



Establishment of Index System for Effect Evolution of Poverty-alleviation Fund in Rural Area-- Take the Research Result in Leishan County, Guizhou Province as an Example

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Abstract

This paper try to utilize both economic and mathematic methods to set up an evolution index system of poverty-alleviation fund in rural area by analyzing the source, the target of investment, the operation and management of poverty alleviation. The establishment of index system for effect evaluation of poverty-alleviation fund is analyzed from its theory, principle and content. Primary selection of the index system is selected via Analytic Hierarchy Process (AHP). Meanwhile, through unit testing and whole testing of the index system, a five-dimensional index system for effect evaluation of poverty-alleviation fund is finally established. Finally empirical testing of the index system is conducted.

Keywords: Poverty alleviation funds in rural area, Evaluation index system, AHP, Funds utilization efficiency

Although our country has been increasing the investment in poverty-alleviation fund, the expected and deserved profit has not been realized. Still there is certain number of people in poverty. For this problem, it is worthy of people's deep reflection. If exploring the reason, the faulty target and investment decision of poverty-alleviation fund probably are the two major reasons. Viewing from the work of poverty-alleviation all over the country, all things conducted are centered by fund no matter in terms of achievement, experience, or confliction and frictions. According to some scholar's typical investigation in northwest and southwest areas, the leakage of poverty-alleviation fund in China is no less that 50% of its total amount, or even may as mush as 70%(Wang, 2005)(Note 1). To learn lessons from the practice of poverty-alleviation, first of all, it is necessary to assess the effect of poverty-alleviation fund objectively and completely. However, in the past, the effect assessment of poverty alleviation in our country usually started from a superficial and subjective perspective, which then reached relative unilateral result. Therefore, with the existing strategy of poverty alleviation, this paper summarizes the practical experience in the modes of poverty alleviation in rural area, and explored other corresponding subsystems including poverty alleviation decision, transmission, and acceptance and monitoring and so on. At the same time, the whole and specific operation system, the existing problems and the corresponding solution are also studied. All these are helpful for the realization of the goal of poverty alleviation in 21st century in our country.

1. Basic content of effect evolution index system of poverty-alleviation fund in rural area

The content of effect evolution of poverty-alleviation fund discussed and implemented presently is mostly defined at the micro level of performance issues, which is then characterized in multiple value standards and multi-dimensions. The effects of poverty- alleviation fund not only include the direct and partial output, but also cover the indirect wider and long-term impact, that is, to give attention to the social effects and impact, and the involved beneficiary (loss-suffered) groups, the scope of impact and time and so on.

Based on the above statement, the basic content of evolution of government's poverty-alleviation fund should cover the following facets:

1.1 Evaluation of goal

This facet includes the rationality, clearness, systematism, and evaluableness of the government's goal of poverty alleviation and the clearness of government department's performance and duty.

1.2 Evaluation of fund (disbursement)

Poverty-alleviation should be supported by fund. To study the operation effect and function of fund, currencies and its transformation is one breakthrough point for the research of poverty alleviation. Concerning this point, it covers rationality of the amount and structure of budget, consistency of investment and source of actual fund and budget, consistency of actual disbursement and budget, rationality of actual disbursement and the standardization of the management of poverty-alleviation fund.

1.3 Evaluation of performance and operation

This point includes the finishing process of goal of performance, corresponding result of the expected performance (output, effect and achievement) and the influence of final result (wider and longer impact) and so on. In the process of performance evaluation, it is also necessary to attach importance to sustainable effect of poverty-alleviation.

1.4 Evaluation of resource allocation and utilization efficiency

It includes rationality of public resources allocation and distribution, economic rationality of performance structure and fund utilization, comparison between input of various resources and the output. Resource allocation and utilization efficiency is the important and decisive factor for the work of poverty alleviation.

1.5 Evaluation of implementation and management

In this regard, it includes the implementation ability, management level and financial management quality of the departments, which are reflected by the implementation of poverty-alleviation programs and projects. To be specific, it include the evaluation of the country's sense of master, development ability, knowledge, study and innovation, task arrangement and opportunity selection, and management of the harvest and the cooperation and harmonious consistency in the process of implementation.

