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Research on Accounting Information Integrity Verification Method based on Blockchain

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Abstract: Conventional accounting information integrity verification method mainly uses SOA mode to obtain verification parameters, which is susceptible to the influence of cloud memory verification transmission bandwidth, resulting in high information integrity verification overhead, therefore, this paper designs a new accounting information integrity verification method based on blockchain. The experimental results show that the designed blockchain-based accounting information integrity verification method has a smaller verification overhead under different data blocks, which proves that the designed accounting information integrity verification method has a better verification effect, has the advantage of low energy consumption, has a certain application value, and makes certain methodological innovations for solving the distortion problem of accounting information.

Keywords: Blockchain; Accounting Information Integrity; Verification Method.

1. Introduction

Accounting information has an important impact on the resource allocation and business decision-making of enterprises, and in the context of economic development, the competition between enterprises in China has become more and more intense, and in order to improve their competitive strength, enterprises need to obtain effective enterprise accounting information and formulate corresponding enterprise development programmes. Affected by the agent of accounting information, principal benefit, the integrity and authenticity of accounting information is getting lower and lower, and it is difficult to make reference for the enterprise development decision. In view of the above problems, China has optimized the process of accounting information supervision in recent years and promulgated many standards related to the supervision of accounting information, but the problems related to it still arise frequently, which is not conducive to the survival and development of enterprises in China. In order to improve the quality of accounting information, it is necessary to design an effective method to verify the integrity of accounting information.

2. The Design of Accounting Information Integrity Verification Method Using Blockchain Technology

The integrity of accounting information and its embodiment of the objectives, confirmation of the elements, measurement, information subject has an important correlation, therefore, in order to effectively carry out the integrity verification must be clear about the integrity characteristics of the accounting information, this paper designs the method according to the joint concept of the FASB / IASB for the integrity of the accounting information to carry out an effective analysis [1]. the joint concept of the FASB / IASB mainly from the eight stages of the joint FASB/IASB concept is based on eight stages of judging the integrity of accounting information, as shown in Table 1 below.

Table 1. Stages of Judging the Integrity of Accounting Information

Step	Details
Phase-A	Objectives and Qualitative Characteristics
Phase-B	Elements and recognition
Phase-C	Measurements
Phase-D	Reporting Entity
Phase-E	Presentation and disclosure, including1 reporting boundaries
Phase-F	Framework purpose and GAAP hierarchy
Phase-G	Applicability to the not-for-profit sector
Phase-H	Entire framework

As can be seen from Table 1, the validation elements of accounting information can be effectively split according to the above assessment phases and assessment contents [2], at which time the relationship between each quality feature can be determined according to the principles of relevance, verifiability, and completeness, and the hierarchical schematic diagram of accounting information integrity features can be constructed. Different levels of integrity verification features have different impacts on the final accounting information verification decision [3], therefore, reasonable trade-offs need to be made according to the differences in features in the verification process.

3. Constructing Accounting Information Integrity Validation Model Based on Blockchain

In order to solve the problem of high information integrity validation overhead caused by the cloud memory validation transmission bandwidth when obtaining the validation parameters in the enterprise system architecture (SOA) model, and to improve the reliability of information integrity validation [7], the application of blockchain can effectively carry out the validation traceability, so as to solve the problem of validation fluctuation [8].In this paper, we combine the blockchain technology with the three-stage bookkeeping method, and firstly, through the blockchain platform to determine the accounting information, a smart contract is generated, the integrity verification process needs to be continuously shared in the public chain, so at this time, the

accounting information bookkeeping records can be determined, the generated blockchain-based integrity verification confirmation model diagram. The integrity verification confirmation model diagram can effectively determine the accounting information accounting amount fluctuation [9].

After the accounting information is generated, the above model can determine the addition and deletion status of the accounting information based on the enterprise's asset relationship, record the accounting information generation time using timestamps, and carry out unified numbering [10]. After the numbering is completed, the existing accounting information are all traceable information, and the integrity of the accounting information can be quickly determined based on the number of the traceable information, and then shared through the distributed samples for integrity verification.

