 40(4), 1221-1245.
- Cheng, C., & Huang, Q. (2020, January). Exploration on the application of blockchain audit. In *5th International Conference on Economics, Management, Law and Education (EMLE 2019)*. Atlantis Press.
- Chowdhury, E. K. (2019). Transformation of Business Model through BT. *The Cost & Management*, Institute of Cost and Management Accountants of Bangladesh. 47(5), 4-9.
- Christensen, H. B., Floyd, E., Liu, L. Y., & Maffett, M. (2017). The real effects of mandated information on social responsibility in financial reports: Evidence from mine-safety records. *Journal of Accounting and Economics*, 64(2-3), 284-304.
- Coyne, J. G., & McMickle, P. L. (2017). Can blockchains serve an accounting purpose?. *Journal of Emerging Technologies in Accounting*, 14(2), 101-111.
- Dai, J., & Vasarhelyi, M. A. (2017). Toward blockchain-based accounting and assurance. *Journal of Information Systems*, 31(3), 5-21.
- Deloitte. (2019). *Industry insight New Zealand ports and freight yearbook*. Retrieved from <https://www2.deloitte.com/nz/en/pages/finance/articles/new-zealand-ports-and-freight-yearbook.html>
- Dinh, T. T. A., Liu, R., Zhang, M., Chen, G., Ooi, B. C., & Wang, J. (2018). Untangling blockchain: A data processing view of blockchain systems. *IEEE Transactions on Knowledge and Data Engineering*, 30(7), 1366-1385.
- Drake, M. S., Lamoreaux, P. T., Quinn, P. J., & Thornock, J. R. (2019). Auditor benchmarking of client disclosures. *Review of Accounting Studies*, 24(2), 393-425.
- Fedyk, A., & Hodson, J. (2019). Trading on talent: *Human capital and firm performance*. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3017559.
- Fullana, O., & Ruiz, J. (2021). Accounting information systems in the blockchain era. *International Journal of Intellectual Property Management*, 11(1), 63-80.
- Giannetti, M., & Wang, T. Y. (2016). Corporate scandals and household stock market participation. *The Journal of Finance*, 71(6), 2591-2636.
- Gietzmann, M., & Grossetti, F. (2021). Blockchain and other distributed ledger technologies: where is the accounting?. *Journal of Accounting and Public Policy*, 40(5), 106881.
- Grigg, I. (2005). Triple Entry Accounting. Systemics Inc. http://iang.org/papers/triple_entry.html
- Hail, L., Muhm, M., & Oesch, D. (2021). Do Risk Disclosures Matter When It Counts? Evidence from the Swiss Franc Shock. *Journal of Accounting Research*, 59(1), 283-330.
- He, X., Pittman, J., & Rui, O. (2016). Reputational implications for partners after a major audit failure: Evidence from China. *Journal of Business Ethics*, 138(4), 703-722.
- Healy, P. M., & Wahlen, J. M. (1999). A review of the earnings management literature and its implications for standard setting. *Accounting horizons*, 13(4), 365-383.
- Ilbiz, E. (2020). Blockchain: a new disruptive innovation for knowledge risk management. *Knowledge Risk Management: From Theory to Praxis*, 119-132.
- Kimani, D., Adams, K., Attah-Boaky, R., Ullah, S., Frecknall-Hughes, J., & Kim, J. (2020). Blockchain, business and the fourth industrial revolution: Whence, whither, wherefore and how? *Technological Forecasting and Social Change*, 161, 120254.
- Lewis, A. (2018). *The basics of bitcoins and blockchains: an introduction to cryptocurrencies and the technology that powers them*. Mango Media Inc.
- Monrat, A. A., Schelén, O., & Andersson, K. (2019). A survey of blockchain from the perspectives of applications, challenges, and opportunities. *IEEE Access*, 7, 117134-117151.
- Nakamoto, S. (2008). A peer-to-peer electronic cash system. *Decentralized business review*, 21260.
- Nakashima, T. (2018). Creating credit by making use of mobility with FinTech and IoT. *IATSS Research*, 42(2), 61-66.
- Patil, S., & Puranik, P. (2019). BT. *International Journal of Trend in Scientific Research and Development*, 3(4), 573-574.
- Rozario, A. M., & Vasarhelyi, M. A. (2018). Auditing with Smart Contracts. *International Journal of Digital Accounting Research*, 18.
- Schmitz, J., & Leoni, G. (2019). Accounting and auditing at the time of blockchain technology: a research agenda. *Australian Accounting Review*, 29(2), 331-342.
- Semerl, K. (2018). Blockchain—A potential technological revolution for increasing efficiency in cross-border trade processes? [Working paper]. *Blockchain Research Accelerator*.
- Stanciu, A. (2017). Blockchain based distributed control system for edge computing. *21st international conference on control systems and computer science (CSCS)* (pp. 667-671). IEEE.
- Vasarhelyi, M. A., Kogan, A., & Tuttle, B. M. (2015). Big data in accounting: An overview. *Accounting Horizons*, 29(2), 381-396.
- Wang, J., & Wang, D. (2022). Corporate Fraud and Accounting Firm Involvement: Evidence from China. *Journal of Risk and Financial Management*, 15(4), 180.
- Warburg, B. (2016). How the blockchain will radically transform the economy. *TED Summit*.

- www.ted.com/talks/bettina_warburg_how_the_blockchain_will_radically_transform_the_economy?language=en
- Xia, H., Dawande, M., & Mookerjee, V. (2014). Role refinement in access control: Model and analysis. *INFORMS Journal on Computing*, 26(4), 866-884.
- Yermack, D. (2017). Corporate governance and blockchains. *Review of Finance*, 21(1), 7-31.
- Yu, T., Lin, Z., & Tang, Q. (2018). Blockchain: The introduction and its application in financial accounting. *Journal of Corporate Accounting & Finance*, 29(4), 37-47.

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