A Structural Equation Model of Resource Planning with Linear Regression Weights

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Abstract—**ERP provides a powerful guarantee and a basic platform for the centralized management of group funds. This paper uses Likert's five-point method to design questionnaires, obtain original data, and apply structural equation models. Then it establishes a framework for centralized management of corporate group funds in an ERP environment, collects data through questionnaires, and explores the framework for centralized management of corporate group funds under the ERP environment. It uses linear regression models to describe experts' recognition of the capital management framework by establishing a structural equation model to test the key factors influencing the construction of a centralized fund management system. Results show that the factors influencing the construction of the centralized fund management framework include: risk control, fund budget control, fund management decision-making system, online banking, financial, logistics and other modules in formation integration, and fund monitoring. This paper can help companies not only sort out the contexts, and strengthen capital management, but also improve the efficiency and effectiveness of financial monitoring, and increase the risk control of monetary capital management. It has important practical significance for strengthening group capital management and reducing capital costs.**

Keywords—resource planning, regression weights, linear regression model, structural equation model

I. Introduction

The enterprise group is a corporate legal person consortium composed of a parent company, subsidiary companies, shareholding companies and other member companies or institutions. Under this system of organization, capitals functions as the link, the parent company and its subsidiaries serve as the main body, and the group charter defines common behaviors. In an enterprise group, many problems such as enterprise survival, development and profit ability are all revolving around fund management. Therefore, fund management is a focus of the daily financial management for these groups. They have to improve fund management control, realize an efficient operation of corporate funds, and improve the efficiency of capital utilization. For such purposes, most enterprise groups opt for centralized management and a unified operation of funds through internal banks, settlement centers, or financial companies. With the popularization and in-depth application of ERP (Enterprise Resource Planning), specific forms and processes of fund management have changed accordingly. How to promote the centralized intensive and transparent management of the Group's fund sunder the ERP environment has become a research hot spot of corporate group finance. Companies can optimize their asset structures in turn, and reduce capital occupation. Besides, they can maximize the efficiency of capital use, avoid unnecessary capital flows caused by internal transactions, and reduce the intransit time of fund settlement.

Scholars have discussed the necessity of centralized management of enterprise group funds, the mode of centralized management of funds, and the implementation strategy of centralized management of funds from different perspectives. The theoretical basis, implementation strategy and mode of this special fund management have been elaborated up on from different levels, by which a host of practice have been in place. And the theory of centralized management of funds has accordingly been enriched. Xu Xusong et al.(2019) believe that, the characteristics of big data, big connection sand big cooperation in the Internet era have brought about four changes in traditional enterprise organizations, that is, (1) the concept of resources with synergy as the core breaks the traditional closed resource concept; (2) the organizational-environmental value system of large organizations breaks the traditional organizational-individual value system; (3) the nonlinear way of thinking breaks the tradition all near way of thinking; (4) the centralized management model breaks the traditional relationship management model. Zhuang Guochun et al. (2021) put forward that it takes over 20 years for China's enterprise groups to get to where it is today. In recent years, enterprise groups enjoyed such a rapid development. Meanwhile, many problems have occurred in the fund management. With the development of enterprise management in the direction of grouping and internationalization, the centralized fund management mode with the fund network control system as the carrier can effectively solve the contradiction between financial group

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centralization and decentralized management of enterprise groups. The network control system constructed by software and hardware can harden the fund management system, and avoid the ineffective implementation of the system and imperfect internal control caused by human errors. It functions through network information construction in two ways. On the one hand, it can reduce the operating costs of enterprises, improve efficiency and quality of centralized management of funds, and effectively integrate the financial resources of enterprise groups. On the other hand, it can help grasp the information on the acquisition, distribution and value-added of the enterprise group as a whole, and provide a set of timely, real and reliable financial information for the decision of the enterprise group. Chen Jin(2019) pointed out that enterprises were the core of the national innovation system, and world-class enterprises were the "leading geese" for the construction of science and technology innovation. Long Chengming (2020) held that the expansion of an enterprise increased its structure complexity, and the way for enterprises to manage its money becomes much more important. He analyzed the fund management of enterprise groups from the perspective of synergies, and put forward a clearing center model of Internet under the realization of synergies. It includes the establish men to fan account model, a market-based internal fund lending mechanism, an intra-group corporate transaction settlement mechanism, a highly centralized debt management, and a major investment. With all these, financing activities are concentrated in the headquarters, the settlement center system and the group finance (or ERP) system.

However, there are two shortcomings in the above research. First, it introduces only a single mode of centralized management of corporate funds, without taking into account of the overall framework of centralized fund management. Second, descriptive description is the main research method. In some cases, it is to focus on descriptive expressions in research methods, using some cases to introduce the successful experience of implementing centralized management of funds. Furthermore, it has three lacks: lack of a large sample test, lack of quantitative and scientific theoretical model support, and lack of certain practical experience universality.

ERP is an effective carrier for management ideas, management techniques and management methods. It integrates enterprise management concept, business process basic data, computer hardware and software together. It also integrates the resources of the whole group with the help of modern network communication technology to achieve integrated management. ERP will bring far-reaching changes to corporate fund management. ERP provides a strong guarantee and foundation platform for centralized management of group funds, through the structural equation model. It also establishes a framework of centralized management of enterprise group funds under the ERP environment. Among others, it tests the key influencing factors of the centralized management system of funds, and helps companies to clear the context and strengthen fund management. Thus, it will eventually help improve the efficiency and effectiveness of financial monitoring, and strengthen the risk control of monetary fund management. This has important practical significance for strengthening group fund management and reducing capital cost.

