



# The Empowerment and Subversion of Information Technology to Accounting Information System

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**Abstract.** In the era of digital economy, the accounting information system is facing unprecedented challenges: the principal is further refined into investment investors (small and medium shareholders) and management investors (large shareholders), which makes the “second type of agency problem” widely exist, which in turn promotes obvious changes in information demanders; however, from another perspective, based on the empowerment and subversion of information technology, the development of accounting information systems can be described as even more powerful. To this end, the author proposes: firstly, reshape the accounting information system based on “blockchain technology” and replace “numbers” with “data”; secondly, use “big data + machine learning” to reconstruct accounting algorithms to realize disruptive innovation on financial calculation and forecasting; finally, add data asset elements to the balance sheet to realize the instant and visualization of information disclosure.

**Keywords:** Information Technology · Accounting Information Systems · Numbers and Data · Accounting Algorithms

## 1 Introduction

The corresponding accounting method in primitive society has gone through three stages: “physical counting method”, “knot counting method” and “engraved counting method”; with the appearance of writing, human beings began to apply single-entry accounting method; Luca Pacioli invented the double-entry bookkeeping method; in 1907, Xie Lin and others first introduced the ‘debit/credit’ symbol from Japan to China [1]. Double-entry bookkeeping has gone through the process of “manual accounting” to “computerized accounting” in China, and then evolved into an ERP system that integrates business finance. In the era of digital economy, with the help of science and technology “empowerment”, the accounting industry has begun to use big data, artificial intelligence, mobile Internet, cloud computing, and Internet of Things technologies to form today’s “financial sharing”, “smart accounting”, “cloud accounting”, “Big Data Accounting” and “Blockchain Accounting”. The digital transformation of enterprises has achieved cost reduction and efficiency enhancement, strategic synergy, centralized management

and control, business optimization and resource integration. In today's society, everything can be encoded. On March 30, 2020, the Central Committee of the Communist Party of China and the State Council issued the "Opinions on Building a More Perfect Market-Based Allocation System and Mechanism", which identified data as the fifth factor of production after land, labor, capital, and technology, and made it clear that the cultivation of Data Element Market should be accelerated. After land, labor, capital, and technology, data has officially become the fifth factor of production. As the application of blockchain technology enters the 3.0 era [2], its impact on traditional accounting will be disruptive or a disruptive innovation.

## **2 The Analysis of the New Challenges Faced by "Accounting Information System"**

### **2.1 Traditional Challenges to Accounting Information Systems**

The result presented by the accounting information system is data, and the centralized presentation is financial statements. At present, there are many problems with financial statements. Firstly, the authenticity of the data is doubtful, and the endless emergence of financial fraud cases has greatly hurt the credit of the capital market; secondly, the timeliness is difficult to guarantee, which is closely related to the traditional technical foundation; thirdly, the relevance of the statements is obviously insufficient. Existing research shows that the explanatory power of financial indicator systems for stock prices has dropped from 90% in the 1950s to 50% in recent years, if the influence of financial analysts and non-accounting filings with the Securities and Exchange Commission is excluded, the amount of new value-related information provided by the current accounting information disclosed by the company is only about 5% [3]. At present, the information revolution has led to the disconnection of intellectual capital, innovation activities and accounting measurement, and the value relevance of accounting information is rapidly lost (Huang Shizhong et al., 2020). In addition to the above problems, the author further analyzes and finds that the accounting information system also faces new challenges.

### **2.2 The "Second Type of Agency Problem" Prompts Changes in the Users of Accounting Information**

In the past, we paid attention to the principal-agent problem caused by the separation of powers, but now the owners of property rights (investors) are divided into investment investors (small and medium shareholders) and management investors (large shareholders), and there are often serious conflicts between the two parties. Such Conflicts of interest form the type II agency problem, that is, the problem that large shareholders cannot be fully supervised by small and medium shareholders and thus act detrimental to the interests of small and medium shareholders [4]. The ownership and management rights of small and medium shareholders are completely separated, and they are usually more interested in the dividends and the appreciation of the market value of securities than actively participating in directing the company's affairs; while the major shareholders are more concerned about the performance of the entrusted responsibilities of the

**Table 1.** Shareholding structure of listed company in chinese A stock market (n = 3561)

Capital Market	State Holding		Regulatory Holding		Average Ratio of Outstanding Shares	HHI 1	HHI 5	HHI 10
	num	average ratio	num	average ratio				
A-Shares	15%	21%	62%	18%	75%	33%	54%	60%
Main board	21%	22%	38%	14%	94%	36%	55%	60%
SME	10%	17%	88%	16%	74%	32%	53%	59%
GEM	7%	19%	93%	24%	63%	29%	52%	60%

