

Influencing Factors of Farmers' Willingness to Transfer Land in Urban Suburbs --A Case of Guangzhou Survey in China

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Abstract: The study of farmers' willingness to transfer land is important for accelerating the modernization of agriculture. This paper aims to analyze the influencing factors of farmers' willingness to transfer land and the characteristics of farmers without the willingness to transfer land from the perspective of farmers' endowment characteristics by constructing the factor analysis model, logistic regression analysis model, and cluster analysis model, taking farmers in each town of Nansha District, Guangzhou City as the research object. The results show that : (1) Farmers' willingness to transfer land is high in the survey area, and farmers' willingness to transfer land is mainly influenced by factors such as arable land conditions, political situation, transportation, risk type, and social relationship, and is most significantly influenced by arable land conditions. (2) Farmers' willingness to land transfer-in is higher than their willingness to land transfer-out, and there are differences in the factors influencing farmers' willingness to land transfer-in and to land transfer-out, as the willingness to land transfer-in is not influenced by factors related to farmers' income, but the willingness to land transfer-out is influenced by factors such as income sources and the number of acres of cultivated land. (3) Farmers with no willingness to land transfer-in exceed 70% and farmers with no willingness to land transfer-out exceed 50%, and targeted measures could be implemented to change their attitudes according to their characteristics.

Keywords: land transfer; logistic regression; system clustering; influencing factor; land management

1 INTRODUCTION

Land transfer refers to the act of transferring land management rights from farmers who have contracted land management rights to other farmers or economic organizations [8, 15]. In the context of the gradual completion of land titling nationwide, the land transfer has become an effective means to improve land use efficiency, promote agricultural efficiency, increase farmers' income and rural prosperity, and lay the foundation for intensive and large-scale land management in China's rural areas. In-depth research on factors affecting farmers' willingness to transfer land has a positive role in improving farmers' enthusiasm for land transfer, guiding the orderly transfer of land [15], and realizing large-scale agricultural production [1]. However, at present, farmers are not very active in land transfer across the country, leading to a low rate of

land transfer being more common ^[16]. The generation of effective land transfer requires strong support from the state and is inseparable from the will of farmers themselves. As the most developed agricultural area in the economy and society, the suburban area is an objectively existing and intricate geographical complex between urban and rural areas and is a special, important, and sensitive zone in the process of urbanization and industrialization in China. Due to its unique geographical location, its regional economic level, production development in rural areas, and land use are significantly different from other regions. Compared with general rural areas, it is susceptible to urban economic radiation, suburban agriculture, etc., and land use conversion is more frequent and more prone to land transfer behavior ^[4, 13], and farmers' willingness to transfer land is higher than that of general rural areas, and it is important to study farmers' willingness to transfer land in suburban areas to promote the improvement of the national land transfer rate ^[2].

On the whole, scholars have conducted a certain number of studies on the factors influencing farmers' willingness to transfer land ^[2], and the mainstream research direction focuses on how the characteristics of farmers' endowments affect the transfer of agricultural land, and the studies show that there are both facilitating and inhibiting influences of farmers' endowments on land transfer-in and land transfer-out ^[6, 19]. Wei-Lin et al. (2022) found that awareness of land transfer, satisfaction with transfer policies, and per capita income were indirect factors influencing willingness to transfer land, while total household size and age were direct factors. Chen Shuling et al. (2022) found that the influence of farmers' age in willingness to land transfer-out of has a hindering effect, and farmers' per capita net income and arable land area have a facilitating effect on willingness to transfer out of land, indicating that high per capita net income and arable land area are the main factors affecting farmers' willingness to land transfer in Heilongjiang Province; Wang Hazi et al. (2022), through a comparative analysis of farmers' willingness to land transfer-in and land transfer-out in some areas of Shandong, concluded that behavioral attitudes have different effects on farmers' willingness to transfer in and out of land, with farmers who transfer in their land mainly starting from the inherent value of the land, while farmers who transfer out their land mainly consider from economic rationality; Wang Nan et al. (2021) took the Yellow and Huaihai Plain as an example and concluded that farmers' willingness to transfer land differs at different stages of development of villages, influenced by income levels, main sources of income and policy understanding, and conducted a comparative analysis; Li Zhenjie and Han Jie (2019), through an empirical analysis of 25 cities, found that the number of non-farm household members and household income were positively associated with farmers' willingness to transfer land, the establishment of family farms, farmers' engagement in cultivation of special products and farmers' participation in e-commerce sales are positively associated with the willingness to inflow land, and non-agricultural cultivation and multiform transfer routes are positively associated with land outflow of ordinary farmers.

