

Research Article

Influencing Factors Analysis on Land-Lost Farmers' Happiness Based on the Rough DEMATEL Method

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Received 24 November 2019; Accepted 10 February 2020; Published 12 March 2020

Academic Editor: Maria Alessandra Ragusa

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In this paper, fifteen indicators from four dimensions are selected to construct an evaluation system for the happiness of land-lost farmers. The factors affecting the happiness of land-lost farmers are analyzed using the rough DEMATEL method. The results show that land expropriation compensation (F6) and job stability (F7) are the driving factors for improving the happiness of land-lost farmers. The government can improve the social environment policies, such as land acquisition, social security, and employment to influence other factors and improve the level of happiness of land-losing farmers. This study has important guiding significance and reference value for the reform of China's land expropriation, the protection of land-lost farmers' rights and interests and the improvement of their happiness, and the maintenance of social harmony and stability.

1. Introduction

Since the 1980s, with the acceleration of China's urbanization, land expropriation has not only released large-scale benefits of land, but also made more and more farmers lose their land, and become a special group, land-lost farmers [1]. According to statistical data, during the period 2013–2018, the rural population decreased by 81.13 million, a decrease of 13.52 million per year [2]. In 2018, the urban population increased by 17.9 million. The proportion of urban population to the total population (urbanization rate) reached 59.58%, an increase of 1.06% from the previous year. According to a report released by the National Academy of Economic Strategy under the Chinese Academy of Social Sciences, China's urbanization rate will reach 70% by 2035. This means that China's urbanization progress will continue, and the number of land-lost farmers will become larger and larger.

While expropriating rural land, the Chinese government is trying to protect the rights and interests of land-lost farmers through economic compensation and other

measures [3–7]. For farmers, land plays multiple roles, such as means of production, economic sources, and social security. Land-lost farmers are not only facing changes in production and lifestyle but also difficult to integrate into urban life in the short time due to the huge differences between urban and rural culture. They might be under pressure from employment, life, spirit, and other aspects because of the imperfection of social security and land expropriation compensation system, and their happiness index has been greatly affected. Farmers are a large group in China. If the problems of land-lost farmers are not handled properly, they may have a negative impact on China's social development and political stability. Therefore, land-lost farmers have been widely concerned by the government and scholars in recent years [8, 9].

This paper aims to fill the gap in the existing research in the following two respects.

First, we analyze the influencing factors of land-lost farmers' happiness, although land acquisition and related issues have become a hot issue of concern by the government and scholars [10–13]. However, most of the existing research

in this area focused on the economic and legal aspects of these policies and paid little attention to the happiness of land-lost farmers [14]. Based on the investigation of the land acquisition system, employment and social security, and cultural and psychological impact, this paper constructs an evaluation system of the influencing factors of land-lost farmers' happiness. We feel that this study could add some insights to the existing literature on land-lost farmers.

Second, the rough DEMATEL method is used to evaluate the influencing factors of land-lost farmers' happiness [15]. Although there have been a few attempts to study the happiness of land-lost farmers [14, 16, 17], however, these studies generally assumed that the factors that affect the happiness of land-lost farmers are independent of each other and did not analyze the relationship between the factors. This assumption may limit our understanding of the happiness of land-lost farmers and is not conducive to the improvement of measures. A combined evaluation method based on the rough set theory and DEMATEL method considers the mutual influence of various factors, and the evaluation result of land-lost farmers' happiness is more objective. In this paper, the evaluation system of the happiness of Chinese land-lost farmers is established using the rough DEMATEL method.

The remaining part of the paper is arranged as follows: Section 2 presents a brief review of the literature on the land-lost farmers' happiness. Section 3 details the methodology, which combined the rough set and DEMATEL method. The rough DEMATEL approach is applied to evaluate the influencing factors of land-lost farmers' happiness, and the results are discussed in Section 4. Finally, a brief conclusion and some design suggestions are offered in Section 5.

2. Literature Review

2.1. Happiness. Happiness is a measure of life, which is the ultimate goal that people pursue [18]. The level of happiness directly affects people's physical and mental health, and a high level of happiness contributes to a healthier lifestyle and longer lifespan [19, 20]. In recent years, happiness has become a hot issue in the field of psychology, sociology, and economics [21]. Existing research shows that happiness is related to people's personal characteristics, such as age, health status, income, and marital status [22]. Age is seen as the most important factor affecting happiness. Some scholars believe that the level of happiness will decline with the increase of age, while other scholars believe that there is a U-shaped relationship between age and happiness [23]. Mroczek and Spiro found that people with good physical conditions and marital relationships would have higher life satisfaction [24]. Zhu et al. suggested that the residents who get married and have higher incomes seem to have higher levels of happiness [25]. Most scholars consider that there is a positive relationship between education and happiness, while others believe that there is no significant relationship between education and happiness [26, 27]. In addition, the influence of psychological factors on happiness has also received attention. Luchesi et al. found that psychological factors have a positive correlation with happiness [28].

