

# Research on University Cost Management Based on Blockchain Technology

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**Abstract:** With the wide application of blockchain technology in various business fields, accounting work, which records, confirms, measures, calculates, and reports businesses after their completion, has changed accordingly. The basic accounting theory has also undergone substantial changes. The accounting and management of university operating costs and per-student costs, as an important part of accounting work, have also changed. From non-existent to existent, from small-scale accounting to comprehensive accounting, from traditional cost accounting to activity-based cost accounting, and from rough accounting to detailed accounting, all are inseparable from blockchain technology. This article starts from aspects such as university development, the content of university operating costs, and the efficiency of the use of financial funds, combines the characteristics of blockchain technology, analyzes the impact of blockchain technology on accounting work and basic accounting theory, and thereby studies the university cost management model based on blockchain technology.

**Keywords:** Blockchain; University Operating Costs; Per-Student Costs; Cost Management.

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## 1. Introduction

Since 2000, China's higher education has developed rapidly, the scale of running schools has continued to expand, and the investment in education funds has also been increasing [1]. In order to improve the efficiency of fund use, clarify the per-student cost, and facilitate government financial allocation and cost control in colleges and universities, on August 17, 2020, the Ministry of Education and others issued the notice of "Opinions on Further Strengthening and Regulating the Management of Education Charges", proposing to improve the fee management system and strengthen the investigation of education training costs. At the same time, the Ministry of Finance has issued the "New Government Accounting Standards" and released the "Basic Guidelines for Cost Accounting of Public Institutions", requiring that the cost accounting in colleges and universities should also follow this standard to strengthen cost accounting work. Taking six provinces of Zhejiang, Fujian, Henan, Hunan, Sichuan, and Yunnan as pilot provinces, they are required to submit reports to the local financial department every month starting from January 2024. Subsequently, in March 2021, the General Office of the Ministry of Finance printed and distributed the "Outline of the '14th Five-Year' Plan for Accounting Reform and Development (Draft for Soliciting Opinions)", proposing to study and formulate specific guidelines for cost accounting in colleges and universities, and steadily promote cost accounting in public institutions. For this reason, colleges and universities must strengthen the accounting of education costs, clarify the composition of education costs, and control education costs, which has become a strong support for improving the quality of higher education in China [2].

## 2. Contents of University Cost Management

As a non-profit institution, although the economic sources of universities are multi-channel, they mainly come from the national financial allocation[3]. Therefore, universities are

under the control of the state and enjoy the decision-making power of running schools and the right to use funds under the premise of implementing relevant national laws, regulations and policies. They educate students through various methods such as classes, scientific research and practice, and their achievements are mainly the intellectual achievements condensed on students[4]. University costs are divided into broad and narrow senses. In the broad sense, the main body of cost occurrence refers to all the expenses consumed by the state, families and society to cultivate a university student, and its types include financial cost and opportunity cost. According to the functional characteristics of universities, university costs can be divided into education cost (talent cultivation cost), scientific research cost and social service cost. The education cost of universities in the narrow sense refers to the value of educational resources consumed by universities for student cultivation and measurable in currency, that is, the financial cost (monetary cost), which is mainly the cost of universities for talent cultivation. This article mainly discusses the education cost of universities in the narrow sense [5].

### 2.1. Cost Accounting Object in Universities

There are different types of students receiving education in universities, including doctoral students, undergraduate students, higher vocational students, adult students and online students, etc. In order to measure the average learning cost of higher education, the average cost of students in the total education can be calculated by dividing the total cost by the number of standard students. According to the difference in resource consumption, the average education cost of students at different levels and categories can be measured[6].

When measuring the education cost, students who have not received academic education should generally be excluded because the education standards and financial support for these students vary greatly. There are different allocation and compensation rules for the cultivation cost, and the cultivation cost should be calculated separately.

According to Article 12 of the "Basic Guidelines for Cost

Accounting of Public Institutions", the unit can determine the accounting object from three perspectives: (1) Determine according to the type of business activity; (2) Determine according to the policy and project; (3) Determine according to the public service or product provided. In the academic field, no unified viewpoint has been formed on the measurement object of university education cost. The focus of the debate is the third point, that is, whether the educational product of universities is service or student. One view holds that taking students as the accounting object, the product of university education is students, and they can be classified according to the level and major of students. Another view holds that the product of university education is educational service, and the educational service quantity provided by the school for a single student in one year can be taken as the accounting object. This article believes that higher education belongs to the service industry, and the cultivation of students by universities is a basic function. In this way, the true meaning of the product should be a kind of service, not a student. However, since the "service product" is virtual, some accounting problems need to be solved by accounting for specific service objects. Specifically, the accounting object of education cost can be defined as the educational service received by students of different levels and types.