II. THEORY AND ASSUMPTIONS

ERP was first proposed by the American Gartner Company in the early 1990s. Based on information technology, it can comprehensively balance and optimize the comprehensive resources of people, finance, materials, information, time and space owned by enterprises. The goal is to coordinate the various management departments of the enterprise, carry out business activities around the market, and improve the core competitiveness of the enterprise, so as to achieve the maximized economic benefits. As a fusion of modern advanced information technology and new management ideas and methods, ERP integrates advanced management concepts and methods, business processes, basic data and computer hardware and software together. And it harnesses modern network communication technology to manage the entire group's resources integrated.

In the ERP environment, the centralized management of corporate group funds has presented new characteristics. The system not only takes the enterprise financial management and accounting management at its core, but also emphasizes the enterprise resources overall planning and comprehensive integration system management. Therefore, it is an application of information technology means, and it is coupled with data analysis functions. It can effectively promote the refinement of enterprise cost management, emphasize the function of predictive, control and performance management, assist the smooth development of enterprise business, and improve the level of management and productivity. Dong Junwei (2019) believes that ERP has created necessary conditions for the enterprise group to set up a centralized management and control platform for funds. By integrating and optimizing the centralized management process and standards, the Group's internal funds data concentration and information sharing are fully realized. Thus, their operations are effectively supervised and monitored in real time, and the ability of the Group's capability to dynamically control the funds is enhanced. Guo Feng (2019) proposed a solution for centralized management of group funds under the ERP environment: (1) centralized monitoring layer of funds; (2) unified centralized settlement management of funds; (3) fund management decision support layer. At the same time, it is necessary to establish a capital budget control system, a fund settlement control system and a full-time early warning system for funds.

This paper draws references from a combination of the research results of ERP theory and centralized management of enterprise group funds theory. It combines the centralized management framework of group funds under the ERP environment proposed by Xu Guangcheng, and establishes relevant assumptions from three aspects:

A. Centralized Capital Monitoring Layer

Under the modern enterprise governance model, the owner (shareholder) entrusts the operator(agent) to exercise control over the enterprise. Thus, it actually establishes a principal-agent relationship. Liu Yougui (2006) believes that

the core of principal-agent theory is to solve the problem of the principal's incentive to the agent in the case of conflicting interests and asymmetric information, namely the agent problems. In order to achieve the goal of their own design, the principal makes the interests of the agent and the principal as uniform. The reason is that it could be through a set of constraints and incentive mechanisms, namely, the principle of equal rights and obligations, and remuneration and labor. Compared with a single enterprise, an enterprise group has a more complex principal-agent relationship. Huang Yeqiu (2007) believes that group companies must strengthen centralized management of funds; otherwise, agents are likely to use information advantages to pursuit their own interests decreasing the economic interests of the principal directly or indirectly. Therefore, through the centralized management funds, the agent's economic behavior can be effectively restrained, and the agency cost can be reduced. Therefore, the agent can set maximizing the interests of the principal to as the action goal.

In the ERP environment, the above objectives are achieved through the centralized monitoring subsystem of the group funds. By using the centralized monitoring subsystem of the funds, the planning and centralized monitoring system of the group enterprises can clearly grasp a real-time fund dynamics of the entire group, and analyze the major and abnormal transfer of funds. The monitoring of group funds under the ERP environment is conducive to give a full play of the overall economies of scale of the group's funds. It uses the inter-bank policy for three purposes. First, it can obtain the spread income in the bank, and reduce the overall financial expenses of the group through the internal loan system. Second, it can invest in the investment business to obtain investment income. Third, it is beneficial to strengthen a real-time ability of fund allocation, distribution and collection, to avoid idle funds, improve the utilization rate of funds and reduce settlement costs. Therefore, in the ERP environment, group enterprise fund planning and centralized monitoring system can promote the performance of centralized fund management.

Thereby comes the first assumption:

F1: The greater the strength of fund monitoring, the more favorable the centralized management of funds.

B. Daily Unified and Centralized Settlement

Centralized capital management of an enterprise group is used for two purposes. The first is to gather the distribution right of important resources and the decision-making right of major issues in the group to the headquarters for centralized management and monitoring. The second is to improve the performance of centralized capital management of the group and strengthen the financial control of a group. Li Yuan(2010) believes that capital budget control is an important basis for centralized management and control of funds, and that it is the basis for the funds management center to allocate them. It is also an important tool for monitoring, analyzing and assessing the funds and expenditures of member companies. Xie Jianhong (2009) also believes that accurate and effective budget is the premise of centralized fund management, and that it is also the fundamental guarantee for unified centralized settlement management of funds. Under the ERP environment, the unified settlement management of enterprise implementation funds can be considered separately from the technical level and the business level.

From the perspective of ERP technology, Feng Yan (2020) believes that online settlement can be used to save time and smooth division of labor and collaboration among various departments within the enterprise, and more effective cooperation with supply chain enterprises and banks. The ERP-based network environment solves the problems of online payment, online inquiry, online collection, online reconciliation, etc., and improves settlement efficiency. The online payment center does not need to enter any data. The payment center does not make any changes to the payment information of the enterprise. It is beneficial to transfer its payment information directly to the receiving company, and the member units can check the settlement details in real time. Through online settlement businesses, the internal transfer and settlement business between different settlement companies and banks are realized. Various documents are transmitted online and down payment management is used to achieve efficient automation of daily capital business between the company and the bank.