**Table 2.** Corporate governance information of listed company in chinese A stock market (n = 3561)

Capital Market	The Correlation Between HHI10	Chairman and General Manager	Director Share holding	Supervisor Shareholding	Executive Shareholding	Independent Director in the Same City
Main board	21.40%	23.72%	67.93%	43.38%	67.03%	13.62%
SME& GEM	96.42%	37.84%	90.66%	53.71%	88.43%	47.64%

company’s managers in the past period, they still retains the right to directly supervise business managers. Then the demanders of accounting information are divided into three aspects: managers (trustees), management investors (large shareholders) and investment investors (small and medium shareholders) [5].

In order to further prove this conclusion, the author selected a total of 3,561 sample companies of A-share listed companies (including 1,902 companies listed on the main board, 921 companies listed on the SME board, and 738 companies listed on the GEM board). The relevant statistical results are shown in Table 1 and Table 2.

**2.2.1 Major Shareholders of Listed Companies Have Obvious Control Ability**

Firstly, “Accounting Standards for Business Enterprises No. 2 - Long-term Equity Investment” Application Guide (2014) stipulates that when an investor directly or indirectly holds more than 20% but less than 50% of the voting rights of the investee, it is generally considered that the investor has a significant impact on the investee. Secondly, “Measures for the Administration of Acquisition of Listed Companies” stipulates that when investors can actually control more than 30% of the voting rights of the listed company’s shares, they have control over the listed company. At last but not least, the “Securities Law” stipulates that, unless otherwise specified, a resolution made at a general

meeting of shareholders shall be passed by more than half of the voting rights held by the shareholders present at the meeting. From Table 1, it can be seen that the average shareholding of the largest shareholder of the 3561 A-share sample companies is 33.4%, and the largest shareholders basically have the control ability; Looking at the company's top five shareholders, the average number of shares held by them is 52.21%. Compared with the total number of shares held by the top ten shareholders, there is not much difference, that is to say, the top five shareholders have achieved absolute control. If we consider the relationship between major shareholders, the control ability will be stronger. As shown in Table 2, 21.4% of the companies on the main board have related relationships among the top 10 shareholders; among the SME board and the GEM board, this proportion has reached to 96.42%. From this, it is concluded that the listed companies in china do have a centralized shareholding structure of "one share dominance", as well as the objective fact that the major shareholder has the ability to control.

### **2.2.2 The Conspiracy Between Major Shareholders and Management has the Basis of Interest and Governance Structure**

It can be seen from Table 1 that among the 3,561 A-share sample companies, 62.15% of the companies have shares held by the regulatory authorities; further looking at the governance information in Table 2, in an average of 23.72% of the companies, the chairman and the manager are the same person. Furtherly, an average of 67.93% of the companies have directors Shareholding, and an average of 43.38% of the companies have shares held by supervisors, and an average of 67.03% of companies have shares held by executives. The corresponding proportions of the SME board and GEM board are higher. From the perspective of the agency problem between owners and operators, this governance structure can well prevent information asymmetry, and encourage managers to create performance, and also protect the interests of owners. However, it is obvious that such an arrangement creates a conspiracy basis of interests and governance structure between major shareholders and regulators. In addition, compared with small and medium investors, major shareholders and regulators have absolute information advantages. When they care about their investment returns (stock price rise and dividends), but the company's assets and liabilities, profits, and cash flow data are not ideal, there are Motivation to conspire to cheat and take advantage of the opportunity to cash out, harming the interests of small and medium investors.

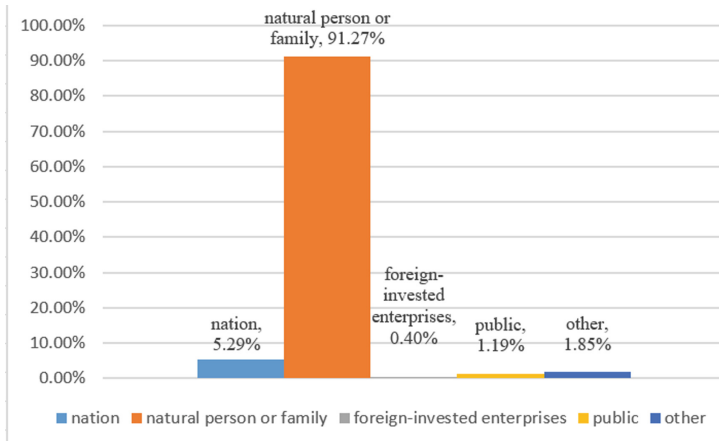
### **2.2.3 The Second Type of Agency Problem of Private Listed Companies is Particularly Obvious**

The author analyzes the governance structure of 756 private listed companies in A shares as shown in Table 3.