At present, when considering the factors influencing farmers' willingness to transfer their land, the existing literature does not compare and contrast research from two perspectives of willingness to flow out of land and willingness to flow in, and does not propose targeted methods to promote their willingness to transfer for heterogeneous farmers ^[9-10, 18], and at the same time, it does not consider regional differentiation characteristics, especially lacking the examination of land transfer behavior in the special area of urban suburbs. Compared with other rural areas, suburban areas have different influencing factors affecting both willingness to transfer in and out of land due to differences in non-farm employment transaction costs, transportation levels, economic living standards, and land resource endowments. Therefore, based on the differences in farm household endowment characteristics under urban-suburban areas, the impact of the

occurrence of farmland transfer behavior is the focus of current research that needs to be further explored [3, 10, 12]. In this paper, 150 field research questionnaires are used to analyze the impact of different farmers' endowment characteristics differences on the occurrence of land transfer behavior by using Factor analysis and Logistic regression models in each town of Nansha District, Guangzhou. Further, systematic clustering is used to classify farmers without the willingness to transfer according to the differences in their endowments, and targeted methods are proposed that could promote their willingness to land transfer.

2 OVERVIEW OF THE RESEARCH AREA AND DATA SOURCES

2.1 Overview of the research area

Nansha District is located at the southernmost tip of Guangzhou and on the west bank of the Humen Waterway of the Pearl River, where the Xijiang, Beijiang, and Dongjiang rivers converge. It is bordered by Dongguan City to the east, Zhongshan City and Shunde District of Foshan City to the west, Shawan Waterway to the north, and the mouth of the Pearl River to the south. The district has a total area of 803 square kilometers, with six towns under its jurisdiction. Nansha District has a resident population of 725,000, of which 415,400 are registered. The total agricultural area of Nansha District is 355,000 mu, including 252,000 mu of plantation and 103,000 mu of aquaculture.

2.2 Data sources

The data used in this paper come from field research, using the method of cluster sampling, the six towns in Nansha District as a whole are divided into six clusters, each cluster adopts the method of systematic sampling, numbering each farm household according to the number of households in the town and randomly selecting samples. Therefore, 157 questionnaires were distributed and collected factly, excluding 7 invalid questionnaires such as missing information and misfiled questionnaires, 101 valid questionnaires were collected, with an effective rate of 95.5%.

3 MODEL AND VARIABLE SELECTION

3.1 Selection of variables

The questionnaire of this study includes seven aspects of information such as basic information of the respondents, household demographic characteristics, and land transfer characteristics, the statistics are shown in Table1 below. Combining the existing research results and the research field situation, 14 different types of influencing factors are selected as independent variables in the questionnaire, and whether to transfer in or out of the land is taken as the dependent variable for quantitative analysis, as shown in Table1 below.

Table 1: Variable description.

Types of variables		Names of variables	Explanation of variables	Mean
Dependent variables		Willingness to land transfer-in	1=Yes; 0=No	0.39
		Willingness to land transfer-out	1=Yes; 0=No	0.37
Independent variables	Basic information of interviewees	Sex	1=Man; 2=Woman	1.29
		Professional	1=Farming;2=Concurrent-business;3=Work;4=Village officials and others	2.10
		Educational level X_1	1=Elementary school;2=Junior middle school;3=High school;4=College or above	2.21
	Household demographic characteristics	Population X_2	-	4.20
		Total labor force X_3	-	3.24
		The number of workers X_4	-	1.50
		The number of farmers X_5	-	1.73
	Social capital	Political situation X_6	The number of Party members/village cadres in the registered population	3.65
			Number of Party members/village cadres among relatives and friends	2.02
		Social relationship X_7	1=Village surname;2=Village surname;3=General	2.04
			1=Few friends and relatives;2=In general;3=More	2.14
	Risk categories	Risk preference type X_8	1=Conservative;2=More conservative;3=In general;4=More aggressive;5=Radical	2.64
	Farmland resource	Contracted land area X_9	Mu	4.66
		Traffic conditions X_{10}	1=Very poor;2=Poor;3=In general;4=Better;5=Very well	3.34
Irrigation condition X_{11}		1=Very poor;2=Poor;3=In general;4=Better;5=Very well	2.59	
Fertility condition X_{12}		1=Very poor;2=Poor;3=In general;4=Better;5=Very well	2.68	

	Income	Annual income X_{13}	1=less than 10000;2=10000-30000;3=30000-50000;4=50000-100000;5 = More than 100000	3.24
		Income source X_{14}	1=Mainly farming;2=Mainly work;3=Business oriented;4=Mainly renting;5=Other	1.82

3.2 Model construction

Based on the 14 factors influencing willingness to transfer land, construct the factor analysis model to reduce the influencing factors dimensionally, and then construct the logistic linear regression model to carry out regression analysis on them. To further explore the situation of farmers without the willingness to transfer land, the system clustering analysis model was constructed based on the willingness of farmers to transfer land, and grouping characteristics analysis was carried out.