From the ERP business level, the implementation of a unified centralized settlement management of funds requires restructuring, reshaping and optimization of the Group's financial business processes. Business process reengineering (BPR) was first proposed by Michael Hammer and Jame Champy (2003) in the United States, and the theory reached its full bloom in the 1990s. BPR emphasizes fundamental rethinking and a thorough redesign of existing business processes. It utilizes advanced information technology and modern management methods. It maximizes the functional integration of functions and harnesses management functions to break the traditional functional organizational structure. In this way, it establishes a new process-based organizational structure to lower the cost of business operations, and to realize great improvements in quality, service and speed. It makes an in-depth analysis of the defects of the traditional accounting business process of enterprise group fund management. The way to use the management concept of process reengineering tore organizes the business process of daily management of funds. Thus, it is one of the key factors determining the success of centralized management of enterprise groups. Based on the basic idea of BPR, Xu Guangcheng (2009) studied the integration of internal capital flow, information flow and business flow of the group enterprise. He believed that the enterprise group funds could be improved through their engineering of organizational structure, business process and capital flow. The overall operational efficiency promotes the formation of it score competitiveness and maximizes corporate value. Mu Jinjian (2019) holds that in the ERP system environment, once the business manifests itself, the accountant can not only collect detailed business and financial information, but also realize the information flow and logistics of the whole process of production, operation, supply and marketing of the enterprise. The integration of capital flow and data sharing can directly convert the physical flow of materials into the flow of funds in value form, ensuring the interaction and coordination of business and financial information. Therefore, the flow of funds reflects the operational quality and economic effects

of the enterprise group.

This paper proposes that through the integration between the financial logistics and other modules such as in formation integration, we can establish a unified, centralized clearing bank across the platform. In addition, we can put in place a management system of the bank on the net through the net silver interface network connection with the bank. Among others, we can realize a concentrated collection of funds to guarantee a real-time and automatic transfer and delegation, which will be translated as a dynamic monitoring and control of funds.

Therefore, the assumptions are as follows

F2: Good control of capital budget is conducive to centralized management of funds.

F3: Online banking is good for budget control.

F4:The integration of financial, logistics and other module information is conducive to dynamic supervision of funds.

C. Fund Management Decision Support Layer

According to modern cybernetics, information is the basis of management process control. Only by centrally managing financial information and non-financial information of enterprises, can the effectiveness of fund management decisions be guaranteed. Therefore, the formulation and implementation of fund management decisions require financial manages: (1) to organically integrate information technology with various decision-making models; (2) to establish decision-making models according to decision-making needs, changes in economic environment; (3) to obtain the information needed for decision-making from the data base in real time, so as to provide information available for senior management. Hu Gaofeng (2007) believes that the ERP environment has the five functions: (1) to accurately reflect the dynamic income and expenditure status of enterprise groups; (2) to control funds in real time; (3) to reasonably dispatch and adjust idle funds; (4) to accelerate capital circulation and turn over; (5) to form a centralized capital management mode that integrates decision-making of fund management at the top level, and monitoring and settlement of funds at the middle and lower levels. Li Yao (2009) also believes that after the establishment of ERP information platform environment, the centralized capital management of enterprise groups will move to the direction of the integration of information, process, function and data sharing. Meanwhile, the collection, management, analysis and transformation of capital data will make the data available information and truly serve the enterprise decision-making.

The fund management decision support layer has four roles: (1) to strengthen the control of the centralized management process of the enterprise group by the means of establishing an appropriate internal authorization mechanism; (2) to effectively control the internal risks of the group by establishing an early warning mechanism; (3) to transfer the various risks of members to the capital market; (4) to reduce and resolve the group's financial risks. In the ERP environment, the fund management decision-making sub system acquires internal (current data and historical data) and external information (collaboration) within the group. To that end, it uses tools and components such as data mining, data warehousing, evaluation index system, decision model library, data presentation and release, (partner data, information service provider data, public information on the network). Meanwhile, it carries out fund stock analysis, fund flow analysis, internal and external ratio analysis of settlement funds, budget execution analysis and capital position forecast analysis. In this way, it provides fund managers with a clear picture of fund management and forecast funds based on these analyses. Therefore, the assumptions are as follows:

F5: The fund management decision system facilitates the provision of information available.

F6: Internal authorization, process management can control risk.

III. VALIDATION MODEL OF CENTRALIZED FUND MANAGEMENT FRAMEWORK

A. Structural Equation Model

Structural equation modeling (SEM) is a statistical method using linear equation system to express the relationship between observed variables and latent variables, and among latent variables. It is a generalized linear model in essence, and the model reflecting the causal relationship between latent variables is

$$\eta = B\eta + \Gamma\xi + \zeta \tag{1}$$

where η is an exogenous variable, ξ is an endogenous variable, ζ is a random interference term, and B is an endogenous latent variable coefficient matrix. Γ is the exogenous latent variable coefficient matrix.

The model reflecting the relationship between latent variables and measurable variables is

$$X = \Lambda_x \xi + \delta \tag{2}$$

$$Y = \Lambda_y \eta + \varepsilon \tag{3}$$

where X is the observation index of exogenous variables ξ ,Y is the observation index of η , are the measurement errors, $E(\eta) = 0, E(\delta) = 0, E(\xi) = 0$, ε and η , ξ and δ , δ have nothing to do with ξ .