Happiness is affected not only by individual characteristics but also by social environmental and ecological factors [29–40]. External environmental factors such as inflation, unemployment, welfare systems, and public insurance also have a definite impact on happiness [37]. Wolfers found that high inflation and high unemployment rates reduced subjective well-being [38]. Bjornskov et al. analyzed the relationship between social system and well-being, and the results indicated that there were great differences between developing countries and middle- and high-income countries in the impact mechanism of a formal system on well-being [39]. Furthermore, some scholars also pay attention to the relationship between climate, natural environment, and happiness. Welsch (2006) showed that pollution measured by nitrogen dioxide had a negative impact on overall happiness [40].

2.2. Determination of Land-Lost Farmers' Happiness in China.

Despite the growing interest in happiness, there are still relatively few studies on the happiness of land-lost farmers and its influence factors in developing countries such as China, which is experiencing rapid urbanization [41]. The existing researches on Chinese residents mainly consider personal factors, such as age [42], gender [43], health [44, 45], education [43], income [46], marriage [47], employment [48], and psychological factors [49]. At the same time, social environmental factors such as commuting [41, 50], community environment [51], social security system [52], and air quality [53, 54] are also to be concerned about. There have been some attempts to study the happiness of the elderly [55], children [49, 56], and urban residents [42, 46]. There are also some studies on the happiness of rural residents in China [57], but it is difficult to see the research on the happiness of land-lost farmers in the process of urbanization [14].

In the context of rapid urbanization, the number of land-lost farmers in China is increasing, and many problems and conflicts are emerging [3, 58, 59]. Huang et al. analyzed the impact of land acquisition on the livelihood vulnerability of the farmers in urban fringe areas and revealed that housing condition, income, education, land compensation, and social capital had a greater impact on the response capability of land lost farmers [60]. They also emphasized the importance of improving the education level and occupational skills for the improvement of land-lost farmers' livelihood ability. The research of Yang and Wu showed that farmers would face a series of changes after losing their land, including social and economic conditions, psychological conditions, and cultural norms, which might have a negative impact on the happiness of land-lost farmers [16]. The higher social capital and health level would have a positive impact on the happiness of land-lost farmers. Zhang and Hu concluded that land acquisition reduced the happiness of land-lost farmers through comparative analysis before and after land acquisition, and job satisfaction, family income, and compensation satisfaction were the main reasons that affected the subjective happiness of land-lost farmers [17]. Wang et al. showed that the great deprivation of farmland and compensation inequality

reduce the happiness of land-lost farmers. On the whole, the research on the happiness of land-lost farmers has not attracted much attention of scholars, and the existing research lacks systematic analysis on the factors affecting the happiness of land-lost farmers, and does not take into account the relationship between various factors [14].

3. Methodology

3.1. Construction of an Evaluation System of Influencing Factors of Land-Lost Farmers' Happiness. An evaluation system of the influencing factors of the land-lost farmers' happiness is established based on the situation of employment and social security of Chinese land-lost farmers. We select 15 criteria from four dimensions (see Table 1). To confirm the availability of the system, we consulted experts in economics, management, sociology, and agriculture.

The dimensions of the evaluation system mainly include individual characteristics (D1), economic situation (D2), social environment (D3), and psychological factors (D4). Among them, individual characteristics (D1) mainly reflect the personal characteristics of land-lost farmers, including four indicators: age (F1), marital status (F2), health status (F3), and education level (F4). Economic situation (D2) mainly reflects the current family economic status of land-lost farmers, including household income (F5), land expropriation compensation (F6), job stability (F7), and housing conditions (F8). Social environment (D3) mainly balances from the perspective of government policies, including social security (F9), land requisition system (F10), employment policy (F11), and community humanistic environment (F12). Psychological factors (D4) mainly evaluate the mental state of land-lost farmers from the psychological point of view, including compensation satisfaction (F13), job satisfaction (F14), and living satisfaction (F15).

3.2. Rough DEMATEL Method. The Decision Making Trial and Evaluation Laboratory (DEMATEL), introduced by the Geneva Research Centre of the Battelle Memorial Institute, is a useful method to build and analyze the interrelationship among factors through matrixes or digraphs [72]. This method uses the experience and knowledge of experts to cope with complex social problems, especially for those systems with uncertain element relationships [73, 74].

