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Application of Blockchain in Financial Management

Pingquan Wang*

Inner Mongolia University of Finance and Economics, Inner Mongolia, China

wangpq@imufe.edu.cn

**corresponding author*

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Abstract: Blockchain technology is an important achievement of the rapid development of Internet technology. Because of its outstanding performance in data processing and security performance, it is more and more widely used in real life. Financial management is one of the main application fields of blockchain technology. The application of blockchain technology in financial management system can optimize the system in many aspects. "Blockchain + financial management" has become a mainstream trend and plays an irreplaceable role in modern financial management system. In order to further analyze the application of blockchain technology in financial management system, this paper will take this as the main research purpose. This paper is mainly divided into three parts. The first part is the related basic theoretical research. The research and analysis believe that although blockchain technology is not mature enough, it has realized its unique advantages in the financial field. This paper believes that research efforts can be increased to promote the integration of modern technology. The second part is to redesign the financial management system based on blockchain technology, which further strengthens the security performance, and optimizes the existing functional modules with blockchain technology. The redesign of the function module basically meets the development needs of small and medium-sized enterprises. In order to further test the actual performance of the financial system, in the third part of this paper, a number of related experiments are done. From the number of concurrent users and the system response time and other experiments, the experimental data shows that many performances of the modified system meet the current mainstream standards, and show excellent performance. The analysis shows that the system in this paper is an upgrade of the traditional financial management system, and has achieved ideal results.

1. Introduction

Internet technology, big data, cloud computing, artificial intelligence, blockchain It greatly affects the direction of future economic development. Blockchain technology is applied to finance, credit, Internet of things, insurance and other fields. With its unique advantages, it helps related industries reduce costs, improve efficiency, and inject new vitality into related industries. Blockchain technology is a kind of distributed ledger, which packs data into blocks and arranges them in chronological order to ensure that the data will not be tampered with or tampered with, making use of the technical advantages of computer encryption algorithm. Therefore, blockchain based ledgers also have the characteristics of decentralization, trust removal and tamperability: first, decentralization. Blockchain does not rely on centralized ledger records, and any party in the blockchain network can become a "bookkeeper". The generation of any new data block needs to audit all nodes. The account books of each node are the same, updated in real time and exist independently to ensure the authenticity and integrity of transaction information. The second is the distrust mechanism. Blockchain information is distributed and stored in each node. Due to the encryption protection of encryption technology, information users can read the blockchain data of any node, no longer rely on the trust endorsement of any individual or institution, and achieve the effect of de trust. Third, it can't be tampered with, chain block encryption makes data more secure, chain block, distributed storage of books more open and transparent information. Any node forcibly tampering is invalid and will not be tampered by other nodes, so as to ensure the authenticity, integrity, security and reliability of the interlocking block data, greatly reducing the recognition and trust problems caused by data security risks.

The progress of information technology is an important force to promote social development, and technological innovation continues to provide strong vitality for the innovation and development of enterprises. With the rapid development of Internet technology in the past 20 years, the global economy, politics and culture have undergone tremendous changes. China has also begun to explore and develop globalization with this wave of technology. At present, the Internet plus finance mode is still the main mode of financial management and an important direction of enterprise financial development. But in the actual economic and business operation, the problem of "Internet plus finance" is quite obvious. For example, the cost of capital turnover is relatively high, the financial operation process is more complex, and the business time is longer, which restricts the operation of economic globalization. The main reason for these problems is centralized management. As one basic protocols of new generation Internet, blockchain technology has shown its influence on future social development. Blockchain technology has the unique advantages of decentralization and non tampering. Building a decentralized and untrusted database based on blockchain technology can well reduce the impact of trust endorsement of central institutions and third parties on economic and business development. The application of blockchain technology in accounting can simplify accounting, realize audit automation, reduce financial operation cost and prevent financial risks. At present, the accounting industry is moving from the era of financial accounting to the era of management accounting. How the blockchain technology will affect this process and whether it will inject new development elements into the future of accounting is an important issue we need to pay attention to. Based on the essence of blockchain technology, this paper focuses on the application of blockchain in modern financial management.

