Research on performance evaluation system of poverty alleviation project

--- a case study of Zhangjiakou City, Hebei Province, China

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Abstract

The article construct the "performance evaluation system for poverty alleviation projects" from four aspects: project investment, process, output and influence. With the principle of efficiency, comprehensive, dynamic and feasible, the principal component analysis is applied to the poverty alleviation project, the input and use of poverty alleviation funds, the management of poverty alleviation projects and the achievements of poverty alleviation projects, And it regards the dynamic evaluation of Zhangjiakou city in Yangyuan County and Chongli district as the research sample and research. The results show that under the octagonal village poverty alleviation project performance photovoltaic "good" apricot tree grafting project performance "good" kiln photovoltaic poverty alleviation project performance Tao "excellent", the evaluation index system is correct and feasible and has extensive applicability.

Keywords: *precision poverty alleviation; performance evaluation; Zhangjiakou City; principal component analysis*

1 Introduction

Since the reform and opening up, China has made great efforts to promote poverty alleviation and development. In order to further improve the effectiveness of poverty alleviation, it is necessary to constantly improve policies and mechanisms for poverty alleviation. With the precise poverty strategy formally put forward and participatory work, positioning and

implementation of poverty alleviation projects will also have a new change. Poverty alleviation project performance evaluation is no longer suitable for the original thinking, and it must be innovated and improved.

Previous researches on poverty alleviation performance evaluation index system and assessment methods¹ have already been discussed. However, China still lacks the comprehensive evaluation research on the performance of poverty alleviation projects from the aspects of poverty alleviation, resource allocation, project management and subjective participation. Especially, the research on the construction of evaluation index system and the application of evaluation methods from the point of view of precision is lack of practical guidance. Therefore, this paper attempts to improve the evaluation of poverty alleviation performance evaluation ideas, evaluation procedures, and select and analyze applicable evaluation methods. And then by the construction of the evaluation index system, it analyses the application of participatory data in precision in performance evaluation.

2 Establishment and analysis of "Performance Evaluation Model of Poverty Alleviation Project"

2.1 Performance analysis

From the field research situation, the progress of precision poverty alleviation project is difficult to have a fair evaluation, so that it can not have a good game between the projects. Therefore, the government needs a good performance evaluation system to measure the operation of the project, so as to take appropriate measures to control the progress of the project

From the perspective of the general project operation, the performance evaluation uses the "input - process - output - impact" of the basic ideas. In the premise of the necessary capital (including material capital, human capital, etc.), we achieve the necessary goals. In the capital into the output process, use appropriate management tools, and then output services or construction projects, and the region or the object have a certain impact. Poverty alleviation projects and the general project is the difference between the pursuit of the target and the relationship between input and output is different, so the design of the performance evaluation index of the poverty alleviation project is still different. According to the previous assessment experience², poverty alleviation project performance evaluation is generally divided into four aspects: target targeting, resource input, management process, project effectiveness (see Table 1-3). There may be a certain correlation with a number of evaluations. In this regard, we hope

to use the idea of reducing dimension to extract the indicator principal component and reclassify, making the system more scientific.

2.2 Model theory analysis

Principal component analysis is a method of reducing dimensionality to data in mathematics. The basic idea is to try to replace the original indicators with a number of unrelated indicators that have a large number of relevant indicators P (12 indicators in this question) and reassembled into a smaller number of irrelevant indicators F_m . The goal of the principal component analysis is to reflect the information represented by the original variable X_p to the greatest extent and to ensure that the new indicators remain independent of each other (information does not overlap). Let i be the first i principal component, and each principal component is composed of P indicators, which is,

$$\begin{cases} F_1 = a_{11}X_1 + a_{12}X_2 + \dots + a_{1p}X_p \\ F_2 = a_{21}X_1 + a_{22}X_2 + \dots + a_{2p}X_p \\ \dots\dots\dots \\ F_m = a_{m1}X_1 + a_{m2}X_2 + \dots + a_{mp}X_p \end{cases}$$

The amount of information extracted by each principal component can be measured by its variance, the greater the variance $\text{var}(F_1)$ is, the more information that F_1 includes. So we need to use the existing information to carry out the rotation of the matrix, so that the results of the largest. In this way we set up the performance evaluation system that can load more and be more accurate.

