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Evaluation of Farmers' Working Quality in Jilin Province on the Basis of AHP

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Abstract In terms of the working quality of agricultural production and the working quality of non-agricultural production, the evaluation index system of the working quality of farmers is established. By using integrated fuzzy method based on AHP, we determine the weight of each index, and establish membership matrix of this evaluation index system. Taking Jilin Province as an example, we select developed regions, underdeveloped regions and comparatively developed regions respectively to conduct survey. By using the data from survey, according to the established evaluation index system, we conduct empirical analysis of the working quality of farmers. The results show that the working quality of farmers in the developed regions is relatively high, the working quality of farmers in the comparatively developed regions is ordinary, and the working quality of farmers in the underdeveloped regions is relatively low; the physical quality, educational quality and technological quality of farmers in the developed regions are high; the operation quality of agricultural production of farmers in the underdeveloped regions is high; the operation quality of non-agricultural production of farmers in the comparatively developed regions is high; the working quality of agricultural production of farmers in the comparatively developed regions and underdeveloped regions is higher than the working quality of non-agricultural production of farmers in the comparatively developed regions and underdeveloped regions; the working quality of non-agricultural industries of farmers in the developed regions is higher than the working quality of agricultural production. The urgent priority of constructing new village is to coordinate urban-rural development, and to offer preferential policies and capital for the villages with backward economic development level.

Key words The working quality of farmers, Evaluation index system, AHP, Jilin Province, China

Jilin Province is a big agricultural province, but not strong agricultural province. For the time being, the quality of farmers in Jilin Province is still low, so establishing evaluation system of the working quality of farmers in Jilin Province, measuring the level of quality, and analyzing the influencing factors, are of great significance, to fostering new farmers, and promoting new village construction. In the perspective of the working quality of farmers, by using integrated fuzzy method based on AHP, we establish the evaluation index system of the working quality of farmers. Taking Jilin Province as an example, we select developed regions, underdeveloped regions and comparatively developed regions respectively to conduct survey. By using the data from survey, according to the established evaluation index system, we conduct empirical analysis of the working quality of farmers, in order to get scientific enlightenment.

1 Establishment of evaluation index system

On the basis of referring to the researching results of the predecessors, by comprehensive investigation, research analysis and composite argumentation, four-level evaluation index system is established in terms of farmers' working quality of agricultural production and farmers' working quality of non-agricultural industries finally.

1.1 The working quality of agricultural production Compared with other sectors, agriculture is labor-intensive industry, and agricultural production is manual labor. With the continuous

development of China's economy, productivity level has been greatly improved, and it has raised high requirements on the agricultural production. Therefore, the requirements on physical quality of laborers are high. In terms of farmers' physical quality, farmers' educational quality and farmers' agricultural production and operation quality, the research is to assess the working quality of agricultural production of farmers in the new era of new village construction. We select "food expenditure per capita" and "health care per capita" as the indices of measuring the physical quality; we select "educational level", and "cultural and educational expenditure per capita" as the indices of measuring the educational quality of farmers; we select "the farmland area per capita", "agricultural income per capita" and "the number of agricultural machinery ownership" as the indices of measuring the agricultural production and operation quality^[1].

1.2 The working quality of non-agricultural production

As for the farmers' working quality of non-agricultural industries, it is propounded from two aspects as follows: in the first place, the degree of farmers' moonlighting is getting higher, moonlighting is an important source of increasing the income of farmers, and in the perspective of moonlighting, we should foster farmers' working quality of non-agricultural industries; in the second place, in the perspective of social development, we will gradually realize urbanization, multitudinous farmers need to be transferred from the land, and in the perspective of transferring agricultural labor forces, we need to foster farmers' working quality of non-agricultural industries. In terms of technological quality of farmers and the operation quality of non-agricultural industries, we are to assess the farmers' working quality of

non-agricultural industries^[2]. We select "whether participating in the training of non-agricultural skills" and "whether having the technical grading certificate" as the indices of measuring technological quality; we select "whether moonlighting", "moonlighting time", "types of moonlighting", "non-agricultural

income per capita", "market adaptability" and "consciousness of legal system" as the indices of measuring the operation quality of non-agricultural industries. The specific information can be seen Table 1.