4. Design of Accounting Information Integrity Verification Mechanism

According to the accounting information integrity verification model designed above, the integrity verification mechanism can be further designed to obtain reasonable integrity verification standards. First of all, according to the integrity verification classification principle, to determine the fit of accounting information with the Extensible Business Reporting Language (Structured Business Reporting Language, SBRL), the introduction of a new concept of coverage, coverage and completeness are always positively correlated between the assumptions, at this time the accounting information to be verified, the verification of relevance to obtain the formula is shown below.

$$P_{it} = \alpha_0 + \alpha_1 eps_{it} + \varepsilon_{it}$$

In the formula, are on behalf of the surplus difference, on behalf of the verification of the absolute value, on behalf of the verification of the constant, according to the validation of the relevance of the above can determine the degree of surplus within the accounting information, at this time you can calculate the profit manipulation of the difference as shown below.

$$TA = \beta_1 (\frac{1}{Asset})$$

In the formula, on behalf of the revenue growth, on behalf of the total assets at the end of the period, according to the profit manipulation difference can be verified on the existing accounting information of the surplus variable, this time the absolute value of the verification variable as shown below.

$$NDA = \frac{TA}{Asset} * \delta$$

In the formula, it represents the total accrued profit, and after the absolute value of the validation variable is confirmed, the non-manipulative profit of the accounting information can be verified, as shown below.

$$XBRL(t) = \sum_{j=1}^{N} \Delta REC$$

In the formula, on behalf of the number of financial information elements, according to the above calculation of variables, at this time, it can be assumed that the financial information of the accounting information has a moderating relationship, therefore, you can use the Feltham model for information relevance of the split, to generate the relevance of the validation function, as shown below.

$$DA = v_0 + NDA + Roa + TobinQ$$

In the formula, on behalf of the parameters of the explanatory variables, on behalf of the information relevance, on behalf of the reliability of the accounting information, the integrity of the information and its relevance is always positively correlated, therefore, after determining the relevance of the validation function only need to determine the number of integrity elements within the accounting information can be generated to validate the integrity of the target function, as shown below.

$$f = \frac{1}{DA} \sum_{j=1}^{n_j} x_a$$

In the formula, on behalf of the integrity adjustment coefficient, the integrity of the accounting information data into the above objective function can be generated to verify the integrity of the accounting information verification mechanism, from different levels of integrity verification.

In the process of actual accounting information integrity verification, different verification nodes can be viewed as independent verification factors to generate the information user body structure, so as to build a complete information verification mechanism. In this verification mechanism, the integrity data has a distributed storage relationship, so the integrity verification can be carried out through different blockchain clusters. The designed verification mechanism can get

Several integrity verification modes are obtained, one of which is the anonymous verification mode, which can determine the relationship between the information and the subject according to the transaction records of the accounting information to complete the integrity verification; the second is the binding verification, which is verified according to the number of the information; and the third is the anonymous verification mode, which needs to be verified and registered according to the authentication status of the blockchain, so as to run the reasonable verification mechanism of the accounting information. In addition, it is also necessary to pay attention to the accounting information processing link in the verification process, try to reduce the verification bias generated by each link, fundamentally improve the effectiveness of the integrity verification of accounting information, and reduce the final verification time overhead.

5. Experiment

In order to verify the verification effect of the designed blockchain-based accounting information integrity verification method, this paper analyzes the basic experimental ideas, selects effective experimental samples, and conducts comparative experiments with the information integrity verification method based on the hidden channel in Literature I and the information integrity verification method based on no bilinear pairs in Literature II.

Combined with the accounting information integrity verification requirements, this paper sets up an effective integrity verification scheme, i.e., collecting the original accounting information data, uniformly carrying out the first digit distribution test (Benford test), looking for the internal existence of the vulnerable data, and then setting up the

experimental indexes to construct the test system. According to the experimental sample training process can be experimental samples and experimental indicators selection. The experimental samples selected in this paper are the accounting information samples of listed companies in a region from 2010 to 2020, which come from the CSMAR authoritative accounting public database, which is set up in the experimental samples of the type of violation and coding as shown in Table 2 below.