2. Theories, methods and frame of the establishment of index system

2.1 Theories and methods

There are many methods for the selection of index systems. This paper adopts Analytic Hierarchy Process (AHP) as it reflects the decision-making features of hierarchy of the system. In other words, it displays a difficult issue as a structure with hierarchies in order based on people's judgment and their repulsion degree for the decision. It is characterized in practicability, concision and systematism, which can be used in decision-making of social economic system. The detailed steps for initial selection of the index of AHP are as below:

2.1.1 Divide the difficult issue into several components, namely elements, and then divide these elements into several groups in accordance with their attributes in order to form different hierarchies. Take the elements on the same hierarchy as principle, they predominates other elements in next hierarchy while are predominated by the elements in the last hierarchy. Such predominant relationship from top down then forms a step-shape structure. Usually there is only one element on the top, which is the expected goal and idea result of the target problem. The middle hierarchies contain element like principles and sub-principles, and the elements in the bottom hierarchy are indexes.

2.1.2 Make comparison between every two elements and build judgment matrix and calculate the weight vectors. Through comparison between every two elements, the relative importance of each element is specified. By using quantitative method, the judgment matrix is built. The value of the judgment elements stands for people's realization of its relative importance. Generally speaking, 1-9 scale method and its reciprocal scale method will be adopted.

2.1.3 Arrange for simple sequence of hierarchies and verify its consistency. The answer of question of judgment matrix A latent root $\lambda_{\max} W$ is W , after normalization, it become the sequence weight of comparative importance of the elements in the corresponding hierarchies comparing with certain elements in the last hierarchy. The process is then named simple sequence. In order to conduct verification of the consistency of judgment matrix, the consistency index is required to be calculated.

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

When the random Consistency Rate

$$CR = \frac{CI}{RI} < 0.10$$

It can be regarded that the simple sequence is of satisfied consistency. Otherwise, the value of the element in judgment matrix needs to be adjusted.

$$W = [W_1, W_2, \dots, W_n]^T$$

$$W_i = \frac{\bar{W}_i}{\sqrt{\sum_{j=1}^n \bar{W}_j \bar{W}_n}}$$

$$M_i = \prod_{j=1}^n a_{ij}, j = 1, 2, 3 \dots n, j = 1, 2, 3 \dots n$$

The values of average consistence indexes are listed in Table 1:

Insert Table 1 here

2.2 Framework of index system

After primary selection and verification of indexes, the roughly selected testing system of poverty alleviation by AHP is listed in Table 3.

Insert Table 2 here

2.3 Interpretation of the indexes

1. Farmer's average net income = total annual income in the village / total number of villager

Total annual income in the village = laborers' remuneration + family operational income + transfer income + property income

Laborers' remuneration = total income gained from first, secondary and tertiary industries

2. Average cultivated land = total cultivated land / total number of villager

3. Year-ended average amount of livestock on hand = total amount of livestock on hand / total number of villager

4. Year-ended average original cost of productive fixed assets = total year-ended original cost of productive fixed assets / total number of villager

5. Occurrence rate of poverty = number of people under poverty line / total number of villager

6. Average house area, highroad and electrical wire of a family = total house area (highroad and electrical wire) / total number of villager

7. Average cultural station = total cultural station / total number of villager

8. Average school construction = total number of primary and middle schools / total number of villager

9. Average construction of free market = total number of free market / total number of villager

10. Average development of tourism project = total number of tourism project / total number of villager

11. Population proportion enjoying safe drinking water = total number of people enjoying safe drinking water / total number of villager

12. Rate of school aged children at school = total number of 7-14 children at school / total number of 7-14 children in the village

13. Rate for the use of hygienic toilet = total number of toilet / total number of villager

14. Average times of training for each person = total trainings conducted in the village / total number of villager

15. Average construction of firedamp project = total number of firedamp project / total number of villager

16. Area of water and soil loss = area of water and soil loss in the village last year - area of water and soil loss in the village this year -