First of all, this paper describes the basic concepts and technical core of blockchain technology in detail. Through the analysis, it is believed that the distributed ledger is the core technology in the financial management of the independent accounting in the blockchain technology. Using these two

points can reduce the management cost and financial risk to a large extent, and make the financial management system more perfect. This paper analyzes the modern financial management system objectively, and describes its development now. In order to make the blockchain technology get better application in the financial management system, this paper designs the financial management system based on the blockchain technology according to the needs of enterprises. The system uses private blockchain, which not only meets the management needs of enterprises, but also further ensures the financial security of enterprises. In order to ensure the stability of the system, this paper redesigns the system architecture, the new architecture has better performance and higher flexibility. In view of the system security design, this paper decided to adopt the latest C# technology, from the language point of view, the technology has better security performance. For the design of functional modules, in principle, it meets all the needs of most small and medium-sized enterprises. In order to further verify the actual performance of the system in this paper, at the end of this paper, the relevant system test experiments are established. The experimental data shows that the financial management system based on blockchain technology can meet the financial management needs of enterprises in terms of performance and security. This study has achieved ideal results and can be widely used [1-3].

2. Basic Theory and Core Concepts of This Paper

2.1. Definition of Blockchain Technology

Although blockchain technology originated from bitcoin, the concept of blockchain is not defined in the bitcoin white paper. On the contrary, chain ledgers recorded in chronological order are represented by blockchain, and later collectively referred to as distributed storage technology. In a narrow sense, blockchain is a kind of distributed ledger, in which the blocks composed of transaction details are connected in chronological order to form a chained data structure. Cryptography is used to encrypt data internally to fully ensure that internal data will not be tampered with or forged. Broadly speaking, vehicle chain technology defined as process of using data structure to test and save data blocks according to the order chain, using encryption method generated by distributed multi-node consensus algorithm, using encryption and refresh data, and ensuring the safe transmission and access of data, Using automated scripts written in scripting language (called smart contracts) to operate data infrastructure and a new type of distributed computing. The blockchain technology we are talking about now mainly refers to the generalized blockchain technology [4-6].

2.2. How Blockchain Works

The core technology of blockchain is that in the current chain, all participating nodes jointly maintain the transaction information stored in the chain, so the transaction information is based on the principles of cryptography rather than trust. Therefore, any agreement that can be reached by both parties of any transaction requires that they can trade with each other without the participation of a third party. Technically speaking, block is the data structure for recording transactions, reflecting the capital flow of transactions. The transaction blocks completed in the system are connected together to form a backbone network, and all nodes participating in the calculation record a part of the backbone network. A block consists of three parts: transaction information, hash of the previous block, and random number. Transaction information is task data stored in blocks. Transaction information includes the number of transactions between two parties and the digital

signature of electronic currency. The purpose of the hash of the previous block is to connect the blocks so that they are chronologically sorted by past transactions; random numbers are used as the core part of the transaction. All the miner nodes compete to calculate the answer of random number first. The miner node that finds the answer first has the right to keep the account of the newly generated block, and broadcast the block to the network for update, so as to complete the transaction. In essence, blockchain is a huge and decentralized ledger database. With the continuous generation of transactions, all participating miner nodes continuously verify the transaction information and find the appropriate block to store the transaction. This chain structure will continue to grow and expand, and these blocks will be added to the original block chain in chronological order [7-9].

2.3. Characteristics of Blockchain Technology

(1) Decentralization

Discretization is the core feature of blockchain technology, which eliminates the control and intervention of the central node and does not need a third party. Transaction information and data are stored in the public ledger of each distributed node. The transmission of transaction data realizes the direct point-to-point interaction, making the information transmission more efficient and secure. The distributed book in the block chain is maintained by multiple distributed nodes, and the consistency between each node is based on the corresponding rules (cryptographic algorithm). Therefore, each node is an equal block chain network, with the same rights and obligations. The decentralized node block chain network attacks a single node and cannot control or destroy the whole network [10-11].

