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Automated Analysis and Optimization Strategies for University Financial Budget Management Based on Big Data

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Abstract:

With the development of the world economy, the number of universities is showing a trend of diversified development, and the scale and mode of education are also constantly changing. From the perspective of financial shared services, this paper deeply analyzes the necessity, feasibility, and feasibility of optimizing the current financial management model in universities, and proposes corresponding suggestions from multiple dimensions. Optimize financial management mode through big data analysis technology and achieve informationization of financial management. This provides assistance for universities to make up for financial management deficiencies, enhance risk defense capabilities, and improve information transparency, as well as new ideas for private universities to improve the quality of cross regional education.

Keywords: big data; University finance; Financial Management Informatizationn

1.INTRODUCTION

Nowadays the traditional financial model of universities has generally lagged behind the needs of large-scale, multi-campus and strategically differentiated expand of key universities. Due to inefficiency of current financial model [1-2], the high cost, the weak ability to implement financial regulations, and the inability to provide effective decision support, there were a lots of problems in accounting and budget management of financial management in universities [3]. By combining theories and cases, this paper takes the information digitization era and changes in the accounting system reform of universities as breakthrough point, introduces advanced and powerful management tool of financial sharing, and takes the financial sharing model successfully constructed by enterprises as the reference object , with process reengineering and the interconnection and integration of information systems as the core of improvement, by creating an integrated financial sharing platform with university industry characteristics, to optimize business processes, improve university financial models, and further improve how universities work based on big data technology [4]. Research on improving the level of financial management informatization in universities, breaking traditional barriers, and resisting financial risks, discovering research problems in universities, and putting forward optimal development opinions and strategies for university budget management automation.

2.RELATED WORKS

Local governments, and all sectors of society have invested more and more in education. Meanwhile, people have paid more and more attention to budget disclosure and budget implementation. Accurate, more standardized, more reasonable and more detailed financial budget. Secondly, each university has different sources of funding, different levels of financial resources, and corresponding expenditure priorities and budget allocation methods, which require flexible financial budget preparation methods [5]. Furthermore, the preparation of the financial budget for the new year and the major financial decisions should refer to the comparative analysis of the data and the implementation of the financial budget over the years, and the preparation of the financial budget over the years is required to be consistent, normative and comparable [6].

The current mainstream university budget management system architecture includes: adopting the network architecture design through the financial management department, campus network construction and remote office equipment and WAN-based browser server), which can realize the connection between various departments that have budget connections in the campus [7]. The front-end operation interface system adopts common web development tools; or adopts client-server) architecture design, and develops the method of front-end operation interface to operate the back-end database through object-oriented language; or adopts browser server) and client server) structure at the same time to realize Two operating interfaces, web page and desktop, operate the background database [8].

The budget system and the accounting system are seamlessly connected and integrated, and the budget system is inseparably linked with the financial accounting system in function. The preparation of the current year's budget needs to analyze the actual occurrence of financial accounts in the previous year or even in the previous years, and the budget is allocated as a financial account. The indicators and basis for accounting treatment, and all expenditures must be strictly implemented according to the budget. Therefore, strengthening the connection between the two has become one of the inevitable research directions of the budget system [9]. The U.S. federal government placed great emphasis on the comprehensive budget management of educational funds in universities [10]. The budget management includes pre-planning, in-process control and ex-post assessment and rewards. It mainly has the characteristics of standardized budget preparation procedures and strict control of budget expenditures; A study of relevant budgeting tools to enable them to most effectively implement strategic plans for education, taking responsibility for the use of their scarce resources (referring to state grants, research funding and student fees, etc.) [11].

3. AUTOMATED ANALYSIS OF FINANCIAL MANAGEMENT IN UNIVERSITIES

3.1 Financial management informatization

Financial informatization is the product of development of financial management theory, computer and big data technology, and is the development direction of future financial work [12]. Financial informatization is the integration of data and information such as business processes, revenue and expenditure data, and fund control of an organization, and through server hardware facilities and Internet technology to combine financial information with the organization economic activities, so as to share financial information resources and achieve Improve the internal financial management business process, supplement the financial information framework, speed up the role of information transmission, and ultimately achieve the purpose of improving work efficiency, increasing the use of funds.