Table 1 Evaluation index system of the working quality of farmers in Jilin Province

First-class factor	Second-class factor	Content of evaluation index	Index
The working quality of agricultural production	Physical quality	Food expenditure per capita	A_1
		Health care expenditure per capita	A_2
	Educational quality	Educational level	A_3
		Cultural and educational expenditure per capita	A_4
		Farmland area per capita	A_5
	Production and operation quality of agriculture	Agricultural income per capita	A_6
		The number of agricultural machinery ownership	A_7
Whether participating in the training of non-agricultural skills		A_8	
The working quality of non-agricultural production	Technological quality	Whether having the technical grading certificate	A_9
		Whether moonlighting	A_{10}
	Operation quality of non-agricultural industries	Moonlighting time	A_{11}
		Types of moonlighting	A_{12}
		Non-agricultural income per capita	A_{13}
		Market adaptability	A_{14}
		Consciousness of legal system	A_{15}

2 Evaluation method

2.1 Determine weight by using Analytic Hierarchy Process (AHP)

(1) Establish model with hierarchical structure.

First, we decompose the complicated problem into several elements, and group these elements according to target layer, criteria layer and scheme layer, to form layers that do not intersect each other, so that we establish a model with multi-layered structure. Following this, the subsection relations among the elements in this model are also determined.

(2) Construct all the judgment matrixes in each layer.

The judgment matrix means that relative to a certain factor in the previous layer, the mutual importance degree among all factors in this layer adopts 1–9 graduation method.

(3) Calculate the relative weight of each index.

We can adopt Eigenvalue method, the iterative method, the square root method, the root method and the summation method.

(4) Consistency test.

Calculate consistency index CI ; look up the average random consistency index RI from the table of the average random consistency index; calculate the relative consistency ratio as follows: $CR = CI/RI$; use consistency ratio CR to test and judge the consistency of matrix, and the smaller the CR , the better the consistency of the judgment matrix. It is generally believed that when $CR < 0.1$, the judgment matrix has satisfactory standard of consistency, and the inverse matrixes that are pairwise compared can be accepted, otherwise, we need to correct the judgment matrix until it is tested and passed^[3].

According to AHP method, we are to determine weight:

$$W = w^1, w^2, \dots, w^p \quad (1)$$

(5) Determine the set of evaluation factors^[4].

Let the evaluation set of the working quality of farmers be as follows: $U = (u_1, u_2, \dots, u_t)$, which reflects farmers' work-

ing quality of agricultural production and farmers' working quality of non-agricultural industries, specifically including "food expenditure per capita", "health care expenditure per capita", "educational level", "cultural and educational expenditure per capita", "farmland area per capita", "agricultural income per capita", "the number of agricultural machinery ownership", "whether participating in the training of non-agricultural skills", "whether having the technical grading certificate", "whether moonlighting", "moonlighting time", "types of moonlighting", "non-agricultural income per capita", "market adaptability" and "consciousness of legal system".

2.2 Determine evaluation sets $V = (v_1, v_2, \dots, v_s)$ is a set of levels, and each level can correspond to a fuzzy set. In evaluation, we set comment with 4 levels for each index, namely "high", "relatively high", "ordinary", and "relatively low". Let the intervals of evaluation are $[0.75, 1)$, $[0.50, 0.75)$, $[0.25, 0.50)$, and $[0, 0.25)$ respectively.

2.3 Establish membership matrix Let the evaluation object be $Y = (Y_1, Y_2, \dots, Y_m)$ and composite evaluation index system as $U = (u_1, u_2, \dots, u_n)$, then the evaluation index system of m evaluation objects which corresponds to n indices can be denoted by index matrix X as follows:

$$X = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \dots & \dots & \dots & \dots \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} \quad (2)$$

2.4 Non-dimensional-normalization of matrix As the index type this research involves is benefit-oriented index, so we use range transformation formula as follows:

$$r_{ij} = (x_{ij} - \min(x_{ij})) / (\max(x_{ij}) - \min(x_{ij}))$$

After we conduct non-dimensional-normalization of matrix, we can get the standardized evaluation matrix $Y = (y_{ij})_{m \times n}$ as follows:

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \dots & \dots & \dots & \dots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix} \quad (3)$$

In the matrix R , r_{ij} in the i line, j column refers to the performance of an evaluation object in terms of a certain index, which is depicted by one actual value to be evaluated.

2.5 Result of fuzzy evaluatiuon By using the appropriate operator, we use W and the fuzzy evaluation vector R of all objects to generate the fuzzy evaluation result vector B :

$$B = W \circ R^T = (w^1, w^2, \dots, w^n) \circ \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \dots & \dots & \dots & \dots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix} \quad (4)$$

In the above formula, \circ is fuzzy composition operator, and this research uses the weighted average operator $M(\cdot, \oplus)$ to conduct calculation. According to the value of the calculation result b_j , we are to judge the working quality of farmers. The greater the value of b_j , the higher the working quality of farmers.