This paper has four purposes: (1) to better use the method of quantitative analysis; (2) to reflect the change law of the obvious variable factors through the measurement of latent variables; (3) to reduce the particularity, subjectivity and non-standard nature of the case; (4) to strengthen large sample surveys, and make the established fund centralized management framework more universal. To that end, each latent variable is measured by the explicit variable. Then, this paper uses the latent variables and explicit variables to construct the structural equation model. The model is the integration of module information. The information includes fund monitoring, fund budget control, online banking, finance and logistics, fund management decision-making system and internal authorization process management as latent variables of the model, and the comprehensive performance of centralized fund management elements as the obvious variables to construct the model. Thus, this paper verifies the degree of influence of the above factors on the centralized management of funds, explains and verifies the influencing factors of enterprise group fund management

under the ERP environment and the guiding significance for practice.

To better reduce the particularity, subjectivity and nonstandard nature of the case and make the established fund centralized management framework more universal, it can be seen from the theory and hypothesis that the fund monitoring strength, fund budget control, online banking, financial and logistics module information integration, fund management decision-making system and internal authorization process management are potential variables of the model, and each potential variable is measured by the explicit variable. Use the latent and explicit variables to construct the structural equation model, explain and verify the influencing factors of enterprise group fund management under the ERP environment and its guiding significance for practice. In the study of centralized fund management in China, the literature is mainly case study. Although it can summarize typical events in the economy, summarize experience, promote enterprises to improve the level of fund management, and provide some guidance for practice, this kind of case study is obviously characterized by particularity, subjectivity and non-standard, and lacks large sample investigation. Therefore, it is of universal significance to study the framework construction of centralized fund management through structural equation model.

B. Model Parameter Estimation and Testing

According to models (1)-(3), suppose the covariance of model fitting is $\Sigma(\theta)$, then

$$\Sigma(\theta)=\begin{bmatrix}\Lambda_y Var(\eta)\Lambda_y'+\Theta_\varepsilon & \Lambda_y Cov(\eta,\xi)\Lambda_x' \\ \Lambda_x Cov(\eta,\xi)\Lambda_y' & \Lambda_x Var(\eta)\Lambda_x'+\Theta_\delta\end{bmatrix} \tag{4}$$

Denoted as

$$Var(\xi)=\Phi, Var(\eta)=(I-B)^{-1}(\Gamma\Phi\Gamma'+\Psi)(I-B)^{-1\prime}$$

$$Cov(\eta,\xi)=(I-B)^{-1}\Gamma\Phi, \ddot{B}=(I-B)^{-1}$$

Then

$$\Sigma(\theta)=\begin{bmatrix}\Lambda_y \ddot{B}(\Gamma\Phi\Gamma'+\Psi)\ddot{B}'\Lambda_y'+\Theta_\varepsilon & \Lambda_y \ddot{B}\Gamma\Phi\Lambda_x' \\ \Lambda_x\Phi\Gamma'\ddot{B}'\Lambda_y' & \Lambda_x\Phi\Lambda_x'+\Theta_\delta\end{bmatrix} \tag{5}$$

Let Σ be the covariance of the observed population. If the theoretical model is true, then $\Sigma(\theta)=\Sigma$. For the observed population, the sample covariance is often used instead of the covariance of the population. Then use the maximum likelihood estimation method to estimate the parameters of the model, construct the fitting function

$$F_{ML}=\log|\Sigma(\theta)|+tr[S\Sigma^{-1}(\theta)]-\log|S|-(p+q) \tag{6}$$

where $tr[S\Sigma^{-1}(\theta)]$ is the trace of matrix $S\Sigma^{-1}(\theta)$, $|\Sigma(\theta)|$ is the determinant of matrix $\Sigma(\theta)$, p and q are the number of endogenous and exogenous measurable variables respectively. It is usually assumed that S and $\Sigma(\theta)$ are positive definite matrices, $\Sigma(\theta)$ has an inverse matrix, and the measurable variables follow a normal distribution. Under the condition of a large sample, if S is closer to $\Sigma(\theta)$, then F_{ML} is smaller. Choosing the parameter $\hat{\theta}$ that minimizes F_{ML} is the parameter estimation of the model,

$$\hat{\theta}=\arg\min_{\theta}\{F_{ML}\} \tag{7}$$

Whether the constructed model is suitable, according to the difference of $S-\Sigma(\hat{\theta})$, construct a goodness-of-fit statistic to test. Establish assumptions

$$H_0:\Sigma=\Sigma(\theta) \tag{8}$$

$$H_1:\Sigma\neq\Sigma(\theta) \tag{9}$$

When H_0 is true, the statistic is

$$\chi^2=(N-1)F\sim\chi^2\left(\frac{q}{2}(q+1)-k\right) \tag{10}$$

Among them, N is the sample size, F is the estimated value of the fitting function, and q is the number of measurable variables, including the number of exogenous and endogenous variables.

C. Questionnaire Design

Through interviews with university accounting professors, senior corporate executives and chief accountants, the authors understand the financial and non-financial benefits brought by the centralized fund management to the enterprise. The authors also collect the key problem sand difficult problems in the centralized fund management of the enterprise, and then prepare the scale questionnaire. The questionnaire is composed of 12 questions for the variables involved in the research based on 6 hypotheses. They are: the greater the intensity of fund monitoring, the more conducive to centralized management of funds (F1), the better control of fund budgets is conducive to centralized management of funds (F2), and online banking is conducive to centralized management of funds (F3), finance, logistics and other module information integration is conducive to the dynamic supervision of funds (F4), the capital management decision-making system is conducive to the centralized management of funds (F5), and the control of risks is conducive to the centralized management of funds (F6). The authors design 12 questions, and the respondents will respond according to their work experience and personal subjective feelings. All these are measured by the Likert Scale. The respondents' answers to each question were divided into five levels: very satisfied, satisfied, average, dissatisfied and very dissatisfied. The corresponding scores are5, 4, 3, 2 and 1 point. F1−F6 represent six hypotheses (Latent variable), respectively, and S1−S12 represent observed variables, respectively. The hypotheses and observed variables are summarized in Table I.

