

Applications of Blockchain Technology in the Field of Auditing: A Review of Research Progress

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Abstract. Blockchain is a distributed registry, which has the following properties: high security, transparency, and immutability. Over the past years, as the model of the enterprise transaction is being digitalized, the traditional auditing has increasingly shown its weaknesses against the more complicated information space. Blockchain auditing appeared and gained great popularization as a field of research. Blockchain auditing possesses numerous fundamental benefits. This technology is based on decentralized data storage and is based on smart contracts, which makes the auditing process semi-automated and automated. The auditing emphasis is no longer in confirming bookkeeping numbers, rather confirming records and the technical systems producing numbers. Through such transformation, auditing quality and efficiency are improved and auditing costs are reduced, however, it leads to certain issues: complexity of blockchain technology, lack of specialized auditors, absence of corresponding standards, and insufficiency of regulation. In this paper, the search methods are based on the use of key words to locate the literature on the topic of blockchain auditing and to perform a systematic analysis and summary. It is intended to uncover the massive development potential and the key issues in this area that are of high importance to improve the market awareness, acceptance, and trust in blockchain auditing, enable auditors to adjust to the technological changes, facilitate developing regulatory policies, and offer a guideline of further research.

Keywords: blockchain, auditing, smart contracts

1. Introduction

Blockchain is a distributed peer-to-peer ledger composed of a series of ordered and mutually replicated data blocks. Its high security, transparency, and low cost characteristics [1] have enabled this technology to develop extensively in fields such as finance and healthcare. In the digital age, the business operation and transaction models of enterprises are undergoing changes, and massive electronic data have become an important carrier of company operations and financial information, which undoubtedly increases the workload and difficulty of auditing. Traditional auditing has gradually exposed many limitations when dealing with these complex and variable data environments. Thus, auditing with blockchain has received more and more attention. In recent years, academic interest in the application of blockchain technology in auditing has been increasing [2], and most scholars believe that this field has become a new research direction with broad

development prospects [3]. From 2017 to 2024, the research papers on the development of blockchain technology in accounting and auditing have a compound annual growth rate (CAGR) of up to 38%, indicating that this field is in a rapid development stage [4]. Blockchain auditing is decentralized, secure, highly informational transparency, non-modifiable, traceable, efficient, and automated, compared to traditional auditing, which has radically changed the regulations and procedures of recording and processing transaction information [1] and can streamline the auditing process and save auditing expenses [5]. This technology will greatly transform the way of auditing by implementing more secure and efficient ways of data management and verification as well as bringing the accounting and auditing system to a new era of modernization [6].

This review provides a systematic analysis and thorough assessment of the existing research and practice and present the existing state of development of blockchain technology in the auditing profession. It gives a summary of the essence of benefits and primary issues of blockchain auditing over conventional auditing in various angles. At the practical guidance level, this study will contribute to increasing awareness of the auditing professionals on the effects of new technologies on the auditing industry, to motivate auditors to assess and eliminate the relevant practical risks, to keep pace with the times, and to ensure the effective development of blockchain technology and auditing sector in the practical process. On the industry standard level, the proposed study is expected to initiate societal thinking and concern regarding the current issues, encourage the academic community to listen to the particular use of blockchain technology in the real world, and facilitate the development of the standards and policies used in the industry.

2. Core advantages of blockchain

2.1. Change in data storage method

Blockchain provides another approach to information recording in which the information is stored in each block [1]. There is a particular information between each block of the chain that creates a complete network of blockchain that is maintained by a large number of nodes. This decentralized and distributed data storage method eliminates the need for centralized and unified management, avoiding the drawbacks of being monopolized by a central database [7].

