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Theverification of integrated management organization of governmental non-profitable investment projectsby structUralequationmodeling

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ABSTRACT

The scale of governmental non-profitable investment projects in China is bigger now. As owners of governmental non-profitable investment projects, it needs a higher management level to ensure to the goal of construction. The integrated management organization is built based on the full-life cycle management theory, which is beneficial to take control of investment, quality and time limit for projects, etc. Firstlythe definition is given about governmental non-profitable investment projects integration management. According to its characteristic, the integration management organizationis constructed. Based onThe integrated management organization of governmental non-profitable investment projects, the quantitative analysis is using by the structural equation modeling (SEM), the statistical data processing is using by SPSS16.0. By using AMOS17.0 the modeling and analysis work of structural equation modeling (SEM) is done. The basic data is required by the method of questionnaire. It is involved25 observation variables, 6 latent variables. The calculation results show that the fitting indexes of the model meet the requirement. The latent variables have higher construct reliability. The conclusion is that the integratedmanagement organization based on the full-life cycle management theory is effective to the owner of governmental non-profitable investment projects.

KEYWORDS

Structural equation modeling; Government investment; Integration; Management organization.

INTRODUCTION

According to the investment source of construction projects, it can be divided into governmental investment projects and non-governmental investment projects. According to the profitability of governmental investment projects,it can be divided into governmental profitable investment projectsand governmental non-profitable investment projects. Governmental non-profitable investment projects refer to non-profitable. The construction purpose is that realizingthe maximization of social benefit, such as school, hospital, administration buildingand as so on.

The investment source of governmental non-profitable investment projectshas a rising trend in China recently. The participators are increasingand theirregionsare dispersed. The scale of the management organization and the level of management arelarge. Therefore, the establishment of efficient governmental non-profitable investment projects integrated management organization is particularly important to the owners.

Structural Equation Modeling (SEM) is proposed by Swiss statist Karl Joreskog and Dag Sorbom, in the 1970's. SEM is the multivariate statistical analysis methodabout the relationship between sensible variables and latent variables. It belongs to multivariate higher statistics. SEM can be used to analyze the relationship of latent variables, in order to process and analysis of complex multivariate data inquiry. Through SEM we can get quantitative results[1].

This thesis uses SEM toget quantitative analysis of the integrated management organization of governmental non-profitable investment projects. Statistical data processing uses SPSS16.0. The modeling and analysis of SEM is on AMOS17.0 platform.

BACKGROUND

At present, there is not definition about the integrated management of projects. It considered that integrated management of governmental non-profitable investment projects based on full life-span cycle is: as governmental non-profitable investment projects based on full life-span cycle the object, as to serve the community the ultimate goal, the full life-span cycle planning, coordination and control from thedecision stageto the operation and maintenance stage, organizing the participators integrated, in order to completeprojects successfully in the plan period, achieve the construction goalsand reach the improving project management performance.(As shown in Figure 1)