TABLE I
HYPOTHESIS AND TABLE OF OBSERVED VARIABLES

Hypothesis	Observation variable
The greater the monitoring of funds, the more favorable the centralized management of funds(F1)	Master the real-time dynamics of funds to better monitor funds(S1)
	Provide guidance on the use of funds, and fund analysis is conducive to centralized management of funds(S2)
Good control of capital budget is conducive to centralized management of funds(F2)	Good budget control of funds can reduce capital occupation(S3)
	Low capital turnover rate is conducive to centralized fund management(S4)
Online banking is conducive to centralized management of funds(F3)	Online banking can integrate real-time data of integrated funds(S5)
	Real-time funding data is conducive to budget execution(S6)
The integration of financial, logistics and other module information facilitates dynamic monitoring of funds(F4)	Financial and logistics modules provide useful information for the budget(S7)
	Good budget is conducive to dynamic monitoring of funds(S8)
Fund management decision system is conducive to centralized management of funds(F5)	The fund management decision system can analyze the implementation of the budget(S9)
	Fund management decision system can make fund forecast(S10)
Control risk is conducive to centralized management of funds(F6)	Internal authorization and process management can improve the efficiency of fund use(S11)
	Increased use efficiency of fund scan reduce or resolve the risk of funds(S12)

Statistical software AMOS can be used to analyze the input data, fit the structure model proposed above, determine the path coefficients between variables, and verify the influence of various factors on the construction of a centralized fund management framework.

IV. MODEL CONSTRUCTION AND DISCUSSION

A. Survey Object

The sample of the questionnaire is a company or enterprise group that has implemented centralized management of funds. The questionnaire with completed at a and no signs of filling out is deemed to be a valid questionnaire. The respondents are the financial supers or general finance staff of the company. A total of 146 questionnaires were collected (Table II).

TABLE II
COMPOSITION OF QUESTIONNAIRE STAFF

Personnel	Number of people	Proportion of total survey
Accounting supervisor of central enterprise	24	16.44%
Accounting supervisor of large listed companies	38	26.03%
Provincial enterprise financial personnel	84	57.53%
Total	146	100%

B. Questionnaire Reliability Analysis

Reliability is the degree of consistency of the results obtained by repeating measurements on the same object in the same way. The liability indicators are mostly expressed by correlation coefficients. To correctly reflect latent variables, the selection of indicators and the naming of latent variables require careful design and trade-offs. Reliability testing is affected by the time between the two in tervals and the number of times of testing. For the same que stionnaire to be measured multiple times at different time po ints, or to shorten the interval between two tests, the reliabili ty will be improved. In the structural equation analysis, the traditional method uses the Cronbach's alpha coefficient(α)to measure the reliability of the questionnaire.

Embedding Cronbach's alpha coefficient formula is

$$\alpha = \frac{n}{n-1}\left(1-\frac{\sum_{i=1}^{n} S_i^2}{S_t^2}\right) \tag{11}$$

Among them, n is the number of test question, S_i is the variance of the score of the i-th question, and S_t is the variance of the total score of all the test questions.

According to the collected questionnaire data, the authors use the reliability calculated by AMOS software to conduct a test of whether each set of questions can measure the target variable or not. The results are shown in Table III.

TABLE III
QUESTIONNAIRE RELIABILITY ANALYSIS

	Estimate
S12	.602
S11	.647
S10	.613
S9	.667
S8	.613
S7	.674
S6	.688
S5	.692
S4	.687
S3	.605
S2	.694
S1	.604

The results show that the overall reliability of the 146 questionnaires collected by the questionnaire are relatively high, and the Cronbach α value of the composition of the 12 latent variables are all higher than 0.6. It can be seen that the reliability of the questionnaire is very high, and the research basis is obtained as sure.

C. Building a Linear Model and Discussion

Let Y be the interviewee for 12 observed variables, $S_i, i = 1, 2, \cdots, 12$, the given score, the latent variable related to Y are $F_1, F_2, \cdots, F_6$, the corresponding scores are expressed as $X_1, X_2, \cdots, X_6$, and

$$X_i = S_{2i-1} + S_{2i}, i = 1, 2, \cdots, 6 \quad (12)$$

Experts scored 12 observed variables, and the size of the score reflects the degree of recognition of the fund management framework. The score is above 45, which means we agree with it: it is represented by Y=1. Otherwise, it is represented by Y=0. In order to explore the recognition of the fund management framework, we assume that Y has a linear relationship with $X_1, X_2, \cdots, X_6$.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_6 X_6 + \varepsilon, \quad \varepsilon \sim N(0, \sigma^2) \quad (13)$$

β_i are unknown parameter.

Based on these 146 interviewees, 146 observations were obtained and the equation was constructed.

