

## CONSTRUCT IDENTIFICATION ON BLOCKCHAIN IMPLEMENTATION IN EMERGING ACCOUNTING AND ASSURANCE DOMAIN

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**Abstract:** Blockchain, popularly characterized as a distributed ledger technology, has been perceived as a revolutionary innovation. Due to its rapid development, blockchain has the capabilities to influence many domains, including accounting and assurance. Besides improving the efficiency and effectiveness of a business, blockchain has several features that ensure any information's reliability. Currently, many industries are exploring this emerging technology so that it could be implemented in their organizations. This research tried to identify the constructs on blockchain implementation in the accounting and assurance domain through a Systematic Literature Review (SLR). The five steps conducted in this research are identification, search strategy or study selection, data extraction or quality assessment, data analysis, as well as data synthesis, and report preparation. This research identified blockchain constructs in internal control, accounting, and auditing functions. We also analyzed the private blockchain network is more appropriate to be implemented in these sectors. Subsequently, three aspects need to be considered in implementing blockchain technology, namely technology, business, and environment. This research hopes will contribute to the development of Blockchain-based technology in future accounting and assurance domains.

**Keywords:** blockchain, accounting, assurance, construct, systematic literature review

**Abstrak:** Blockchain, populer digambarkan sebagai teknologi berbasis distributed ledger, dianggap sebagai salah satu inovasi revolusioner di era modern ini. Hal ini terjadi karena perkembangannya yang sangat cepat, Blockchain dipercaya memiliki kemampuan untuk dapat mempengaruhi berbagai bidang, termasuk didalamnya bidang akuntansi dan asuransi. Disamping bermanfaat untuk meningkatkan efisiensi dan efektifitas pelaksanaan bisnis, blockchain memiliki berbagai fitur yang dapat menjamin keandalan berbagai informasi yang dikelola. Saat ini berbagai jenis industri sedang berupaya mengeksplorasi teknologi blockchain ini, agar dapat diimplementasikan di organisasi masing-masing. Penelitian ini dilakukan dalam rangka mengidentifikasi konstruk terkait pengimplementasian teknologi blockchain pada bidang akuntansi dan asuransi dengan menggunakan pendekatan Systematic Literature Review (SLR). Lima langkah yang dijalankan sebagai protokol penelitian terdiri dari proses identifikasi, strategi pencarian atau pemilihan telaah, ekstraksi data atau quality assessment, analisis data, dan sintesis data serta penyiapan laporan. Penelitian ini mengidentifikasi konstruk pada teknologi blockchain di bidang pengendalian internal, akuntansi, dan auditing. Kami juga menemukan bahwa jaringan blockchain berbasis pribadi (private blockchain network) lebih sesuai untuk diimplementasikan pada ketiga bidang tersebut. Disamping itu, terdapat tiga aspek yang harus dipertimbangkan dalam pengimplementasian teknologi blockchain, yaitu aspek teknologi, bisnis, dan lingkungan. Implikasi dari penelitian ini diharapkan dapat berdampak pada upaya pengembangan teknologi berbasis Blockchain di bidang akuntansi dan asuransi di masa yang akan datang.

**Kata kunci:** blockchain, akuntansi, asuransi, konstruk, systematic literature review

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## INTRODUCTION

Blockchain technology development has predicted to disrupt an established business process and business model. It is expected to help the organization in increasing their operational effectiveness and efficiency, as well as in increasing their system security. Nowadays, several industries have started to implement and conduct various research on blockchain implementation in their areas. A survey to 2,965 C-suite executives has shown that one-third of organizations have actively engaged or considered blockchain technology to be a value-added organization (IBM, 2017).

Many kinds of research described blockchain as a technology capable of open collaboration and exchanging any information. It can improve business value in altering inter-organizational relationships and enabling trusted information flows. Recent research focuses on revealing and improving the limitations of blockchain from privacy and security perspectives.

