Accounting Information Quality Optimization of the Listed Company Based on Blockchain

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ABSTRACT. Focusing on accounting information quality optimization of the listed company, this paper proposes a blockchain-based accounting process to optimize accounting information quality. It will effectively reduce the accounting fraud behavior and seriously affected the process of value discovery, which will enhance securities market effectiveness. The blockchain-based accounting process involves four parts: (a) confirmation of accounting information; (b) measurement of accounting information; (c) recording of accounting information; (d) reporting of accounting information. The blockchain-based accounting process makes it possible to automate all the transaction by smart contracts. The cryptographic algorithms guarantee the security of the transaction data. The new accounting method attempts to record the accounting information of the listed company by distributed ledger technology. Consensus mechanism verifies the validity of accounting process. Finally, this paper uses EVA to evaluate the performance of the listed company after adopting blockchain-based accounting process. Hence, the blockchain-based accounting process can avoid accounting fraud, which will protect investors from financial fraud and ensure the effectiveness of the security markets.

KEYWORDS: blockchain-based accounting process, smart contracts, the listed company, accounting information quality

1. Introduction

As an enduring topic in academia and practice, accounting information quality of securities markets has been discussed ever since the late sixties. Today's securities markets demand better accounting information to protect investors and enhance securities markets efficiency. However, the phenomenon of accounting fraud is still common and the quality of accounting information is worrying. It becomes one of the tension points of today's securities markets.

Acknowledging the fact that accounting information quality is significantly important, more and more solutions are proposed in academia and practice. The

traditional solutions mainly include the following three methods. Firstly, strict accounting personnel management system improves the quality of accounting work. Secondly, strengthening the responsibility of the person in charge of the unit constrains the behavior of senior executives. Thirdly, improving the accounting legal system strengthens accounting supervision. Once the higher quality information disclosure is formed, the more transparent the business will be. In this way, it guarantees the normal order of the securities market and realizes the effective allocation of resources. The traditional solutions focus on the laws and regulations, which can not relieve the financial fraud.

The emergence of blockchain provides a new way to optimize the accounting information quality. It is acknowledged that blockchain technology will effectively improve the accounting information quality. Essentially, blockchain is a freely open and publicly shared database that keeps track of information and protect the information from tampering [1]. Once the transaction is committed, it is practically irreversible and immutable unless the majority of the blockchain users collude. Therefore, it can address the accounting information fraud.

This research seeks to apply blockchain for improving accounting information quality. By reviewing a lot of literatures, this paper proposes a blockchain-based accounting process to improve accounting information quality. We believe this research will solve the problems that exists in securities markets for many years. The Blockchain-based accounting process can provide real-time accounting and continuous monitoring services, which will prevent transactions fraud.

The remainder of the study is organized as follows: Section 2 is a review of existing research methods in accounting information quality. Section 3 proposes a framework of applying blockchain technology to improve accounting information quality. Section 4 takes ZTE as the research object and uses empirical research to evaluate the performance after adopting the blockchain-based accounting process. Section 5 concludes the paper and discusses the future research.

2. Existing methodology

By reviewing existing literature, we find that accounting information quality has always been a research hotspot for experts and scholars. Héctor Horacio Garza Sánche et al. (2017) [2] adopt T-test and find that compared to in local regulations, the international approved standards can improve accounting information quality. Quan Chunmei et al. (2018) use the modified Jones model and find that the monitoring of the board of directors will improve accounting information quality. Ham, Charle et al. (2017) [3] use the high-level echelon theory as the research perspective to study the relationship between CFO background characteristics and accounting information quality. The study found that the stronger the CFO's financial professional ability could lead to significant improvement of accounting information quality. Zhang Xiaohong et al. (2016) [4] argue that optimizing the management structure of the listed company can improve the transparence of accounting information. Cheng Q et al. (2017) [5] conduct an empirical analysis of

the impact of internal accounting control on accounting information quality. The results show that if the internal accounting control quality index is high, the steerable accruals will be lower and the quality of accounting information will be higher. Some researches focus on improving accounting information quality by external supervision. Using well-established empirical models and a treatment effects model, Manthos D. Delis (2018) [6] find that regulatory interventions (enforcement actions) complement market discipline in promoting regulatory compliance and decrease financial risk. Huang Xiaoyong et al. (2018) [7] use the modified Jones model, which shows that the audit quality is significantly positively correlated with accounting information quality. Some scholars show that the implementation of EVA assessment and the construction of transparency assessment system for accounting statements can also improve accounting information quality.