The work involved in financial department is the last link of the outflow of funds in economic activities. The review opinions of each department on the business will eventually be summarized to the financial department. Therefore, the establishment of a financial information system is to unify independent and scattered functional departments in the organization. the most efficient way. Through the data connection between the financial system and the systems of various functional departments, it realizes the information sharing, provides timely, complete and reliable financial information for the leaders of the organization, and provides feedback on the project progress and the dynamic situation of funds for each functional department. When conducting routine billing business, it is necessary to grasp the standards of pre-investigation, in-process control, and post-event analysis, especially when key economic activities occur, play the role of risk warning to ensure the smooth operation of financial work.

3.2 Internal Control Theory

3.2.1 Basic theory

Internal control is generally explained as managing and controlling the interior of the organization. The Initiating Organization Committee under the US Anti-False Financial Reporting Commission released a clear concept in the Internal Control-Integration Framework issued in 1992: Internal control is to achieve operational efficiency and realize capital. The process of achieving the goals such as real and reliable financial statements, not violating laws and regulations and industry systems, etc., and affecting the participants in business operations, including directors, managers, and department management, so as to provide reasonable assurance for the achievement of goals. To sum up, internal control is the effective supervision, management and control of staff who hold different positions.

The basis for realizing the internal control of university informatization is that each department has a business management system that is consistent with its own economic business, and effective management and integration between various systems can realize the internal control function of informatization and improve the internal control. Scientific, timely and effective.

It should be emphasized here that information and communication run through the whole process of the internal control system. It does not itself become a specific control measure, but it is a prerequisite for the effective implementation of a series of internal control measures. Information and communication refer to the horizontal

and vertical transmission of information within the school: all management of the school must receive clear information from the leadership and earnestly perform their control duties; all teaching staff must understand their position and control in the entire internal control system Relationships; staff must have a way to pass important information up [14]. Once the information communication is poor, the implementation effect of internal control will be reduced, and there will be a phenomenon of information asymmetry among participants. For example, an infrastructure project that cannot be started as planned due to weather will result in unplanned labor costs and material storage costs. Due to time and space constraints, it is difficult for financial personnel to make accurate judgments on the status of the project site, and the Logistics Infrastructure Office, which is the project supervision department, will provide information on rationalization of costs to hide unreasonable parts from a functional standpoint. Therefore, when reviewing these derived costs. It is difficult for financial personnel to make accurate judgments and control the expenditure of funds, which will cause the failure of post control activities to a certain extent, and then have a negative impact on the effect of internal control.

3.2.2 Coupling theory

Coupling Theory Coupling has different interpretations in different disciplines. In electric power, it mainly refers to the transfer of energy between circuits or between certain components of circuits. In communication technology, it mainly refers to two or two. The combination of the above circuits or devices mainly refers to the connection between modules in the software system structure. □□

After the development and extension of the coupling theory, it is mainly summarized as the phenomenon that two or more systems influence each other through various interactions and even produce a combination, interdependent dynamic relationship [16]. The coupling effect originates from group psychology, where the meaning of the interconnection between the coupled systems is taken, and the phenomenon of promoting and generating force under the interaction of two or more systems is defined as the coupling effect. In the improvement of computer information technology, various departments in university should not be isolated islands, but integrate their respective business system modules to establish a harmonious coupling of interconnection, interaction and interdependence, create a coupling effect, and promote the business integration of various internal departments. Good operation between. □□At present, there is a situation in which the financial system and the business system of functional departments are not integrated in colleges and universities [17].

3.2.3 Process Reengineering Theory

Process Reengineering Wheel Business Process Reengineering Theory refers to the transformation and optimization of the original business process by continuously introducing advanced technology, re-establishing the organizational structure, maximizing the integration of the management functions of each branch, and taking the realization of customer needs as the ultimate goal. It makes it difficult for the organization to survive in the changing market economy. In the face of this unfavorable situation, the organization has to change its own process, so the theory of process reengineering came into being. A series of activities generated to achieve a predetermined economic purpose is referred to as a business process by us. The theory of process reengineering refers to the dismantling, analysis and sorting of the original process, and then improving or even eliminating the backward links that are not suitable for the current development. Process of business process. Low and backward business processes [18] are no longer in line with the operation mode of universities. It is necessary to correct these defects exposed by the original business process according to the development situation and build a new business process. Using the theory of process reengineering to reset the process that is not in line with the improvement of universities, and combine it with establishment of financial information system is a very important method to realize the financial information management of universities.

