

The Research of Agricultural Enterprise Management Fuzzy Mathematics Evaluation System based on DEA Research

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Abstract

Agriculture enterprise management' comprehensive quality evaluation, is the important content for transformation of agricultural and talent cultivation. This paper through the expert investigation method, a wide range of questionnaire investigation, establishing agriculture enterprise management' comprehensive quality evaluation system, and using the method of fuzzy mathematics evaluation for agriculture enterprise management' quality, working for the professional information construction personnel training to provide feedback.

Keywords: *comprehensive quality, expert investigation, fuzzy mathematics*

1. Introduction

With the introducing of modern enterprise system, many agricultural enterprises separate proprietary rights from management rights. In order to preserves their rights from infringement, at the same time, less direct interference in the enterprises operation, the owners of the agricultural enterprise demand actively a set of scientific and practical agricultural enterprises performance evaluation system to keep track of operation and potential for development of business and provide objective grounds for their investment. and appointment or removal of manager [1-3]. In order to improve the comprehensive quality of primary command talent agricultural system gradually established, to establish to adapt to the agriculture reform of agriculture enterprise management' comprehensive quality evaluation system is particularly important.

The article which uses for reference the results of the research and studies on enterprises' performance evaluation from china and foreign countries, from the angle of investors ,combining the situation of agricultural enterprise in our country, considering large numbers of factors which have influence upon the performance of enterprise, study deeply the problem of the agricultural enterprises performance system, try to find the deficiency of the present performance evaluation system, gropes and put forward a set of agricultural enterprises performance evaluation system suitable for the present situations of the agricultural enterprises to promote the establishment and perfection of agricultural [4].

1.1 West Point Agriculture Enterprise Management Leadership Training and Agricultural System

The agriculture enterprise management leadership training system rules the agriculture enterprise management training draft learning and training in agriculture enterprise, disassemble it as Career anchors, professional behavior, Team spirit, Influence others, Caring for others, Professional ethics, Organize, delegate, Monitor ability, Train subordinates, Decision-making ability and Expression ability, total 12 kinds, for each ability, there are same clear and observable behavior criteria; based on this, establish "agriculture enterprise management' 12 kinds of leadership criteria" which is more

operational stronger, give the scientific gist for agriculture enterprise management leadership ability evaluation [5].

1.2 Current Situation of Agriculture Enterprise Management' Comprehensive Quality Evaluation in our Agriculture Enterprise

For agriculture enterprise management quality evaluation, our agriculture enterprise established "graduate agriculture enterprise management physical skill examination Detail rules" and "Outstanding agriculture enterprise management selection criteria", evaluate agriculture enterprise management' scientific culture and other abilities.

- (1) During the process of agriculture enterprise management evaluation, we should pay more attention on agriculture enterprise management' daily performance, evaluate agriculture enterprise management' tasks by corresponding "evaluation form for completing mission".
- (2) During the process of agriculture enterprise management evaluation, we should invite agriculture enterprise management' leaders, teachers and classmates who are familiar with the agriculture enterprise management, give evaluation from different ways.
- (3) Should set up feedback system for agriculture enterprise management evaluation, feedback the lack of agriculture enterprise management during evaluation to agriculture enterprise management timely, formulate corresponding measure to improve insufficient. So we can improve effect by evaluation.

2. Research Method

Selecting in a variety of different meanings of indicators to be indicators is a systematic work, the specific choice for indexing, the frequency statistics method can be used, multiple factor comparison method and expert evaluation method, *etc.* Frequency statistics method, is based on a large number of literature reading and reference for the related evaluation system, frequency statistics, for each index factor to choose those using high frequency index; Multiple factor comparison method is at the same time, many of the same element can be characterized by factor analysis, choose more representative indexes used to evaluate the system; Expert evaluation method is preliminarily established the basis of the evaluation system, and consulting experts, to reasonably adjust the index system, to achieve the optimization purpose is accurate, reasonable and easy to operate the index factor is to build a good foundation of evaluation index system of agricultural enterprise management quality [6].