## 2.2. Cost Accounting Cycle, Accounting Basis and Principles in Universities

Regarding the period of university cost accounting, there are roughly three viewpoints: (1) Take the Gregorian calendar year as the accounting cycle; (2) Take the academic year as the accounting period; (3) Combining the above two viewpoints, the school's financial report is prepared on a regular basis according to the Gregorian calendar year, while the education cost report is prepared according to the academic year. Article 9 of the "Basic Guidelines for Cost Accounting of Public Institutions" points out that each unit can determine the cost calculation cycle according to the cost information requirements and the cost accounting object, generate the cycle cost report, and fully reflect the unit cost situation. The teaching activity time of the school has its particularity. It has two semesters in spring and autumn. From September 1st to August 31st of the following year is an academic year. The main business activities of the school are all carried out in this cycle, as well as the students' promotion and graduation. In China, the accounting cycle of university cost accounting is the same as the financial accounting cycle, which is from January 1st to December 31st of the Gregorian calendar year, and the pilot operation has begun in six pilot provinces including Zhejiang, Fujian, Henan, Hunan, Sichuan and Yunnan.

Article 6 of the "Basic Guidelines for Cost Accounting of Public Institutions" stipulates that the unit shall carry out cost accounting based on the financial accounting data under the accrual basis to meet the needs of cost accounting. Set up the relevant detailed subjects of financial accounting for auxiliary accounting. When carrying out the teaching cost accounting in universities, the financial accounting data should be taken as the accounting basis, rather than the budget data. In the process of cost accounting, the setting of relevant subjects is also based on financial accounting.

According to Article 8 of the "Basic Guidelines for Cost Accounting of Public Institutions", when a unit carries out cost accounting, it shall follow the following six principles: Relevance principle, reliability principle, adaptability

principle, timeliness principle, comparability principle and importance principle.

## 2.3. Setting of Accounting Subjects

On October 24, 2017, the Ministry of Finance issued the "Government Accounting System - Accounting Subjects and Statements of Administrative Institutions", from which it can be seen that the cultivation cost mainly consists of five parts: salary and welfare expenditure, commodity and service expenditure, subsidy to individuals and families, debt interest and expense expenditure and capital expenditure. Therefore, when setting accounting subjects, the first-level subject can be set as "Education Cost", the second-level subject can be set as "Business Activity Expense" and "Unit Management Expense", the third-level subject can be set as "Education Expense", "Scientific Research Expense", "Administrative Management Expense" and "Logistics Support Expense", and the fourth-level subject can be set as "Salary and Welfare Expense", "Commodity and Service Expense", "Subsidy Expense to Individuals and Families" and "Asset Depreciation (Amortization)". The fourth-level subject can be set as "Salary and Welfare Expense", "Commodity and Service Expense", "Subsidy Expense to Individuals and Families", "Asset Depreciation (Amortization)".

As far as the current science and technology is concerned, the accounting of university cost is inseparable from information technology. The continuous update of information technology drives the continuous transformation and upgrading of accounting work. As an emerging technology, blockchain technology has the characteristics of high transparency, decentralization, distrust, non-tamperability and anonymity. When blockchain technology increasingly penetrates into various industries and fields, the accounting work indispensable in all walks of life will inevitably change accordingly. Accounting, as a highly theoretical and professional work, has more or less changes in its theory and practice under the influence of blockchain technology.

## 3. The Impact of Blockchain on Accounting Work

Accounting is an economic management activity that uses currency as the main measurement unit and applies specialized methods to continuously, systematically and comprehensively reflect and supervise the economic activities of enterprises, institutions, or other economic organizations. The more the economy develops, the more important accounting becomes. The more technology develops, the higher the degree of accounting informatization. Driven by new information technologies, accounting informatization has achieved significant development, and accounting theories and accounting measurement methods have also changed accordingly. As the underlying technology for signing contracts, blockchain technology plays a crucial role in the use and efficiency improvement of accounting measurement methods in colleges and universities.