3.3 Financial management automation system design

3.3.1 System architecture

The system flow chart mainly describes the flow, processing and storage of different types of information within a system [19]. After system sets up budget items, import the actual number of executions in the previous year, and then allocate and generate budget details for each project. After setting the budget details for each project, summarize and generate a budget summary table. After the budget is generated, you can release the budget and import the current year budget implementation [20]. The budget can be adjusted during the budget execution

process, and finally the budget execution status and budget analysis report are formed through budget statistics and budget analysis. The system flow chart is shown as Figure 1.

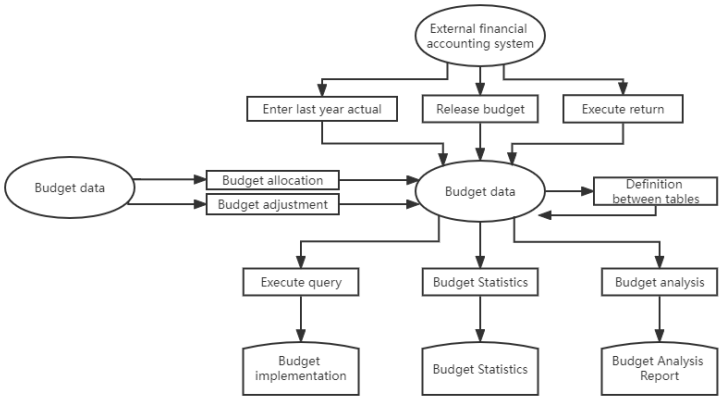

Figure 1 System flow chart

System data includes system setting data, project setting data, and budget management data. System setting data includes annual budget table, user table, authority table, and user authority table. The item setting data includes the total income item setting table, the total expenditure item setting table, the education expenditure item setting table, the unit setting table, the unit annual setting table, and the motor cost item setting table. The budget management data includes the general revenue and expenditure budget table, the total income item budget table, the total expenditure item budget table, the education expenditure budget table, the education expenditure detailed budget table, the education expenditure item budget table, the unit fund budget table, and the maneuver cost budget table. The relationship diagram of the budget management data table is shown as Figure 2.

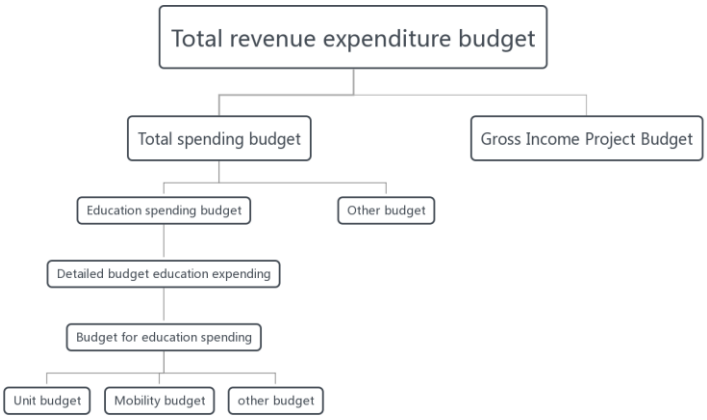

Figure 2 Diagram of budget management class diagram

The functional modules of university financial budget management system are composed of six modules: system management, budget setting, budget allocation, budget adjustment, budget execution, and budget statistical analysis. The system structure diagram function module is shown as Figure 3.

