Construction and Application of Digitalized Audit Trust System Based on Blockchain Technology

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Abstract. Digitization and intelligence are irreversible trends in the process of improving the efficiency of audit business. Data security, privacy protection, data traceability and data verifiability have become the necessary prerequisites for digitalization and intelligence of audit. The current digitalized and centralized management mode has the disadvantage of low cost of data tampering. To solve this problem. This paper summarizes the current situation of blockchain technology and its application, and summarizes the necessity and key capabilities of blockchain technology trust system. It takes engineering material audit and joint audit as examples to apply and refine the reference framework, in order to provide reference for the construction of credit system in the digitalized audit.

Keywords: Blockchain · Digital Audit · Intelligent Application · Trust System

1 Introduction

Data has become an increasingly important factor of production. How to build a virtual space trust system based on digital technology is an important topic in the process of data value flow. With the expansion of audit scope and the complexity of audit environment, digitization technology has become a necessary means to improve audit efficiency. After going through the traditional paper stage and office software stage, audit business has gradually entered the digitization and intelligent stage. Big data technology and intelligent algorithm play an increasingly important role in improving the accuracy of mining problem clues. With the development of research and application of blockchain technology, its application advantages in privacy protection, data tamper prevention, data storage, data verification, access control are becoming more and more obvious. Blockchain is helping to form a new economic blueprint [1]. A great number of scholars have carried out research on the application of blockchain in audit. The result shows that the blockchain technology is applied in many aspects of audit business, mainly as following: audit evidence collection, audit modes and methods, blockchain audit platform and audit quality improvement.

In terms of blockchain application in audit forensics, described the impact of the change of audit carrier and audit risk [2], proposed that there are different audit forensics

modes and methods according to different audit businesses, and proposed a theoretical framework of the impact of blockchain on audit forensics.

In terms of blockchain application of audit modes and methods [3], analyzed the applicability of blockchain technology embedded audit, and proposed that blockchain technology application can realize the transformation from ex-post audit, sampling audit, manual audit and data audit to real-time audit, comprehensive audit, intelligent audit and algorithm audit, so as to promote the evolution of audit paradigm. elaborated on database technology, the relationship between ERP system and blockchain technology [4], the construction of accounting ecology based on blockchain technology, and the reconstruction of audit mode based on blockchain technology, and systematically analyzed the impact of blockchain technology on improving audit efficiency, reducing audit cost, and curbing fraud, solving the trust crisis, continuously monitoring abnormal data and improving the real-time performance of auditing.

In terms of audit quality improvement [5], proposed a scheme to improve the quality of accounting information, beginning with the concept and technology simulation audit function of integrated blockchain, secure multi-party computing and secret sharing, which can protect the privacy of reasonable accounting information, find false participants, eliminate unnecessary human influence and avoid the bias of audit report without inputs being exposed.

2   The Necessity of Digitalized Audit Trust System

At present, digitization and intelligence are becoming an important force in the new round of productivity industrial revolution in the key stage from the introduction period to the expansion period. Compared with the traditional audit form, the in-depth development of digitalized and intelligent audit puts forward higher requirements for the comprehensive audit in the new period. It is the urgent to establish a set of trust system to provide trust guarantee in the process of digitization.

Due to the change of audit carrier in the digital economy environment, the reduction of data tampering cost in the centralized management mode, the use of data under the premise of privacy protection and other current situations and requirements, it is urgent to use multi-party and multi link trusted technology to ensure the smooth development of digital audit. Therefore the technical characteristics of blockchain have become the key technology to promote the solution of the trust problem of digital audit.

3   Key Capabilities of Blockchain Technology Trust System

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3.1   Provide Algorithm Credibility

With Internet and computer system as the infrastructure, encryption algorithm as the technical basis, and algorithm trust the core mechanism, blockchain is decentralized, involving Hash algorithm, asymmetric encryption, smart contract and other algorithms which can guarantee the authenticity and tamperability of its data and the recognition of participants. Regardless of data encryption algorithm [7], consensus algorithm or smart contract mechanism, they are all open, transparent and authoritative, providing a trusted foundation for blockchain applications.

