Rural Land Circulation Scale and Comprehensive Performance Analysis

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Abstract: Land circulation is an important way to promote the growth of farmers' economic income. Improving the comprehensive performance of land circulation is the key to achieving sustainable development. This paper takes XX town as an example to analyze the scale and quality of rural land circulation. This paper has established a comprehensive performance evaluation index system for land circulation from the four aspects of economy, society, environment, and farmers' perceptions, by proposing a reasonable rural land transfer system to improve rural land transfer policy, establish a farmland circulation program, and improve the comprehensiveness of rural land circulation performance.

1. Introduction

At present, domestic land circulation has become a hot issue in the research field. As the scale of agricultural land circulation continues to expand and the frequency of the agricultural land circulation continues to increase. The scope is continuously expanding and the market for agricultural land circulation grows. Due to the imperfect information, property rights, and management of circulation, the risk of agricultural land circulation will be affected by any type of institutional innovation. The risks are the same. Once a dispute arises, it will still cause various social problems. In short, it is urgently needed to study the circulation of agricultural land and guarantee the development of the health science of agricultural land. Therefore, the analysis of farmland circulation and performance will have a positive impact on the innovation and healthy development of agricultural land in China, and it will play a complementary and perfect role in the theoretical research system of rural land circulation in China.

2. Introduction of Index System

2.1 Evaluation Index System

In setting land circulation performance indicators, there are four dimensions of economic, social, environmental and farmer perception. The first one is economic performance evaluation indicators, including average land value, per capita net income, land use rate, and unit land use rate, unit labor investment in land. The second one is social performance evaluation indicators, including urban and rural residents' income differences and poverty rates. The third one is the environmental performance evaluation indicators, including the amount of fertilizer per unit of land, the use of pesticides per unit of land, and environmental protection input per unit of land. The fourth one is the farmers perceptual evaluation indicators include the farmers' satisfaction with the income before and after land transfer, the farmers' understanding of the transfer procedures, and the farmers'own sense of security.

2.2 Weight Determination Method

There are four evaluation indicators involved here, including economic, social, environmental, and farmer perceptions, which are high-dimensional data types. Therefore, in order to facilitate further comprehensive evaluation, it is necessary to use projection pursuit technology to reduce the dimension processing of high-dimensional data through projection. Then, the data structure characteristics of high-dimensional data are deduced from low-dimensional data.

So we project a high-dimensional data set, evaluate the index weight as the projection direction,

and obtain a one-dimensional projection value:

$$f_i = \sum_{j=1}^{m} a_j x_j \quad (i = 1,2,.....,n) \ \sum_{j=1}^{m} a_j = 1$$

Ais the proportion of the j index in the comprehensive evaluation. M is the total number of comprehensive evaluation indicators. Fi is the composite score for the i farm transfer example. In order to maximize the reflection of similarities and differences between the examples to be evaluated, the objective function H is set, specifying H=w·f

$$w = \sqrt{\sum_{i=1}^{n} (f_i - \bar{f}_i)^2 / n} \quad f = \sum_{i=1}^{n} \sum_{j=1}^{n} (R - r_{ij}) I(R - r_j)$$

Among them, w is the difference between different types of cases to be evaluated, and f is the gap between the same types of cases to be evaluated. Where rij is the distance between sequence points, and I is a unit jump function, R=1. When the function H takes the maximum value, the evaluation index weight j can be calculated, so that the largest comprehensive characteristic of each example to be evaluated can be reflected. The model uses max(H).

3. Analysis of Land Circulation

XX towns and cities are the “Top ten rural villages and towns” in a city and are characteristic agricultural townships. Here we select two examples of land transfer for comprehensive performance evaluation. The first was the Land A, where 400 acres of land implemented, and Land B with 500 acres of land implemented.