(2) Cannot be tampered with

Time stamp, asymmetric encryption algorithm and other technologies in blockchain system can make information transmission irreversible, traceable and tamper proof. Once the node information, transaction records and other data are stored on the blockchain, they will exist permanently and cannot be tampered with. This feature of blockchain technology can play a role in various fields of business activities, judge the authenticity of data, and bring convenience to solve the trust problem.

(3) Data transparency

The rules, transactions and records of the blockchain system are open and transparent to the nodes of the whole network. The access principle and consensus algorithm of blockchain are consistent to make the whole network visible: all nodes jointly verify, receive information, backup and broadcast to reach a transaction, and the process itself is completely open and transparent. In the process of transaction, the information received and fed back by each node is recorded, and there is no cheating between nodes.

(4) Anonymity

Blockchain technology protects users' privacy, does not require users to disclose personal identity and account information, and can exchange data anonymously. This is because nodes follow a fixed password algorithm, so they can trade directly without mutual trust, not based on personal identity, but based on address. Therefore, in the process of transaction, both parties can trust each other without disclosing their personal identity, which is called anonymity [12-13].

2.4. Current Situation of Financial Management System

If enterprises want to keep up with the trend of internationalization and improve their competitiveness, they must carry out reforms to solve the problems of business process

standardization, resource information collection and sharing, and strong market adaptability. In the face of these reforms, the management skills of enterprises need to be greatly improved, such as the establishment of a sound financial management system. With the rapid development of economy. The financial management of enterprises has gradually moved towards the direction of China's economic development, and has formed a financial management system suitable for China's national conditions, but there are still deficiencies, which need to be improved [14-16].

(1) Difficult to promote

China's financial management system is lack of computerization of budget, profit analysis and decision-making guidance of financial information, so it is difficult to make correct decisions on the allocation and management direction of enterprises. For small and medium-sized enterprises, due to the principle of cost-effectiveness, they are more willing to choose traditional management methods to reduce costs.

(2) Lack of practical research

The analysis and management of data information in the existing financial management system may not be true or real-time, which is mainly due to the lack of in-depth understanding of domestic enterprise management software, different enterprise scale, different management means, and different financial management modules. Therefore, first of all, it is necessary to investigate and analyze the enterprise, and combine the financial accounting method with the financial management function effectively.

(3) Insufficient understanding of work

The enterprise has changed from the traditional management mode to the modern technology management mode, and has realized the informationization of management and decision-making. Some enterprises lack professional financial management talents, which leads to the relatively backward level of capital management. Some enterprises' capital management is in the hands of powerful decision-makers, who may not have the relevant financial knowledge and skills, and cannot carry out reasonable, scientific and correct financial management. As a result, the development of enterprises lags behind, the financial personnel are not professional enough, which to a certain extent increases the crime rate.

2.5. Advantages of Blockchain in Financial Management

(1) Chain block independent accounting and information encryption protection function, can achieve anti-counterfeiting, consistent data storage, decentralized features and block chain can prevent all kinds of malicious damage (EXTERNAL OR INTERNAL). It can ensure the authenticity of books, security, privacy and information are correct, and reduce financial risks [17-19].

(2) Using the advantages of distributed ledgers, blockchain technology can speed up the transmission of enterprise information and change the problem of information asymmetry under the traditional financial management mode. It helps to improve the operation efficiency, reduce the management cost and improve the customer experience.

(3) In the block chain system, enterprises use intelligent point-to-point transaction contracts with customers and suppliers. The contracts can take effect quickly, and the transactions will spread to every node in the block chain system. It can significantly improve the transparency of financial management information, open, and tamper free, significantly saving more time.

(4) In addition to financial management blockchain system, enterprises can also use blockchain technology to directly publish enterprise information. It increases the transparency and openness of

enterprise financial information, and improves the credibility and authenticity of enterprise information.