2.2. Transformation of audit methods

Gao Tingfan et al. believe that the impact of blockchain technology on the auditing industry aligns with the theory of industrial life cycle. Blockchain auditing will evolve towards a semi-automatic and automated stage. This largely depends on smart contracts. As a computer program, smart contracts are the core element of the blockchain and also an important advantage of blockchain auditing over traditional auditing. Due to the pre-set standards and conditions for triggering contract execution in the program, smart contracts enable the blockchain to operate autonomously according to certain rules without human control, automatically performing functions such as data collection, transportation, and storage [7]. This real-time recording and the immutability of the blockchain allow auditors to obtain accurate and complete information promptly, making continuous auditing (i.e., real-time auditing) possible [8]. Devianto, H. et al. pointed out that continuous auditing is the future development trend in the auditing field, and auditing services under the blockchain technology are gradually transforming from regular auditing to real-time auditing. Here, financial transactions can be audited and verified as they happen and the auditors can transition to year round auditing as opposed to the end of year auditing which requires the auditor to rely on previous data

and end year auditing [2] and this will significantly decrease their dependence on historical data and year end auditing. The change would increase the openness of accounting information and would give auditors ability to offer more profound supervision, timely risk evaluations and preventive techniques. Furthermore, the technology prevents numerous errors that can be committed in manual data processing within the traditional auditing system, facilitates the auditing process, and minimizes the risks associated with the given process, as well as enhances the efficiency and reliability of auditing [9].

Blockchain can transform the mode of operations of auditing firms and their business design and development paradigm completely in the future. The auditing business has realized the massive potential of blockchain technology and the four big accounting companies have incorporated blockchain into its services and have actively formed alliances with major technology firms like Microsoft [10].

2.3. Shift in audit focus

Technological progress and the implementation of smart innovative audit tools have become some of the determining factors of audit quality [11]. By building models, the blockchain system may determine the completeness of data collection during the audit, the data transmission consistency, determine data storage, and the traceability of data storage [1], ensure the authenticity and reliability of data provided to auditors [12], and improve the quality of the audit. Similar findings were made by research conducted by Qader, K.S., et al., according to which the blockchain affects the audit quality by positively influencing the auditing process and identifying fraudulent activities [13,14].

The manpower and time required to complete the standardized processes have been minimized through the automation of the audit process and improvement of audit data reliability, which have considerably enhanced efficiency to the audit. This has enabled auditors to avoid expending a great deal of effort on labor-intensive tasks, such as manual data collection and manual verification of financial data. Therefore, the objects of the audit industry have undergone significant changes. The audit focus has shifted from verifying accounting figures to verifying records and the technical systems that generate numbers. For example, traditional auditing focused on verifying the authenticity of data, the compliance of internal control systems, etc. While the blockchain automatically executes preset rules through smart contracts, auditors need to review the accuracy and security of the logic of smart contract codes, check for any vulnerabilities, and ensure that smart contracts are not attacked and can operate normally. In addition to auditing the deployment environment and operating environment themselves, auditors also need to detect whether each transaction node operates in compliance during the verification process of data updates [1]. The shift in audit focus, although requiring auditors to possess knowledge related to information technology, also enables auditors to focus more on strategic-level work [2], such as the assessment of enterprise internal control levels, risk management, strategic decision-making, and other more valuable services.

3. Main issues faced by blockchain auditing

3.1. Technical level

Blockchain technology requires a strong computing power support. Every transaction recording requires the full network computing power for calculation. The operation of consensus mechanisms, smart contracts, etc. is based on high-performance computer hardware equipment. Moreover, with

the rapid development of information technology, massive and multi-dimensional heterogeneous audit data have emerged, leading to an increasing length and complexity of the blockchain [7]. However, most enterprises do not have sufficient computing processing capabilities and storage capacity to cope with this technological change. Even if the hardware environment is complete, the existing technologies still have great difficulties in handling the inherent complexity of financial statements and audits. Currently, an important issue is the integration of blockchain with traditional accounting information systems [2]. Most accounting information systems are built based on traditional database technologies, while the technologies used by blockchain, such as distributed ledgers, chain structure, and smart contracts, have significant differences in technical structure, data format, storage and management methods from traditional accounting information systems. This leads to challenges in data compatibility during interaction between the two, making it difficult to seamlessly connect and causing data flow gaps and delays. On the other hand, the operation of blockchain largely depends on smart contracts, and smart contracts may have security vulnerabilities, being vulnerable to attacks, and bringing technical risks [4].