Few scholars pay attention to exploring how to optimize accounting information quality from a technical perspective. The emergence of the blockchain technology give us a new idea to improve accounting information quality. Blockchain technology emerged in 2008 as a core component of the bitcoin cryptocurrency [8]. Blockchain is a decentralized distributed database in which the recorded data is immutable and irreversible. Blocks are linked together by a reference to the previous block. As more and more transactions are recorded in the blocks, they will form a chain in the end. It is shown as Fig.1.
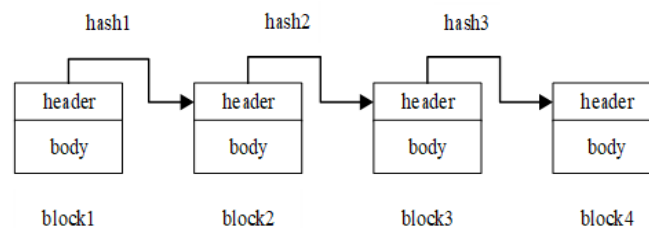

Figure. 1 The structure of the blockchain

Each block in the blockchain consists of the following elements: the data record, the root hash of the current block, the root hash of the previous block, the timestamp, and other related information. In this way, all transactions recorded in the blockchain are transparent and immutable. It can ensure the authenticity of accounting information, thus improving the accounting information quality of the listed company. So, this paper attempts to propose a blockchain-based accounting process to improve accounting information quality.

3. Blockchain for acounting

The reliability of accounting information of the listed company is significantly important. Accounting information can help the listed company fully understand the financial status of a certain period of time. At the same time, it helps the listed

company establish a good image and further improves economic efficiency. Good accounting information disclosure also helps investors make the right investment decisions and realize the price discovery process, which contributes to realizing the rational allocation of the social resources. However, the traditional double-entry bookkeeping method has defects. There is a risk of tampering or forging the original transaction information. The emergence of the blockchain technology makes it possible to solve the fraud of the accounting information. Blockchain is a freely open and publicly shared database that keeps track of transactions and protects data from tampering. This paper uses the blockchain technology to optimize the accounting information quality from confirmation, measurement, record and report of accounting information. The specific blockchain-based accounting process is shown in Fig.2.
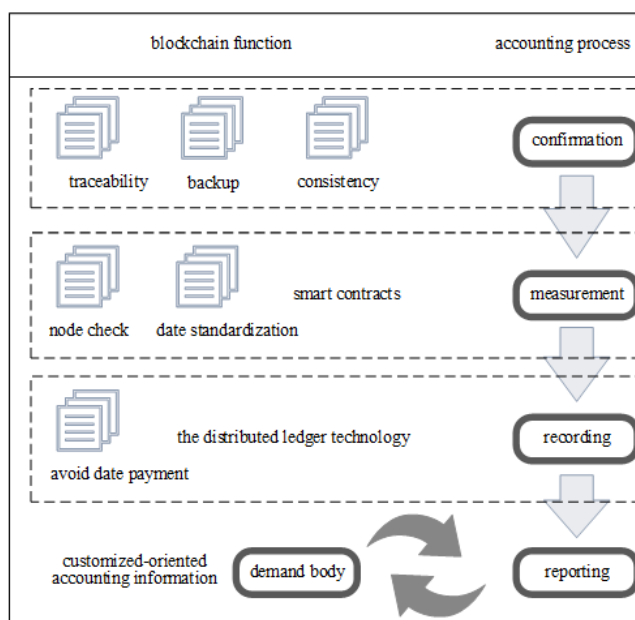

Figure. 2 The blockchain-based accounting process

3.1 Confirmation of accounting information

The first one refers to the confirmation of accounting information, which runs through the entire accounting work. Accounting confirmation defines the scope of accounting records and determines the content of financial statements. It is necessary to ensure the accuracy of accounting information in the accounting confirmation process.