Nowadays, there are three primary research focuses discussed in blockchain development, i.e., blockchain report, blockchain improvement, and blockchain application (Kokina et al. 2017; Treiblmaier, 2018; Yli-Huumo et al. 2016). It is projected that in 2021, blockchain investment would amount to around USD 2.312 billion, increasing by about 61.5 percent per year, from USD 210 million in 2016 (Markets, 2016). Cisco (2019) estimated that 10 percent of global GDP in 2027 would be stored on the blockchain (Pickup 2019).

Blockchain technology can be used to provide formal guarantees and capture the transaction details like the state of the product, product ownership, product origin, and footprint. It is useful for the supply chain management process to increase their transparency with customers. It is also helpful to make transactions trustworthy without the need to trust anyone. This feature is usually referred to as trustless trust (Hoffman, 2015; Kaal, 2017).

Specific blockchain utilization also appears in the medical field for medical record management, legal medicine, data analytic, medical research, and others (Roman-Belmonte et al. 2018). The government sector is used to maintain several processes like taxes,

passports, land registries, and other public services (Economist 2017; Hutt 2016; Hyvärinen et al. 2017). Specific industries that are also involved in using blockchain technology are financial sectors, real estate, legal services, e-commerce, and digital platforms (Davidson et al. 2018; Li et al. 2018; Lundy, 2016; Nofer et al. 2017).

As in other industries, the use of blockchain technology in the accounting and assurance sectors can connect stakeholders to the distributed data. Data is the most potent resource in accounting and assurance because all of the activity and decisions should be supported with reliable financial and non-financial data.

Currently, there are at least five topics related to accounting and assurance, namely financial accounting, management accounting, accounting information systems, financial audit or review services, and internal control. These topics have the usability potential of blockchain technology.

In 2016, several large accounting firms and the American Institute of Certified Public Accountants (AICPA) converged to discuss blockchain technology's potential in the accounting and assurance industries. A few moments later, they started to research the technology. Deloitte forms a Deloitte Rubix, which assigned to analyze the potential of blockchain application. EY set up the research team, which focuses on business model pricing, digital contract implementation, integration of inventory information, invoice generator, and payment service. PwC launched DeNovo platform that focuses on potential blockchain development in the FinTech industry. KPMG collaborates with Microsoft Corp in creating blockchain nodes in two European and Asia countries (Kokina et al. 2017).

The implementation of blockchain is estimated to provide essential benefits for accounting and assurance services in order to protect data integrity, share appropriate information, make reliable and automatic control mechanisms, and provide the foundation for automatic assurance and enabling a more agile and precise audit model (Jun Dai and Vasarhelyi 2017). The benefits will be beneficial in adding accounting cycles' essential function such as generating an invoice, processing automatic payment, contracts, and document index in significant implications (Kokina et al. 2017).

Despite its seemingly game-changing potential of blockchain implementation, a careful examination of its prospect for accounting and assurance appears to have a shortage of attention for the professions. Because it is believed will give some benefits for the future digital era of accounting and assurance domains, especially to increase its effectivity, efficiency, and security processes through some reliable and distributed mechanisms. Through this research, we intend to answer the question as to what constructs could be identified or emerged from the current work in blockchain technology that could potentially be useful in the accounting and assurance domain. It is provided by studying the best practices from other sectors, which are published in academic and professional publications.

## METHODS

This research has done by conceptual analysis through deep digging scientific literature approach from seven journal databases which have known for accounting, technology, and information system areas, namely IEEEExplore, ACM Digital Library, Science Direct, American Accounting Association (AAA), Emerald Insight, AISnet.org, Taylor & Francis.

All of the secondary data gathered from manuscripts had been through the process of collection, extraction, classification, interpretation by systematic and scientific methodologies. The research was conducted within the period of July until November 2019. All of the research did by desk research proceed toward varieties of discussion and synthesis between researchers.