there are many kinds of agriculture enterprise management evaluation models, a commonly used model is: hierarchical analysis model; Pressure-state-response model, three elements model, the hierarchical analysis model is used in this paper to integrated use of pressure-state-response model, agriculture enterprise management quality evaluation index system can be divided into four levels: firstly, the goal layer, namely to agriculture enterprise management quality as the general objective, comprehensive analysis and characterization of agriculture enterprise management quality present situation and development trend; The second layer is the essential factor layer, taking the ecological environment pressure, agriculture enterprise status, social and economic as three elements, evaluating from different aspects about agriculture enterprise management quality; The third layer is the project, in the agriculture enterprise management system contains some evaluation and analysis on the basic structure for the project, will refine the second of three elements, evaluation of agriculture enterprise management quality from different angles; The fourth layer as an index, district respectively different agriculture enterprise management indicators, in the form of a quantitative evaluation of agriculture enterprise management quality.

This paper uses data envelopment analysis method for calculating efficiency of agricultural enterprise management development in Henan province. Data envelopment

analysis (DEA) is a non-parametric method of the measurement of inputs and multiple indicator output relative efficiency. by input and output indicators of original samples data it can evaluate and judge validation of decision making unit (DMU), its aim is to reflect that the DMU can reach "with minimal investment, maximum benefit" decision results [7-8]. The basic model of DEA is the C2R model. C2R is used for evaluation of decision making units at the same time as the "technical efficiency" and "scale efficiency" typical model. According to the result of calculation, when θ is 1, it calls the DMU as DEA efficient, when $\theta < 1$, it calls DMU as non-DEA effective. "Projection" for non DEA efficient decision making units can also measure input redundancy and output value, and make improvement. Because agricultural production system involves many input and output indicators and some are overlapped, the dimensions of input and output indicators are also obvious difference. Therefore, the evaluation of the efficiency of the system of agricultural production must take into account a variety of input and output elements, and does not take into account the dimension difference of each index. Since DEA is the most effective method calculating the multiple input and output without considering dimensions, this paper uses DEA method to quantitatively measure the efficiency of the development of agricultural enterprise management in Henan province, based on the result to obtain the adjustment in the invalid region.

2.1. The Selection of Indicators and Data Sources

Application of DEA analysis on agricultural eco-efficiency scientifically evaluated, depends in a large extent on the input and output parameters whether are reasonable to be chosen. Because resources efficiency and recycling is as the core of the agricultural enterprise management, from saving agricultural resources, protecting the ecological environment and improving the economic benefit, at the same time of improving the efficiency of agricultural production, we should make decrement of the recycling of resources and environmental protection for the purpose. Therefore, the evaluation index should be able to reflect the principle of enterprise management and characteristics. Because the input and output variables involved in the production of agricultural enterprise management are more, the DEA model has quantity requirements of input and output variables, namely the number of decision making units should be close to or more than 2 times of input variable and output variable, so the number of input and output variables should not be too much, try to reflect the characteristics of the agricultural enterprise management and the typical variable. In terms of input variables, this article selects the main crop planting area to represent the agricultural inputs of land, agricultural professionals to represent the human capital investment, the two indicators reflect the situation of the resources in agricultural enterprise management; Appropriate amount of fertilizer has a big impact on agricultural environmental, so choosing appropriate amount of agricultural fertilizer indicates environmental impact of agricultural enterprise management. In terms of output variables, many scholars have adopted an ecological-economic output value, per capita annual net income of rural households and food production. Because the animal husbandry fishery output and per capita annual net income of rural households, the two indexes are related to the price, and food production truly embodies results of agricultural production of a region, this paper only selects an output index of grain yield, as shown in Table 1.