Although the DEMATEL model has been successfully applied in many areas, it still suffers from a major drawback, viz., ignoring the complex relationship among the factors [75]. Recently, many improved DEMATEL methods have been proposed to solve this problem. Fuzzy theory and rough set theory are widely used to overcome the limitation [15, 76]. The paper adopts the rough DEMATEL method proposed by Song and Cao [15], and the main steps of this method are as follows.

Step 1: Generate the direct-relation matrix.

m experts are invited to evaluate the relationship between all the influencing factors in the system. In

order to facilitate evaluation, we establish the following evaluation criteria. Numbers 0, 1, 2, 3, and 4 represent no influence, very low influence, low influence, high influence, and very high influence, respectively. The direct-relation matrix of the k expert is as follows:

$$Q_k = \begin{bmatrix} 0 & d_{12}^k & \cdots & d_{1n}^k \\ d_{21}^k & 0 & \cdots & d_{2n}^k \\ \vdots & \vdots & \ddots & \vdots \\ d_{n1}^k & d_{n2}^k & \cdots & 0 \end{bmatrix}, \quad k = 1, \dots, m, \quad (1)$$

where d_{ij}^k represents the influence score of factor i on factor j obtained by the k th expert evaluation, m represents the number of experts and n represents the number of influencing factors. The group direct-relation matrix of m experts can be described as follows:

$$\bar{D} = \begin{bmatrix} 0 & \tilde{d}_{12} & \cdots & \tilde{d}_{1n} \\ \tilde{d}_{21} & 0 & \cdots & \tilde{d}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{d}_{n1} & \tilde{d}_{n2} & \cdots & 0 \end{bmatrix}, \quad (2)$$

where $\tilde{d}_{ij} = \{d_{ij}^1, d_{ij}^2, \dots, d_{ij}^k, \dots, d_{ij}^m\}$

Step 2: establish the rough group direct-relation matrix.

According to rough set theory, d_{ij}^k can be represented by a rough number and defined by its lower limit $\underline{\lim}(d_{ij}^k)$ and upper limit $\overline{\lim}(d_{ij}^k)$ as follows:

$$\underline{\lim}(d_{ij}^k) = \frac{\sum_{q=1}^{N_{ijp}} x_{ij}}{N_{ijp}}, \quad (3)$$

$$\overline{\lim}(d_{ij}^k) = \frac{\sum_{q=1}^{N_{ijo}} y_{ij}}{N_{ijo}}, \quad (4)$$

where x_{ij} and y_{ij} are the upper and lower approximations of d_{ij}^k and N_{ijp} and N_{ijo} represent the number of objects contained in the lower and upper approximations of d_{ij}^k , respectively. A rough number form of \tilde{d}_{ij} can be obtained as follows:

$$\text{DN}(\tilde{d}_{ij}) = \{[d_{ij}^{1L}, d_{ij}^{1U}], [d_{ij}^{2L}, d_{ij}^{2U}], \dots, [d_{ij}^{kL}, d_{ij}^{kU}], \dots, [d_{ij}^{mL}, d_{ij}^{mU}]\}, \quad (5)$$

where $d_{ij}^{kL} = \underline{\lim}(d_{ij}^k)$ and $d_{ij}^{kU} = \overline{\lim}(d_{ij}^k)$.

Then, the rough group direct-relation matrix D can be obtained as follows:

TABLE 1: Evaluation system of influencing factors of land-lost farmers' happiness.

Dimensions	Criteria	References
Individual characteristics D1	Age F1	Godoy-Izquierdo et al. [61]; Mroczek and Spiro [24]
	Marital status F2	Diener et al. [62]; Helliwell [63]
	Health status F3	Steptoe et al. [64]; Lobos et al. [23]; Graham et al. [45]
	Education level F4	Blanchflower et al. [26]; Wen et al. [55]
Economic situation D2	Household income F5	Luchesi et al. [28]
	Land expropriation compensation F6	Huang et al. [60]
	Job stability F7	Louis and Zhao [65]; Stutzer [66]
	Housing conditions F8	Zhang et al. [67]
Social environment D3	Social security F9	Dolan et al. [68]
	Land requisition system F10	Bjornskov et al. [39]
	Employment policy F11	Huang et al. [60]
	Community humanistic environment F12	Doherty and Kelly [29]; Cao [69]
Psychological factors D4	Compensation satisfaction F13	Zhang and Hu [17]
	Job satisfaction F14	Benzo et al. [70]; Chitchai et al. [71]
	Life satisfaction F15	Dolan et al. [68]; Bieda et al. [49]

$$D = \overline{[\text{DN}(\tilde{d}_{ij})]_{n \times n}} = \begin{bmatrix} [0, 0] & [d_{12}^L, d_{12}^U] & \cdots & [d_{1n}^L, d_{1n}^U] \\ [d_{21}^L, d_{21}^U] & [0, 0] & \cdots & [d_{2n}^L, d_{2n}^U] \\ \vdots & \vdots & \ddots & \vdots \\ [d_{n1}^L, d_{n1}^U] & [d_{n2}^L, d_{n2}^U] & \cdots & [0, 0] \end{bmatrix}. \quad (6)$$