Researchers conducted this work with a Systematic Literature Review (SLR). There are at least two reasons why we used the SLR approach to maximize the quality of evidence and minimize the risk of bias (Kodja, 2010). Building on previous studies (Beecham et al. 2008; González et al. 2010; Kitchenham et al. 2007), there is at least five foremost steps of SLR which we applied:

1) Research identification. In this phase, we developed a research goal, research question, and research method. Our research goal is to provide some conceptual basis to be implemented in blockchain utilization. This paper's research question is: What constructs could be identified or emerged from current work in blockchain literature that could

potentially be useful for the assessment in the accounting and assurance domain? The research method applied in this study have some modification of previous SLR approach, which adjusted with our specific research question and research goal.

- 2) Search strategy/study selection. This phase includes developing a research protocol, determining a database journal or another additional resource, and searching logic for each database. We developed some inclusion and exclusion criteria for the research protocol, as well as word variants, synonyms, spelling variants, and plural-singular forms. The database journal in this research consists of IEEEExplore, ACM Digital Library, Science Direct, American Accounting Association (AAA), Emerald Insight, AISnet.org, Taylor & Francis. Afterward, we used Boolean searching algorithms to do a reliable search. For the additional resources, we used a developed search model base on specific topics or issues. The media of its resources consist of the magazine, white paper, and other professional publications.
- 3) Data extraction/quality assessment. We were determining the minimum standard for further analysis and comprehension. Based on the searching strategy above, we performed the two-step of data extraction. In the first step, we extract the paper collected by its paper title and abstract. When it is below the predetermined standard, we then eliminate the paper, whereas the second extraction step is continued when the paper is considered to be above the predetermined standard. In this final extraction, we read the full content of the paper. In this phase, we also developed the reading material based on what we found in primary manuscripts, which have been set.
- 4) Data analysis. We were performing an internal peer review process to decide the criteria that have been specified. We checked each paper to one another and discussed several issues within the paper.
- 5) Research synthesis and report preparation. Synthesizing the data collection and adjusting it into the research report structure. In this process, we create the research synthesis and produce a report written in this paper.

Research framework, build upon elaborations above, and this research can be seen in such a graphical framework (Figure 1).

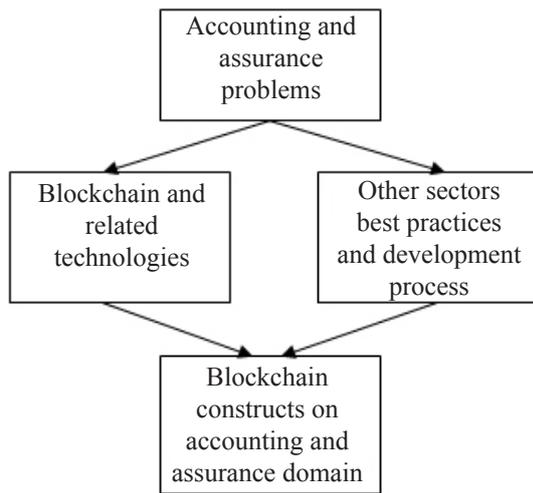


Figure 1. Research Framework

## RESULTS

Based on our methodology, there are at least three literature search selection steps. The first search strategy was implemented based on inclusion and exclusion criteria and some specific keyword variant determinations. We searched in 7 predefined database journals. In this phase, we just collected each paper title, authors, abstract, publication date, and journal outlet. Secondly, we performed an advanced search strategy based on our quality assessment methodology. We did our quality assessment in two layers. First, it assessed base on its manuscripts title and abstract. Afterward, we did a full-read paper from selected title-abstract papers in the first layer. In this second phase, we found 23 manuscripts. Certainly, in the last phase, we discuss, analyze, and synthesize our draft of the manuscript. In this last paper development phase, we add and deepen our literature to update the issues, especially some issues related to the development of blockchain and other advanced technology in the accounting and assurance sector, until we finally found 45 references that we used in this paper.

Similar to the other industries, accounting and assurance have been starting to develop blockchain technology for its applications. As mentioned above, several sectors, such as supply chain management, medicine, government, legal service, and many other sectors, have started developing blockchain, aside from cryptocurrency. Supply chain management is estimated to be one of the most intensive sectors which may benefit from blockchain technology utilization. It is because supply chain management involved many

actors, processes, documentation, and coverage areas. The use of blockchain can make their activities more effective and efficient.