Table 1. Evaluation Index System of Agricultural Enterprise Management Efficiency in Henan

Element layer	Index layer	
	3R index	Specific index
Input index	Resource index	Total crop sown area X1/khm ²
	Environment index	The agricultural workers x2
Output index	Economic index	Agricultural fertilizer surueyed
		Grain output

From a purely technical and scale efficiency, DEA has 4 effective pure technical efficiency, and scale efficiencies are also effective, and no input redundancy and lack of output. Therefore, this may be considered agricultural enterprise management and output efficiency of the 4 cities is the best, agricultural enterprise management maintains a good momentum of development. Agricultural resources and environmental elements should have appropriate percentage, agricultural technology level, management level and scale of operation should be on speaking terms agricultural enterprise management development is in the optimal state. Pure technical efficiency and scale efficiency value of non DEA effective seven cities is different. Among them, pure technical efficiency is effective in the four cities of Hebi, Zhengzhou, Pingdingshan and Xinyang, but the scale efficiency is invalid. Invalid reason of comprehensive efficiency of these four cities mainly lies in the scale, the pure technical efficiency positive impact on the overall efficiency is offset by low scale efficiency. And from the perspective of the type of return to scale, the four cities are in a state of increasing return to scale, so the invalid agricultural enterprise management of the four cities mainly because of the small size in agricultural resources. If we can expand agricultural inputs, the output will increase a larger proportion, agricultural economy of scale. But along with the increase of the investment it should be guided by the "3 r" principle, to ensure the sustainable development of agriculture. The pure technical efficiency and scale efficiency of three cities of Tangshan, Hebi and Zhengzhou are less than 1, which indicates that the pure technical level and scale configuration of the three cities are not the best. All kinds of factors of production in agricultural are belong to the edge non efficiency collection, agricultural technology level and management level does not adapt its business scale, agricultural production and operation performance has not been fully played, agricultural enterprise management of agricultural enterprise management has low efficiency.

2.2. Proposal to Escalation of Henan Agricultural Enterprise Management Efficiency

According to the result of empirical analysis, the efficiency of agricultural enterprise management in different cities in Henan province is obvious regional difference, so making agriculture enterprise management development policy should not impose uniformity in all cases, and should adjust measures to local conditions. In measuring the efficiency of agricultural enterprise management in Henan province, despite five cities belong to the DEA effective, but it is relatively effective, and comparing with agricultural resources use efficiency of the other seven cities, it is higher, but not absolutely effective. Relative to the goal of agricultural enterprise management development, a lot of problems still exist in these cities. In these regions, therefore, maintaining high efficiency of agricultural enterprise management at the same time should also continue to increase the supply of agricultural innovation achievements and the continuous improvement of food production through the improvement of quality of the labor force and the investment of agricultural science and technology. In the cities that agricultural enterprise management is invalid, the invalid of four cities is caused by the scale, and the four cities are increasing return to scale, that is to say, for the four cities increase of agricultural investment will

significantly improve the level of agricultural output. Therefore, agricultural enterprise management of the four cities should be given priority in order to improve the efficiency of the scale efficiency. Small and scattered farmers scale is currently one of the main bottlenecks of restricting agricultural scale efficiency. In the area of low scale efficiency it can land moderate scale management in order to improve the efficiency of scale: firstly, the establishment of effective circulation mechanism of land resource can form land scale operation mechanism of concentration. Second, through cultivating the core farmers and supporting policies, it can strengthen the implementation of the agricultural scale management main body, as the core of peasant household continually expand the scale of production and operation, forming a family farm. Third, developing agricultural specialized cooperative organization is also an inevitable choice for the current expand the scale of agricultural production. In the cities of agricultural enterprise management invalid, there are three cities whose pure technical efficiency and scale efficiency are invalid. Therefore, improving the efficiency of agricultural enterprise management of the three cities should consider two aspects: one is the adjustment and improvement of the pure technical efficiency, the other is adjustment and improvement of scale efficiency.