The traditional accounting confirmation refers that the listed company confirms accounting information on its own transactions or events. There is no doubt that

some listed companies may falsify financial data in the process of accounting information confirmation for their own interests. The decentralization and traceability of the blockchain can alleviate the fraudulent behavior in the process of accounting information confirmation.

The listed company's accounting information comes from transactions among suppliers and customers. Therefore, this paper takes the supplier, internal organizations and customers as the nodes in the blockchain network. It is shown in Fig.3. Every node needs to apply for a unique digital ID. This ensures that all the accounting information of the listed company can be recorded on the block. Due to the decentralization of the blockchain, all the nodes can get a complete accounting information.
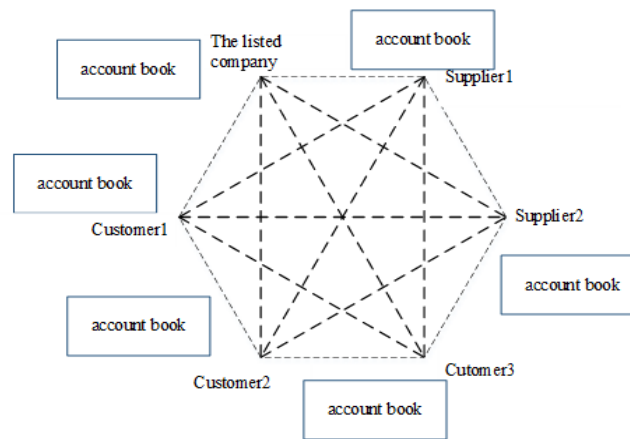

Figure. 3 The value chain network based on blockchain

How does the blockchain technology solve the he fraudulent behavior in the process of accounting information confirmation? The blockchain includes all the stakeholders, such as suppliers, the listed company and customers. If the listed company initiates a transaction to suppliers or customers, the transaction will be broadcast to all the nodes participating in P2P network. The receiving node will check the transaction information. Only if more than 51% of the nodes verify that the new transaction is valid, the new block can be officially incorporated into the blockchain after the consensus algorithm process. At the same time, the transaction block will be linked to the end of the previous block. Transaction information is recorded independently by each participant in the economic activity. The transaction date will be transmitted to the economic activity participants for storage after being broadcast and verified on the whole network. Because all the accounting information originates from the blockchain-based accounting process. In this way, the accounting information held by each participant will be timely and identical. At the same time, because everyone has the right to record and can supervise each other, which improves the correctness and efficiency of accounting information

confirmation process. In this way, the accounting information will be traceable and verifiable.

3.2 Measurement of accounting information

The second layer concerns the measurement of various economic business processes by currency or other measurement unit. The emergence of the smart contracts can transfer the property rights and value. In this way, it appears to have the potential in integrating the business and capital flows. This paper uses the smart contractss to improve the accuracy of accounting measurement.

Smart contractss are essentially containers of code that encode and reflect the real-world contractsual agreements in the cyber realm. A key premise for contractss is that they represent a binding agreement between two or more parties where every entity must fulfil their obligations according to the agreement. Another important element is that the agreement is enforceable by code, which is protected by laws. As a listed company, it needs to purchase the raw materials from upstream suppliers. Smart contractss record transactions information that includes product description, quantities, prices, shipment date, delivery date and payment terms in the form of code and automate the transactions between upstream suppliers and the listed company[9]. If the listed company wants to buy material from the suppliers, it will create a smart contracts in form of code to the suppliers. Suppliers choose to accept the smart contractss and send raw materials to the manufacturer. If the listed company receives the raw material, the smart contracts will be triggered automatically. In the end, the listed company and suppliers complete transfer of value in the form of smart contractss and the transactions are closed. The same circumstance applies to transactions between other stakeholders.
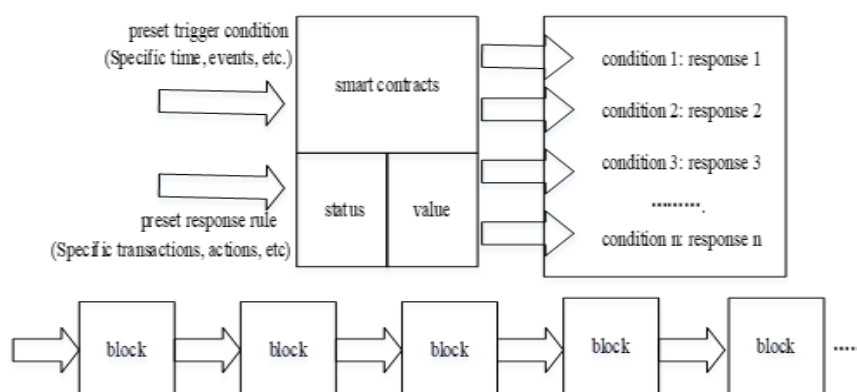