First, the covariance matrix s_{ij} needs to be calculated

$$s_{ij} = \frac{1}{n-1} \sum_{k=1}^n (x_{ki} - \bar{x}_i)(x_{kj} - \bar{x}_j)$$

Secondly, we find the eigenvalues λ_i of Σ and the corresponding orthogonal unit eigenvectors

$$F_i = a_i' X, \quad a_i = \lambda_i / \sum_{i=1}^m \lambda_i$$

Select the main component (using the variance cumulative contribution rate $G(m)$ to choose)

$G(m) = \sum_{i=1}^m \lambda_i / \sum_{k=1}^p \lambda_k$ (When the cumulative contribution rate $G(m) > 85\%$, it is considered sufficient to reflect the original variable information, the corresponding m is extracted before the m main components.)

Calculate the principal component load

$$l(Z_i, X_j) = \sqrt{\lambda_i} a_{ij} \quad (i = 1, 2, \dots, m; j = 1, 2, \dots, p)$$

Calculate the main component score

$$F_i = a_{1i}X_1 + a_{2i}X_2 + \dots + a_{pi}X_p \quad (i=1, 2, \dots, m)$$

The effect of the dimension should be eliminated before the principal component is calculated, and the raw data should usually be standardized.

We can use SPSS software to practice the above theory. First of all we need to test if our elements are suitable for the use of factor analysis or not. Test methods we commonly use are Reflections correlation coefficient matrix test, KMO test and Bartlett test (for more detailed explanation of the word ²). This question we use KMO and Bartlett test, artificially made 12 factors into 12 choices, and set the option to 10. 0-9 respectively indicate the importance of increasing sequentially. 500 questionnaires were distributed to people in different fields by questionnaires, and 483 valid questionnaires were obtained. Import the results into the SPSS software and get the following results in Table 1-1:

Table 1-1 KMO and Bartlett inspection table

KMO sampling fitness quantity.	.896
Bartlett sphericity test Approximate card side	1281.635
Freedom	28
Saliency	.000
Chi square statistic of Bartlett' s sphericity test	0.000

By means of KMO and Bartlett 's sphericity test, it is found that the value of KMO is 0.896, and that the chi square statistic of Bartlett' s sphericity test is 0.000, which is fit factor analysis. We use the SPSS software, through the method of principal component analysis, feature extraction is greater than 1 common factors, orthogonal rotation load matrix, put forward 4 main components, and make the load of each component in the value of less than 0.5 components removed, and then we get a load matrix:

By normalizing the load factor, the coefficient of the specific index is obtained, and the evaluation total score is set to 100 points. We used the coefficient to find the corresponding

indicators of the score, which established the following evaluation system Table 1-2-1 and Table 1-2-2 :

Table 1-2-1 Evaluation system

	component			
	1	2	3	4
project debriefing	.887			
Evaluation of the satisfaction degree of poverty alleviation objects	.866			
Project approval and reimbursement management		.623		
Fund structure		.947		
Fund investment and mode of use		.755		
Capital investment prescription		.681		
Poverty reduction effectiveness			.866	
Special effects			.961	
Project aid situation			.685	
Support object targeting mode				.886
Project poverty village level aiming				.829
Project poverty target				.834

2.3 Evaluation criteria

index evaluation criteria

Analysis of the above indicators can be found, some indicators have specific values, and some indicators need qualitative analysis. In this regard, we have established indicators of assessment criteria as follows:

indicators with specific values

For indicators with specific values, we use the normalized method to convert it into a number between 0 and 1 as the percentage of the score for this indicator, as follows

$$x_i^* = \frac{x_i - x_{\min}}{x_{\max} - x_{\min}}$$

Where $x_{\max}$ is the optimal value of this term, $x_{\min}$ is the worst value of this term, x_i is the normalized value of this index, and x_i^* is the normalized value. The x_i^* exceeding the optimum value is denoted 1, and the x_i^* below the worst value is 0. x_i^* multiplied by the score of the index, that is, the index scores.