3. Analysis

Setting up agriculture enterprise management' comprehensive quality evaluation system must include professional base quality, scientific culture quality, leadership ability and psychological quality four first index. According to the requirement of commander quality, there are some second index [9].

During the process of surveying date, using the logarithm of the weighted average method for data conversion, to make sure the weight of each index.

$$\bar{A} = \frac{(A_1 + A_2 + \dots + A_{20})}{20} \quad \bar{B} = \frac{(B_1 + B_2 + \dots + B_{20})}{20} \quad \bar{I} = \frac{(I_1 + I_2 + \dots + I_{20})}{20} \quad (1)$$

Because the full mark during the process of surveying date is 5, the average date will less than 5. Now using 5 as the bottom, do logarithm operation for each average date, we can get the algorithm $a = \log_5 \bar{A}, b = \log_5 \bar{B}, \dots, i = \log_5 \bar{I}$, combine them to get S. Finally, get

the weighted average as $r_{ij} = \frac{x_{ij} - \wedge_j x_{ij}}{\vee_j x_{ij} - \wedge_j x_{ij}}$. delete the item that weight is less 0.06, get the statistical result as below Table 2.

Table 2. Expert Survey Result Analysis

Index	data	level					average	logarithm	weight	
		1	2	3	4	5				
Leadership ability	Decision-making ability	20	0	0	1	8	11	4.5	0.9345	0.1177
	Expressive ability	20	0	0	4	11	5	4.05	0.8690	0.1095
	Innovation ability	20	0	2	3	7	8	4.05	0.8690	0.1095
	Organizing ability	20	0	0	4	4	12	4.4	0.9205	0.1160
	Immediate response ability	20	0	0	3	7	10	4.35	0.9134	0.1150
	Listen to ability	20	0	1	5	11	3	3.8	0.8294	0.1045
	Teamwork ability	20	0	0	1	9	10	4.45	0.9276	0.1168
	Self-sufficiency ability	20	0	3	2	12	3	3.75	0.8212	0.1034
	Influence ability	20	0	1	4	10	5	3.95	0.8535	0.1076

Then we'll get the weight of each index of agriculture enterprise management' comprehensive quality evaluation system.

4. Establish Fuzzy Mathematics Evaluation Model

Table 3. Cadet Leadership Survey Analysis Result

Indexes		Valid data	percentage			
			D	C	B	A
Leadership ability U ₁	Decision-making ability U ₁₁	10	0	2	5	3
	Expressive ability U ₁₂	10	1	4	3	2
	Innovation ability U ₁₃	10	2	5	2	1
					
	Self-sufficiency ability U ₁₈	10	1	3	5	1
Influence ability U ₁₉	10	0	1	8	1	

Table 3 statistics for the results of the survey of some agriculture enterprise management' ability of leadership, the leadership of primary index of U₁ evaluation index set for U₁ = {U₁₁, U₁₂,...U₁₉}, contains nine secondary indexes. Setting evaluation grade V₁ = {V₁₁, V₁₂, V₁₃, V₁₄} = {D, C, B, A}, four grades. If gets 90-100 equal to A, 80-90 equal to B, 70-80 equal to C, 60-70 equal to D.

At First, evaluates the single index U_{1i}, then determining the membership of index of evaluation grades from U_{1i} V_{1j} (j = 1, 2, 3, 4) membership R_{ij}, get the set of indicators to evaluate R_{ij} I = {R_{i1} R_{i2} R_{i3} R_{i4}}, shows the single index evaluation of U₁ from i. Then we can constitute a fuzzy evaluation matrix:

$$R_1 = \begin{pmatrix} R_{11} & \dots & R_{14} \\ \vdots & \ddots & \vdots \\ R_{91} & \dots & R_{94} \end{pmatrix} \quad (2)$$