From Table 3 and Fig. 1, it can be seen that among the 756 private companies in A-shares, the actual controller has an average of 40.9% of the control rights, and the phenomenon of "one share dominance" is even more prominent. Furtherly, 91.27% of the actual controllers are natural persons or their family, and only 5.29% of the actual controllers are the state. Looking at the average attendance rate of shareholders' meetings, the rate is only 52.12%, which means that nearly 48% of small and medium shareholders

**Table 3.** The Governance information of private listed companies in chinese A stock market (n = 756)

Index	Ratio
The Actual Controller’s Control Right Ratio (avg)	40.90%
The Attendance Rate at the General Meeting of Shareholders (avg)	52.12%
The Actual Controller Acts as the Chairman or General Managers	74.47%
The Chairman and General Manager are the Same Person	41.81%
The Shareholding Ratio of Directors	85.05%
The Shareholding Ratio of Supervisor	48.28%
The Shareholding Ratio of General Manager	78.65%



**Fig. 1.** The structure of actual controller of private listed companies in chinese A stock market (n = 756)

did not attend the shareholders’ meeting. The “Securities Law” stipulates that the resolution of the general meeting of shareholders generally requires more than half of the voting rights held by the shareholders attending the meeting to pass. From the current situation, the actual controller has a dominant share, and nearly half of the shareholders did not attend the meeting, as a result, there is only one outcome: that is the actual controller decides all the resolutions of the general meeting of shareholders. In addition, in 74.47% of the companies, the actual controller is the chairman or general manager, 85.05% of the companies have directors shareholding, 48.28% of the companies have supervisors Shareholding, and 78.65% of the companies have the shares hold by general manager. Such a governance structure can be described as “one share dominance”. The controlling shareholders absolutely control the general meeting of shareholders, and directors, supervisors, and executives directly hold shares, so that the collusion between major shareholders and regulators is easy to achieve, in that way, who will protect the

interests of small and medium-sized investment? which is also not conducive to the development of a healthy capital market.

### 3 In the Era of Digital Economy, Information Technology Empowers and Subverts Accounting Information Systems

#### 3.1 Reshaping the Accounting Information System Based on “Blockchain Technology”, and Replacing “Numbers” with “Data”

The current accounting information system still uses currency as the main unit of measurement. After the business documents are processed by the accounting information system, the presentation is the accounts and figures, which finally generate our financial statement items as well as financial indicators. The result of this process is that accounting information is easy to fall into the digital circle of “from finance to finance”, and financial information measured in currency greatly reduces the relevance and usefulness of financial information. If users of accounting information are based on an all-encompassing “number”, and it is difficult to see the economic substance behind it and to make a correct value judgment (Fig. 2).

The “data” in the digital economy era is far richer than the “number” connotation. A number is a written symbol used to represent numbers. For example, we commonly use Arabic numerals in financial statements as the main unit of measurement. Data is the result of facts or observations, it is a logical induction of objective things, and an unprocessed raw materials used to represent objective things. Data can be continuous values, such as sounds and images, called analog data; or discrete values, such as numbers, symbols, and words. That is to say, the accounting information system can present not only numbers, but also sounds, images, words, symbols, and so on. The accounting information system based on blockchain technology adopts a P2P network architecture and defines a permissioned network. Each transaction information stored in it includes the source of income (In), the hash value of the transaction block of the source of income (Previous tx), the source of income area, the specific transaction in the block (Index), the sender’s private key signature (Scriptsig), the output party (Out), the sent currency value (Value), the receiver’s public key (Scriptpubkey) and many other information. As a result, the transformation of financial information from numbers to data can be realized. Finally, the accounting information system based on blockchain technology forms a distributed ledger (or data) that can be mastered by the whole network by continuously solidifying and transparentizing the transaction information, which is enough to generate trust between strangers. Replacing pure numbers with massive data can provide more

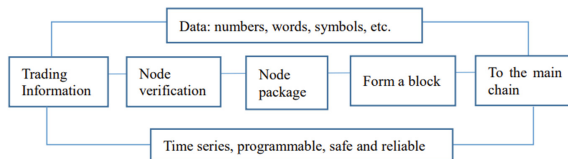


Fig. 2. How the blockchain data layer works

comprehensive and valuable information, and provide a comprehensive and credible database for subsequent financial analysis and forecasting.