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_6 x_{i6} + \varepsilon_i, i = 1, 2, \cdots, 146 \quad (14)$$

Using R statistical software to compile a program, the parameters of the above linear equation are estimated as shown in the table below,

TABLE IV
PARAMETER ESTIMATION OF MODEL

	Estimate	Std. Error	t	Value *Pr*(>|*t*|)
Intercept	-4.92891	0.52439	-9.399	<2e-16 ***
*X*1	0.13612	0.03611	3.769	0.000241 ***
*X*2	0.11838	0.02397	4.938	2.23e-06 ***
*X*3	0.10292	0.02275	4.525	1.29e-05 ***
*X*4	0.11465	0.02147	5.341	3.68e-07 ***
*X*5	0.14262	0.01809	7.886	8.28e-13 ***
*X*6	0.11975	0.02393	5.003	1.67e-06 ***

Sign if. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.264 on 139 degrees of freedom
Multiple R-squared: 0.5324, Adjusted R-squared: 0.5122
F-statistic: 26.38 on 6 and 139 DF, p-value < 2.2e-16

The above table IV shows that each coefficient in the linear regression equation is valid at a significant level of 0.001. This shows that latent variables can be used as influencing factors to describe the framework of the impact on the centralized management of group funds. Furthermore, the centralized management does play the role of the hypothesis we designed at the beginning of this paper.

TABLE V
EXPERT SCORE

H=F1+F2+F3+F4+F5+F6	*H*≥45	H<45
Experts score	123	23
Percentage	81.70%	18.30%

23/123*100%=18.70%, where the maximum score is 52 and the minimum score is 41. It shows that only about 18.70% of the experts disagree with our hypothesis, that is, they don't agree with our statement. However, it also shows that 81.30% of the experts agree with our idea, and their scores are all above 45 points (including 45 points). In other words, the six important factors affecting the centralized management of corporate group funds under the ERP environment we designed are established.

D. Model Construction and Discussion

For many problems in reality, the relationship between multiple indicator variables is often more complicated. It is not always possible to use a set of independent variables to explain a dependent variable because there are not only direct effects but also indirect effects arising from multiple variables. In addition, many latent variables are not independent of each other. Thus, AMOS software is used in the following to construct structural equations (1), (2) and (3) to describe the relationship between latent variables.

The regression weights are shown in Table VI.

TABLE VI
REGRESSION WEIGHTS OF LATENT VARIABLES TO OBSERVED VARIABLES

	Estimate	S.E.	C.R.	P	Label
S1←F1	1.000				
s3←F2	1.000				
s4←F2	-.687	.148	-4.656	***	par_1
s5←F3	1.000				
s6←F3	2.250	.346	6.500	***	par_2
s7←F4	1.000				
s8←F4	1.907	.314	6.069	***	par_3
s9←F5	1.000				
s10←F5	-1.471	.272	-5.407	***	par_4
s11←F6	1.000				
s12←F6	.987	.157	6.295	***	par_5
S2←F1	.972	.357	2.726	.006	par_21

Table VI shows the results of the load fitting of the latent variable to the observed variable. The table lists the non-normalized estimated value, standard deviation, the ratio of the estimated value divided by the standard deviation. The null hypothesis is with the parameter test value of 0 the P value of the contact. It can be seen from the P value column that all loads are not equal to zero at the 0.05 level.

Table VII shows the fitting results of the covariance in the model. It can be seen from the P value column that all the covariance are significantly not 0 at the 0.05 level, and all the covariance relationship have been significant. This shows that the correlation between latent variables is supported by actual data.

TABLE VII
COVARIANCE FITTING RESULTS

	Estimate	S.E.	C.R.	*P*	Label
F1←→F2	.264	.087	3.020	.003	par_6
F2←→F3	.392	.083	4.723	***	par_7
F3←→F4	.210	.047	4.461	***	par_8
F4←→F5	.252	.060	4.182	***	par_9
F5←→F6	-.473	.106	-4.449	***	par_10
F1←→F4	.163	.048	3.386	***	par_11
F1←→F5	.172	.070	2.458	.014	par_12
F2←→F6	-.689	.120	-5.726	***	par_13
F3←→F6	-.391	.082	-4.784	***	par_14
F1←→F3	.131	.050	2.597	.009	par_15
F1←→F6	-.194	.077	-2.521	.012	par_16
F2←→F4	.323	.066	4.890	***	par_17
F2←→F5	.453	.106	4.260	***	par_18
F3←→F5	.336	.080	4.199	***	par_19
F4←→F6	-.258	.058	-4.467	***	par_20

Table VIII shows the results of the variance fitting of the latent variables in the model. The fitting results shows that there is not too much meaningless variance or variance of the negative values in the model. Therefore, the fitting result of the variance is valid. It can be seen from the *P* value column that all variances have been significant. The above results can be displayed by the model.

TABLE VIII
VARIANCE FITTING RESULTS OF LATENT VARIABLES

	Estimate	S.E.	C.R.	P	Label
F1	.527	.128	1.777	.046	par_22
F2	.686	.173	2.229	.026	par_23
F3	.553	.079	3.213	.001	par_24
F4	.537	.047	2.939	.003	par_25
F5	.673	.138	2.691	.007	par_26
F6	.691	.143	3.425	***	par_27
e1	.782	.138	5.659	***	par_28
e2	1.227	.174	7.051	***	par_29
e3	1.012	.177	5.716	***	par_30
e4	1.425	.178	7.986	***	par_31
e5	.654	.082	8.016	***	par_32
e6	.700	.162	4.326	***	par_33
e7	.382	.050	7.652	***	par_34
e8	.707	.115	6.149	***	par_35
e9	1.234	.160	7.715	***	par_36
e10	1.091	.194	5.611	***	par_37
e11	.835	.125	6.698	***	par_38
e12	1.095	.149	7.355	***	par_39

It can be seen from Figure 1 that the load coefficients of the various standardized factors of the measurement model are significant at the level of 0.05, and are closely linked. This fully shows that the questionnaires designed by the research can properly express and measure each latent variable.