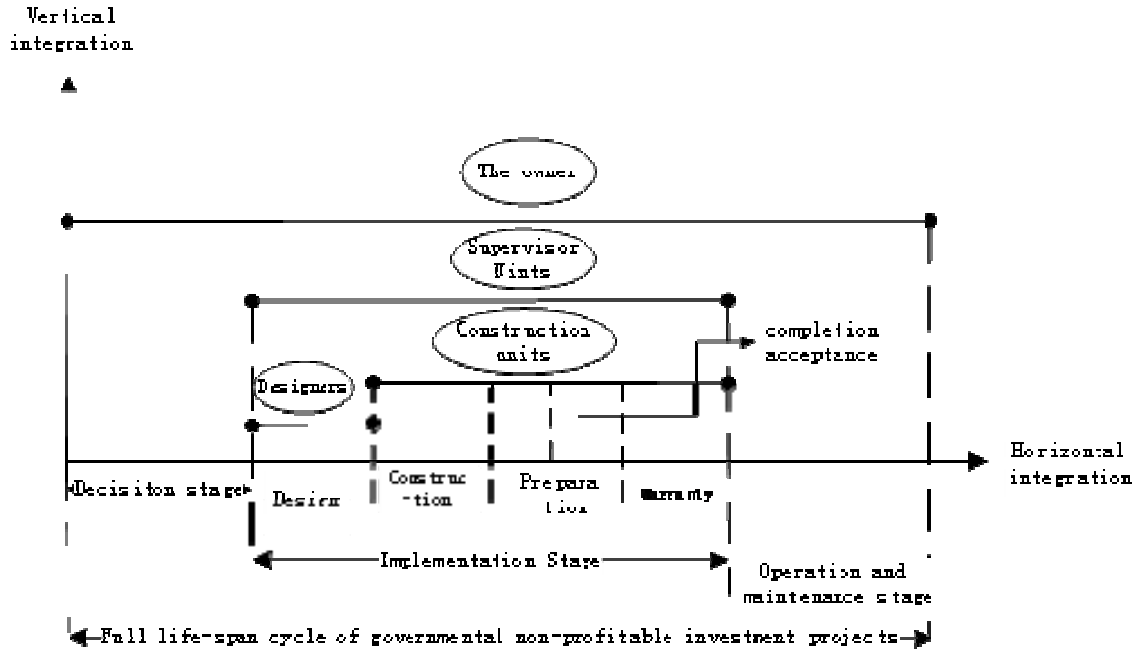

Figure 1 : The concept of full life-span cycleowners'integrated management of governmental non-profitableinvestment projects

Based on the meaning of integrated managementof governmental non-profitable investment projects, its features as follows:

(1) Ensure the goals of governmental non-profitable investment projects, make the goals get maximum satisfaction.

(2)Makingthe participators of governmental non-profitable investment projects management organization to join in the process of construction as soon as possible, as early as possible to make control and management.

(3)Greatly improve the running efficiency of governmental non-profitable investment projects. Using the principle of concurrent engineering, effectively shorten the construction period and ensure the reliability of projects implementation.

(4)Usinggovernmental non-profitable investment projects management organization to realize integrated management, improving the reliability of design, and reducing change and negotiationsin the construction.

(5)Realizing the overall optimization of construction and giving full play to the potential of participators involved.

(6)Making participatorsconstruction goals consistency, and realizing integrated management effectively.

Overall, based on the owner'sfull life-span cycleintegrated management organization it requires owners to break the boundaries of time and space. With the system point of view, it can make participators ofgovernmental non-profitable investment projectsmanagement organization penetration and interaction to build an effective integrated management organization.

TESTING

It is used the internal variables survey scale of management organization and integrated management organization survey scale, by the means of questionnaire survey data[2], to bring the owners of governmental non-profitable investment projects integrated management organization the higher-order factor model (two-stage), in order to build governmental non-profitable investment projects management organization structure equation and testing by SEM.

The testing object

The study object of SEM is based on full life-span cycleintegrated management organization of governmental non-profitable investment projects.

The model components

The model involves twenty-five observed variables andsix latent variables. The relationship is complex.

The model path

The model path of governmental non-profitable investment projects integrated management organization is shown in Figure 2.

Integrated management organization η_1 is made up of three exogenous latent variables: organization tasks ξ_1; organizationreputation ξ_2; organization coordination ξ_3.

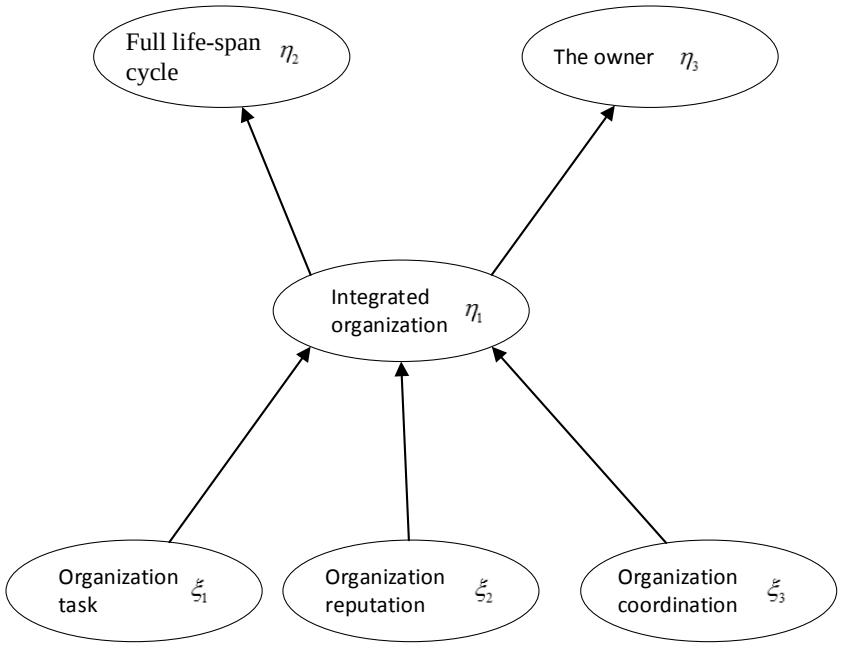

Figure 2 : The model path

The model structure

The way of obtaining basic data is sampling from different participators. From the owner the sample data is fifty. From designers the sample data is fifty. From general contractors the sample data is fifty. From the supervisorsthe sample data is fifty. From the professional subcontractors (respondents the foundation subcontractors)the sample data is fifty. So the sample data is two hundred and fifty.