Fourteen factors influencing willingness to transfer land are used as independent variables for the model construction. Considering that the number of independent variables is large, the independent variables are reduced in dimensionality and a factor analysis model is constructed. The factors are extracted using principal component analysis and the model is constructed as follows:

$$\begin{cases} F_1 = a_{11}X_1 + a_{21}X_2 + \dots + a_{n1}X_n \\ F_2 = a_{12}X_1 + a_{22}X_2 + \dots + a_{n2}X_n \\ \dots \\ F_n = a_{1n}X_1 + a_{2n}X_2 + \dots + a_{nn}X_n \end{cases} \quad (1)$$

where $F_j(j = 1, 2 \dots n)$ is the principal component, $X_1, X_2, X_3, \dots X_n$ is each influencing factor, and $a_{11}, a_{21}, a_{31}, \dots a_{n1}$ is the coefficient score of each influencing factor in the principal component F_j .

The independent variable of the model is the principal component obtained from factor analysis, and the dependent variable is the farmers' willingness to transfer land. In this paper the dependent variable is a binary discrete variable, so the binary logistic linear regression model is used, and its probability function is:

$$Y = \ln\left(\frac{P}{1-P}\right) = b_0 + \sum b_i F_i \quad (2)$$

Where P is the probability that farmers are willing to transfer in or out of their land, when $P = 1$, it means that farmers are willing to transfer in or out of their land, and when $P = 0$, it means that farmers are not willing to transfer in or out of their land; F_i is the main component affecting farmers' willingness to transfer their land; b_0 is the constant term; b_i is the partial regression coefficient, reflecting the degree of influence of the independent variable F_i on the dependent variable Y .

- The sample data of farmers without land transfer in or out are used as the original sample n for clustering, and 14 influencing factors are selected as variables to obtain the variable matrix. Define the inter-sample distance, inter-class distance as Euclidean distance, and Ward's method, construct a cluster analysis model ^[11].

3.2 Model testing

KMO test and Bartlett's test are performed on the data. From Table2 below, it can be seen that when the factor molecular method is applied the KOM test coefficient > 0.5 and p-value < 0.05 are valid.

Table 2: Validity test results

KMO Measure of Sampling Adequacy		0.555
Bartlett's test of Sphericity	Approx Chi-Square	964.191
	df	91
	Sig.	0.000

4 EMPIRICAL ANALYSIS

4.1 Basic information on the land transfer-in Nansha District

Among the 150 households surveyed, 127 households, or 84.67% of the total sample, have the willingness to transfer their land. Among them, 119 households were willing to land transfer-in, accounting for 79.33% of the sample size; 104 households were willing to land transfer-out, accounting for 69.33% of the total sample, as shown in Table3 below.

Table 3: Basic situation of land circulation in Nansha district

Willingness to transfer land	Number of samples (household)	Proportion (%)
Willingness to transfer land	127	84.67
Land transfer-in	119	79.33
Land transfer-out	104	69.33
No willingness to transfer land	23	15.33
Total	150	100.00

4.2 Factors influencing willingness to land transfer

4.2.1 Factors influencing willingness to land transfer-in

The analysis of the principal components and the orthogonal rotation method with maximum variance show that the 14 original variables constitute six new common factors and the cumulative contribution of the six factors is 71.33%, so it is considered that the information of the 14 original variables can be reflected by these six common factors, as shown in Table4 below.

Using the public factor in Table4 as the independent variable and the dichotomous variable of whether one is willing to transfer land in or out as the dependent variable, a logistic regression model is established and a stepwise regression method is used to retain significant independent variables at the 95% confidence level to obtain the final results shown in Table5 below.