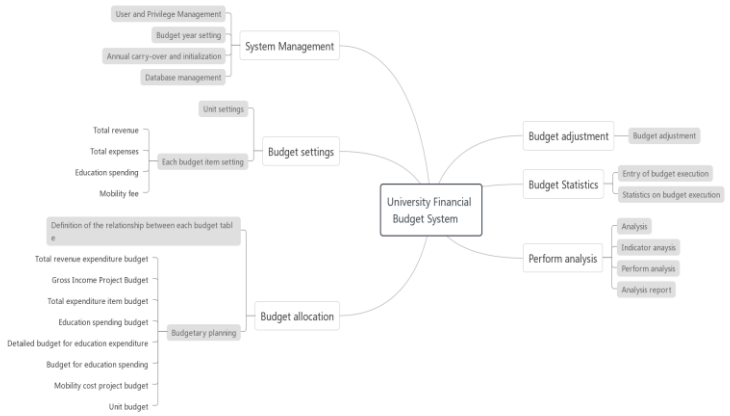

Figure 3 System functional module structure diagram

If the budget system of universities is to be intelligent, it must be combined with modern new technologies. More precise control of all aspects of the budget system, including budget preparation, budget control and release, and budget analysis and supervision. First of all, the process of budget preparation includes the budget of each department and institution, and also involves the summary budget of the school. There are many people involved in this process, so the intelligent budget system should automatically verify the logic of the report and the reasonable indicators of each department. sex, etc. And can automatically obtain the data of the annual budget, the actual number of budget execution, the variance of the forecast and the variance ratio and other elements. Through establishment of intelligent budget system, the functions of budget declaration, budget review, budget adjustment, budget determination, budget release and appropriation can be directly performed online, and online declaration of school department budget, scientific research budget, treasury fund plan, etc. can be carried out, and the error rate of data can be reduced. Effective control of expenditures. After application is successful, the project leader should be notified to improve the project-related information, especially the main member information. Intelligent budget supervision should cover the structural analysis of budget items, the analysis of appropriation progress, the analysis of execution progress and the preparation of various related forms. In this way, budget items can prepare budgets, approve budgets, and monitor budgets through the Internet, which can also improve the efficiency of budgeting and speed up the budgeting process. □□

3.3.2 System database construction

The system uses the database development platform to develop the background database. Through the huge and mature database management function of the database development platform, the system can finally standardize the budget setting of colleges and universities, allocate budget funds reasonably, and improve the execution and analysis of budget funds in a timely manner. The quality of database design determines the quality of system performance. In specific design of database, the principles of standardization and reducing data redundancy should also be followed to improve efficiency of system database. According to system functional requirements, the system database has set up the budget project setting table, project budget detail table, budget summary table, system setting table, etc. Change, set up each budget table, and can define the fetching relationship between each budget table, achieve better compatibility, and make the table and table have both connection and independence at the same time. See Figure 4 for details.

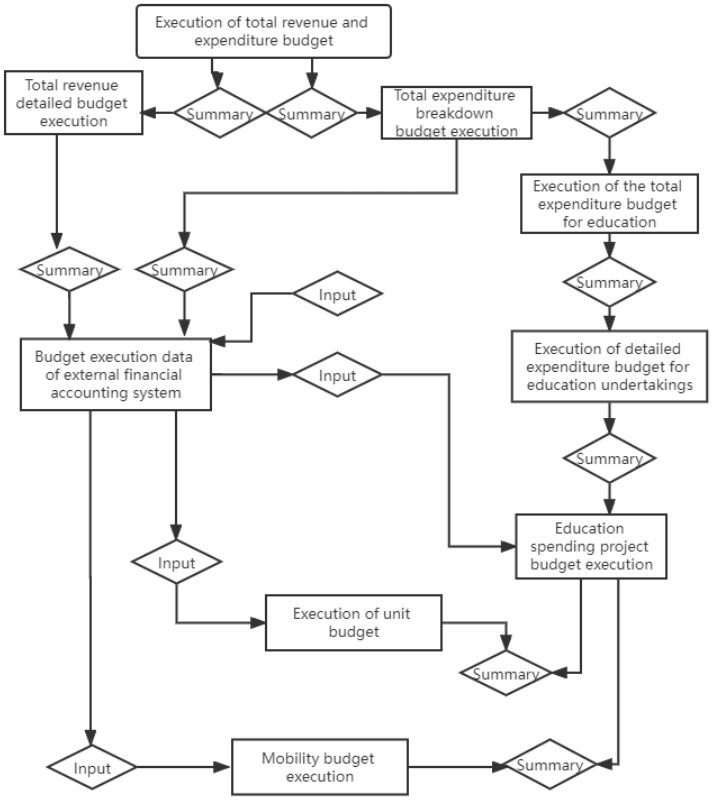

Figure 4 E-R diagram of executive function module

The specific designs of several different types of data tables are listed as follows:

(1) Unit budget table

The unit budget table (see table is used for budget management of the unit annual setting and type of funds. It is carried out by the enabling unit of the unit annual setting table. Budget; it is summarized into the budget table of education expenditure items step by step through the number of the budget table of education expenditure items, which is shown in Table 1.

Table 1 Unit budget table

Field Name	Field meaning	Data type	Length	Primary key
Nd	Year	Int		Yes
Dwbh	Unit number	Char	4	Yes
Jfig	Fund Type	Char	10	Yes
Pcx	Budget order	Int		No
Ysts	Budget type	Char	6	Yes
Jss	Fund number	Char	8	Yes
Jews	Fund name	Char	12	No
Swst	Actual last year	Float		No
Bdbs	Filing this year	Float		No

(2) Education Expenditure Items

Education Expenditure Items Table is used to record all educational expenditure items. Because the expenditure items may vary each year, set the education expenditure items that need to be budgeted in the current year by setting whether to enable the field; the system provides three. The settings of the different classifications of the group and the properties of the two groups are provided for the use of the system statistical query (See Table 2 for details).

Table 2 Educational Expenditure Item Table

Field Name	Field meaning	Type of data	Length	Primary key
Xnbw	Item Number	Num	Auto numbering	Yes
Dwbh	Unit number	Char	4	Yes
Xh	Serial number	Int	10	Yes
Xmmc	Project name	Varchar		No
F11	Category 1	Varchar	30	Yes
F12	Category 2	Varchar	40	Yes
F13	Property 1	Varchar	40	No
Sx2	Property 2	Varchar	40	No
Sfqy	Whether to enable	Char	3	No
Bz	Remark	Varchar	60	Yes

4. FINANCIAL BUDGET PERFORMANCE EVALUATION BASED ON DATA ANALYSIS

This paper constructs key performance indicators for budget performance evaluation from four dimensions.

4.1 Financial dimension

$$R_f = inv_r / total_p \times 100\%$$

The indicator R_f represents the proportion of scientific research investment, it expresses the proportion of research expenses, management expenses, data collection expenses, etc. in the project funds. inv_r represents investment in scientific research, $total_p$ represents total project funds. This value is positively related to the scientific research investment of the project. The greater the value, the greater the investment.

$$T_f = team_r / total_p \times 100\%$$

The indicator T_f represents the proportion of team building investment, it expresses the proportion of team building, professional inquiry, labor costs, etc. in the project funds. $team_r$ represents investment in team building. The proportion of team building is positively related to the investment of project funds. The larger the proportion, the more the project will invest in talent recruitment, and the better the team organization will be.

$$L_f = lab_r / total_p \times 100\%$$

The indicator L_f represents the proportion of investment in instrument equipment and laboratory construction, it expresses the proportion of the cost of instrument facilities and laboratory creation in the project funds. lab_r represents investment in instrument equipment and laboratory construction. If the ratio is larger, it means that there is more capital replenishment for equipment construction during project implementation.

$$B_f = book_r / total_p \times 100\%$$

The indicator B_f represents the proportion of investment in books and materials, it expresses the proportion of books and materials in the project funds. $book_r$ represents investment in books. The higher the ratio value is, the more capital is invested in this project.

$$A_f = academic_r / total_p \times 100\%$$

The indicator A_f represents the proportion of investment in academic exchange, it expresses the proportion of academic exchange in the project funds. $academic_r$ represents investment in academic exchange. The larger the relevant value is, the more financial subsidies for academic exchanges in this process are, and the more attention the organization has paid to academic cooperation projects.