Integrated management organization η_1 usesthree exogenous latent variables ξ_1、ξ_2、ξ_3 corresponding elevenquestions in internal variables survey scale,remembered to $X_1 \sim X_{11}$,which refers to external observation variable. λ_{ik}^x is the i observed variables in the factor loading on the k exogenous latent variables. d_i refersto measurement error, $i = 1,\ldots\ldots,11$. So the measurement formula is:

$$X_i = \lambda_{ik}^x \xi_k + d_i \; i = 1,\ldots\ldots,11, k = 1,2,3 \quad \textbf{(1)}$$

The structural equation is corresponding to high-order factor of integrated management organization η_1 in Formula (1) (matrix A^T showsthe transpose of A):

$$\eta_1 = [\gamma_{11} \quad \gamma_{12} \quad \gamma_{13}]\,[\xi_1 \quad \xi_2 \quad \xi_3]^T \quad \textbf{(2)}$$

The fourteen questions inintegrated management organization questionnaire scaleremembered to $Y_1 \sim Y_{14}$. Building two internal latent variables: full life-span cycle η_2, the owner η_3; Measurement error e_m, $m = 1,\ldots\ldots,14$. The measurement formula is built :

$$Y_m = \lambda_{ml}^y \eta_l + e_m \; m = 1,\ldots\ldots,14, l = 2,3 \quad \textbf{(3)}$$

The overall SEM formula:

$$\begin{bmatrix} \eta_2 \\ \eta_3 \end{bmatrix} = \begin{bmatrix} \beta_{21} \\ \beta_{31} \end{bmatrix} [\eta_1] + \zeta \quad \textbf{(4)}$$

$\zeta = \begin{pmatrix} e_{20} & e_{21} \end{pmatrix}^T$ is the 2×1 internal latent variable residual matrix.

Testing result

Model assumption

1)Indicator X_i and Y_m have non-vanishingfactor loading of correspondinglatent variables. But in other latent variables the factor loadingsarezero.

2)Measurement error d_i and c_j have not nothing to do withfactor ξ_k. measurement error e_m have not associated withfactor η_2, η_3. And measurement error d_i is not related with measurement error e_m.

The overall fitting evaluation

With fitting method and evaluation of SEM, we can use the following criteria to evaluate the model[3].

1) GFI (a Goodness of Fit Index) is between 0 ~ 1. When closer to 1, the whole fitting is better. It is generally believed that its value is close to 0.90, which easily accepted.

2) CFI (Comparative Fit Index) is between 0 ~ 1. When closer to 1, the judgment model is better.

3) RMSEA(Root Mean Square Error of Approximation)is less than 0.1, which means better fitting.

By AMOS Maximum likelihood estimation is used. The number of iteration is sixty times. The output of fully standard resultis shown in Figure 3. The overall fitting results are shown in TABLE 1.

TABLE 1 : The fitting index of the whole model

Model	GFI	CFI	RMSEA
Full model	0.770	0.994	0.873

We can see from TABLE 1 thatGFI, CFI and RMSEA have reached the requirement of goodness of fit.