Table 2. Violation types and codes of experimental samples

Violation type code	Violation behaviour	Violation type code	Violation behaviour
P2501	Fictitious profit	P2509	Unauthorised change of use of funds
P2502	Misrepresentation of assets	P2510	Occupation of company assets
P2503	False Records	P2511	Insider Trading
P2504	Delayed Disclosure	P2512	Unauthorised Trading of Shares
P2505	Material Omission	P2513	Material Omission
P2506	Inaccurate Disclosure	P2514	Unauthorised Guarantees
P2507	Fraudulent Listing	P2515	General Accounting Mishandling
P2508	Contribution irregularities	P2599	Others

Combined with the experimental sample violation types and codes in Table 2, considering the limitations of this experiment, this paper only selects the listed companies with information integrity errors in their annual reports, and deletes the fraud samples of the companies in the fixed industry. According to the screening requirements of the experimental samples mentioned above, this paper excludes a total of 8,589 pieces of sample data, retains 18,453 pieces of sample data, and adjusts the sample data in accordance with the ST and PT standards.

Once the above experimental validation indicators have been selected, descriptive analyses can be carried out for the selected samples, starting from the number of companies and the existence of the annual stratification problem, and the statistics of accounting information incomplete samples. In order to improve the effectiveness of the experiment, this paper uses Excel software to process the selected accounting information samples, the missing part of the sample using SPSS software to fill in effectively, in order to meet the experimental requirements, this paper uses the ABS function to select the absolute value of the experimental sample of the data, at this point, the main validation indicators of the frequency distribution of the relationship between the following Table 4 shows.

As can be seen from Table 3, after the initial data sample processing, the main validation indicator characteristics can be obtained, and at this point the distortion indicator characteristics can be further analyzed according to the principle of correlation goodness-of-fit.

From the above correlation calculation data, it can be seen that the selected experimental indicators meet the subsequent experimental standards, from which samples with problems in information completeness are selected to participate in the goodness-of-fit test, and the test samples are output to generate data blocks of different sizes, so as to carry out the subsequent validation experiments of information completeness.

Table 3. Frequency distribution relationship of the main validation indicators

Indicator	1	2	3	4	5	6	7	8	9
Q1	178	74	38	24	16	20	12	9	22
Q2	149	48	35	29	35	31	18	25	23
Q3	128	56	43	39	35	20	27	21	24
Q4	128	71	51	39	31	29	12	21	11
Q5	129	74	47	41	33	18	15	23	13
Q6	57	61	64	56	64	36	32	14	9
Q7	252	88	28	13	7	1	2	0	2
Q8	124	76	43	43	27	26	18	17	19
Q9	90	77	59	38	32	29	21	27	20
Q10	140	70	41	38	24	25	21	15	16
Q11	101	66	65	45	30	27	17	22	20
Q12	114	66	52	44	29	36	26	17	9
Q13	245	38	5	7	2	7	3	18	68
Q14	357	25	6	3	1	1	0	0	0
Q15	259	67	19	13	3	5	5	8	14

6. Experimental Results and Discussion

Combined with the above experimental preparation, the application of the above selected experimental samples can be carried out accounting information integrity validation experiments, first of all, adjust the validation environment to a unified state, determine the experimental parameters in the MATLAB experimental platform, set up a number of accounting information validation data blocks, at this point in time, pre-use of this paper's design of the blockchain-based accounting information integrity validation method for validation.

Experimental results: the calculation time of the literature II method is between 0s-1s when the number of accounting information integrity verification data blocks is 200; when the number of data blocks is 400, the calculation time of the integrity verification method of the literature II is between 2.0s-3.0s; when the number of data blocks is 600, the calculation time of the integrity verification method of the literature II is close to 3.0s, and based on the above results, it is known that the integrity verification time overhead of the literature II method is relatively high. As can be seen from the experimental results, the verification overhead of the blockchain-based accounting information integrity verification method designed in this paper is relatively low, the verification effect is better, it has the advantage of low energy consumption, and it has certain application value.

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