Although the current accounting system is still based on the "centralized ledger", through the chain-based acquisition method of original vouchers, the authenticity of accounting original vouchers becomes more transparent, thereby expected to improve problems such as incomplete entry and announcement of accounting information and susceptibility to tampering.

### **3.1. Improving the Accuracy of Accounting Information Recording and Measurement**

Under the traditional accounting model, enterprises need to check the economic business that occurs first, then record the information, and be confirmed by a third-party bank, which is equivalent to the separation of business flow and fund flow. In the blockchain, the transmission of data is direct and reliable, so there is no need for separate confirmation by a third-party bank. That is, while confirming the economic business, the data will be transmitted to complete the corresponding accounting, and the business flow and fund flow are integrated. In this link of accounting information recording in the traditional method, since accounting uses currency as the main measurement unit, whether historical cost measurement or fair value measurement is adopted, the accuracy of measurement is affected by the value of the currency itself and its conversion process. Now in the blockchain, because it is a chain data structure and is encrypted and protected by cryptography, it is non-tamperable. If the currency value calculation operation program is set in advance, relative stability can be maintained, which greatly improves the accuracy, authenticity and security of accounting measurement. And in the distributed ledger system, every participating node retains a complete accounting record in chronological order. The front and rear blocks on the same chain are mutually confirmed through the secret key, and all records will be broadcast on the entire network after completion. This method makes information fraud and tampering almost impossible, and there is no possibility of artificially adjusting the accounting period.

It can be known from the organizational structure of the blockchain that it has no central node and the status of all nodes is the same, so there is no problem of centralization. Its accounting model is also distributed. There are no specialized accounting personnel for traditional double-entry bookkeeping, but each participant in the economic activity independently records. These data will be collected and transmitted to the participants in the economic activity for storage. In this way, the materials mastered by each participant will be timely and the same. And because everyone has the right to record and view the records of other participants, they can supervise each other, thereby improving the accuracy and efficiency of accounting work and reducing the cost of subsequent work such as auditing.

### **3.2. Improving the Efficiency of Accounting Information Processing and Transmission**

In traditional accounting, the processing of information mostly relies on manual operation, and is affected by human factors from the beginning of confirmation to the formation of statements. In the blockchain, due to its "autonomy" feature, data can be exchanged without human intervention and without obstacles. If the operation program is set in advance, the data will be confirmed in accordance with the established rules, and only the correct data can enter the next step of the program, so the probability of errors will decrease. At the same time, in the set program, the machine will automatically do some work instead of humans. For example, for enterprise tax declaration, the blockchain can automatically operate according to relevant information, which reduces the work of accounting personnel and improves the accuracy of work. For accounting personnel, it has become less important to master accounting processing methods. Instead, learning information

technology processing methods and blockchain knowledge has become a compulsory course.

Because the blockchain uses the hash algorithm, which is irreversible, the information is irreversible during the transmission process. Once the transmission starts, it cannot be traced back. Therefore, the entry of the original voucher at the source becomes extremely important, while the subsequent accounting processing becomes less important. Traditional accounting measurement and accounting processing work have become a simple step in the program.

### **3.3. Improving the Correct Rate of Accounting Information Disclosure**

At present, the disclosure of accounting information mainly relies on the financial statements published by the company to the outside world. The publication of this information is regular and in a fixed form, lacking timeliness and flexibility, and not being comprehensive and specific enough. But in the blockchain, because the public chain is open and the data mastered by everyone is the same, accounting information can be extracted at any time. This is conducive for users to understand accounting information in a timely manner and thereby judge the situation of economic activities, and to a certain extent, solves the problem of information asymmetry between the two sides of information use. At the same time, users can also form corresponding data according to their own needs, which is more convenient and targeted, and deepens the association between users and information. In addition, a highly transparent and open state can obtain more effective supervision from more people and reduce the occurrence of errors. In the blockchain, the public chain is a completely open data source for those in need to find the required data; the private chain can perform permission control. The coexistence of the two can ensure the comprehensiveness and security of accounting information publication.

In traditional accounting, the publication of financial information depends on trust. The information publisher must gain the trust of the public in order for the published financial information to be trusted by everyone. However, this publication method can also lead to the exposure of some privacy of the information publisher itself. In the blockchain system, each participating node is anonymous. Data is judged by the set program for validity and does not need to obtain trust by stating one's identity. Information users can exchange information, but cannot know who the other party is. This improves the confidentiality of information and the security of transactions to a certain extent.