Figure. 4 The smart contracts functional diagram

The combination of smart contractss and blockchain technology not only ensures that the measurement of accounting information in the blockchain is authentic, but

also integrates business flows and capital flows. Because accounting is based on currency as the main unit of measurement. Whether using historical cost measurement or fair value measurement, the accuracy of measurement is affected by the value of the currency itself and its conversion process. Blockchain is a chained data structure that is cryptographically protected and cryptographically modified. If we set the currency calculation program in the smart contracts in advance, the measurement of accounting information will be relative stability.

3.3 Recording of accounting information

The third layer concerns the recording of accounting information. Accounting recording not only describes and quantifies the movement of capital in detail. At the same time, the data is classified, aggregated and processed. This paper uses the distributed ledger technology to record the accounting information.

The blockchain technology has changed the traditional accounting method, which realize the decentralization. This paper proposes to create a shared accounting book. The nodes involved in the blockchain can record the accounting information independently. Based on blockchain, all the suppliers, the listed company and customers need to register their own accounts in the network. If the listed company who trade with suppliers or customers, the transactions data will be broadcast to all the nodes who involved in the blockchain. Once the transaction data is verified, the accounting information will be encrypted by SHA-256 algorithm. Once the entire network node accepts the block, the new block will be linked to the blockchain. The accounting information stored in each block is arranged in chronological order, because timestamp of the transaction is unique. Meanwhile all transaction information is completely public. Therefore, the repetitive transaction will not be recognized by other blocks, which solves the problem of "double payment" to some extent.

Overall, the transaction data in the blockchain is unique and continuous, which can be accurately located, verified and traced. The traceability of blockchain data facilitates real-time tracking and query of accounting information compliance, while preventing accounting information from being tampered with. In this way, it effectively reduces accounting errors and fraudulent behavior, which ensures high-quality information records.

3.4 Reporting of accounting information

The accounting information report of the listed company is an important part of information disclosure. The timeliness and accuracy of information disclosure are significantly important for the securities market. It affects the discovery process of the listed company's stock price and determines the investor's decision. Traditional accounting information is formulated by the listed company. It can not meet the needs of different people, which is not targeted. The emergence of the blockchain will solve the problem.

Based on the blockchain, the accounting information report of the listed company will be automatically disclosed. In the P2P network at the bottom of the blockchain, each stakeholder needs to apply for an account, and the system will automatically assign a digital ID (including private key and public key) to each user. All the nodes involved in the blockchain will have a copy of the distributed ledger, which is convenient for the stakeholders to accept all the accounting information. They can use digital ID to apply for the report of the accounting information they needed. The emergence of blockchain technology has turned the traditional human-oriented information search into customized-oriented information to the demand body. Based on blockchain, all the stakeholders participating in the P2P network can obtain customized accounting information that are trackable in real time, which eliminates the risk caused by information asymmetry. However, one can only obtain relevant accounting information because each user's private key is different.

4. ZTE empirical analysis

As the topic of academic and practical circles, the accounting information quality optimization contributes to improving efficiency of the securities market. It is crucial that accounting information of the listed company can be timely and accurately passed to investors. Only when the information disclosure meets the authenticity and timeliness, the investor can accurately realize price discovery. The blockchain-based accounting process ensures that all the accounting information among the listed company, suppliers and customers are truly recorded. Under the premise that the financial data of the listed company is true and reliable, this paper selects ZTE Corporation (Zhongxing Telecommunication Equipment Corporation) as the research object. Meanwhile this paper proposes to use EVA to assess the economic effects based on the blockchain-based accounting process.