The blockchain implementation in supply chain management can give four benefits (Yunsen Wang and Kogan 2018): 1) Extended visibility and traceability; 2) Supply chain digitalization and disintermediation; 3) Improved data security; 4) Smart contract.

It is hipotesized from the characteristics above, and the benefits are also applicable in accounting and assurance. The use of blockchain can assist the company to maintain their financial and non-financial data accountable in term of data visibility and traceability, as well as practical and efficient activity through the direct process between them without any third party, secured by its immutable characteristic, and a reduction in social roles to minimize error and fraud.

Baron added some of the accounting and auditing domain that could have a benefit from blockchain implementation (Baron, 2017), namely: Traceable audit trails; Automated audit processes; Authentication of transactions; Tracking ownership of assets; Development of smart contracts; Registry and inventory systems for any asset, ranging from raw materials to intellectual property.

### Blockchain in Internal Control

Several researchers above have mentioned the advantage of smart contracts. They believe that technology could also have a massive impact on the internal control process. In a smart contract, we just need to set out some transaction criteria that are appointed to the systems (Treiblmaier, 2018), and the technology maintains the remaining processes. This scheme is including a contract delivery process from specified parties execute digitally, updating programs based on consensus mechanism, releasing approved digital document which used as proof of transaction by relevant parties, and also making a Dividend Payment Control System (DPCS) (Hyvärinen et al. 2017; Kinnaird and Geipel, 2017; Yunsen and Kogan, 2018). Smart contracts are significant technological, legal, and societal, which can lead to a significant impact on security, dispute resolution, and the removal of intermediary and potential job loss implications (Yunsen and Kogan 2018).

Openness and trust are parts of the internal control concept that the blockchain could facilitate. As mentioned in the previous section, blockchain technology provides significant access to all of the network members to record each transaction. This concept is a part of openness. Therefore every individual can access any transaction data managed by the system. Blockchain-based platforms are both open horizontally (at infrastructure technology and interface level) and vertically (at complementors and users level) (Eisenmann et al. 2009).

On the other hand, based on research by Wang and Kogan (Yunsen and Kogan 2018), trust is known as one of the most potent forces of interest application in the blockchain. Trust has increased because transparency and security of the system have been developed to extend assurance on each transaction. Hence each transaction has its time-stamp. If the system is open to be checked together and could be trusted, internal control can be more focused on the system's reliability than on checking the truth of the transaction.

The use of blockchain as an internal control mechanism relies on the use of digital signature and token technologies. Every transaction carried out on the blockchain is signed by the sender's digital signature using their private key; afterward, it is decrypted by the receiver (Lyasota, 2018). The token is used as a transaction trigger; whenever a transaction is initiated, tokens are transferred from the payer's account to the recipient's account. An example of the use of the token is to ensure some amount of promised dividend paid or the amount of any tax return issued to each other, to prevent a double-spending situation (Hyvärinen et al. 2017).

### **Blockchain in Accounting**

One of the critical concepts that could be applied by using a blockchain is a triple-entry accounting system in the accounting field. The main concept of a triple-entry accounting system is that it requires a third party that acts as a neutral intermediary who records and give transaction authorization beside the one who acts as "seller" and "buyer" (Grigg, 2010). It is developed from a previous accounting recording system that only two parties make a transaction record, which translated into a debit-credit concept.

The triple-entry accounting system can use blockchain to automate transaction storage and verification (J. Dai and Vasarhelyi, 2017). The implementation of triple-entry accounting by using blockchain could be even more sophisticated. It could streamline the recording process when a transaction can be performed in a single event but immediately recorded to all parties. This process could also eliminate the need to check and reconcile the information, possibly saved in multiple databases. It will save considerable time by increasing the speed of transactions and substantially reducing human error or fraud, as well as reducing verification and transaction costs (Kokina et al. 2017; Yingli et al. 2018).

