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Exploring the Ecological Model of Financial Basic Information Sharing in Universities —— Taking D University as an Example

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Abstract: In recent years, the integration of budget management by the Ministry of Finance has put forward high requirements and challenges for the accuracy and consistency of basic financial information in universities. By analyzing relevant theories and the current situation of university construction, this paper summarizes the three major factors that constrain the sharing of basic information and maintain data accuracy and consistency. In this context, an innovative ecological model for sharing financial basic information in universities is proposed, which is designed from three dimensions: software data, hardware network, and sharing mechanism. D University has preliminarily implemented this model through exploration and practice, significantly improving the standardization, timeliness, and consistency of financial basic information. This model also has certain reference significance for brother universities.

Keywords: Integrated budget management; University finance; Basic information sharing; Ecological model

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1. Introduction

In 2020, the Ministry of Finance issued the "Norms for Integrated Budget Management (Trial)", which defined the integration of budget management as follows: "With unified budget management rules as the core, the integrated budget management system as the main carrier, and embedding unified management rules into the information system."[1]. The integrated construction of budget management is a business management loop that covers budget management from preparation to execution and then to accounting. It is a fundamental work to deepen the reform of budget management system and improve the level of budget management through systematic thinking and information technology. In October 2022, the Technical Requirements for the Integrated Financial Budget Management System were officially released and implemented by the State Administration for Market Regulation and the National Standardization Administration. It details the field standards required for various data of budget units, including financial, student, personnel, assets, bidding and procurement, and contract information. In March 2023, the Ministry of Finance issued the "Integrated Budget Management Specification (2.0 Edition)", which requires basic information management to follow the principles of standardization, standardization, consistency, and comprehensiveness, especially to achieve "one number, one source", and direct calling of various businesses without repeated reporting.

The integrated budget management system collects various financial basic data from multiple sources, and then conducts reverse logical judgment and control through the correlation relationship between various data elements, which puts forward stricter requirements for the accuracy of financial basic data in universities. Therefore, universities must start from the top-level design, scientifically plan the linkage ecological mechanism between systems, establish a good financial basic information sharing

ecosystem, and ensure consistency between internal systems and between internal and integrated systems. How to adapt to the new requirements and changes of integrated budget management is currently a problem that universities are facing and urgently need to solve.

2. The Current Situation of Sharing Basic Financial Information in Universities

2.1 Current Status of Theoretical Research on the Sharing Model of Basic Financial Information in Universities

In recent years, multiple scholars have conducted research and exploration on financial information sharing from multiple perspectives. Li Xiuling[2] believes that it is necessary to strengthen communication and feedback at all levels, improve system function design, maintain dynamic balance between budgeting, execution, and supervision, and form a complete closed-loop budget management structure; Cai Lanying[3] believes that achieving common sharing of financial and tax basic information in information sharing platforms can help reduce tax risks caused by missing and untimely sharing of basic information; Jiang Xiaoqin [4] believes that colleges and universities are moving towards the digital transformation stage of deep integration of industry and finance based on the Internet. It is necessary to break the information barriers between various systems and establish a one-stop financial decision support system; Yang Xiaojuan[5] believes that an intelligent financial platform based on business and finance integration applies artificial intelligence technology to financial work, further improving the accuracy of financial management; Starting from the requirements of integrated budget management, Wang Gaofeng[6] believes that it is necessary to ensure the accuracy, stability, and efficiency of the basic information data of the unit; Wu Guangming[7] believes that a comprehensive, multi subject, and multi-level three-dimensional sharing architecture should be established through informatization; Hua Shuning[8] believes that the construction of financial sharing platforms in universities is an inevitable trend in line with the development of the big data era, providing support for the sustainable development of universities; Lin Pingping[9] comprehensively analyzes the key role of digital technology in the construction of financial sharing platforms from three dimensions: tructural empowerment, resource empowerment, and psychological empowerment.

2.2 The Current Situation of Financial Basic Information Sharing Construction in Universities - Taking D University as an Example

With the vigorous construction of information systems in various departments of universities, various basic databases within universities have rich deposits. However, due to the different construction cycles and leading departments of each system, most of them operate independently after completion, without any interaction between systems, becoming information islands. Although some universities have started to carry out system integration, most of them are only based on short-term business needs and still cannot form an effective inter system linkage ecological mechanism. It is urgent to achieve data integration and sharing among various systems.