17. Construction of irrigation works = total amount of irrigation works / total number of villager

18. Total reduced criminal cases

19. Proportions of poor households engaged in village layout = poor households participated in village layout / total number of villager

3. Empirical testing of the effect evaluation of poverty-alleviation fund in rural area

3.1 Data of evaluation indexes

By gathering the original data in Leishan County, all data of each index are given in the following table:

Insert Table 3 here

3.2 Investment and utilization of poverty-alleviation fund in Leishan County

Insert Table 4 here

3.3 Statistic of the testing result

In order to measure the function of poverty-alleviation fund in the increase of farmer's income in rural and poor area, econometric model can be built for further testing and analysis.

$$\text{Model: } I_n = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + u_2$$

Farmer's income is defined as dependent variable--y, the investment in planting (crops, cash crop, medicinal materials), Breeding (hog, cattle, sheep, birds, fish and grazing) is defined as independent variable--X1, investment in irrigation works (fundamental cultivated land, terrace transformed from slope, flood control, transportation (road and bridge) -- X2, investment in drinking water (for human beings and small water pools and wells)-- X3, investment in methane-- X4, Cultural education (cultural stations, network and school construction, investment in distance teaching-- X5, and investment in sanitation and birth control (offices of sanitation and birth control) -- X6. C is a constant, through regression analysis of the invested capital in each project by Eviews software, the testing value -- t is then obtained.

The result of regression analysis is 5.24 and 2.74 for X1 and X3, which are larger than the level of significance test. Regulation factor R is 0.67, which indicates high identical degree. In other words, by using the above index factors, the changes of farmer's average income can be well explained. At the same time, through analysis, it is found that the function of poverty-alleviation fund in decreasing the number of poor people has been weakened. That is, with the increase of poverty-alleviation fund, the number of poor people is decreasing gradually slower, which maintain consistency with the present situation of poverty-alleviation in our country.

To increase the investment in the investment planting (crops, cash crop, and medicinal materials), breeding (hog, cattle, sheep, birds, fish and grazing) and drinking water (for human beings and small water pools and wells) will also facilitate sharp increase of farmer's income. Other factors are of relative low significance.

Viewing from marginal analysis, if increasing the investment by 1 Yuan to average poverty-alleviation fund for planting and drinking water, the corresponding net incomes of a household will increase by 5.24Yuan and 2.74Yuan.

4. Directions for further research

For this research, the following points should be noticed in actual practice conducted in the future.

4.1 To combine with the evaluation of poor people's participation. This research only carries out assessment of the exterior effect of integrated poverty-alleviation. As for the poor people's own judgment of the integrated poverty-alleviation work, they should give their one opinion about it and be involved in the judgment work personally. If the poor people believe that the effect of integrated poverty-alleviation is not good, then they would not actively participated in integrated poverty-alleviation work. Thus no good effect will be obtained.

4.2 The original data is the foundation for the judgment. In order to reduce the error of effect evaluation, statistic work in the village should be conducted as well as possible and then report the work to the superior.

4.3 If expecting the evaluation to be realized in large scale, then exclusive intelligent decision support system (IDSS) for effect evaluation should be developed. The realization of integrated poverty-alleviation evaluation system is a complicated operation system, particularly to conduct iterative computation manually for the obscure integrated evaluation and data envelopment analysis model is already very difficult, if no computer was used to assist with the evaluation, large-scaled evaluation of this research would be difficult to be realized. intelligent decision support system can fully display the features of expert system to solve qualitative analysis by using knowledge reasoning, and well combine qualitative analysis with quantitative analysis, thus it is quite suitable for the solving the operation of the model of integrated poverty-alleviation evaluation system. Therefore, the key point for future study is to develop intelligent decision support system exclusive for the evaluation of integrated poverty-alleviation work.

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Note

Note 1. Wang Sangui, the efficiency of poverty-alleviation fund requires system innovation. *Forestry Economy*, 2005 (5).