Table 1 Table of Land A Transit Indicators and Change Index

Change index before and after circulation	Average land output value (yuan/ mu)	Land utilization rate (%)	Per capita net income (yuan/ person)	Unit land artificial input (person/ mu)	Unit land mechanization utilization (%)	Income difference (%)	Poverty rate (%)	Application amount of fertilizers per unit of land (kg/ha)	Utilization of pesticides per unit of land (kg/ha)	Environmental protection input per unit of land (yuan/hectare)
Before land transfer	4760	57	5730	0.183	42	32	5.2	421	11.5	420
After land transfer	9850	74	1067	0.11	74	84	1	234	6.8	2130
Change index (%)	102.3	32	93.12	30.23	58	42	78	36.83	38.23	377.76

As shown in Table 1, the average production value of land A was 4,760 yuan per mu, and the land circulation was 9,850 yuan per mu, and the change index was 102.3%; the land utilization rate was 57%, and the land circulation was implemented. 74%, the change is 32%; when the land did not flow, the per capita net income was 5730 yuan. After the transfer it was 1067 yuan, the change was 93.12%. When the land did not flow, the artificial investment was 0.183 persons per mu. After the transfer it was 0.11 person per mu. The change index before and after the circulation was 30.23%; the land mechanization utilization rate was 42%, the circulation was 74%. The land did not transfer the change is 58%. The land did not transfer the income difference is 32%, after the transfer is 84%. The difference before and after the change is 42%; the land did not circulate the poverty rate as high as 5.2%, after the transfer is only 1.0%, the flow of change is 78%. The land did not transfer the use of fertilizer is 421kg/hm2. After that, it was only 234kg/hm2, a change of 36.83%; whose utilization rate of pesticides in unit land without land circulation was 11.54kg/hm2. The utilization degree of

pesticides in unit land after circulation was 6.84kg/hm2, and the change rate was 38.23%. The environmental investment per unit of land is 420 yuan/hm2 when it is not circulating. It is 2130 yuan / hm, with the change index as high as 377.76%.

From the above information, we can see that after the transfer of Land A, the greatest change in the index is the amount of environmental protection investment per unit of land, which is four times as much. The second is the average land output value, which has been doubled. The smallest change index is the unit land labor input and land utilization rate, which has changed by 30.23% and 31.5% respectively.

Table 2 Table of Indicators and Change Index of Land B Transfer

Change index before and after circulation	Average land output value (yuan/ mu)	Land utilization	Per capita net income (yuan/ person)	Unit land artificial input (person/ mu)	Unit land mechanization utilization degree (%)	Income difference (%)	Poverty rate (%)	Unit land fertilizer application amount (kg/ha)	Unit land use pesticide (kg/ha)	Unit land environment Protection investment
Before land transfer	4800	59	6120	0.169	50	40	6	395	13.4	401
After land transfer	9600	69	1014	0.11	79	90	0.8	199	6.3	2500
Change index (%)	87.1	8.12	61.77	27.23	60.23	45	74	43.22	39.98	509.54

As shown in Table 2, the average land output value before the change of Land B is 4,800 yuan per mu. After the flow, it is 9,600 yuan per mu, the change index is 87.1%. The utilization rate of land without circulation is 59%, and the flow is 69%. The change was 8.12%; the per capita net income before land transfer was 6,120 yuan. The per capita net income after circulation was 1,014 yuan. Before and after land circulation, the per capita net income change index was 61.77%. When the land did not flow, labor was 0.169 person/mu. After the transfer, it was 0.11 persons per acre, with a change of 27.23%. When the land did not circulate, the utilization rate of land mechanization was 50%. After the circulation, it increased by 79%, with a change of 60.23%. The difference in income of urban residents before land transfer was 40%. After the transfer, the income difference is 90%, the change before and after the transfer is 45%. The poverty rate is 6% before the land transfer, only 0.8% after the transfer. The change index is as high as 74%; the amount of land fertilizer application is transferred to 395kg of each mu land. After circulation, the figure is 199kg/hm2, whose change index was 43.22%. When the land did not flow, the utilization rate of pesticide in the unit land was 13.4kg/hm2, after the flow was 6.39kg/hm2, with the change index was 39.98%. The amount of protection before circulation is 401 yuan/hm2. It is2,500 yuan/hm2 after circulation, whose change index was 509.54%.

From the above data, it can be seen that the largest change in the land of the B case is the amount of environmental protection investment per unit of land, which has increased by as much as six times. The second is the average land output value, which has doubled. The smallest change index is the land use rate and unit labor input, which has changed by 8.12% and 27.23% respectively.

Table 3 Farmer perception Evaluation of Land A and Land B

	Satisfaction	Degree of understanding of the procedure	Security
Land A	9	5	5
Land B	9	6	6

As shown in Table 3, farmer households on Land A are 9 points out of 10 (out of 10 points) in satisfaction with the land circulation is 5 points (out of 10 points) on the land circulation in rural areas, and the farmer’s own sense of security is 5 points (out of 10 points). Farmers of Land B have

9 points (out of 10 points) of satisfaction with the land after transfer is 6 points (out of 10 points) on the transfer of rural land, and 6 points of security for farmers themselves (out of 10 points).