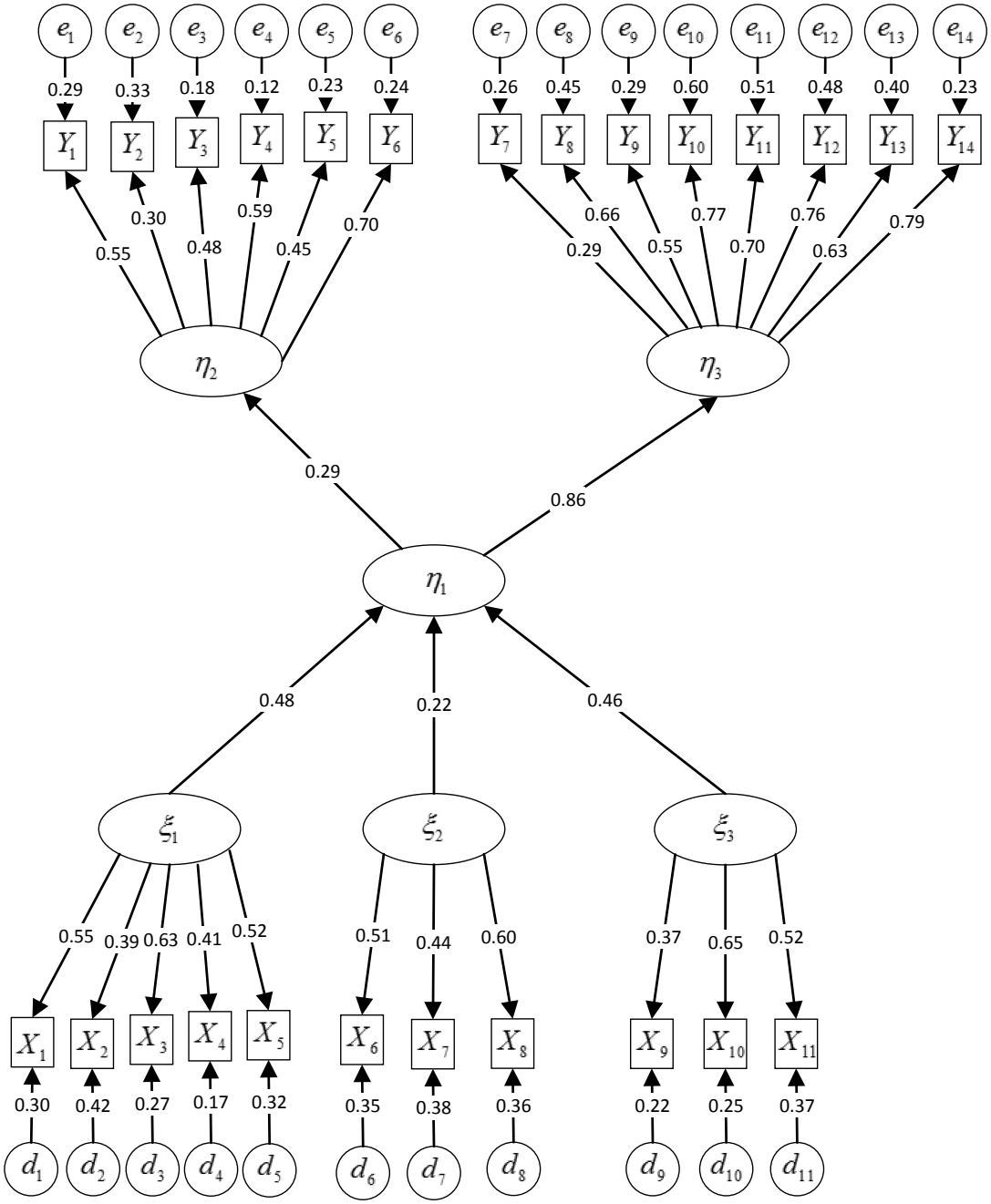

Figure 3 : The model calculations

The construction of latent variables

In order to test hypothesis theory, we should test construct reliability. Construct reliability refers tothe degree of consistency between latent variables and observe variables (not including latent variables η_1).

$$\rho_c = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum(\theta_i)}$$

Construct reliability is ρ_c, the standardized factor loading parameters of observed variables on the latent variable is λ_i, the error measurement of observed variables is θ_i. The evaluation of ρ_c: 0.9 or above means excellent; around 0.8 means good; above 0.6 means be accepted. The results show in TABLE 2.

TABLE 2 : The construction reliabilityof latent variables

Latent variable	Construction reliability	Latent variable	Construction reliability
Organizational task ξ_1	0.80	Full life-span cycle η_2	0.87
Organizational reputation ξ_2	0.69	The owners η_3	0.89
Organize coordinate ξ_3	0.74		

From TABLE 2 we can see that there are threeconstruction reliabilities of latent variables in five is above 0.8. The other twois far more than 0.6.

The analysis of results

By completely standard, we can get the matrix form of Formula (5):

$$\begin{bmatrix}\eta_2\\ \eta_3\end{bmatrix}=\begin{bmatrix}0.29\\ 0.86\end{bmatrix}[\eta_1]+\zeta \quad \textbf{(5)}$$

From Formula (2) we can get:

$$\eta_1=[0.48 \quad 0.22 \quad 0.46][\xi_1 \quad \xi_2 \quad \xi_3]^T \quad \textbf{(6)}$$

Organization task ξ_1 plays the big role tothe higher-order latent variables of integrated management organization η_1 .Organization coordination ξ_3 plays the second role to η_1 .Organization reputation plays the small role to η_1 .

Discussion

It is used questionnaire and scale in this thesis. In order to design the questionnaire and scale we deep into the participators of governmental non-profitable investment projects management organization to get the sample materials. Then SEM is constructed. Theresult shows that the whole fitting index meets the requirement and latent variables have higher construct reliability. By data fitting results, using sample data collected by questionnaire and scale, it is valid to analyze the affecting factors of organizationidentification[4].

CONCLUSION

By SEM, it is concluded that the result is the same between the quantitative analysis and qualitative analysis. Governmental non-profitable investment projects need to form the flexible integrated management organization. In this way, governmental non-profitable investment projectsowners cancomplete the construction goal and build the social benefit best governmental non-profitable investment projects.

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