Verification is designed to use SEM to analyze the structure model in ERP environment fund centralized management framework of building. It is influenced by six factors covering capital monitoring strength. It needs to evaluate the overall fit of the model. If the model fitting degree is high, we can refer to the standardized path coefficient test hypotheses between latent variables established. The model fit results are as follows.

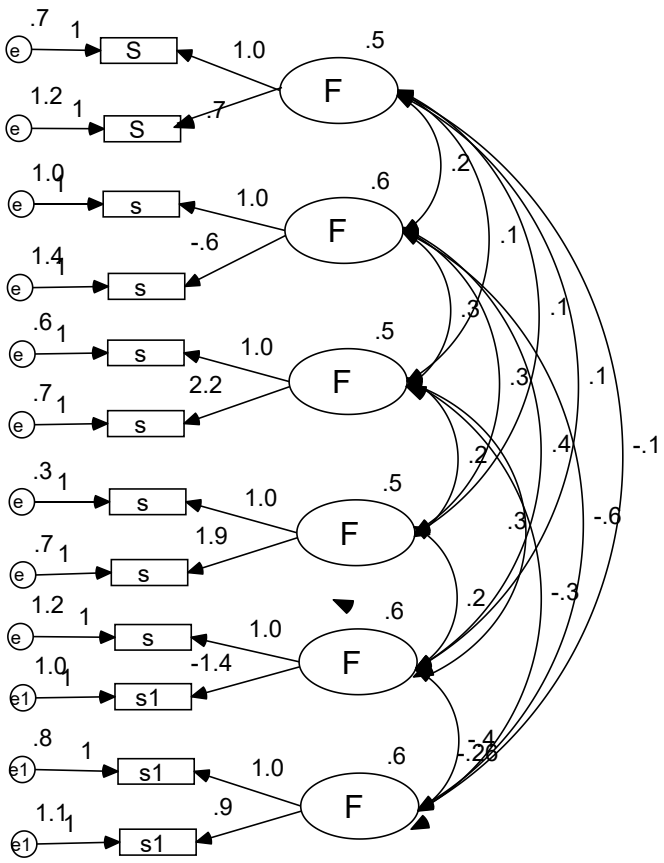

Fig. 1. Fund Centralized Management Frame Work Construction Path Map

This chart investigates 6 hypotheses and 12 key and difficult questions designed by accounting professors at universities as well as senior managers and chief accountants at companies. It is designed to study the variables involved in the financial and non-financial benefits brought about by the centralized management of funds. The obtained data on the centralized management of corporate funds are analyzed by using Amos software. The results in Figure 1 are obtained, showing the relationship between the key elements of the 12 questions affecting the hypothesis. Whether these relationships are significant or not is illustrated by Table VIII and Table IX.

E. Structural Model Analysis

(1) Model Goodness of Fit Test

The model fit results are as follows in Table IX.

TABLE IX
MODEL FIT COEFFICIENT

Model fitness Index	Statistical results	Fitting standard(recommended value)
CMIN/DF	2.568	≤3.0
PGFI	0.547	≥0.5
CFI	0.902	≥0.9
RMSEA	0.104	The smaller the better

The four fitting indicators in Table IX have reached a standard value, indicating that the model generally meets the fitting requirements.

(2) Correlation between latent variables

TABLE X
MODEL PATH COEFFICIENT

Structural model path	Standardized path coefficient	Pvalue
Fund Monitoring Intensity → Centralized Management of Funds	0.527	0.046
Capital Budget Control → Centralized Fund Management	0.686	0.026
Online Banking → Centralized Management of Funds	0.553	0.001
Integration of Financial, Logistics and Other Module Information → Dynamic Monitoring of Funds	0.537	0.003
Fund Management Decision System → Centralized Management of Funds	0.673	0.007
Control Risk → Centralized Management of Funds	0.691	***

Table X is a list of the model paths. The verification of the research hypothesis is shown in Table 10. All the six standardized paths coefficients reach the significance level of 0.05. The analysis of AMOS shows the rationality of the questionnaire design. The structural equation analysis has a high degree of fit, which verifies the six research hypotheses.

F1: The greater the strength of fund monitoring, the more favorable the centralized management of funds (R=0.527, P=0.046), so the assumption is established.

F2: Proper control of the capital budget is conducive to centralized management of funds (R=0.686, P=0.026), assuming that it is established.

F3: Online banking is conducive to centralized management of funds (R=0.553, P=0.001), assuming that it is established.

F4: The integration of financial, logistic sand other module information is conducive to dynamic monitoring of funds (R=0.537, P=0.003), assuming that it is established.

F5: The fund management decision system is conducive to centralized management of funds (R=0.691, P=***), assuming that it is established.

F6: Control risk is conducive to centralized management of funds (R=0.673, P=0.007), assuming that it is established.

The results show that the model has a good degree of fitting, the factor load of the observed variables in the model reaches a statistically significant level, and all the research hypotheses in the model have been verified. The factors affecting the construction of the centralized fund management framework are: control risk, fund budget control, fund management decision system, online banking, finance, logistics and other module information integration, as well as fund monitoring efforts. Therefore, focusing on these six links and coordinating various factors will help improve the level of corporate fund management, reduce the cost of capital for enterprises, reduce risks, and strengthen the control of funds for member units. In the end, it will achieve a centralized management of funds because effective use enables funds to create maximum value added.