ZTE has complete, end-to-end products and converged solutions for the communications industry. Through a full range of products such as "wireless, wired, cloud computing, and terminals", ZTE flexibly meets the differentiated needs of different customers around the world and pursues rapid innovation. The blockchain-based accounting process makes it possible to avoid the accounting information fraud. Therefore, this paper attempts to adopt the EVA valuation model to evaluate the performance of the ZTE after adopting blockchain-based accounting process. We use the following formulas to calculate the financial indicators of ZTE after adopting new accounting method.

$$\text{EVA= Earning before Interest after Tax-Capital Expenses} \tag{1}$$

$$\text{EBIAT= Initial Investment Capital* Rate of Returns of the Investment} \tag{2}$$

$$\text{Capital Expenses= Initial Investment Capital* Weighted Average Cost of Capital} \tag{3}$$

$$\text{The Value of the bank= (Initial Investment Capital+ EVA)* Discount Factors} \tag{4}$$

As the world's leading provider of integrated communications solutions, ZTE is one of the largest listed company in communications equipment in China. ZTE pays

attention to establishing a stable relationship with upstream suppliers and cuteomers. ZTE is committed to optimist the internal organizational structure to increase market share and improve economic benefits. To evaluate the performance of the ZTE after adopting the blockchain-based accounting process, this paper uses the hierarchical analysis method to construct an evaluation index system, which is shown in Table1. Assuming that ZTE's revised value score is a1, a1-100 indicates that it exceeds the level of competition. In this way, ZTE' value is finally corrected.

$$\text{Corrected value= Basic Value}*(a_1\text{-}100)/a_1 \qquad (5)$$

$$\text{The Value of the bank=Basic value + Corrected Value} \qquad (6)$$

Table 1 Evaluation Index

First-Level Index	Second-Level Index	Third-Level Index.
Integration	Relationship attitude	Quality
		Price
		Delivery period
	Relationship length	Time Length of Continuous Cooperation Under Intelligent Contract
Optimization	Strategy	Market Share
		Market Growth Rate
Control	Internal organizational vapabilities	Learning Ability
		Anti-risk Ability
		Coordination Ability

5. Conclusion

The aim of this paper is to optimize the accounting information quality of the listed company in security market based on the emergence of the blockchain technology [10]. This paper is centered on the process of accounting information based on blockchain technology and smart contractss. The blockchain-based accounting process proposed in this paper has potential to solve the fraud of accounting information. And the main content focuses on how the blockchain-based accounting process realize the confirmation, measurement, recording and reporting of the accounting information.

Blockchain and smart contracts technology is proved that they have potential to avoid financial fraud, which will change the traditional accounting method. Smart contractss can operate the transactions among suppliers and customers, which plays a controlling role to a certain extent. The accurate record of the transaction data guarantees the authenticity of the accounting information of the listed company from the source. Compared with double entry bookkeeping method, the blockchain-based accounting process reduces accounting errors due to benefits driven. Because the transaction recorded on the block is transparent and public, which can prevent the

listed company from providing false financial data. The combination of blockchain technology and smart contractss also benefit the supervisory departments who supervise accounting information quality of the listed company. At the same time, it is convenient for auditors to do the audit work. The blcokchain-based accounting process can help investor's judge company value more rationally, which solves the pain point in the security market to some extent.

The blockchain-based accounting process shows promise for improving accounting information quality, decreasing transmission cost and avoiding financial fraud. The limitation of this research is that it does not design a prototype to demonstrate how the blockchain-based accounting process work. Moreover, the underlying technology of the blockchain such as consensus mechanism, and distributed ledger technology is not mature. At the same time, we can't ensure that the blockchain-based accounting process will be accepted by all the listed companies and the government. The future research can continue to develop the blockchain-based accounting processing systems. In the end, we must acknowledge the fact that the blockchain-based accounting process has potential to guarantee the authenticity of the accounting information, which can solve the problems that have existed in security markets for many years.

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