The financial informatization construction of D University started in 1999 and has gradually improved over 20 years of practice, forming a financial model that combines more than 30 financial systems and module data, mobile and web terminals. It has been integrated with more than 10 internal and external systems such as asset systems and bidding and procurement systems, achieving some basic data exchange mechanisms. The development process is extremely similar to that of brother universities and has a very typical representative significance. At present, there are several major constraints on the sharing of financial information in D University:

2.2.1 Data standards are not unified

The integrated budget management system involves the collection and reporting of basic information related to financial systems, asset systems, bidding and procurement systems, personnel systems, and student and graduate school systems. However, the information construction of the financial system started earlier than other systems, and the historical data accumulated is not consistent with the basic information settings of the newly built system. At the same time, the financial system has built multiple system modules in different stages, such as accounting, payroll, tuition, etc. Each module has an independent database, and there are also inconsistencies in the basic code between them. For example, the code information of school departments and financial systems not only differ from external systems, but also from internal systems. This difference can significantly reduce the mapping correlation between systems, and the tedious data conversion and mapping work not only increases the cost of data processing, but may also lead to data errors due to the ambiguity of the mapping mechanism.

2.2.2 Difficulty in smooth network architecture

Due to the high level of security and confidentiality requirements for financial information, the construction of financial systems

pays more attention to hardware and network security protection. A three-layer network mechanism is set up from the inside out, and it is physically isolated from other systems on campus. This often results in a T+1 delay when financial information is reflected in B/S systems such as financial online queries, and even T+N situations when exchanging information with other systems on campus. This delay leads to a decrease in real-time data acquisition between systems, and there are certain errors in accessing information between teachers and students. When basic information is returned from finance to the end of the business system, there are also errors in accurately displaying project balances or quotas.

2.2.3 The sharing mechanism is not sound

At present, the sharing between internal systems in universities often remains on the basis of meeting the short-term needs of system business. In order to achieve fixed asset information sharing, the finance and asset systems have been integrated. To achieve hazardous chemical information sharing, the finance and hazardous chemical systems have been integrated again, and there is also overlapping information that needs to be synchronized between the asset system and the hazardous chemical system. As a result, three interfaces have been integrated between the three systems, resulting in redundant information sharing channels and increasing the cost of system construction. In addition, due to the lack of a scientifically reasonable top-level design, this sharing mechanism has certain limitations and cannot be effectively managed and regulated.

3. Design and Implementation of an Ecological Model for Sharing Basic Financial Information in Universities under the Background of Integrated Budget Management - Taking D University as an Example

3.1 Design of Ecological Model for Sharing Basic Financial Information in Higher Education Institutions

In view of the above constraints on information sharing, a targeted ecological model for sharing basic financial information in universities has been extracted and constructed from three dimensions: software data, hardware network, and sharing mechanism, in the context of integrated budget management, to improve the standardization, timeliness, and consistency of financial basic information in universities.

3.1.1 Standardize system data standards

This is a prerequisite for the ecological model of sharing basic financial information in universities. According to the requirements of the "Integrated Budget Management Norms (Version 2.0)" issued by the Ministry of Finance, the basic code settings in various systems and financial modules on campus are uniformly standardized. Among them, the basic information of personnel follows (it is recommended to change to or follow, the same below) the national standard setting, such as the personnel gender code following the "Classification and Code of Personal Basic Information Part 1: Gender Code of Personnel (GB/T 2261.1-2003)"; Student status information follows the education industry standards of the People's Republic of China, such as the student category code following the "Education Management Information Education Management Basic Code (JY/T 1001-2012)"; The basic information of the department follows the unified setting of school standards. Integrating budget management into various stages and standardizing the basic information and code permissions required for circulation between systems saves mapping requirements between systems and facilitates rapid synchronization and exchange of basic data.

3.1.2 Hardware network partitioning and zoning

This is a necessary foundation for the ecological model of sharing basic financial information in universities. In the "Notice on Doing a Good Job in Networking the Central Integrated Budget Management System" issued by the Ministry of Education, high security requirements have been put forward for terminals accessing the integrated system. Most of the relevant information systems in the school are B/S structure, and at the same time, they need to provide network application services for teachers and students on campus. According to the service objects and main responsibilities of each system, the campus network is accurately divided into zones and domains. At the same time, the financial system applications and clients are included in the exclusive financial domain. Security devices are added at the boundary, and a dedicated network is set up to connect with the integrated system, which can maximize the security and confidentiality of the financial system and the instant convenience of information transmission between systems.