Table 1. Value of consistence indexes *RI*

1	2	3	4	5	6	7	8	9
0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

Table 2. Index system for effect evaluation of poverty-alleviation

Primary index	Secondary index	Third-grade index
index for effect evolution of Poverty-alleviation	index of economic effect	farmer's average net income farmer's average cultivated land year-ended average amount of livestock on hand average fixed assets of a family occurrence rate of poverty average house area, highroad and electrical wire of a family
	index of sustainable development	average cultural station average school construction average construction of free market average development of tourism project
	index of social effect	population proportion enjoying safe drinking water rate of dropout among primary and middle school student rate for the use of hygienic toilet average times of training for each person
	index of environment effect	average construction of firedamp project area of water and soil loss construction of irrigation works
	index of political effect	total criminal cases proportions of poor households engaged in village layout

Table 3. Farmer's economic situation in Leishan County

Index	Year	2001	2002	2003	2004	2005	2006
farmer's average net income (Yuan)		1179	1231	1294	1348	1471	1600
farmer's average cultivated land (Mou)		1.12	1.34	1.56	1.75	1.86	1.91
year-ended average amount of livestock on hand (unit)		0.78	0.89	0.91	1.04	1.15	1.24
average original cost of productive fixed assets (Yuan)		1608.65	1679.57	1746.23	1789.32	1823.45	1947.67
occurrence rate of poverty (%)		85.34	74.23	55.46	46.78	34.23	15.21
average house area, highroad and electrical wire of a family (Square meter)		12.45	15.45	18.36	20.78	22.55	27.89
average cultural station (Square meter)		0.36	0.41	0.79	1.03	1.45	1.45
average school construction		0.01	0.02	0.03	0.03	0.03	0.03
population proportion enjoying safe drinking water (%)		68.45	70.53	72.46	74.90	75.45	78.67
rate of school aged children at school (%)		95.75	94.32	93.07	94.78	92.46	95.35
rate for the use of hygienic toilet (%)		34.51	43.73	47.37	56.89	78.90	80.67
average times of training for each person		0.54	0.79	1.02	1.07	1.24	1.35
rate of owning Methane pool (%)		12.45	13.67	19.80	23.44	26.78	29.56

note: 1. Statistic data of poverty-alleviation development in new phase in Guizhou (2001-2006) by Guizhou Provincial Poverty Alleviation Development Office

2. The price of the index is in that very year

3. The householder's productive fixed assets do not cover livestock.

Table 4. Investment and utilization of poverty-alleviation fund in Leishan County (2001-2006)

Direction of utilization	Year	Capital(Ten Thousand Yuan)	Direction of utilization	Year	Capital(Ten Thousand Yuan)
planting(crops, cash crop, medicinal materials), Breeding (hog, cattle, sheep, birds, fish and grazing)	2001	87.9	irrigation works (fundamental cultivated land, terrace transformed from slope, flood control) transportation (road and bridge)	2001	250.7
	2002	147.5		2002	397
	2003	241.5		2003	432.4
	2004	355.52		2004	523.5
	2005	378.86		2005	578.6
	2006	435.56		2006	634.2
drinking water (for human beings and small water pools and wells)	2001	69	methane	2001	12
	2002	76		2002	20
	2003	78		2003	34
	2004	30		2004	25.5
	2005	86		2005	28
	2006	108		2006	35
Cultural education (cultural stations, network and school construction, distance teaching)	2001	25.5	sanitation and birth control (offices of sanitation and birth control)	2001	22.9
	2002	35		2002	26.4
	2003	36.6		2003	56.7
	2004	42.7		2004	38.3
	2005	48.4		2005	45.6
	2006	58		2006	43.6
market construction (tourism and free market)	2001	0	Training and others	2001	65.7
	2002	0		2002	76.6
	2003	69.8		2003	87.5
	2004	78.4		2004	92.3
	2005	39.5		2005	74.6
	2006	45.7		2006	89.5

note: statistic data of poverty-alleviation development in new phase in Guizhou (2001-2006) by Guizhou Provincial Poverty Alleviation Development Office