Table 4: The common factor of land transfer-in

Common factor	Dominant variable
Economic activity factor	the proportion of farming, the proportion of labor, education level
Cultivated land factor	soil fertility, soil irrigation conditions
Labor factor	labor force proportion, labor force characteristics
Capital factor	political situation, social relations, transportation
Income factor	annual income amount, source of income
Risk factor	risk type, education level

Table 5: Logistic regression results of willingness to transfer-in land

Effect	Coefficient	Odds ratio	P-values
F1 (Economic activity factor)	0.563	1.755	0.0141
F2 (Cultivated land factor)	0.684	1.982	0.0036
F4 (Capital factor)	-0.8518	0.427	0.0001
F6 (Risk factor)	-0.4698	0.625	0.0417

The economic activity factor and the farmland land factor have a significant negative effect on farmers' willingness to land transfer-in, with each unit increase in the economic activity factor and the arable land factor increasing farmers' willingness to switch to land by 1.755 times and 1.982 times respectively. The risk factor and capital factor have a significant positive effect on farmers' willingness to transfer land, with each unit decrease in the risk factor and capital factor reducing farmers' willingness to transfer land by 57.3% and 62.5% respectively. The income factor and labor factor have no significant effect on farmers' willingness to transfer land, indicating that farmers' willingness to transfer land is not affected by them.

4.2.2 Factors influencing willingness to land transfer-out

The analysis of the principal components and the orthogonal rotation method with maximum variance show that the 14 original variables constitute five new common factors and the cumulative contribution of the five factors is 64.32%, so it is considered that the information of the 14 original variables can be reflected by these five common factors, as shown in Table6 below.

The public factors in Table6 above are used as independent variables, and the binary variable of whether one is willing to transfer land in or out is used as the dependent variable to build the logistic regression model. The stepwise regression method is used to retain significant independent variables at a 95% confidence level to obtain the final results shown in Table7 below.

Table 6: The common factor of land transfer-in

Common factor	Dominant variable
Economic structure factor	Proportion of farming, proportion of labor, education level, annual income
Cultivated land factor	Soil fertility, soil irrigation conditions
Labor factor	Labor force proportion, labor force characteristics
Operating environment factor	Political situation, acres, traffic
Personal characteristic factor	Income source, social relationship, risk type

Table 7: The common factor of land transfer-in

Effect	coefficient	Odds ratio	P-values
F2 (Cultivated land factor)	0.3952	1.485	0.0193
F4 (Operating environment factor)	-0.1321	0.876	0.0352
F6 (Personal characteristic factor)	0.3495	1.418	0.0100

The personal characteristic factor and the farmland factor have a significant negative influence on farmers' willingness to land transfer-out, with each unit increase in the economic activity factor and the farmland factor increasing farmers' willingness to land transfer-out by 1.418 times and 1.485 times respectively. The operating environment factor has a significant positive effect on farmers' willingness to transfer their land, with each unit decrease in the business factor reducing farmers' willingness to land transfer-out by 13.4%. The economic structure factor and labor factor have no significant effect on farmers' willingness to change their land, indicating that farmers' willingness to change their land is not affected by them.

4.3 Potential users of willingness to land transfer-in

4.3.1 Willingness to transfer land

The results of the system clustering are shown in Figure1 and Table8 below. As can be seen from the previous section, in terms of land transfer-in, the proportion of farming, the proportion of working, the level of education, soil fertility, and soil irrigation conditions have a negative influence on farmers' willingness to land transfer-in; risk preference, political situation, social relationship, and transportation have a positive influence on farmers' willingness to land transfer-in.

The endowment characteristics of farming households are improved by removing factors that are less relevant and not easy to improve, such as the proportion of farming, the proportion of labor, soil fertility and soil irrigation conditions, etc. Finally, risk type, transportation, and labor quality are retained as classification judgment indicators. According to the above judgment indicators, the five categories of farmers are compared and analyzed to obtain four categories

of farming groups: core farming groups, Strong relevant farmer groups, potential farming groups, and low-value farming groups, as shown in Table9 below. Among them, because of the small differences in the existence of farmers in categories IV and V, they are combined into one category of farmers' groups.