4.2 Social dimension

The indicators involved in the social dimension include project significance, whose significance is to evaluate the realistic disturbance degree of the project exploration to economic and social development; awards, which mainly

covers the status of various award categories involved in the process of the project; publish academic papers and books, which roughly studies the quantity relationship of various papers and textbooks involved in the project; patents, which basically covers the details of patents obtained during project implementation; the project team online guidance, which covers the number of postgraduate students and the number of candidates for postgraduate entrance examination; team's innovation awards, which is basically measured by the number of innovation awards of team members, including competition forms such as the Challenge Cup.

4.3 Internal dimension

$$P_c = P_N / T_N \times 100\%$$

The indicator P_c represents the completion rate of scientific research projects, P_N represents the number of project achievements completed, T_N represents total number of achievements to be completed. It can be seen from the definition formula that the success rate of the project is positively related to the use of funds.

$$E_r = A_T / P_E \times 100\%$$

The indicator E_r represents effective capital ratio, A_T represents total accumulated cost of achievements, P_E represents project expenditure. This indicator expresses the comparison between the use of scientific research funds and accumulation of achievements, and indirectly indicates the positive correlation between expenditure and success rate.

$$S_r = (1 - P_E / P_i) \times 100\%$$

The indicator S_r represents savings rate of project funds, P_i represents project fund input. This indicator indicates the savings in the use of funds. The larger the expenditure, the larger the scale of funds raised.

$$A_r = A_P / S_t \times 100\%$$

The indicator A_r represents application rate of project achievements, A_P represents the number of achievements promoted, S_t represents total scientific research achievements. This indicator shows the application of the results in the promotion stage.

$$Aw_r = Aw_N / S_t \times 100\%$$

The indicator Aw_r represents award rate of project achievements, Aw_N represents the number of awards. This indicator reflects the award rate of project achievements.

4.4 Learning and growth dimension

$$E_T = D_N / P_T \times 100\%$$

The indicator E_T represents education structure of project team members, D_N represents the number of teachers with doctoral degrees, P_T represents the total number of teachers in the project. This indicator indicates the proportion of doctors involved in the project implementation.

$$Title_S = AP_N / P_T \times 100\%$$

The indicator $Title_S$ represents professional title structure of project team members, AP_N represents the number of teachers above associate professor. This indicator can directly see the number of associate professors involved in the project arrangement process and their proportion in the participating teachers.

$$Age_S = Y_N / P_T \times 100\%$$

The indicator Age_S represents age structure of project team members, Y_N represents the number of young teachers. This indicator shows the proportion of young teachers under the age of 45 in the number of the project.

4.5 Weight distribution of key performance indicators for budget performance evaluation

Analytic Hierarchy Process (AHP) regards every decision as a whole, and then divides the whole into several parts. Each part sets its own standard, and obtains the corresponding weight by using the method of fuzzy quantification of qualitative indicators, so as to bring a reasonable way to the final decision. This method combines qualitative and quantitative methods, and uses numerical methods to solve the problem of subjective judgment.

This paper uses the AHP and data analysis to evaluate the performance of financial budget projects in colleges and universities. This method can be used to calculate the weight of each indicator. The basic steps are as follows:

Firstly, a hierarchical model need to be created. This paper needs to investigate the use of college financial budget more deeply, so all indicators are divided into three levels: target level, benchmark level and indicator level. There is a certain relationship between these three levels.

Secondly, define the weight and create a judgment matrix. According to the advantages and disadvantages of each indicator, compare the various statuses of each indicator, judge the advantages and disadvantages of indicators according to the 9-quantile ratio, sort the indicators, and construct a matrix according to the order of arrangement.

Thirdly, measure and test the consistency.

Fourth, compare the proportion of each level and sort according to the proportion.

Table 3 shows the construction of indicator system.