3 Empirical analysis

We select Minglang Village of Yilan Town of Yanji City in developed areas, Shengli Town of Zhenlai County in the under-developed areas, and Wenquan Village of Liangjiazi Manchu Town of Changyi District of Jilin City in the relatively developed areas, to conduct investigation. As for the objects of sample survey, part of the objects are the farmers in the place where the survey is conducted, and part of the objects are the first "One Village One College Student" of Jilin Academy of Agricultural Sciences. They come from the grassroots, with certain representativeness. The survey regions we determine are

either the remote areas, or the suburban areas, which can reflect the actual situation across the province. There are 150 questionnaires to be sent out and retrieved in this survey. We remove the ineffective questionnaires which miss the key issues and get 126 effective questionnaires, with the effective response rate of the questionnaire of 84%. Through the statistical processing of the questionnaire, the explanation of evaluation of all indices can be seen in Table 2. Based on the explanation of evaluation of all indices, ultimately we get the related basic data concerning all evaluation indices, which is shown in Table 3^[5].

3.1 Standardization processing of data We conduct standardized processing on the data, and the processing result is as follows:

$$R = \begin{bmatrix} 0.19 & 0.00 & 1.00 \\ 0.00 & 0.40 & 1.00 \\ 0.00 & 1.00 & 0.43 \\ 0.00 & 0.00 & 1.00 \\ 0.00 & 1.00 & 0.00 \\ 1.00 & 0.00 & 0.00 \\ 1.00 & 0.08 & 0.00 \\ 0.09 & 0.00 & 1.00 \\ 0.00 & 0.35 & 1.00 \\ 0.00 & 1.00 & 0.21 \\ 0.00 & 0.00 & 1.00 \\ 0.00 & 1.00 & 0.00 \\ 1.00 & 0.00 & 0.00 \\ 1.00 & 0.99 & 0.00 \\ 1.00 & 0.00 & 0.00 \end{bmatrix} \quad (5)$$

3.2 Determine index weight According to the grading table of the experts, the weight W is calculated by using *AHP* method, which can be seen in Table 4.

Table 2 Explanntion of value assignment of all evaluation indices

Factor	Evaluation index	Explanntion of value assignment of indices
Physical quality	Food expenditure per capita A_1	Food expenditure per capita per month more than 401 Yuan =5; 301 –400 Yuan =4; 201 –300 Yuan =3; 101 –200 Yuan =2; 0 –100 Yuan =1
	Health care expenditure per capita A_2	Health care expenditure per capita annually more than 1 001 Yuan =7; 501 –1 000 Yuan =6; 401 –500 Yuan =5; 301 –400 Yuan =4; 201 –300 Yuan =3; 101 –200 Yuan =2; 0 –100 Yuan =1
Educational quality	Educational level A_3	Academic credentials of undergraduate courses and above this =5; secondary technical school and junior college =4; high school =3; junior middle school =2; primary school =1; illiterate =0
	Cultural and educational expenditure per capita A_4	More than 1001 yuan =7; 501 –1 000 yuan =6; 401 –500 yuan =5; 301 –400 yuan =4; 201 –300 yuan =3; 101 –200 yuan =2; 0 –100 yuan =1
Operation quality of agricultural production	Farmland area per capita A_5	It is obtained from the actual farmland area per capita of interviewees
	Agricultural income per capita A_6	It is obtained from the actual farmland area per capita of interviewees
	The number of agricultural machinery ownership A_7	It is obtained from the actual number of agricultural machinery ownership of interviewees
Technological quality	Whether participating in the training of non-agricultural skills A_8	Participate in non-agricultural skills training =1; not participate in non-agricultural skills training =0
	Whether having the technical grading certificate A_9	Having the technical grading certificate =1; not having technical grading certificate =0
Operation quality of non-agricultural industries	Whether moonlighting A_{10}	Moonlighting =1; no moonlighting =0
	Moonlighting time A_{11}	More than 3 Years =5; within 3 Years =4; within 2 Years =3; within 1 Year =2; within half year =1
	Types of moonlighting A_{12}	Mental labor =2; physical work =1

Continued (Table 2)