3.2   Provide Identity Credibility

Blockchain technology can establish a unique digital account for users on the chain. Users perform operations on the chain by submitting blockchain transactions. Before the transactions are submitted to the chain, users in various roles in audit activities need to sign the transactions with their own digital accounts. Signature is an asymmetric encryption method, which can confirm that the sender holds the corresponding private key through the public key and signature information without disclosing the sender's own private key. Using the private key to sign the transaction can also bind the identity and information of the transaction sender, and prevent others from pretending to be the sender. This processing cannot only protect the information from being tampered, but also authenticate the identity of the sender and prevent denial, so as to provide the ability and foundation of identity credibility for the system [6].

3.3   Provide Data Credibility

Blockchain technology is alliance oriented whose technical characteristics such as decentralization, openness, tamper resistance and asymmetric encryption can effectively enhance the transparency of data and increase the difficulty of data tampering. Blockchain Merkel tree is an efficient Hash tree structure that can effectively verify whether part of the data exists in the specified data set and has been tampered with or not. No doubt it is able to do a lot in audit data verification and traceability.

4   Overall Framework Design and Example of Digital Audit Trust System

Assuming that a digitalized audit platform and a data center have been established, then a blockchain audit platform needs to be established. The blockchain audit platform is composed of blockchain smart contract, blockchain trusted execution environment, blockchain processing module, task management, process management, intelligent processing services, etc., in which the intelligent processing services include data storage, verification, acquisition, sharing and other service components. Service component categories can be flexibly adjusted according to requirements. The framework of blockchain design platform, source end system, data center (if any) and digitalized audit platform is shown in Fig. 1.
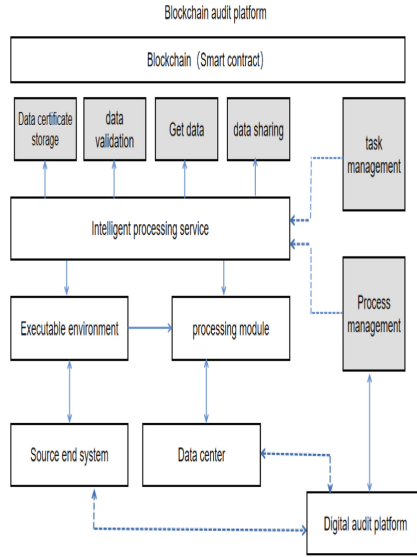
Fig. 1. Overall reference architecture framework of digital audit trust system

In the framework, since most of the current business entities have not established a data center or some business departments have not shared data and uploaded to the data center in consideration of data privacy, the framework also involves the direct interaction between the source end system and the blockchain audit platform.

Taking the case of invoking the data of two or more units to carry out joint audit as an example, the blockchain audit platform can share the handshake protocol and audit model of the joint audit units on the chain, obtain the audit results without knowing each other's data, improve the efficiency of joint audit and save resources [8].

5   Trust Application Scenario in Digitalized Audit

The overall process of digital audit can be divided into data acquisition, data processing and data application, among which application can generally be divided into audit operation and audit management. Therefore, this paper combs the application scenarios of trust in the process of digitalized audit from three aspects: data acquisition and processing, audit operation and audit management. As shown in Table 1.

5.1   Audit Data Usage Scenarios

Data trust is the cornerstone of digitalized audit trust system, while ensuring the credibility of audit data is the fundamental starting point of building digitalized audit trust system. Taking advantage of blockchain technology, the audit data will be stored and linked, aiming to ensure that the audit data storage records can not be tampered with, and provide reliable data vouchers for audit applications. Through the Merkel tree mechanism of blockchain, audit data can be verified efficiently and traced accurately. A trusted

Table 1. Application scenarios of block chain in digital audit

Blockchain application link	Specific application scenarios
Audit data collection and processing	Trusted internal data
	Trusted collection of external data
	Trusted sharing and verification of cross chain data
	Trusted protection of privacy data
Audit operation	Audit model trust
	Job result trust
Audit management	Audit process trust

data environment is formed based on blockchain technology, so that the whole chain business data can be audited and trusted.