3. Design and Implementation of the System

3.1. Blockchain Type Selection

According to the technical means and openness of blockchain, it can be divided into public blockchain, alliance blockchain and private blockchain. The shared blockchain is a completely decentralized operation mode. The public can participate in bookkeeping and anyone can participate in the consensus process. Blockchain alliance is an alliance of multiple industries or groups. Only alliance members can participate in bookkeeping, which belongs to semi decentralized mode. A private blockchain is a partially centralized model in which groups or individuals have the right to book separately. Private chain refers to that the write permission only exists in the organization, and the read permission is only limited to the organization or access permission, so its reading speed is very fast, it can better protect privacy, and the transaction cost is very low. The application of private chain is generally internal, such as more confidential production budget management and financial management. The private chain provides tamper proof, safe and automatic procedures. Because the enterprise is a profit-making organization, the characteristics of the private chain are more suitable for the development of the enterprise.

With the development of enterprises, their economic activities are becoming more and more complex and diversified. Financial management is facing the development situation of diversified scientific research funds, refined budget management and open financial information, so it is necessary to reform the financial management system. With the development of information technology, enterprises need to update their information systems in time. To achieve the timeliness and integrity of monitoring and budget, and lay a good foundation for strategic decision-making, value creation and performance improvement. Through the integration and analysis of financial information through private blockchain, the characteristics of centralized accounting and decentralized storage are realized, so that enterprises can make the best decision in time by using financial information, and realize the rational allocation of resources and information sharing [20-22].

3.2. Blockchain Type Selection

Compared with the general financial management system, the financial management system based on blockchain technology requires higher performance and flexibility, and the data processing ability is not the same. Therefore, it is very important to design a reasonable overall architecture before development. The overall structure of financial system under blockchain technology is shown in Figure 1 [23-25].