Other research found some potential for blockchain implementation in an ERP system. Using blockchain, an ERP system can transfer the function to verify transactions, store secure data, and organize all of the computers connected in the network. Smart contract concepts in blockchain also enable ERP users to design, deploy and customize various controls, adjusted with their business processes (J. Dai and Vasarhelyi, 2017).

### **Blockchain in Auditing**

The use of blockchain in auditing can also offer a huge benefit. It could establish a more detailed audit trail based on multiple historical data recorded in each block. It is also useful in correcting erroneous transactions, complying with an audit guideline, and monitoring the real-time audit transaction process; all these benefits are obtained because it utilized immutable transaction logging.

It is also possible to check all transactions in the population, not just to search in a few samples, as is typically done today (Kokina et al. 2017; Yunsen and Kogan 2018). Even further, it can simplify the audit process's extension to the next step of continuous auditing. Continuous auditing is known as a comprehensive electronic audit process that enables auditors to provide some degree of assurance on continuous information by continuously monitoring, gathering, and analyzing the audit evidence (Rezaee et al. 2002).

## Blockchain Lane and Challenge on Its Implementation

As mentioned before, there are two types of blockchain networks, namely public blockchain and private blockchain. We believe that private blockchain is ideal for accounting, auditing, or other assurance domain. The consistency and integrity of the data would be more controllable if it uses a private (permissioned) blockchain and could assure enhancing privacy, auditability, and increased operational efficiency (Gupta 2018; Yingli et al. 2018; Weber et al. 2016). The use of public blockchain can increase the potential problem from data breaches from unrelated people.

We should consider technology, business, and environment aspects to implement the blockchain in the accounting and assurance domain (Jun Dai and Vasarhelyi 2017). The technological aspect may address how feasible technology is, including its readiness and capability. As we know that blockchain is newly developed in this decade, the technology has not been tested in a big and diverse transaction data. It is found that current blockchain capability is not sufficient enough for financial institution applications, such as payment and settlement networks (Gilbert, 2016). For the well-established blockchain implementation of the Bitcoin transaction, it is known that there are only up to seven transactions per second, far away from the Visa transaction with around two thousand transactions per second (Yli-Huumo et al. 2016). Whereas, financial sector especially banking industry relies on continual efficiency to process their transaction (Aruddy et al. 2019).

The combination of blockchain implementation with other technologies is also essential. There are many current and future technologies that could be collaborated to increase the accounting and assurance processes. For example, the combination of blockchain with the Internet of Things (IoT) devices can further control business activities remotely. If we combine blockchain and Artificial Intelligence (AI) technologies, it could automate more business activities. Then, blockchain-based data processing output can be further processed with Big Data and data science techniques to provide deeper business activity patterns. Besides any other collaboration model that can be developed later.

In a technical aspect, some potential damages on blockchain implementation have also been found. Possible threats are found in smart contract vulnerabilities, application vulnerabilities, cloud infrastructure/server breach, and insider breaches to social engineering breaches (Zamani et al. 2018). Another challenge occurs at an operational cost. Blockchain technology is computationally expensive and resource overuse, leading to an intensive process that several computers have been working on to create and solve a block code (Yli-Huumo et al. 2016).

On the other hand, the business aspect is more focused on the analysis of business costs and benefits. The determination of whether the company will stay with their current businesses or adopt new technology, how much they should pay, and how much/many of them will benefit from the decisions made. As with other newly adopted technology, the implementation of blockchain can drive purchases of some new devices, change some organizational processes, train some employees, and may also extend or change some systems that are already running well. These considerations should be compared with the effectiveness, efficiencies, and economic values that could be achieved.

The environmental aspect can discuss the lack of regulation and standards. Now it is unclear how to determine formal responsibility if blockchain incidents do occur. This problem can undoubtedly increase institutional risk. Another aspect is the existence of the blockchain ecosystem. As mentioned earlier, when more parties are involved, the network will be safer.