$\overline{[\text{DN}(\tilde{d}_{ij})]} = [d_{ij}^L, d_{ij}^U]$ is the average rough interval of $\text{DN}(\tilde{d}_{ij})$ and $d_{ij}^L = (\sum_{k=1}^m d_{ij}^{kL})/m$ and $d_{ij}^U = (\sum_{k=1}^m d_{ij}^{kU})/m$ represent lower limit and upper limit of rough number of $\text{DN}(\tilde{d}_{ij})$, respectively.

Step 3: Construct the rough total-relation matrix.

Using the rough group direct-relation matrix D , the normalized rough group direct-relation matrix $Z = [z_{ij}]_{n \times n}$ is computed by using the following equations:

$$\gamma = \max_{1 \leq i \leq n} \left(\sum_{j=1}^n d_{ij}^U \right), \quad (7)$$

$$Z = \frac{D}{\gamma}. \quad (8)$$

The rough total-relation matrix $T = [t_{ij}]_{n \times n}$ can be calculated as follows:

$$t_{ij} = [t_{ij}^L, t_{ij}^U], \quad (9)$$

$$T^s = [t_{ij}^s]_{n \times n} = Z^s (1 - Z^s)^{-1}, \quad s = L, U. \quad (10)$$

Step 4: Obtain the row and column sums of matrix T . The sum of rows (R) and the sum of columns (C) from the rough total-relation matrix T are defined as

$$R_i = [r_i^L, r_i^U] = \left[\sum_{j=1}^n t_{ij}^L, \sum_{j=1}^n t_{ij}^U \right], \quad (11)$$

$$C_j = [c_j^L, c_j^U] = \left[\sum_{i=1}^n t_{ij}^L, \sum_{i=1}^n t_{ij}^U \right]. \quad (12)$$

To effectively determine the ‘‘Prominence’’ and ‘‘Relation,’’ R_i and C_j need to be converted into the crisp forms R'_i and C'_j by using the following equations:

$$R'_i = \min_{1 \leq n \leq 1} r_i^L + \alpha_i \left(\max_{1 \leq i \leq n} (r_i^U) - \min_{1 \leq i \leq n} (r_i^L) \right), \quad (13)$$

$$C'_j = \min_{1 \leq n \leq 1} c_j^L + \beta_j \left(\max_{1 \leq j \leq n} (c_j^U) - \min_{1 \leq j \leq n} (c_j^L) \right). \quad (14)$$

Suppose \tilde{r}_i^L and \tilde{r}_i^U are the normalized forms of r_i^L and r_i^U , \tilde{c}_j^L and \tilde{c}_j^U are the normalized forms of c_j^L and c_j^U , respectively. The determination of total normalized crisp values can be calculated as

$$\alpha_i = \frac{\tilde{r}_i^L \times (1 - \tilde{r}_i^L) + \tilde{r}_i^U \times \tilde{r}_i^U}{1 - \tilde{r}_i^L + \tilde{r}_i^U}, \quad (15)$$

$$\beta_j = \frac{\tilde{c}_j^L \times (1 - \tilde{c}_j^L) + \tilde{c}_j^U \times \tilde{c}_j^U}{1 - \tilde{c}_j^L + \tilde{c}_j^U}. \quad (16)$$

Step 5: draw the cause-effect relationship diagram.

Finally, we can draw the cause-effect relationship diagram according to the dataset of $(R'_i + C'_j, R'_i - C'_j)$. In the case when $i = j$, $R'_i + C'_j$ illustrates the importance of the criterion. The larger the value of $R'_i + C'_j$, the greater the overall prominence of the factor F_i . Similarly, $R'_i + C'_j$ divides

the criteria into the cause and effect groups. When $R'_i - C'_j > 0$, F_i belongs to the cause group and has a net influence on the other factors. When $R'_i - C'_j < 0$, F_i belongs to the effect group and receives a net effect of the other factors.

4. Research Results and Discussion

4.1. Rough DEMATEL Research Results. The empirical study on the influencing factors of the happiness of land-lost farmers is carried out by using the rough DEMATEL method. Five experts are invited to evaluate the influence factors, including professors specialized in economics (1 person), management (1 person), sociology (1 person), and agriculture (2 persons). After the discussion of 5 experts, the score of interrelationships among the fifteen factors is obtained. The group direct-relation matrix of 5 experts is shown in Table 2.