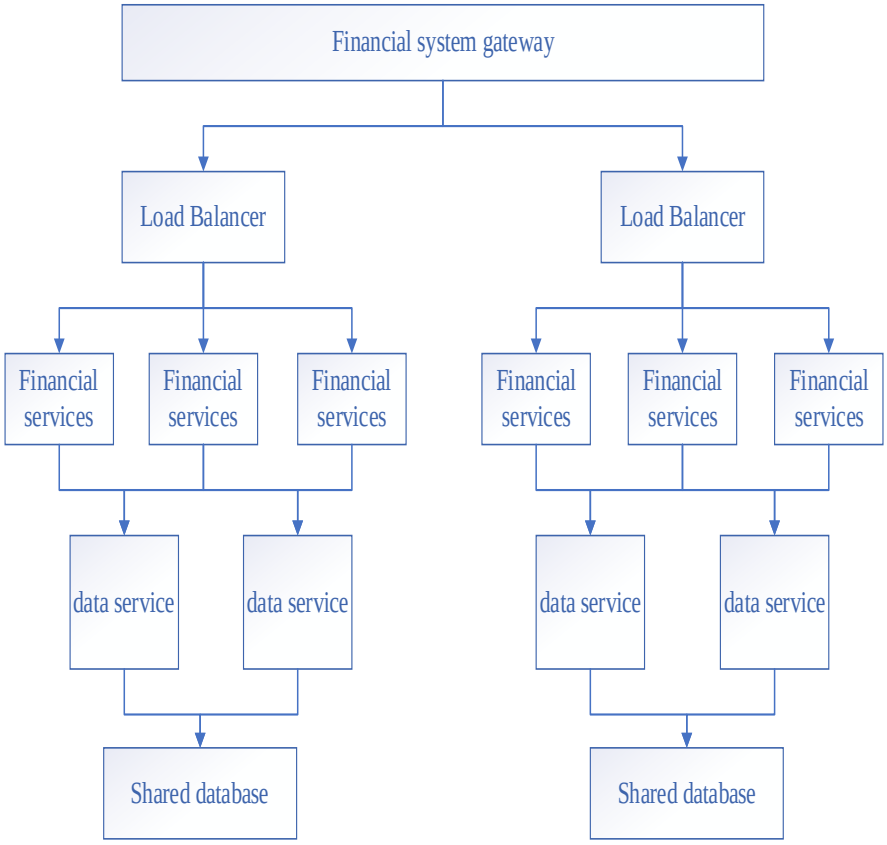

Figure 1. overall structure of financial system

3.3. System Security Design

(1) Development language

Because this system belongs to the financial system, in an enterprise, financial security is very important. So, we put the safety of the system in the first place. We decided to adopt the latest C# technology. From the perspective of language, c# is a simple syntax, a robust, safe, object-oriented and excellent performance multi-threaded dynamic language. In addition, it has the characteristics of close integration, distribution, structure neutrality and portability with the network. The advanced design idea of C# can eliminate the errors in compiling and checking programs in the process of software development. Type checking helps detect many early development errors and provides complete security, including type security. The variable type is safe. Uninitialized variables cannot be used in C#. The compiler is responsible for setting the member variables of the object to zero. When you use a local variable without initialization, the compiler prompts you. C# allows interaction with AP workers who need to pass pointer type parameters in C# style, and can access any entry point of the DLL in the program. C# conforms to the net common language specification, so as to ensure the interoperability between C# components and other language components. The introduction of metadata concept not only ensures compatibility, but also further realizes type security. At the same time, by controlling the memory itself, C# reduces the possibility of memory error and greatly improves the security of program operation [26-27].

(2) System architecture

In the system architecture, B / S architecture is adopted to realize the complete separation of

application server and database server, and the external access to database server is completely isolated.

(3) Login security settings

In the system client login authentication, the user name and password are used for authentication, and the user password is encrypted in the database to ensure the security of the user.

(4) Personnel role

In a system, all users of the system define their roles, and the information in the system can be read and viewed in various ways. You can subdivide permissions in a considerable range to strictly control all operations in the system.

(5) System monitoring

Provide powerful operation records, monitor key information, and generate corresponding reports as required, including operator, operation time, operation object, source data, new data, client IP address, etc. System encryption supports SSL, which encrypts the information transmitted through the network to prevent information from being intercepted or leaked.

3.4. Main Module Design of the System

(1) Data management

After entering the system platform, select the corresponding module to enter the system operation interface. Operators can delete, add, modify, query, set and other operations, save the results to the database, and finally return the result interface to operators.

(2) Voucher management

Enter the bookkeeping part of the system, complete the basic information of bookkeeping, including date, voucher number, etc., then save the bookkeeping information to the database, and finally return the saving prompt information. First, enter the voucher query part, enter the query criteria, call the query method, and display the query results to the system users.

(3) Cashier management

After the cashier logs in to the system, enter the cashier management operation interface. In the cashier management function, you can perform journal management, bank reconciliation management and budget management.

(4) Accounts payable management

The financial personnel first log in to the system, select the function of entering purchase order, enter the information of purchase document, and prepare temporary voucher. After the approval of the financial supervisor, the system automatically generates vouchers. Select the payment processing function, input the payment information, save the data to the database, and return the payment information to the system interface for the financial personnel to view.

(5) Accounts receivable management

The financial business of an enterprise is closely related to the sales department. The accounts receivable management module mainly solves the sales business documents of the sales department. The financial personnel first log in to the system, select the function of entering sales order, enter the information of sales order and prepare temporary sales voucher. After being approved by the financial supervisor, the system automatically generates a sales voucher. Select the collection and processing function, input the collection information, save the data to the database, and return the collection information to the system interface for the financial personnel to view.

(6) Wage management

The first thing to do with the entered salary is to select a department or a month, and then go to

the specific quantity of the salary, which will be calculated automatically by the system according to the wage calculation formula of the wage employee. Finally, save the final salary. In the process of employee salary query, you need to enter the query interface first, and then click the query button. The system will send the query parameters to the server, and then execute the query logic from the database server to obtain the data and return the results to the client. The results will be displayed on the page.

(7) Statistical report management

After the financial personnel log in to the system platform, select the statistics report module, enter the execution conditions to access the business data, and return the statistics report results to the system interface for the financial personnel to analyze. Data management is an essential part of the financial management system. Through the statistics management module, financial managers can define your own reports. Query all kinds of financial data and manage all kinds of reports, including accounting statements, cash flow statements, balance sheets, profit and loss statements, balance sheets, etc.

3.5. System Operation Environment

The system running environment is divided into server and client. The server side is the storage and management of system and system data, and the performance of the server side (such as hardware performance, access bandwidth, etc.) determines whether the system can be run well by multiple users at the same time. The client has low requirements and only needs to access the online shopping system through the Internet [28-30]. The following is the software and hardware configuration of the system server and client:

(1) System configuration.