In traditional accounting, due to human factors involved, it is somewhat difficult to completely avoid the problem of fraud. But in the blockchain, once the information is verified and added to the blockchain system, it will be stored permanently. Unless more than 51% of the nodes in the entire system can be controlled simultaneously, it is invalid to modify the database on a single node. This forms the feature that the information in the blockchain is non-tamperable. This feature can effectively avoid the problem of accounting information fraud and to a certain extent, avoids the situation where accounting personnel are forced to commit fraud due to external factors, increasing the independence of accounting personnel. At the same time, because the data is non-tamperable, the supervision of the enterprise economy from the outside will also be enhanced. For example, the tax authority can directly query the data it needs without

worrying about the problem of fraud.

### 3.4. The Impact on Accounting Personnel

In the context of blockchain, it is not enough for accounting personnel to only have traditional accounting knowledge. They also need to master relevant knowledge such as computer hardware, software, program design, informatization, and blockchain to adapt to the development trend. Because once the data is entered into the blockchain, it is almost impossible to modify, the requirements for the operation and quality of accounting personnel are also correspondingly increased. On the one hand, the development of blockchain may reduce the manpower required for many accounting positions, which has an impact on the professional demand for accounting. But on the other hand, it also requires accounting personnel to keep learning to improve their competitiveness.

## 4. The Impact of Blockchain Technology on University Cost Management

In universities, the teaching activities of universities will surely consume a certain amount of resources, and cost is the monetary manifestation of the resources consumed by universities. The connotation of cost is constantly updated with the continuous development of the economy and society. University cost management refers to the general term for a series of management activities such as cost forecasting, cost decision-making, cost planning, cost control, cost accounting, cost analysis, and cost assessment implemented by universities in daily teaching, scientific research, and other various activities.

The integration of blockchain technology and financial management has broad prospects in improving the level of cost management. Universities can use blockchain technology to pay various expenses and realize automatic settlement of peer-to-peer transactions, reducing intermediary commissions. If the digital currency of blockchain technology is introduced for peer-to-peer payment, the intermediate cost will be reduced more significantly, the transaction process will be simplified, and thus the financial operating cost will be significantly reduced. At the same time, the reliability and transparency of blockchain technology more effectively promote the flow of materials and information in the entire supply chain, and conduct the whole-process monitoring of the cost of purchasing various practical training equipment and practical training consumables in the construction of practical training rooms in universities. In addition, the reliability and transparency of blockchain technology can also directly reduce the demonstration cost and audit cost of large payment data such as the construction of practical training rooms and informatization construction in universities.

When using blockchain technology to calculate the total cost of the university, each node of the blockchain can be regarded as a network ledger record, and a complete ledger copy of all historical transaction records of the participants is saved in different blocks, supplemented by encryption technology. In this way, the logical channels and physical channels for deleting, revoking and modifying data can be cut off respectively, thereby reducing the data storage and management cost, achieving information transparency and data security.

Secondly, the calculated total cost of the university needs

to be distributed among the secondary colleges. During the distribution, in many cases, it is necessary to regard the educational services received by students of different colleges as different major varieties (especially the cost consumption difference between the humanities, social sciences and science and engineering is obvious) for the preliminary distribution.

Again, when calculating the per-student cost of different majors in each department, the educational services received by students of different majors can be regarded as different small batches, and they can be subdivided according to the different characteristics of the major and the different situations of the course arrangement, so as to calculate the total cost of each major.

Then, the total cost of each major calculated in the previous step is aggregated from each grade. It is necessary to calculate the per-student cost of each grade. The educational services from the first year to the fourth year are regarded as four completed steps (the situations such as repeating a grade and staying in the same grade are not common and are not considered for the time being).

Finally, the total per-student cost for the three or four years of university in this major can be obtained. The per-student cost of students is an important basis for financial allocation. The more accurately the per-student cost of students is calculated, the more accurately the funds allocated by the finance will be, the better the performance of the university will be, and the fiscal expenditure can also avoid being excessive.