By equations (3)–(6), all the clear judgments in the direct-relation matrix are transformed into a rough number form. The rough group direct-relation matrix is shown in Table 3. Then, we standardize the direct-relation matrix of the rough group of land-lost farmers' happiness. The rough total-relation matrix is obtained based on equations (7)–(10) (see Table 4).

By equations (11)–(16), we calculate the degree to which each factor affects other factors and the degree to which each factor is affected by other factors, as shown in Table 5 and Figure 1.

4.2. Analysis of Prominence. The higher prominence, the greater the direct influence of influencing factors on land-lost farmers' happiness. As shown in Table 5 and Figure 1, the sequence of influencing factors could be determined as $F5 > F15 > F7 > F8 > F6 > F3 > F10 > F14 > F13 > F2 > F4 > F9 > F11 > F12 > F1$. The results show that household income (F5) has the highest level of prominence, which means that F5 has the most significant and direct impact on the land-lost farmers' happiness. In addition, the impact of living satisfaction (F15), job stability (F7), housing conditions (F8), and land expropriation compensation (F6) is relatively high. On the contrary, Age (F1) has the lowest level of prominence, which means that age has the smallest direct impact on land-lost farmers' happiness. These results reveal that the happiness of land-lost farmers is mainly affected by their economic situation and their adaptation to life. When land-lost farmers are faced with serious economic problems such as low income, unstable work, poor housing conditions, and inadequate compensation for land acquisition, they will be difficult to survive in society, and their happiness will be very poor.

4.3. Analysis of Relation. Based on the values of $R'_i - C'_j$, the fifteen influence factors can be divided into two groups. As shown in Table 5 and Figure 1, the cause group with positive $R'_i - C'_j$ values includes F1, F4, F6, F7, F9, F10, and F11 and has a sequence of $F10 > F9 > F11 > F4 > F6 > F1 > F7$. Among these factors, the land requisition system (F10) has the

largest $R'_i - C'_j$ value, which indicates that the land expropriation system has the highest impact on the land-lost farmers' happiness, and its impact on other factors is greater than that received from other factors. Social security (F9) has the second largest $R'_i - C'_j$ value, which indicates that social security has great impact on the land-lost farmers' happiness. Employment policy (F11) has the third largest $R'_i - C'_j$ value. The land requisition system (F10), social security (F9), and employment policy (F11) belong to social environmental factors, which are the policies made by the government for land-lost farmers. These policies are related to the daily life of land-lost farmers, so they will affect the changes of other factors and affect the happiness of land-lost farmers through economic and psychological factors. It can be seen from the analysis that social environmental factors have the greatest influence on the happiness of land-lost farmers, either directly or indirectly.

The effect group with negative $R'_i - C'_j$ values includes F2, F3, F5, F8, F12, F13, F14, and F15 and has a sequence of $F15 > F13 > F8 > F14 > F5 > F12 > F2 > F3$. The factors belonging to the effect group are those that are influenced by other factors more than their influence on other factors. The smaller the $R'_i - C'_j$ value of a factor is, the greater the influence of other factors is. Living satisfaction (F15) has the smallest $R'_i - C'_j$ value, which indicates that living fitness is most affected by other factors. In addition, living satisfaction (F15) has a high value of $R'_i - C'_j$, which rank second among all the factors, suggesting that living satisfaction (F15) is a very important factor affecting land-lost farmers' happiness. Compensation satisfaction (F13) has the second smallest $R'_i - C'_j$ value, which indicates that living fitness is heavily affected by other factors. Housing conditions (F8) and job satisfaction (F14) have the third and fourth smallest m-values, respectively. Although household income (F5) is only slightly affected by additional factors, its prominence is 3.591, ranking first among all factors, so its influence on the whole system and other factors is very great.

Living satisfaction (F15), compensation satisfaction (F13), and job satisfaction (F14) belong to psychological factors, which are mainly affected by additional factors. It can be seen that the psychological satisfaction of the land-lost farmers with their life, land compensation, and their existing work is easily affected by other factors. Whether it is personal conditions, economic conditions, or government policies, they all have an impact on the psychological state of land-lost farmers, thus affecting the happiness of land-lost farmers.

4.4. Strategy Analysis. Adopting the idea of four zones proposed by Pan and Chen [77], we have further classified the prominence and relation of all criteria into the following four strategic zones as shown in Figure 1.

- (1) Priority zone-high prominence and high relation: land expropriation compensation (F6) and job stability (F7) in economic situation perspective. These criteria are the cause criteria and the core criteria influencing other criteria. They are the driving

TABLE 2: The group direct-relation matrix of 5 experts.