5.2   Audit Operation Scenario

For the cross audit or joint audit problems involving the simultaneous calls of the data of two or more entities for audit analysis, the audit platform based on blockchain technology can share the handshake protocol and audit model of the joint audit unit on the chain, obtain the audit results without knowing the other party's data, improve the efficiency of joint audit and save resources. For example, when auditing the operation and maintenance expenses of a line of company A, it may be necessary to refer to the expenses of units with the same level of economic development. Configure the joint audit task of B, C and D companies of line operation and maintenance expenses based on the smart contract, and specify the corresponding multiple data sources and audit models. According to the task configuration of the joint audit task contract, notify the blockchain audit service of companies B, C and D in the form of contract events, and perform the corresponding line operation and maintenance cost data audit task B, C, D and their branches shall audit the line operation and maintenance cost data of the data center of the company according to the audit model specified by the joint audit task, and deposit the audit results to the joint audit task contract respectively [9]. Finally, company A, as the initiator of the joint audit, summarizes and consolidates the audit results of the line operation and maintenance cost data submitted by companies B, C and D according to the joint audit task contract, and puts them on the chain.

5.3   Audit Management Scenario

According to the principle of blockchain "code is law", the blockchain smart contract mechanism provides an open and transparent audit management process for the automatic control application of the whole process of audit projects, and improves the efficiency of audit management on the basis of credibility. During the control of the whole audit process, there are preconditions for the completion of each step. In order to strengthen the compliance management of the whole audit process, the smart contract
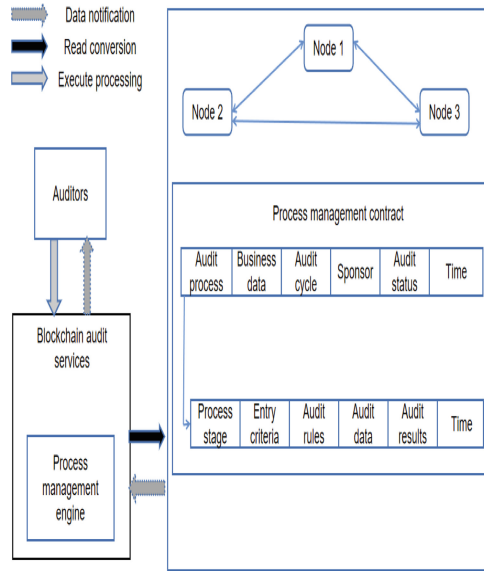
Fig. 2. Schematic diagram of whole process control of project based on smart contract

mechanism is introduced to control the process promotion and ex-post evaluation of project implementation quality, so as to realize the reliable flow and verification of the whole project process from audit task initiation, audit model design, audit task execution to audit result certification, and eventually improve project transparency and whole process control efficiency. The whole process control of the project based on smart contract is shown in Fig. 2.

Based on the smart contract of blockchain audit platform, auditors carry out audit task process management configuration. The process management engine checks the current status of the task and detects whether the access conditions of the corresponding stage are met, such as whether the audit task execution link can be officially carried out, whether the design of the audit model is completed, whether it is time for audit execution, etc.

On the premise that the access conditions are met, the process management service sends a task handling notice to the link handler to urge the responsible person to handle relevant tasks in time. According to the audit notice issued by the process management service, the auditors perform the corresponding audit tasks, and link the audit draft, audit doubts and audit results. Auditors can query the audit processing results or status of each link. The above technical solutions involve typical scenarios of audit operations and management, such as audit original data, audit operation model, audit result data and whole process of audit management, which provide a reference for the application of blockchain technology in audit business [10].

6 Conclusion

Based on the overview of blockchain technology and its application status, this paper emphasizes the necessity of establishing the trust system of digitalized audit, and combs the trust application scenarios in digitalized audit from three dimensions: audit data collection, audit operation and audit management. Among them, audit data collection includes internal data information call [11], external data trusted collection, cross chain data trusted sharing and verification, and privacy data trusted protection. Audit operations include privacy data black box audit, audit model trust and operation result trust. Audit management mainly refers to the automation of audit management process based on blockchain smart contract technology.

Blockchain technology plays a promising role in the construction of digitalized audit trust system. In the future, detailed research on each module of blockchain audit service can be carried out to provide support for the implementation of blockchain in the audit trust system.

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