To overcome the homogenization, using the optimal formula (the bigger one) transformed the eigenvector matrix R₁, get the relative membership degree matrix:

$$\tilde{R}_1 = \begin{pmatrix} \tilde{R}_{11} & \dots & \tilde{R}_{14} \\ \vdots & \ddots & \vdots \\ \tilde{R}_{91} & \dots & \tilde{R}_{94} \end{pmatrix} \quad (3)$$

Relative membership degree is:

$$r_{ij} = \frac{x_{ij}}{\vee_j x_{ij} + \wedge_j x_{ij}} \quad (4)$$

or

$$r_{ij} = \frac{x_{ij} - \wedge_j x_{ij}}{\vee_j x_{ij} - \wedge_j x_{ij}} \quad (5)$$

r_{ij} describes the relative membership degree of the j to i, $\vee_j x_{ij}$ is the max, $\wedge_j x_{ij}$ is the min, which are both eigenvalues of i, with j = 1,2...n.

The fuzzy optimum selection model like:

$$u_j = \frac{1}{1 + \left\{ \frac{\sum_{i=1}^m (\omega_i (g_i - r_{ij}))^p}{\sum_{i=1}^m (\omega_i (r_{ij} - b_i))^p} \right\}^{\frac{2}{p}}} \quad j = 1, 2, \dots, n \quad (6)$$

P is the distance parameter, which is Hamming distance when equals to 1, Euclidean distance by 2.

4.2. Fuzzy Comprehensive Evaluation

We can get the fuzzy matrix of the evaluation grades of U_1

$$R = \begin{bmatrix} 0 & 2 & 5 & 3 \\ 1 & 4 & 3 & 2 \\ 2 & 5 & 2 & 1 \\ 0 & 1 & 2 & 7 \\ 1 & 2 & 6 & 1 \\ 3 & 5 & 2 & 0 \\ 0 & 1 & 3 & 6 \\ 1 & 3 & 5 & 1 \\ 0 & 1 & 8 & 1 \end{bmatrix} \quad (7)$$

From the matrix we can get:

$$g_1 = (1 \quad 0.8 \quad 0.83 \quad 1 \quad 0.86 \quad 1 \quad 1 \quad 0.83 \quad 1)^T \quad (8)$$

$$b_1 = (0 \quad 0.2 \quad 0.17 \quad 0 \quad 0.14 \quad 0 \quad 0 \quad 0.17 \quad 0)^T \quad (9)$$

According to the leadership of each index weight, we can get:

$$\omega_1 = (0.1177 \quad 0.1095 \quad 0.1095 \quad 0.1160 \quad 0.1150 \quad 0.1045 \quad 0.1168 \quad 0.1034 \quad 0.1076)^T \quad (10)$$

By using formula (6) and make p equals to 1, we can get:

$$\mu_1 = (0.0025 \quad 0.209 \quad 0.8043 \quad 0.3038) \quad (11)$$

The evaluation matrix normalized processing, then:

$$\mu_1 = (0.0019 \quad 0.1583 \quad 0.6093 \quad 0.230) \quad (12)$$

Then we can get the leadership comprehensive evaluation value of $U_1 = 85.64$.

According to the evaluation procedure, the basis for professional quality, scientific quality and psychological quality, we can get the data from others and the inspection results of agriculture enterprise management, then establishing the corresponding eigenvector matrix, using the optimal relative formula, converts it to optimal relative matrix, the calculation using the fuzzy optimization model, then the results and evaluation rating score vector multiplication, finally get the indexes of evaluation results[10].

5. Conclusion

This paper through modeling agriculture enterprise management' comprehensive quality evaluation system, establishes agriculture enterprise management comprehensive test and evaluation of the performance. At the same time, using expert questionnaire method and fuzzy mathematics method to evaluate, using a combination of qualitative and quantitative analysis, more scientific and objective, can make agriculture enterprise management realize themselves, focus on foster strengths and circumvent weaknesses. The managements of the university can find the cultivating method through the feedback information, according to their aptitude, to carry out special training plan of the agriculture enterprise management' individual.

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