	F1	F2	F3	F4	F5	...	F13	F14	F15
F1	0, 0, 0, 0, 0	2, 3, 2, 3, 3	3, 3, 2, 1, 3	0, 2, 1, 1, 0	1, 3, 2, 0, 1	...	0, 0, 0, 0, 1	0, 0, 0, 0, 1	3, 3, 3, 1, 1
F2	0, 0, 0, 0, 0	0, 0, 0, 0, 0	2, 1, 0, 0, 0	0, 0, 0, 0, 0	1, 2, 2, 3, 1	...	0, 0, 0, 0, 0	0, 0, 0, 0, 1	0, 3, 1, 0, 1
F3	0, 0, 0, 0, 0	3, 3, 0, 1, 0	0, 0, 0, 0, 0	0, 3, 0, 2, 0	4, 3, 3, 2, 1	...	0, 1, 0, 0, 1	0, 2, 0, 0, 1	2, 3, 3, 2, 1
F4	0, 0, 0, 0, 0	3, 3, 3, 2, 0	0, 0, 0, 0, 0	0, 0, 0, 0, 0	4, 3, 4, 2, 2	...	0, 1, 0, 1, 1	0, 3, 2, 1, 2	0, 3, 3, 1, 2
F5	0, 0, 0, 0, 0	3, 4, 3, 2, 0	1, 3, 1, 1, 1	0, 3, 3, 0, 0	0, 0, 0, 0, 0	...	0, 2, 0, 1, 1	3, 2, 3, 1, 3	2, 4, 4, 1, 2
F6	0, 0, 0, 0, 0	2, 2, 0, 0, 0	1, 2, 2, 0, 0	0, 2, 1, 0, 0	4, 3, 4, 0, 1	...	4, 4, 4, 3, 3	0, 2, 0, 0, 2	2, 3, 3, 2, 3
F7	0, 0, 0, 0, 0	2, 2, 2, 3, 0	0, 3, 1, 1, 0	0, 3, 2, 2, 0	3, 4, 3, 1, 0	...	0, 4, 2, 1, 0	3, 2, 3, 2, 2	1, 3, 2, 0, 1
F8	0, 0, 0, 0, 0	2, 2, 0, 1, 0	1, 2, 1, 3, 0	0, 0, 0, 0, 0	0, 0, 0, 0, 0	...	2, 2, 2, 2, 2	0, 2, 0, 0, 1	3, 3, 2, 2, 3
F9	0, 0, 0, 0, 0	2, 2, 0, 0, 0	3, 3, 3, 0, 2	0, 3, 0, 0, 0	3, 3, 3, 1, 1	...	2, 3, 2, 0, 2	2, 3, 3, 0, 0	2, 3, 3, 0, 2
F10	0, 0, 0, 0, 0	1, 1, 0, 0, 0	0, 1, 0, 0, 0	0, 1, 0, 0, 0	4, 3, 2, 0, 2	...	4, 3, 3, 2, 2	0, 3, 1, 2, 0	3, 3, 3, 3, 3
F11	0, 0, 0, 0, 0	0, 2, 0, 0, 0	0, 1, 0, 0, 0	0, 1, 0, 0, 0	3, 3, 3, 0, 3	...	1, 1, 2, 2, 0	2, 3, 4, 3, 3	3, 3, 3, 2, 1
F12	0, 0, 0, 0, 0	0, 1, 1, 1, 0	0, 1, 1, 1, 1	0, 1, 0, 1, 0	0, 1, 0, 0, 0	...	0, 1, 2, 2, 0	0, 1, 0, 0, 0	3, 3, 3, 1, 3
F13	0, 0, 0, 0, 0	0, 1, 0, 0, 0	2, 1, 0, 0, 1	0, 1, 0, 0, 0	0, 0, 0, 0, 0	...	0, 0, 0, 0, 0	0, 1, 0, 0, 0	2, 1, 1, 0, 2
F14	0, 0, 0, 0, 0	0, 1, 0, 0, 0	1, 1, 1, 0, 0	0, 1, 0, 0, 0	0, 0, 2, 0, 0	...	0, 1, 0, 1, 0	0, 0, 0, 0, 0	2, 1, 2, 1, 2
F15	0, 0, 0, 0, 0	0, 1, 0, 0, 1	2, 1, 1, 0, 1	0, 1, 0, 0, 0	0, 2, 2, 0, 0	...	0, 1, 2, 1, 2	2, 1, 2, 0, 2	0, 0, 0, 0, 0

Note: numbers 0, 1, 2, 3, and 4 represent no influence, very low influence, low influence, high influence, and very high influence, respectively.

TABLE 3: The rough group direct-relation matrix of land-lost farmers' happiness.