3.1.3 Improve the sharing ecosystem mechanism

This is the key design of the ecological model for sharing basic financial information in universities. The financial related basic information required for the integrated budget management system is not only present in the financial system, but also distributed in the student, graduate, personnel, asset, and procurement systems. Firstly, it is necessary to clarify the responsible parties of each basic information provider, consolidate their responsibilities, and ensure the authenticity and completeness of the information source;

Secondly, it is necessary to facilitate the flow of information between various systems. Due to the requirements and limitations of an integrated private network, and in order to save costs and expenses incurred by multi system integration, the basic information of each system is collected in the financial information pool of the data center and reported uniformly through dedicated lines; Finally, it is necessary to implement the upload and distribution of integrated system data. Not only should information be uploaded in a timely manner, but the status of data information processed through the integrated system should also flow back to each system for synchronous verification and updating. The specific design is shown in Figure 1.

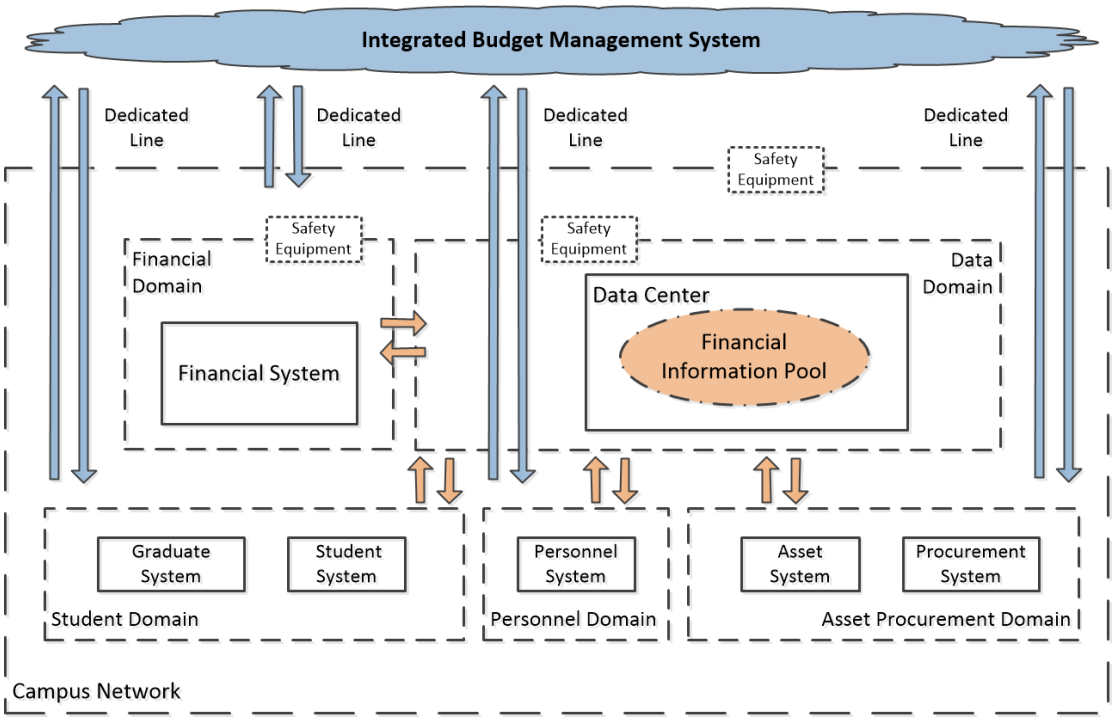

Figure 1 Mechanism Design of Ecological Model for Sharing Basic Financial Information in Universities

3.2 Preliminary Implementation of the Ecological Model for Sharing Basic Financial Information in Higher Education Institutions

Starting from the above three dimensions, D University has analyzed the current situation of shortcomings one by one and taken optimization and improvement measures. Currently, a preliminary financial basic information sharing ecological model has been formed. The specific implementation is as follows:

3.2.1 Unified implementation of data standards

D University has defined in detail the basic data standards related to internal finance, such as the national standard code, the unified code of the Ministry of Education, the asset category code, and the custom department code, based on the standards issued by various levels of leadership departments and fully considering the characteristics and needs of the school itself. This measure ensures the accuracy and consistency of financial data formats and definitions, providing an important prerequisite for data sharing. Afterwards, the financial system cleaned, organized, and merged the same defined fields that were originally scattered in various module databases such as salary and tuition fees according to corresponding standards. They were mapped to the new database standard code using one-to-one, one to many, and many to one methods, and comprehensively and meticulously sorted and summarized the data involved to ensure the completeness and standardization of the new data.