Hardware configuration: CPU P4 1.5g, hard disk 250g, memory 8054m

Operating system: Windows server2007

Web server: Ⅱ s

Database server: SQL server2007

(2) Client configuration.

Hardware configuration: CPU p41.8g or above, memory 256M

Operating system: Windows 2007

Client: powerbuilder7.07965 or above.

4. System Test and Analysis

4.1. System Response Speed Test

Table 1 shows the survey details and management system of the system response speed test. In this table, the financial budget is based on the block chain technical information, payment, credit information, financial annual statistical inspection and other functions. The operation of each function in the test performance test items of the above functions should be used to determine whether the expected target detection system response performance can be achieved.

By looking at the test data in Table 1 and Figure 2, this performance test is successful because concurrency tends to increase at each stage, and the average response time of each functional operation is within the expected target.

Table 1. Statistical table of system response speed test

Test items	Concurrent number	Expected target	Average response time
transaction detail enquiry	50	<2s	0.289s
	200		0.962s
	300		1.579s
Budget information submission	50	<2s	0.324s
	200		0.576s
	300		1.687s
Payment	50	<2s	0.472s
	200		0.961s
	300		1.472s
View collection information	50	<2s	0.823s
	200		1.367s
	300		1.839s
Financial year statistics	50	<2s	0.752s
	200		1.093s
	300		1.779s

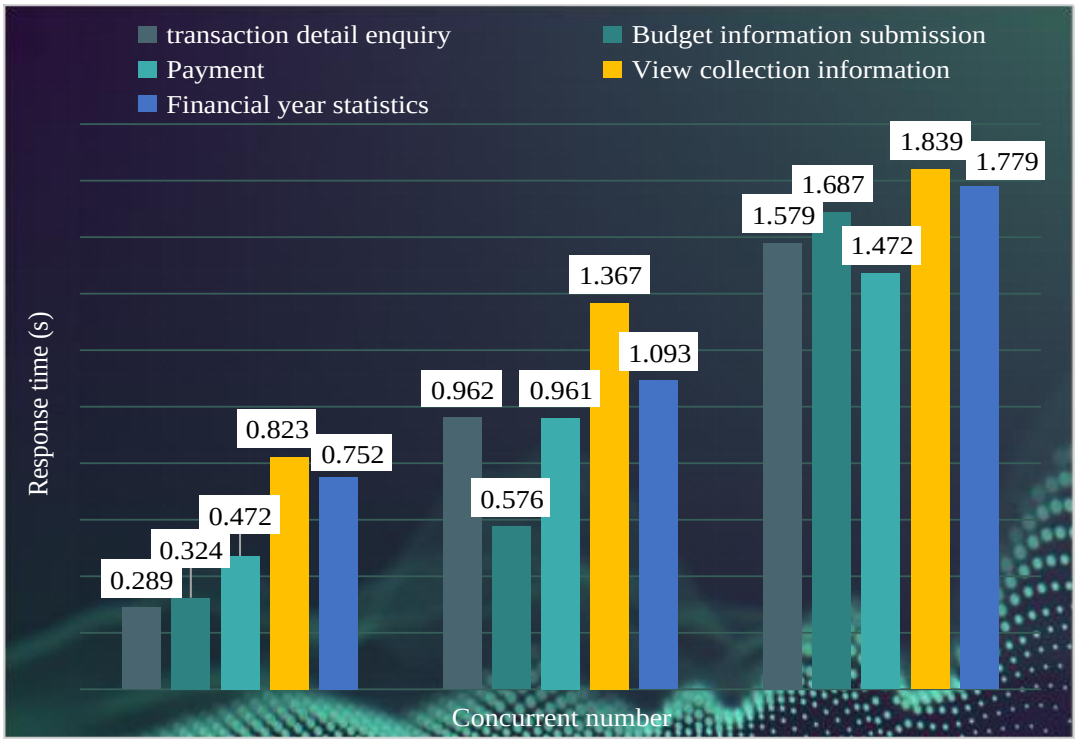

Figure 2. Statistical analysis diagram of system response speed test

4.2. Financial Supervision and Management Function Test

The financial supervision and management function inspection table. The main functions in the financial supervision and management function are simulated and tested. Through the normal user operation process, complete the main application operation within the function, and test whether the response of the system test is within the reasonable expectation range.