indicators that require qualitative analysis

For qualitative analysis of the indicators, we assume that the impact of a small index of n indicators of the same, are $1/n$. And each factor is divided into excellent (100%), good (80%),

Table 1-2-2 Performance evaluation system

Principal component	Specific indicators	Indicator content	Score	Total
Poverty alleviation targets	Target aiming method (0.09)	Integrity of program implementation	3	26
		Openness of the process	3	
		The effectiveness of the specific way of project selection	3	
	Project poverty village level aiming(0.08)	Project Village covers the proportion of poor people	4	
		Project village development capacity	4	
	Project poverty target (0.09)	Percentage of households with low remedy	4	
		The proportion of poor households in the project households	5	
Poverty Alleviation Project Fund Management	Project acceptance and reimbursement management(0.06)	Acceptance of project completion	3	30
		Capital reporting rate	3	
	Capital structure(0.09)	The proportion of the source funds	2	
		The actual financing of the source funds and the amount of financing	4	
		The ratio of funds for poverty alleviation to other sources	3	
	Capital investment and use(0.08)	The proportion of financial poverty relief funds to households	5	
		Innovative use of funds	3	
	Capital investment prescription (0.07)	The source of funds in place aging	4	
		Capital to complete investment aging	3	
Principal component	Specific indicators	Indicator content	Score	Total
Progress and satisfaction	Project Progress(0.09)	Progress of project construction	4.5	18
		Cycle project construction progress	4.5	
	Evaluation of Satisfaction Degree of Poverty Alleviation (0.09)	The extent to which the project meets its own needs	2	
		Project openness and fairness	2	
		Project object participation	2	
		Project effectiveness satisfaction	2	
		Overall satisfaction	1	
Project effectiveness	Poverty reduction effectiveness (0.09)	Poverty reduction rate	4.5	26
		Project poverty income growth rate	4.5	
	Project aid situation(0.07)	Poverty village aid situation	3	
		Establishment of poor households	4	
	Special effects (0.1)	Industry scale	3	
		technical level	4	
		sustainable development	3	

medium (60%), poor (20%) four grades. Firstly, each small factor is graded, and then each small factor score is weighted to sum, and the obtained value is the index score.

2.4 Outcome evaluation criteria

In order to facilitate the calculation of project performance, the total score is set at 100, and the performance evaluation standards are as follows: compared with the actual situation in Table 1-3:

Table 1-3 Performance system scoring criteria

Standard	excellent	good	medium	poor
Percentage	0.8-1	0.6-0.8	0.4-0.6	0-0.4

2.5 Results and discussions

In order to verify that our performance evaluation model is suitable for different projects in different villages, we take the research of Zhangjiakou city in Hebei province China under the octagonal village of distributed photovoltaic power generation projects, under the octagonal Murayama Anju projects and Taojiayao village distributed photovoltaic power generation project as examples. Through the quantitative evaluation of the 4 principal components of 12 indicators, the project performance results are as follows:

Summing up the scores of the ingredients can be obtained:

The performance score of the next octagonal distributed PV project is:
$$W_1 = \sum_{i=1}^{12} w_{1i} = 76.55$$

that the project is well performing.

The performance score of the next octagonal mountain almond tree grafting project is:

$$W_2 = \sum_{i=1}^{12} w_{2i} = 76.21$$
 that the project is well performing.

Tao Jiayao distributed photovoltaic power generation project performance score:

$$W_3 = \sum_{i=1}^{12} w_{3i} = 85.87$$
 that is, excellent project performance.

References

1. L. Sun, research on performance evaluation of poverty alleviation project: Based on the perspective of precision Poverty Alleviation: [doctoral dissertation] Beijing: China Agricultural University, 2015

2. *L. Sun, B. F. Chen.* Research on performance evaluation of poverty alleviation and development project based on AHP-TOSPSIS method -- Taking Sichuan and Liangshan as an example, [J]. science and technology, 2015, (1):62-66