Table 8: sample classification of willingness to transfer-in land users

Type	Sample number
I	115、134、150、139、143、116、149
II	141、142、108、101、106
III	117、147、120、138、140、100、105
IV	145、146、148、114、135、136、102、121、118、137
V	122、144

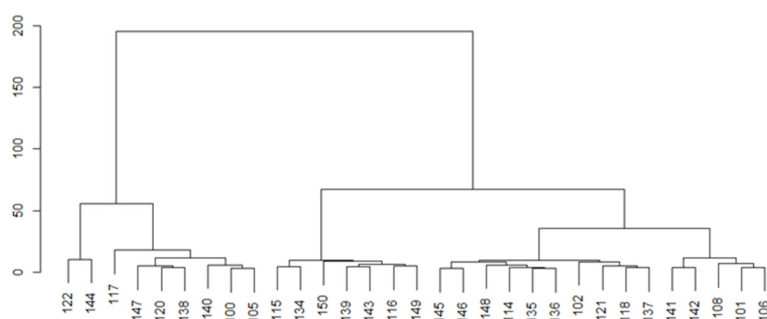


Figure 1: pedigree of potential land transfer-in users(self-painted)

- Core group of farmers

The risk appetite of this group of farmers is conservative; the education level of the family members is low, with an average of junior high school level; and the condition of farmland is good. The lowest cost is required to increase the willingness of this group to land transfer-in. The main factors limiting the willingness of the core group of farmers to transfer land in are risk appetite and the literacy level of the workforce. The government can enhance this group's willingness to land transfer-in through risk education and the formulation of relevant policies to influence farmers' expectations, as well as the provision of agricultural skills training.

- Strong relevant farmer groups

The risk appetite of this group is very aggressive and risk-loving; the transportation conditions of the farming land are very poor; the education level of the labor force is low, and the average education of the labor force is mainly junior high school. Factors that limit this group's willingness to land transfer-in are transport conditions and literacy. The government can improve this group's willingness to transfer land in by building roads and providing training in agricultural skills.

- Potential farmer groups and low-value farmer groups

The risk appetite of this type of farming household is conservative; the transportation conditions of the farmland are good; the household labor force is highly educated; they have some knowledge of the inflow policy but do not choose to land transfer-in to expand production. The

reasons for these are that their conservative risk appetite determines that they do not have a great need for land transfer, and their high literacy level determines that this type of farmer prefers non-farm employment, so it is difficult for this type of farmer group to increase their willingness to accept land transfer-in, therefore the value is not significant.

Table 9: clustering grouping table of potential users of land transfer-in

	Core farmer group	Strongly related groups of farmers	Potential farmer group	Low value farmer groups
Corresponding type	I	II, VI	V	III
Risk type	More conservative	Very aggressive	Very conservative	More conservative
Traffic	Good	General	Good	Good
Labor quality	All junior high schools	Junior high school is given priority to	High school, middle school equal	High school is given priority to

4.3.2 Willingness to land transfer-out

The results of the system clustering are shown in Figure2 and Table10 below, in which sample No.86 has the intention to land transfer-in, and the actual cultivated area after implementing the land transfer reaches 55 mu, so it is considered a potential user who does not belong to the category of land transfer-out so is excluded.

As can be seen from the previous section, social relations, type of risk, source of income, soil fertility, and soil irrigation conditions all have a negative effect on farmers' willingness to land transfer-out; political situation, number of acres, and transportation have a positive effect on farmers' willingness to land transfer-out.

Farmers' endowment characteristics are improved by removing factors that are less relevant and not easily improved, such as the proportion of farming, the proportion of labor, soil fertility, and soil irrigation conditions. Finally, risk type, transportation, and the number of acres are retained as classification indicators. According to the above judgment indicators, the four categories of farmers are compared and analyzed, and four groups of farmers were obtained: the core group of farmers, the strong relevant farmer groups, the potential group of farmers, and the low-value group of farmers, as shown in Table11 below.

Table 10: sample classification of willingness to land transfer-out users

Type	Sample number
I	1、119、134、139、143、149、150
II	5、30、71、72、73、76、97、98、101、108、141、142
III	69、70、100、138、140、144、147
IV	7、37、51、86、103、114、135、137、145、146、148

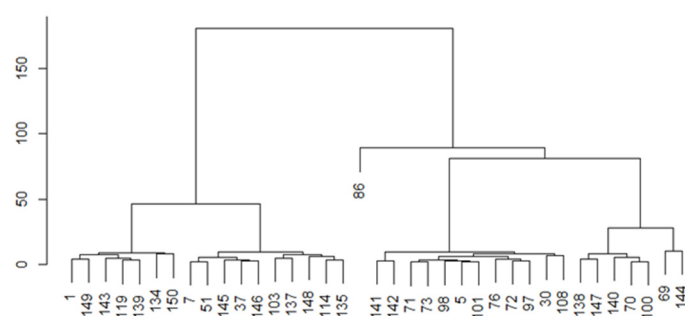


Figure 2: pedigree of potential land transfer-out users(self-painted)