In summary, the perception of farmer in land B is better than that of farmer in A, mainly because the degree of understanding of rural land transfer procedures by B farmers is deeper than that of A farmer. Furthermore, the sense of security of the farmers in the B case is also stronger than that of the A farmer.

4. Analysis of Comprehensive Performance of Land Transfer

Calculate the weight aj according to the objective function mentioned earlier, and obtain the weight as shown in Table 4, and then bring in the formula in the previous text, and you can get the comprehensive score of the two instances.

Table 4 Weights of various indicators and comprehensive performance scores

Economic, social and environmental evaluation index weights	Specific evaluation index weights	Each indicator score of Case A	comprehensive rating value of Case A	Each indicator score of Case B	comprehensive rating value of Case B
Economic Performance Evaluation Index-0.3123	Average land output value (0.1012)	10.35	88.01	8.81	93.89
	Land use efficiency (0.0623)	1.96		0.51	
	Net income per capita (0.0821)	7.65		5.07	
	Unit land labor input (0.0412)	1.25		1.12	
	Unit land use ratio (0.0255)	1.48		1.43	
Social Performance Evaluation Index-0.2601	Differences in income between urban and rural residents (0.1316)	5.53		5.66	
	Poverty rate (0.1285)	10.03		9.25	
Environmental Performance Evaluation Index-0.2014	Land use rate (0.06142)	2.26		2.59	
	Unit land pesticide application amount (0.06122)	2.34		2.51	
	Land Environmental Protection (0.07876)	29.75		40.29	
Farmer evaluation index-0.2262	Satisfaction with income (0.10243)	9.22		9.22	
	Land circulation understanding degree (0.08759)	4.38		5.27	
	Farmers' own sense of security (0.03618)	1.81		2.17	

As shown in Table 4, the economic performance indicators account for 0.3123, of which the average land production value has a weight of 0.1012. The land utilization weight is 0.0623, the per capita net income has a weight of 0.0821. The unit labor force has a weight of 0.0412. The weight of land use ratio is 0.0255. The proportion of social performance is 0.2601, among which the weight difference between urban and rural residents is 0.1316. The poverty rate is 0.1285, the environmental performance index is 0.2014, and the land use rate is 0.06142. The weight of pesticide application amount per unit of land is 0.06122, and the weight of protection of environmental input per unit of land is 0.07876. The proportion of evaluation indicators of farmer households is 0.2262, in which the farmers' weight of satisfaction before and after the land circulation is 0.10243. And the farmer's recognition of land circulation is the ratio of 0.08759. The farmer's own sense of security is 0.03618. The average land output value of the A case is 10.35, the land utilization rate is 1.96. The per capita net income is 7.65, the unit land labor input is 1.25, the unit land mechanization utilization rate is 1.48 to the income of urban and rural residents. The score for the difference is 5.35, whose poverty rate is 10.03. The unit chemical fertilizer application rate is 2.26. The unit land application rate is 2.34, and the unit environmental protection amount is 29.75. The score of satisfaction was 9.22, and the degree of understanding of the transfer program by farmers was 4.38, and the safety rating of farmers was 1.81. The average land value of B cases was 8.81, the land utilization rate was 0.51, the per capita net income was 5.07, the unit land labor input was 1.12, the unit land mechanization utilization rate was 1.43, and the income of urban and rural residents was The score for the difference was 5.66, the poverty rate was 9.25, the unit chemical fertilizer application score was 5.59, the unit land pesticide application score was 2.51, and the unit land environmental input protection score was 40.29. The farmers had before and after land transfer. The score of satisfaction is 9.22, and the degree of knowledge of farmers about the land circulation is 5.27, and the farmers' own sense of security is 2.17.

From Table 4, it can be seen that the comprehensive score of A case of Huadu Bridge is 88.01, and that of B case village is 93.90. It is concluded that the Yunchuan Village has more comprehensive scores due to the fact that there are more farmland flows than Huadu Bridge.

5. Summary

In this paper, according to the problems existing in the land circulation in our country, the corresponding research questions are put forward. The scale of land circulation and the changes of key land input and output factors before and after land transfer are researched. Moreover, it has explored how to evaluate the comprehensive performance of rural land circulation by constructing and improving the evaluation system of land circulation comprehensive indicators.

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