Factor	Evaluation index	Explanation of value assignment of indices
	Non-agricultural income per capita A_{13}	It is obtained from the actual non-agricultural income per capita of interviewees
	Market adaptability A_{14}	Great adaptability =5; comparative adaptability =4; ordinary =3; ill adaptability =2; extremely ill adaptability =1
	Consciousness of legal system A_{15}	Very strong =5; relatively strong =4; ordinary =3; weak =2; very weak =1

Table 3 The relevant data concerning the working quality of farmers in Jilin Province

First-class factor	Second – class factor	Evaluation index	Underdeveloped regions	Comparatively developed regions	Developed regions
The working quality of agricultural production	Physical quality	A_1	2.77	2.83	2.41
		A_2	2.62	3.00	3.20
	Educational quality	A_3	3.42	3.11	3.06
		A_4	4.62	4.28	4.09
	Production and operation quality of agriculture	A_5	3.93	5.80	4.38
		A_6	4 807.69	2 742.22	2 185.19
The working quality of non-agricultural industries	Technological quality	A_7	1.08	0.53	0.57
		A_8	0.15	1.85	1.89
		A_9	0.08	1.87	1.93
	Operation quality of non-agricultural industries	A_{10}	0.96	1.20	1.20
		A_{11}	2.58	1.80	1.61
		A_{12}	1.31	0.91	0.89
		A_{13}	4 815.38	2 330.43	942.59
		A_{14}	3.27	2.85	2.61
		A_{15}	3.23	3.02	2.61

Table 4 The weight of all evaluation indices

First-class factor	Weight	Second-class factor	Weight	The share of all evaluation indices in first-class factors	Evaluation index	The share of all evaluation indices in second-class factors	The share of all evaluation indices in system	
The working quality of agricultural production	0.598 7	Physical quality	0.285 1	0.191 1	A_1	0.401 3	0.114 4	
				0.285 1	A_2	0.598 7	0.170 7	
		Educational quality	0.146 4	0.122 3	A_3	0.500 0	0.073 2	
				0.122 3	A_4	0.500 0	0.073 2	
		Production and operation quality of agriculture	0.167 2	0.133 0	0.078 0	A_5	0.476 2	0.079 6
					0.078 0	A_6	0.279 3	0.046 7
0.068 3	A_7				0.244 5	0.040 9		
The working quality of non-agricultural industries	0.401 3	Technological quality	0.276 9	0.413 2	A_8	0.598 7	0.165 8	
				0.276 8	A_9	0.401 3	0.111 1	
				0.073 8	A_{10}	0.237 7	0.029 6	
		Operation quality of non-agricultural industries	0.124 4	0.078 7	0.078 7	A_{11}	0.254 1	0.031 6
					0.069 0	A_{12}	0.222 4	0.027 7
					0.037 9	A_{13}	0.122 1	0.015 2
					0.025 4	A_{14}	0.081 8	0.010 2
					0.025 4	A_{15}	0.081 8	0.010 2

3.3 Fuzzy evaluation (1) We conduct composite evaluation on the working quality of farmers in underdeveloped regions, relatively developed regions and developed regions, and the calculation result is as follows:

$$B = W \cdot R^T = (0.159\ 5, 0.331\ 6, 0.704\ 3) \quad (6)$$

According to the value of B , the sequence of farmers' quality from high to low is as follows; developed regions, relatively developed regions and underdeveloped regions.

(2) We conduct composite evaluation on second-class factors, and the result can be seen in Table 5.

(3) We conduct composite evaluation on first-class factors, and the result can be seen in Table 6.

The results in Table 5, 6 show that firstly, the working quality of farmers in the developed regions is relatively high, the working quality of farmers in the comparatively developed regions is ordinary, and the working quality of farmers in the underdeveloped regions is relatively low; secondly, the physical quality, educational quality and technological quality of farmers in the developed regions are high; the operation quality of agricultural production of farmers in the underdeveloped regions is

high; the operation quality of non-agricultural production of farmers in the comparatively developed regions is high; the working quality of agricultural production of farmers in the comparatively developed regions and underdeveloped regions is higher than the working quality of non-agricultural production of

farmers in the comparatively developed regions and underdeveloped regions; the working quality of non-agricultural industries of farmers in the developed regions is higher than the working quality of agricultural production.