Table 11: clustering grouping table of potential users of land transfer-out

	Core farmer group	Strongly related groups of farmers	Potential farmer group	Low value farmer groups
Corresponding type	II	IV	III	I
Risk type	Risk neutral	Risk neutral	Risk averse	Risk averse
Traffic	Average	Good	Poor	Average
Labor quality	4.44	3.52	3.01	3.88

- Core group of farmers

The perception of risk among this group of farmers is at an average level; they own farmland with average transportation conditions, but the farmland area is large, at 4.44 mu on average. The main constraint on the willingness of the core group of farmers to land transfer-out is the transportation condition of the farmland, and the government can enhance the willingness of this group to land transfer-out by building machine roads and other methods.

- Strong relevant farmer groups

The perception of risk among this group of farmers is at an average level; the farmland owned by this group is small, with an average of 3.52 mu, and the transportation conditions of the farmland are relatively good. The main factor limiting the willingness of this type of this group to land transfer-out is their risk appetite. The government can influence the expectations of this group by providing them with risk education or formulating relevant policies, to enhance their willingness to switch out.

- Potential farmer groups and low-value farmer groups

The risk perception of the potential farmer group is more conservative; the transportation condition of the farmland is poor and the area of farmland is small. The government can enhance the transportation conditions of this type of farmers by building machine roads, but due to their small farmland area, the economic benefits generated through transfer out of farmland are lower, thus the value of this group is less than that of the group of the strong relevant farmer.

- Low-value farmer groups
- This group of farmers has a conservative level of risk perception, average access to farmland, and an average of 3.88 mu of farmland. Existing policy measures are difficult to influence the willingness of this group of farmers to land transfer-out, so it is difficult for this group of farmers to influence their willingness to transfer, and therefore the value is not significant.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on 150 survey data in Nansha District, Guangzhou, to reveal the main influencing factors of farmers' willingness to transfer their land in the study area to put forward targeted suggestions. The results of the study show that:

In terms of willingness to land transfer-in, farmland conditions, the proportion of farming, the proportion of working, and the level of education have a negative effect on farmers' willingness; risk type, political situation, social relations, and traffic have positive effects on farmers' willingness.

In terms of willingness to land transfer-out, the source of income, social relations, type of risk, and farmland conditions have a negative effect on farmers' willingness; political situation, number of acres and transportation have positive effects on farmers' willingness.

Among the farmers who have no desire to land transfer-in, the proportions of the core group of farmers, the strong relevant farmer groups, the potential group of farmers, and the low-value group of farmers are 22.58%, 48.39%, and 29.03% respectively. Among the farmers who are not willing to land transfer-out, the proportions are 33.33%, 19.44%, 27.78%, and 19.44% respectively.

This paper focuses on the analysis of the influence of different farmers' endowment characteristics on the occurrence of farmland transfer behavior and the classification of farmers according to their willingness. Later studies can establish a more perfect index system for factors with greater influence, find more representative factors, expand the research scope, and analyze from the perspective of time and space; questionnaires can be designed for different types of peasant households to maximize their land transfer willingness.

5.2 Recommendations

5.2.1 National level

- Upgrading the education level of farmers

The government can improve farmers' literacy and professional skills through the provision of agricultural training and employability guidance, thus increasing their motivation for agricultural production.

- Improving the social security system

A sound social security system can facilitate farmers' transfer behavior by changing their expectations of risk.

5.2.2 Social level

- Strengthening rural infrastructure

Village collectives can improve rural infrastructure, thereby increasing the productivity of arable land and facilitating the full use of land resources.

- Enriching rural cultural development

Farmers with high social capital are more receptive to new policies, therefore, activities such as exchange sessions can be organized to strengthen the contact between villagers.

5.2.3 Individual farmer level

- Developing a proper awareness of land property rights

Farmers are often unable to accurately distinguish between ownership, use, and management of land, which is not conducive to land transfer. Farmers themselves should therefore take an active role in understanding policy information and establishing a correct concept of land ownership. Improving the social security system.

- Play the part of public opinion to build good ethos

We should make full use of the social influence of mass media, construct internet morality system to endow mainstream media with powerful guiding force.

- Give play to the role of families and foster a harmonious family tradition

The parents of the youth group should pay attention to the cultivation of family morality, and teach their children by personal example. Local governments should develop a democratic, equal and harmonious family atmosphere.

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