V. CONCLUSION

The linear regression and structural equation numerical results show that the control risk, capital budget control, capital management decision-making system, the integration of online banking, finance, logistics and other module information, and the strength of capital monitoring are the influencing factors for the construction of the orderly centralized capital management framework. It is further expressed as follows in Table XI

TABLE XI
FACTORS AND DEGREES AFFECTING THE CONSTRUCTION OF ERP MANAGEMENT FRAMEWORK

Assumptions of influencing factors correlation or coefficient	R	P	Assumption is true or not
Assume whether it is established or not. The greater the monitoring of funds, the more conducive to centralized management of funds.	0.527	0.046＜ 0.05	true
Well controlled capital budget is conducive to centralized management of funds.	0.686	0.026＜ 0.05	true
Online banking is conducive to centralized management of funds.	0.553	0.001＜ 0.05	true
The integration of financial, logistics and other module information is conducive to dynamic supervision of funds.	0.537	0.003＜ 0.05	true
Controlling risk is conducive to centralized management of funds.	0.673	0.007＜ 0.05	true
The fund management decision system is conducive to the centralized management of funds.	0.691	***	true

Since the above six factors are the main factors that affect the construction of the ERP management framework, i.e., they are also the risk points of the enterprise group's fund management under the ERP environment. Such risk points usually include software and hardware product risk, ERP implementation risk (policy risk, system schedule risk, cost risk and quality risk), ERP process operation risk (personnel risk, data risk, process risk) Capital management risk and

administrative management risk are caused, and in the process of construction, corresponding measures should be taken to strengthen management and control in the following five aspects: careful selection of software and hardware products, strengthening of ERP implementation control, standardization of ERP process operation, improvement of ERP fund management mode, and establishment of a sound management system, so as to ensure the smooth construction of the ERP management framework and the safety of the centralized management of enterprise funds.

Since its introduction to China in 1998, this platform has become increasingly mature. The construction of ERP enterprise fund management mode provides a new platform for the centralized management of enterprise group funds. It can effectively improve the fund utilization rate of the enterprise group, optimize the settlement process, and reduce the fund settlement time. It aims to lay a foundation for the follow-up research and improve the quality of work. The overall research of this paper is relatively macro, and the specific fund centralized management mode, such as cash pool mode, budget-driven allocation mode, implementation method and operability test, are the important directions of the next research.

REFERENCES

[1] Yang Hu. "Innovation and practice of ERP based enterprise group bill centralized management model -- taking Qilian Mountain Cement as an example," *Gansu Finance*, vol.9, No.52,pp: 44-47,2021

[2] Feng Yan. On the new mode of financial management of group enterprises under the ERP system environment. *Energy Science and Technology*, vol.11, no.18,pp: 33-35+56,2020

[3] Wylie L. ERP: A vision of the next-generation MRP II. *Computer Integrated Manufacturing,* vol.2, no.3, pp: 1-5.1990

[4] Long Chengming. Discussion on ERP informatization to improve financial management. *Economic Management Abstract*, vol.13,no.7, pp: 153-154+156, 2020

[5] Hashem Salarzadeh Jenatabadi, "An Application of Moderation Analysis in Structural Equation Modeling: A Comparison Study between MIS and ERP," Applied Mathematical Sciences, Vol.8, no. 37, pp1829-1835, 2014.

[6] Dong Junwei, Shen Nanlin, Li Jun, et al. Optimization Scheme for Assisted Asset Transfer Based on ERP. *Electronic Technology and Software Engineering*, vol.15, No.150, pp: 203-205,2019

[7] Wen-Hsien Tsai, Michael J. Shaw, Yi-Wen Fan, Jau-Yang Liu, Kuen-Chang Lee, Hui-Chiao Chen, "An empirical investigation of the impacts of internal/external facilitators on the project success of ERP: A structural equation model," Decision Support Systems, vol50, no. 2, pp480-490, 2011.

[8] Wang Jinwen, "Qi Yue. The status quo and suggestions of enterprise internal audit under ERP environment," *Journal of Jilin Business College*, vol.34, no.6, pp67-69, 2018.

[9] CRUZ-TORRES Wilmer, ALVAREZ-RISCO Aldo, DEL-AGUILA-ARCENTALES Shyla, "impact of enterprise resource planning(ERP) implementation on performance of an education enterprise: a structural equation modeling(SEM) ," Studies in Business and Economics, vol.16, no.2, pp 38-52, 2021.

[10] Li Guoqiang, Zhao Beijing. "Reflections on strengthening ERP construction and promoting the integration of industry and finance under the background of supply-side reform," China Business Theory, vol.32, no.2, pp36-37, 2018.

[11] Yi-fen Su, Chyan Yang,"A structural equation model for analyzing theImpactof ERP on SCM,"*Expert Systems with Applications*,vol.37,no.3, pp.456–469,2010.

[12] Zeng Ruiyong, "Analysis on the Application of ERP Management System in Enterprise Internal Control," China Chief Accountant, Vol.9, no.2, pp46–49 2010.

[13] Li Ruitong, "Analysis of Enterprise Group Integrated Financial Management Model Based on ERP" , Finance and Economics, vol.23,no.2, pp107–109, 2018.

[14] Jinjian Mu, Guanyu Hu, Lynn Kuo, "Bayesian Variable Selection for Poisson Regression with Spatially Varying Coefficients," WSEAS Transactions on Mathematics, Vol.18, no.2, pp 435-438, 2019.

[15] Tagelsir Mohamed Gasmelseid, "Multiagent Web based Decision Support Systems for Global Enterprises: An Architectural Blueprint," Engineering Letters, Vol.13, no.2, pp173-184, 2006.