### **3.2 “Big Data + Machine Learning” Reconstructs Accounting Algorithms to Realize Subversive Innovation in Financial Calculation and Forecasting**

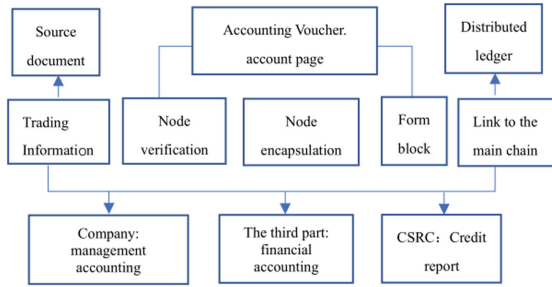
All transaction information is stored in the accounting information system based on blockchain technology, and is composed as chain data. These data can be stored in various forms such as sound, image, text, symbols, numbers, etc. and then comes the challenge of computer storage capacity and computing power with blockchain technology, in order to facilitate storage, network nodes output these data as a fixed-length hash value through a hash function, and then verify, encapsulate, and generate blocks through each node in the network. This treatment greatly reduces the storage pressure. However, due to the requirements of the proof-of-work mechanism, the mining process of each node requires the guarantee of strong computing power. Thanks to the empowerment of cloud computing, the pressure on storage and computing power can be effectively relieved.

The significance of technological upgrading for accounting information systems is: firstly, in the face of certainty, the stability and efficiency of the execution process of accounting algorithms are improved; secondly, in the face of relative certainty, the selection of existing accounting algorithms is optimized, Through the application of improved computing power and non-financial data, the logic of business-driven finance based on mathematical models become clearer, and the accounting estimates become more accurate; finally, in the face of uncertainty, the unique role of people in the implementation of accounting algorithms is highlighted [6]. A large amount of non-financial information is involved in the operation of complex mathematical models, and the addition of big data algorithms and machine learning algorithms will well avoid the defects of “from finance to finance”, and realize the link from business to finance, and furtherly enhance the reliability and timeliness and relevance of information.

### **3.3 Real-Time and Visualization of Information Disclosure for Investors**

Investment investors (small and medium shareholders) often do not have the professional ability to read financial statements, and due to information asymmetry, it is difficult for small and medium shareholders to verify the authenticity of financial statements, and they often rely more on securities company brokers or securities researchers' research report. In order to protect the interests of clients and to regulate and ensure the healthy and stable development of the capital market, an information disclosure system for investment investors should be introduced. On the basis of the big data foundation and accounting algorithm innovation mentioned above, a timely and visual enterprise value report for investment investors become to be the trend (Fig. 3).

With the promotion of digital currency, various transactions in the economy and society are verified by the entire network through the broadcast mechanism and consensus mechanism of the p2p network; then the entire network miner output transaction information as a fixed-length hash value according to the hash algorithm. The above is similar to preparing accounting vouchers for each transaction. Then, by hashing all



**Fig. 3.** The information disclosure system based on blockchain technology

transactions in a certain period of time, a block is generated, which is similar to a registered account page. Finally, the loop operation is to continuously lengthen the blockchain to form a network-wide distributed account book (blockchain) about transaction data. Each account page (block) can be traced back, and the original transaction data can be obtained, even can be traceable to the transaction data of the genesis block. This model allows the original data of economic and social transactions to be stored securely and cannot be tampered with, and can prevent information asymmetry caused by enterprises' self-booking, which is a centralized database.

## 4 Conclusions

Demski et al. (2002) believe that the core competitiveness of accounting lies in its information processing technology, which is the unique information processing method of accounting that enables information users to obtain valuable information from massive accounting data. To this end, the author proposes that the reconstruction of the accounting information system based on blockchain technology will ensure the authenticity and integrity of the data source to a large extent; coupled with the continuous innovation and improvement of accounting algorithms by big data technology and machine learning models, The efficient transformation of data to information will be realized; and in the final disclosure process of information, a timely and visual enterprise value report for small and medium shareholders is added. This will realize subversive innovation of the entire accounting information system, and better serve for the real economy, and reshape new business models to create value. However, the revision of accounting algorithms in practice has seriously lagged behind the development speed of practical innovation, which will become the next research topic. The application of blockchain technology in accounting information system will be another research direction.

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