	F1	F2	F3	...	F14	F15
F1	[0, 0]	[2.36, 2.84]	[1.94, 2.83]	...	[0.04, 0.36]	[1.72, 2.6]
F2	[0, 0]	[0, 0]	[0.17, 1.06]	...	[0.04, 0.36]	[0.5, 1.932]
F3	[0, 0]	[0.627, 2.227]	[0, 0]	...	[0, 0]	[1.787, 2.6]
F4	[0, 0]	[1.52, 2.79]	[0, 0]	...	[0.92, 2.253]	[1.02, 2.543]
F5	[0, 0]	[1.48, 3.213]	[1.08, 1.72]	...	[1.94, 2.83]	[1.907, 3.32]
F6	[0, 0]	[0.32, 1.28]	[0.467, 1.533]	...	[0.32, 1.28]	[2.36, 2.84]
F7	[0, 0]	[1.26, 2.31]	[0.4, 1.667]	...	[2.16, 2.64]	[0.747, 2.08]
F8	[0, 0]	[0.467, 1.533]	[0.747, 2.08]	...	[0.17, 1.06]	[2.36, 2.84]
F9	[0, 0]	[0.32, 1.28]	[1.52, 2, 79]	...	[0.773, 2.373]	[1.333, 2.6]
F10	[0, 0]	[0.16, 0.64]	[0.004, 0.36]	...	[0.457, 1.98]	[2.8, 3]
F11	[0, 0]	[0.08, 0.72]	[0.004, 0.36]	...	[2.2, 3.35]	[1.98, 2.63]
F12	[0, 0]	[0.36, 0.84]	[0.64, 0.96]	...	[0.04, 0.36]	[2.28, 2.92]
F13	[0, 0]	[0.04, 0.36]	[0.36, 1.253]	...	[0.04, 0.36]	[0.747, 1.68]
F14	[0, 0]	[0.04, 0.36]	[0.36, 0.84]	...	[0, 0]	[1.16, 1.84]
F15	[0, 0]	[0.16, 0.64]	[0.65, 1.35]	...	[0.94, 1.78]	[0, 0]

TABLE 4: The rough total-relation matrix of land-lost farmers' happiness.

	F1	F2	F3	...	F14	F15
F1	[0, 0]	[0.098, 0.363]	[0.079, 0.283]	...	[0.01, 0.23]	[0.08, 0.399]
F2	[0, 0]	[0.005, 0.055]	[0.011, 0.081]	...	[0.008, 0.06]	[0.026, 0.134]
F3	[0, 0]	[0.034, 0.185]	[0.008, 0.08]	...	[0.012, 0.092]	[0.082, 0.146]
F4	[0, 0]	[0.07, 0.214]	[0.01, 0.091]	...	[0.051, 0.183]	[0.061, 0.241]
F5	[0, 0]	[0.066, 0.244]	[0.05, 0.168]	...	[0.083, 0.213]	[0.098, 0.293]
F6	[0, 0]	[0.027, 0.166]	[0.03, 0.153]	...	[0.027, 0.147]	[0.119, 0.26]
F7	[0, 0]	[0.057, 0.201]	[0.023, 0.155]	...	[0.092, 0.201]	[0.05, 0.235]
F8	[0, 0]	[0.024, 0.123]	[0.036, 0.132]	...	[0.013, 0.091]	[0.105, 0.191]
F9	[0, 0]	[0.024, 0.181]	[0.069, 0.208]	...	[0.043, 0.209]	[0.081, 0.274]
F10	[0, 0]	[0.021, 0.164]	[0.019, 0.137]	...	[0.036, 0.208]	[0.149, 0.313]
F11	[0, 0]	[0.018, 0.131]	[0.014, 0.099]	...	[0.104, 0.218]	[0.101, 0.234]
F12	[0, 0]	[0.019, 0.088]	[0.028, 0.081]	...	[0.008, 0.062]	[0.093, 0.176]
F13	[0, 0]	[0.005, 0.057]	[0.016, 0.078]	...	[0.005, 0.055]	[0.036, 0.118]
F14	[0, 0]	[0, 0.078]	[0.02, 0.085]	...	[0.007, 0.059]	[0.063, 0.162]
F15	[0, 0]	[0.029, 0.133]	[0.028, 0.096]	...	[0.039, 0.111]	[0.01, 0.077]

TABLE 5: The sums of given and received impact among influencing factors.