From the statistical results, it can be seen that the financial management system based on blockchain technology in this paper has fully achieved the expected goal in the financial supervision and management function test. The results show that the system has a good ability of financial supervision and management, and the experiment is more successful.

4.3. Response Time Test of Multi-user Concurrent Login

In order to meet the needs of rapid development of enterprises, enough personnel should be considered in the design of financial system. For this reason, this paper studies the actual operation ability of the system in the case of multi-user. The test project uses virtual concurrent users to synchronize effective login, number of successful login and average system response time.

From the statistical results in Table 2 and Figure 3, it can be seen that from the average response time, the number of concurrent users of the system is the best within 400, and the average is within 30s, meeting the maximum time requirements of the system requirements. In addition, when the largest user is 700, the response time is also controlled within 1 min, which shows that the system can be applied to large enterprise groups, with good stability.

Table 2. Response time statistics of concurrent login

Number of virtual concurrent users	Number of successfully logged in users	Maximum	minimum value	average value
100	100	18.065	6.174	11.296
200	200	38.152	11.597	25.136
300	300	37.114	0.732	12.14
400	400	59.129	1.206	27.632
500	498	78.678	1.599	38.772
600	593	83.179	1.396	35.693
700	685	118.253	1.172	59.639

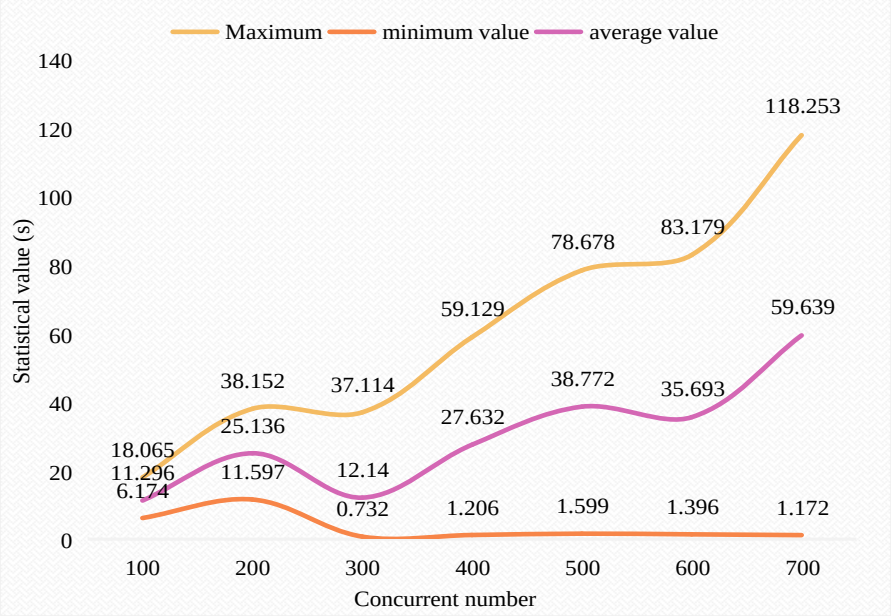

Figure 3. Analysis response time statistics of concurrent login

4.4. Index Analysis of Financial Risk Management and Control Ability

The test sample is enterprise a, the main business is agricultural products, the market involves domestic and foreign, the number of employees is about 800.

From table 3 and Figure 4, it can be seen that from a large perspective, the difference and difference rate of the company's internal control is 1.65, and the difference rate is 31.45%, indicating that the company's financial risk control ability is weak. The financial management system in this paper can achieve the financial risk control function of the company. Through the analysis, the main reason for this problem is that there are some loopholes in the company's internal control system. The effective setting and implementation of internal control links such as control environment, risk assessment, information system integration, supervision and control are not ideal. The main performance is: the fund system is not perfect; independently responsible for the preparation, signing and review of procurement contracts; the physical assets inventory is not timely; there is no mechanism to establish credit files for customers.