## Managerial Implications

This research found that implementation of blockchain technology in the accounting and assurance domain is highly recommended, the benefit of this technology uses as well as business process readiness has been mapped. However, the technical aspects about how both technology and business aspects mated have need to be studied and proven deeply. It is believed there are many positive implications related to the current business problem, long un-answered question, and innovation to solve problems for a business/institution who want to implement this advanced technology, leastwise in the area of internal control, accounting process, also auditing.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

This research aims to elaborate on the possibilities of blockchain implementation in some specific accounting and assurance functions. Since more people talk about blockchain technology's possibilities to transform transaction and security mechanisms, it is exciting to some data-based professions to excavate its advantages. Accounting tasks at first related to the way of transaction identification, recording, and communication processes; for now on, it also relates to other functions like modeling operational, system development, research, and analytic (Jerry et al. 2012; White 2018). Blockchain will not change the purpose of accounting as the language of business, and it increases the value of accounting itself. The assurance sector can also change with blockchain in creating reasonable services based on data processed and extracted. For example, the audit process has predicted a more precise and timely automatic assurance system (J. Dai and Vasarhelyi, 2017).

These technological changes hope it could benefit the trust issue that is becoming one of the accounting and assurance sectors. This is especially prominent since some arisen phenomenal accounting and assurance scandals like Enron (2001), Worldcom (2002), Lehman Brothers (2008), Satyam (2009), Toshiba (2015), 1MDB (2018), and others (Bhattacharyya, 2015; Schuman, 2016). As stated above, blockchain technology could give a more automatic process, more parties involving, minimize face-to-face or intermediary authorization, impossible to alter the historical transaction, and more possible to check the whole transaction.

Precisely some of the blockchain utilization, which is successfully raised in this study like in accounting that could make a triple-entry accounting system happen in the future. Besides, the extent of ERP utilization with blockchain will give additional features. In an internal control function, the use of smart contract believes can control transaction obedience between the person in interest under specific criteria. The blockchain uses could encourage an organization to perform an open-access data yet trusted mechanism as well. The digital signature and token technology that integrate with blockchain shall reduce a collusion practice between respective agents. In the audit practice, blockchain technology allows an auditor to check the audit trail

based on multiple and distributed data sources. Last, the most helpful blockchain technology in auditing is its feasibility to check the transaction population without spending extraordinary resources.

Blockchain could also be combined with other current technologies such as Artificial Intelligence (AI), Big Data, Internet of Things (IoT), and others. The application of several technologies includes blockchain will strengthen the benefit for the company/organization. As an example, the combination of blockchain with big data technology will solve its biggest challenges. It is because blockchain has an ideal fit for big data technology, of which almost all blockchain value propositions beneficial to some critical challenges that existed in the big data industry, like decentralization, security, transparency, and flexibility (Ometoruwa, 2019).

In terms of blockchain network structure, we proposed that the private blockchain is more suitable for the accounting and assurance sectors. We believed it would give a more secure transaction process since it only uses limited users, and the data generated is a confidential category. All the users within a private network should have granted permission to trigger and control transactions (Zamani et al. 2018).

Since the blockchain has not massively developed yet in the accounting and assurance sectors, some aspects need to be considered in blockchain development that could be replicated from others, encompass technical and non-technical aspects related to technology, business, and environment. This study also found some implementation challenges if we want to implement this technology. These challenges could be analyzed with those three aspects stated before.

### Recommendations

While we focused on construct identification of blockchain implementation in the accounting and assurance domain, we realize that this research has limitations, especially in terms of lack of industry-related that explain blockchain implementation in these areas. For future researchers, we recommend focusing on empirical or conceptual research in specific accounting and assurance sectors. For instance, survey the technology and organization readiness, or develop a prototype of blockchain-based solutions for specific industries related to accounting and assurance services.

## ACKNOWLEDGEMENTS

This research was funded by the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia through the 2019 PDUPT-Simlibtabmas Program. The authors would like to thank the participating committees who helped with assistance during the course of this research.

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