Table 3 Indicator System Table

Target level	Benchmark level	Indicator level
W Strategic objectives of financial budget project	N1 Financial dimension	M1 Proportion of scientific research investment
		M2 Proportion of team building investment
		M3 Proportion of investment in instrument equipment and laboratory construction
		M4 Proportion of investment in books and materials
		M5 Proportion of investment in academic exchange
	N2 Social dimension	M6 Project significance
		M7 Awards
		M8 Publish academic papers and books
		M9 Patents
		M10 The project team online guidance
		M11 Team's innovation awards
	N3 Internal dimension	M12 Completion rate of scientific research projects
		M13 Effective capital ratio
		M14 Savings rate of project funds
		M15 Application rate of project achievements
		M16 Award rate of project achievements
	N4 Learning and growth dimension	M17 Education structure of project team members
		M18 Professional title structure of project team members
		M19 Age structure of project team members

According to the performance evaluation criteria of the research project established previously, the data obtained will be formulated in the form of a matrix. Data analysis is adopted in the formulation of indicators, and a judgment matrix is established according to the actual situation and the survey data. The judgment matrices are shown as Table 4 to Table 8.

Table 4 Judgment matrix between W and N

W	N1	N2	N3	N4
N1	1	1	2	2
N2	1	1	1/2	3
N3	1/2	2	1	3
N4	1/2	1/3	1/3	1

Table 5 Judgment matrix between N1 and M

N1	M1	M2	M3	M4	M5
M1	1	4	3	1/5	4
M2	1/4	1	3	1/6	3
M3	1/3	1/3	1	3	1/3
M4	5	6	1/3	1	1/5
M5	1/4	1	3	5	1

Table 6 Judgment matrix between N2 and M

N22	M6	M7	M8	M9	M10	M11
M6	1	2	1	5	3	1/4
M7	1/2	1	1	3	1/3	2
M8	1	1	1	1/2	2	4
M9	1/5	1/3	2	1	1/7	1/5
M10	1/3	3	1/2	7	1	2
M11	4	1/2	1/4	5	1/2	1

Table 7 Judgment matrix between N3 and M

N3	M12	M13	M14	M15	M16
M12	1	5	1/2	1/6	3
M13	1/5	1	2	1/5	1/2
M14	2	1/2	1	3	1/3
M15	6	5	1/3	1	1/4
M16	1/3	2	3	4	1

Table 8 Judgment matrix between N4 and M

N4	M17	M18	M19
M17	1	2	5
M18	1/2	1	7
M19	1/5	1/7	1

According to the established judgment matrix, the weight coefficients of each level are calculated according to the AHP formula, and the consistency verification is carried out. The final results are shown as Table 9 to Table 13.

Table 9 Hierarchy weight coefficient between W and N

Level N	N1	N2	N3	N4
Weight coefficient	0.2068	0.3886	0.2997	0.1049

Table 10 Hierarchy weight coefficient between N1 and M

Level M	M1	M2	M3	M4	M5
Weight coefficient	0.4532	0.2676	0.0512	0.0589	0.1691

Table 11 Hierarchy weight coefficient between N2 and M

Level M	M6	M7	M8	M9	M10	M11
Weight coefficient	0.0572	0.1638	0.0885	0.0889	0.4691	0.1325

Table 12 Hierarchy weight coefficient between N3 and M

Level M	M12	M13	M14	M15	M16
Weight coefficient	0.1512	0.0631	0.0556	0.4101	0.3200

Table 13 Hierarchy weight coefficient between N4 and M

Level M	M17	M18	M19
Weight coefficient	0.4536	0.4061	0.1403

The consistency test result of this study shows that the final data (CR=0.043, CR1=0.028, CR2=0.012, CR3=0.041, CR4=0.029) is less than 0.1, which proves that the matrix meets the consistency, proving that the weight is

reasonable and feasible.

5.CONCLUSION

Financial sharing, as a trend of financial reform, has emerged from global multinational corporations. In recent years, it has also been carried out in full swing in large and medium-sized local enterprises in many countries. With the parallel advancement of the dual-track government accounting system, colleges and universities are gradually aligning with enterprises, and the financial reform of universities is also the general trend. For colleges and universities that are about to face reform, this may be a challenge and an opportunity to cross a historic leap. Financial sharing opens the way, and management accounting runs. The implementation of financial sharing services is not the end of college finance, but the foundation that supports colleges and universities to turn to the digitalization stage of management accounting. In the era of Internet + high digital information, the financial sharing platform promotes the upgrading of university big data platforms and information systems, and measures to create the best overall process will definitely enhance the core competitiveness and value creativity of universities, and promote the fundamental transformation of university management models.

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