Table 3. Statistical analysis of financial risk management and control capability

Statistical items	score	Full mark	Difference value	Difference rate
Effectiveness of risk early warning	5.35	6.7	1.38	21.82%
Perfection of evaluation mechanism	5.62	6.8	1.31	20.03%
Implementation of internal control	3.38	5.2	1.65	31.45%

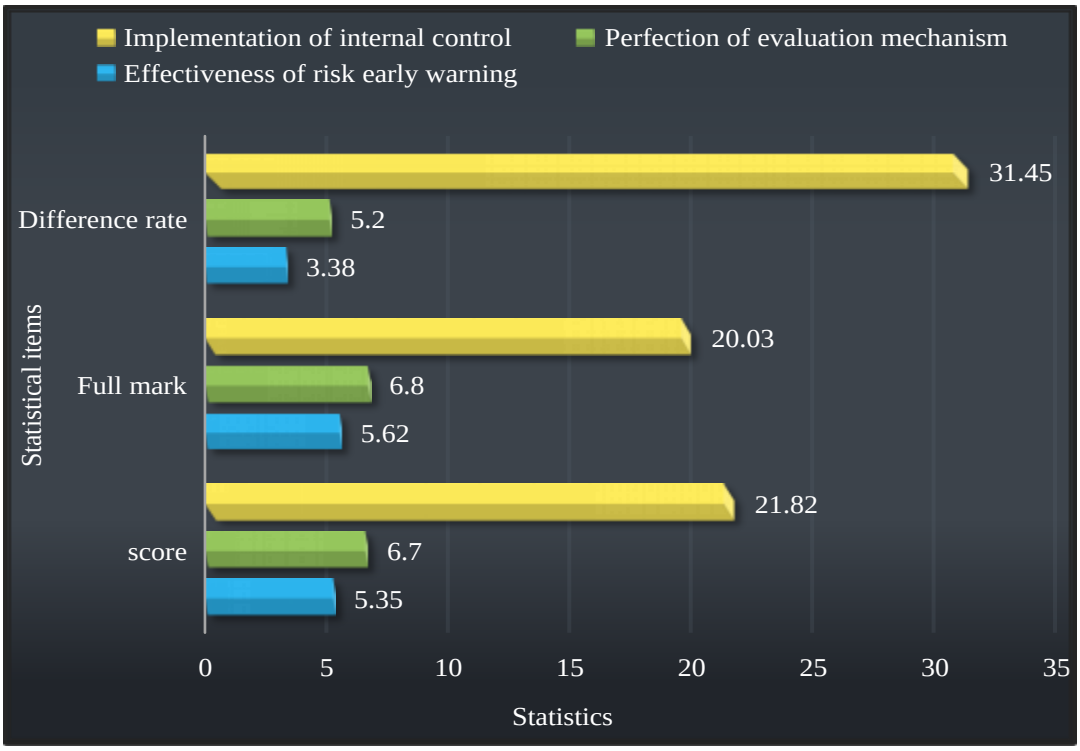

Figure 4. Statistical analysis of financial risk management and control capability

5. Conclusion

Blockchain technology has become the core technology in many high-tech fields. In the field of financial accounting, blockchain technology also shows its advantages. In order to better optimize the traditional financial management system and give full play to the advantages of blockchain technology, this is the main purpose of this paper. Through this study, this paper analyzes that the blockchain technology simplifies the accounting process, and further optimizes the business process, fundamentally reducing the workload of accounting work. Traditional financial management often requires a lot of human and material resources, while the financial management system based on the blockchain technology further reduces the management cost. Through the automation of the whole process, it greatly avoids the thinking factors and decision-making costs. What's more, the technology promotes the modernization and standardization of the financial management field and establishes the foundation for the long-term development of the field. In order to further test the performance of the system in this paper, we set up the corresponding simulation experiment, which tests the performance of the system in the case of multi-user concurrent number, as well as the realization of multiple functions.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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