3.2. Organizational level

Economic globalization has made trade interactions between countries of different development levels increasingly close. However, the auditing methods between developed countries and developing countries have become increasingly distinct due to the differences in technological levels. There is a significant imbalance in global scientific output in the field of blockchain auditing: countries such as the United States, China, Australia, Western Europe, and Turkey have relatively abundant research results; other countries have less, or even no significant reference value literature published [2,5]. This phenomenon reflects the low market acceptance and awareness of blockchain systems in some developing countries [4], resulting in low investment intentions in this field and distrust of auditing results, which is not conducive to the promotion and long-term development of blockchain auditing.

However, even in countries where blockchain auditing is relatively advanced, there is still a significant shortage of multi-skilled auditing talents. Brender, N., et al. indicate that the transformation of the auditing industry towards IT-oriented and forward-looking is an inevitable trend [15], which requires auditors to master cutting-edge information technology-related knowledge and skills to ensure effective management and operation of blockchain systems [16,17]. At the same time, enterprises should also provide professional and continuous training to ensure sufficient resources and support to help auditors adapt to this process. Otherwise, auditing enterprises will not only be unable to utilize the advantages brought by blockchain technology, but also will cause increased auditing costs and low operational efficiency [2].

3.3. Regulatory level

The gap between technological progress and regulatory standards is a key issue [2]. The decentralized nature of blockchain technology may lead to the complexity of governance structures, increasing regulatory costs and difficulties. Currently, professional auditing standards have not yet adapted to the transformation of the auditing field based on blockchain technology, and the legal system for blockchain in accounting and auditing is also not complete. In semi-structured interviews with Swiss auditors, 85% of the auditors pointed out that there is currently a lack of blockchain auditing standards, and industry guidelines urgently need to be updated [15]. For example, there is currently a lack of unified standards for maintaining smart contracts within the industry, and if there

is a problem with the operation of the blockchain, the ambiguous accountability mechanism will not be able to be resolved in a timely manner. Gauthier and Brender further examined the impact of blockchain on auditing standards, indicating that auditing standards need to be adjusted in a timely manner to adapt to the application of blockchain technology, which is crucial for ensuring that auditing techniques remain relevant and effective in the digital age [17]. Moreover, the blockchain technology is also updated and iterated at a high rate, whereas the legal process is rather complicated, which causes the delay in the legal system of blockchain in accounting and auditing. The use of blockchain technology is associated with numerous legal problems, including the ownership of the data, access controls, the utilization of electronic signatures, the juridical correctness of smart contracts, and other aspects, which are not provided by the definite legal regulations.

4. Conclusion

This paper provides an overview of certain already existing sources and breaks down the aspect of positive change of blockchain technology in the area of auditing into three dimensions, namely, data storage, auditing methodologies, and auditing priorities. Based on this technology, financial data no longer relies on centralized management and manual processing, but is automatically stored in each block, fundamentally changing the original operating mode of the auditing industry, reducing auditing costs, improving auditing quality and efficiency, while also bringing significant impacts. Problems such as technical risks, talent shortages, and regulatory gaps follow one after another. Governments, enterprises, and auditors should actively respond to the current challenges and jointly adapt to the new development trends of the auditing industry under technological progress.

The contribution of this review is as follows: 1. Systematically summarizes the research trends in the field of blockchain auditing from 2019 to 2025, focuses on the most advanced research progress in this field, constructs a "background - core advantages - main problems - conclusion" research framework, emphasizes the huge development potential of this field, which is conducive to improving the market acceptance of blockchain auditing and the trust of stakeholders in the results of blockchain auditing; 2. Extracts three types of core research gaps, providing clear directions for subsequent research; 3. Compares the research differences in different countries, providing references for the coordinated development of global blockchain auditing. At the same time, this article has certain limitations: did not adopt scientific bibliometric methods to integrate and deeply analyze the references, lacking rigor; the selected literature coverage is limited, and did not discuss the negative impacts of blockchain on the auditing field. Future research should focus on solving how to apply blockchain technology to the actual environment of enterprises: improving data compatibility, achieving the comprehensive integration of blockchain technology and accounting information systems; providing professional suggestions and guidelines for enterprises to cultivate "audit + artificial intelligence" interdisciplinary talents; assessing the specific technical risks of blockchain, formulating response measures and relevant laws and regulations, ensuring the full fulfillment of the advantages and potential of blockchain auditing.

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