Table 5 The composite evaluation result of the working quality of farmers in terms of second-class factors

Regions	Physical quality	Educational quality	Operation quality of agricultural production	Technological quality	Operation quality of non-agricultural industries
Underdeveloped regions	0.076 4	0.000 1	0.524 1	0.052 1	0.285 8
Comparatively developed regions	0.241 8	0.500 0	0.325 4	0.142 0	0.540 9
Developed regions	1	0.712 9	0.162 5	1	0.305 1

Table 6 The composite evaluation result of the working quality of farmers in terms of first-class factors

Regions	The working quality of agricultural production	The working quality of non-agricultural industries
Underdeveloped regions	0.182 8	0.124 7
Comparatively developed regions	0.375 7	0.265 8
Developed regions	0.650 6	0.784 5

4 Conclusion and enlightenment

To sum up, in the regions with backward economic developmental level, the farmers are more inclined to be engaged in agricultural production, while in the regions with relatively high economic developmental level, the farmers are more inclined to be engaged in non-agricultural production. Often the farmers who depend on agricultural production and operation cannot be lifted out of poverty and backwardness, and the farmers who are at adept at non-agricultural production and operation are more capable of casting off poverty and backwardness.

The working quality of farmers in Jilin Province is the epitome of the working quality of farmers in China. In the light of the evaluation analysis of the working quality of farmers in regions

with different economic developmental levels in Jilin Province, the working quality of farmers is closely related to the level of economic development. Given that the level of economic development in China is extremely uneven, and the gap between the poor and the rich is too large, the urgent priority of constructing new village is to coordinate urban-rural development, and to offer preferential policies and capital for the villages with backward economic development level.

References

- [1] XIA YX, LU X. Research on farmers' quality evaluation system and their income on new era[J]. Population & Economics, 2008(6): 31 - 35. (in Chinese).
- [2] ZHANG YH. The inevitable choice of increasing farmers' income is to improve the quality of farmers[J]. Journal of Shandong Agricultural Administrators' College, 2009(1): 16 - 17. (in Chinese).
- [3] LI HZ, ZHANG DZ. The key to increase farmers' income is to improve their quality[J]. Agricultural Economy, 2008(8): 26 - 27. (in Chinese).
- [4] HU LH. Quality, the quality of farmers, the quality of new farmers [J]. Rural Economy and Science - Technology, 2007(10): 74 - 75. (in Chinese).
- [5] Jilin Bureau of Statistics. Jilin Statistical Yearbook[M]. Beijing: China Statistics Press, 2009. (in Chinese).

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4.4 Strengthening the transformation of rural environment and improving environmental quality of rural living

The county and township government should strengthen the publicity of transforming rural environment, according to the practical condition, proceed in reasonable plan, establish transformation group and increase the political level. It can also boost the finance sourcing. In the meantime of take full use of government finance, adopting various methods to increase the capital supply. For example, through the money collection of rural residents, centralizedly install running water pipe, gas (natural gas) pipe, flush toilet, wide band, etc. for every household.

References

- [1] CHEN DY, ZHANG R, DIAO HT. Construction of Rural Public Service Currently in FuYang areas[J]. Journal of Shanxi Agricultural University: Social Science Edition, 2010(4): 452 - 456. (in Chinese).
- [2] ZHENG FB, JU ZJ. Research on achieving the equalization of public services, urban and rural ways in China[J]. Heilongjiang Foreign

- Economic Relations & Trade, 2010(7): 74 - 75. (in Chinese).
- [3] China has built the world's largest rural power grid[EB/OL]. (2006 - 10 - 09). <http://news.sina.com.cn/o/2006-10-09/092510187173s.shtml>. (in Chinese).
- [4] Brilliant "Eleventh Five": Rural water conservancy construction of key projects to achieve new results [EB/OL]. (2010 - 10 - 18). <http://www.c-water.com.cn/news/cn/20101018/1241866.html>. (in Chinese).
- [5] "Eleventh Five - Year" series of reports on economic and social development achievements Seven: Transportation outstanding achievements [EB/OL]. (2011 - 03 - 04). <http://news.hexun.com/2011-03-04/127713709.html>. (in Chinese).
- [6] Ministry of Finance: free compulsory education in rural areas during the Eleventh Five have been fully achieved[EB/OL]. (2010 - 12 - 23). http://news.ifeng.com/mainland/detail_2010_12/23/3660345_0.shtml (in Chinese).
- [7] "Eleventh Five - Year" period and cultural projects that benefit the construction review[EB/OL]. (2011 - 02 - 01). <http://www.Chinanews.com/cul/2011/02-01/2825169.shtml>. (in Chinese).
- [8] The development of Chinese medical and health take solid steps "During Eleventh Five - Year" period[EB/OL]. (2010 - 10 - 15). http://www.gov.cn/jrzq/2010-10/15/content_1723601.htm. (in Chinese).