In this mode, the financial system of D University can seamlessly integrate with the basic information fields of other systems during synchronization. This information flow method not only improves data processing efficiency, but also significantly enhances the smoothness and accuracy of information flow. If there is a need for one-to-one correspondence between department codes in the financial and scientific research systems, there is no need for additional mapping steps, and they can be directly transmitted and received.

3.2.2 Implementation of hardware network configuration

D University's finance department has upgraded the Windows+SQL Server model that has been in use for many years, using a more secure Linux server cluster. The backend adopts Oracle RAC database and Mongo database, forming a comprehensive information platform supported by VMware virtualization platform, backup integrated server, and remote storage. Abandoning

the original network architecture, incorporating the financial backend server and departmental terminals into a dedicated financial domain, and implementing security devices such as external firewalls to strictly restrict access to corresponding addresses and ports for incoming and outgoing information flows. At the same time, the B/S system for applications such as student work and assets will be separately incorporated into different network application partitions such as student domain and asset domain, and corresponding access restrictions will be established between partitions. All financial and other systems have been evaluated and passed the Ministry of Public Security's 2.0 rating. The user terminals of the Integrated Budget Management System are dedicated to private networks, each with a private network IP and corresponding exits.

In this mode, the security of D University's financial and other systems has been significantly strengthened, and data linkage between systems has become faster, even breaking through the limitations of T+1. The status data of outstanding students circulating in the student and graduate systems, i.e. achieving hourly synchronization; The student status data circulating in the financial and welcoming/leaving system has been updated and returned in minutes.

3.2.3 Preliminary Implementation of Shared Ecological Mechanism

D University first standardized the responsible parties for sharing various financial basic information sources. Undergraduate information is provided by the student system, graduate information is provided by the graduate system, personnel basic information is provided by the personnel system, fixed and intangible asset information is provided by the asset system, procurement and contract information is provided by the procurement system, and other financial information is provided by the financial system. Corresponding integrated budget management special uKeys are issued to clarify the rights and responsibilities of each system. At the same time, with sufficient data conditions and hardware support, the data center of D University has established an upload and download channel for financial related basic information of the above system, opened standard data interfaces, and established a financial information pool, setting up financial specific field codes for the collection and circulation of financial basic data on campus. For the basic data reporting and issuance of the integrated budget management system, automated robots are used for uploading and obtaining, but the frequency of uploading and obtaining still needs to be manually controlled, which has a certain lag.

In this mode, the financial related basic information sources of D University are standardized and reliable, with clear responsibilities, and can be effectively and timely circulated within the campus to maintain synchronization and consistency among various systems. After a new employee joins, once new personnel information is added to the personnel system, it will be promptly synchronized to the basic information database of multiple systems on campus and uploaded to the integrated system to maintain consistency among all parties.

3.2.4 Conclusion and Future Prospects

By initially implementing an ecological model for sharing financial basic information in universities, D University has achieved significant results in promoting information sharing and integrated system construction, improving the standardization, timeliness, and consistency of financial basic information. This achievement also has reference value for brother universities. The reason why the current ecological model cannot be fully implemented is that the quota for integrated system docking has not been fully opened, and the on campus system cannot be docked in real time through interfaces. But with the deepening of integration budget management and the continuous improvement of university informatization level, the basic information sharing ecological model will play a greater role in helping universities adapt to higher requirements and faster changes.

In the future, universities should continue to pay attention to top-level design, optimize the linkage ecological mechanism between systems, promote the deep integration and efficient interoperability of various departmental business systems, and at the same time, pay attention to the development and application of emerging technologies such as artificial intelligence, continuously improve the intelligence level and auxiliary analysis and decision-making ability of financial related basic information sharing, and provide more refined, superior, and efficient support for the construction of financial management in universities and national integrated budget management systems.

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