## 5. Taking the Per-Student Cost of a Certain University as an Example

In accordance with the requirements of the local finance, after repeatedly checking the financial account data of the university from 2019 to 2022, and based on the data collection form and the calculation rules in the system, discussions and coordination were carried out with the relevant departments of the provincial department. Data were constantly revised and improved. As of May 22nd, the calculation results of the per-student cost for the four years are more in line with the actual situation. The calculation results are as follows:

**Table 1.** The per-student cost from 2019 to 2022 (Unit: Ten thousand yuan)

year / annual	2019	2020	2021	2022
per-student cost / cost per student	3.18	3.08	2.32	2.11

At the end of 2019, the number of enrolled students was 3,564, the average number of students throughout the year was 2,322, the per-student cost was 31,800 yuan, and the total education cost of the school was 74 million yuan. At the end of 2020, the number of enrolled students was 6,326, the average number of students throughout the year was 3,794, the per-student cost was 30,800 yuan, and the total education cost of the school was 117 million yuan. At the end of 2021, the number of enrolled students was 9,175, the average number of students throughout the year was 7,013, and the per-student cost was 23,200 yuan. In 2022, the number of enrolled students was 10,794, the average number of students throughout the year was 9,251, and the per-student cost was 21,100 yuan.

**Table 2.** The per-student cost of each major category from 2019 to 2022

Category of majors	Per-student cost (ten thousand yuan)			
	2019	2020	2021	2022
Major category of equipment manufacturing	3.25	3.23	2.39	2.15
Major category of culture and art	3.24	2.91	2.26	2.30
Major category of civil construction	3.22	3.09	2.33	2.08
Major category of public security and justice	3.21	3.00	2.23	2.09
Major category of environment and safety	3.21	3.09	2.33	2.13
Major category of electronics and information	3.10	3.08	2.35	2.13
Major category of transportation	3.10	2.91	2.29	2.09
Major category of tourism		0.80	2.15	1.98
Major category of finance, economics and business			0.83	1.98
The per-student cost of each secondary college from 2019 to 2022				
Secondary College / Subordinate College	Per-student cost (ten thousand yuan)			
	2019	2020	2021	2022
School of Safety Management	3.15	2.96	2.17	2.01
Institute of Artificial Intelligence	3.16	3.15	2.36	2.10
Institute of Emergency Technology	1.08	2.90	2.31	2.17
Institute of Creative Design	1.17	3.14	2.25	2.05
Institute of Intelligent Equipment	1.04	3.18	2.43	2.19
Institute of Intelligent Architecture		0.84	2.56	2.17

## 5.1. Cost Data Analysis

The cost accounting system of the provincial department calculates the per-student cost including five aspects: direct wages, direct expenses, indirect expenses (the expenses of each administrative and logistical department apportioned to each secondary college), equipment depreciation and intangible asset amortization, and book purchase. When our school compiles the budget, it is calculated and allocated according to the standard of 12,000 yuan per student by the finance. After the student fees such as tuition fees and accommodation fees are paid to the finance, they are reasonably allocated according to the project expenditure, and the per-student allocation is calculated in total. Therefore, the calculation caliber of cost is slightly larger than the caliber of per-student allocation.

## 5.2. Cost Management based on Blockchain

Under the technical basis of blockchain, the calculation method of university cost has slightly changed. Under the technical basis of blockchain, the calculation method of university cost has changed to a certain extent. First, the distributed ledger of blockchain ensures the real-time update and synchronization of data, enabling various departments of universities to obtain the latest cost information in time, so as to carry out cost forecasting and decision-making more accurately. In the process of cost accounting, the non-tamperable feature of blockchain ensures the authenticity and integrity of the original data. Every cost expenditure is clearly and accurately recorded on the blockchain, avoiding data fraud and errors. Using smart contract technology, the cost control rules can be automatically executed.

## 6. Conclusion

Through the combination of blockchain technology and

university cost management, universities can better grasp the total cost of running schools in universities and better calculate the per-student cost. Public universities can accurately calculate the per-student cost and the total cost, and use blockchain technology to reduce the total cost of running public universities, which can reduce government fiscal expenditure, save costs, improve the efficiency of fund use, and improve performance. At the same time, in today's highly developed science and technology information technology, informatization is improving our work level and living standard little by little. As accounting workers in the new era, we must use information as a means to improve our work ability and work level. At the same time, as accounting theory researchers, they should also constantly learn and update their theoretical knowledge in a timely manner according to the development of science and technology, so as to help...

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