	R'_i	C'_j	$R'_i + C'_j$	$R'_i - C'_j$
F1	0.402	0	0.402	0.402
F2	0.295	1.409	1.704	-1.114
F3	0.856	1.044	1.9	-0.188
F4	1.102	0.501	1.603	0.601
F5	1.516	2.075	3.591	-0.559
F6	1.327	0.735	2.062	0.592
F7	1.193	1.148	2.341	0.045
F8	0.651	1.412	2.063	-0.761
F9	1.48	0.091	1.571	1.389
F10	1.795	0.078	1.873	1.717
F11	1.162	0.263	1.425	0.899
F12	0.416	0.914	1.33	-0.498
F13	0.261	1.483	1.744	-1.222
F14	0.627	1.243	1.87	-0.616
F15	0.424	2.43	2.854	-2.006
Mean	—	—	1.889	-0.088

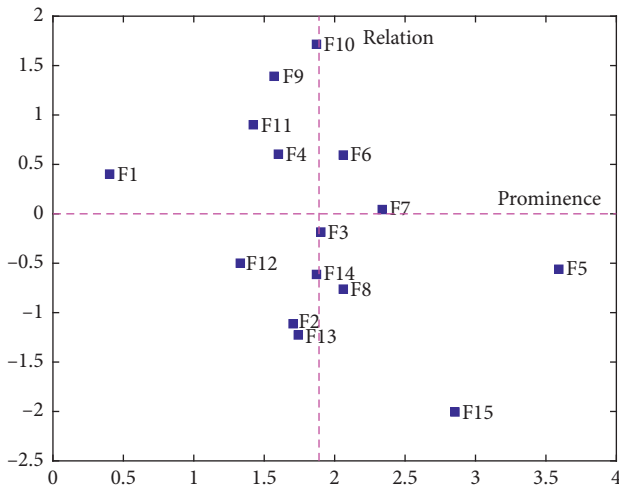


FIGURE 1: The interactive influence between the 15 criteria.

factors for improving the happiness of land-lost farmers.

- (2) Long-term zone-high prominence and low relation: (a) health status (F3) in individual characteristics perspective, (b) two criteria from economic situation perspective including household income (F5) and housing conditions (F8), (c) living fitness (F15) in psychological factor perspective. These criteria are the effect criteria and are greatly affected by other factors. When other indicators are improved, these indicators can also be improved.
- (3) Contingency zone-low prominence and high relation: (a) age (F1) and education level (F4) in individual characteristics perspective and (b) social security (F9), land requisition system (F10) and employment policy (F11) in social environment perspective. Specifically, education level (F4), social security (F9), land requisition system (F10), and

employment policy (F11) have a relatively large impact on other factors, but are less affected by additional factors. The government should consider gradually improving four criteria in order to improve the economic environment for the survival and development of land-lost farmers. Age (F1) has a slight impact on other factors, which indicate that it is relatively independent.

- (4) No-priority zone-low prominence and low relation: (a) marital status (F2) in individual characteristics perspective, (b) community humanistic environment (F12) in social environment perspective, and (c) compensation satisfaction (F13) and job satisfaction (F14) in psychological factor perspective. These criteria do not show significant importance to other factors. These indicators are difficult to be directly improved in the short term, but we can improve these criteria when other criteria are improved.

5. Conclusion

Land-lost farmers are a large and special group in the process of urbanization in China. After leaving the land on which they live, they are faced with various pressures from employment, life, and psychology, and their happiness level is generally low. If the land-lost farmers cannot be properly resettled, they may not only lose their land, but also lose their jobs and cannot be integrated into urban life. This may lead to new social contradictions and conflicts, which is not conducive to China's economic development and social stability. Therefore, it has become an important task for the government to explore and study on how to evaluate and improve the happiness of land-lost farmers.

One of the main limitations of previous research on the influencing factors of land-lost farmers' happiness is that they assume that these criteria are independent, and there is no interaction or causality between them. However, this assumption may limit the ultimate improvement of such factors. In order to solve this problem, the rough DEMATEL approach is applied to evaluate the happiness of land-lost farmers in the process of urbanization in China. Fifteen criteria from four dimensions are selected to analyze the influencing factors of land-lost farmers' happiness. The evaluations of influence relationships among factors are given by 5 experts. Then, the influencing factors analysis on land-lost farmers' happiness is carried on using the rough DEMATEL approach. Finally, the influencing factors are classified into 4 types based on the prominence ($R'_i - C'_j$) and relation ($R'_i + C'_j$), which provides a decision-making tool for government departments.

The result indicates that land expropriation compensation (F6) and job stability (F7) are important indicators that affect additional indicators and are also the driving factors for improving the happiness of land-lost farmers. The reasons are as follows. Land expropriation compensation (F6) directly affects the current economic situation of land-lost farmers, and job stability (F7) directly affects the long-term economic income of land-losing farmers. Both of these

criteria are related to the survival and development of land-lost farmers. In addition, social security (F9), land requisition system (F10), and employment policy (F11) have a relatively large impact on other indicators and are important indicators that can be improved by government departments. Therefore, the government should formulate more reasonable policies on land acquisition compensation, employment, and social security systems to improve the happiness of land-lost farmers.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request. The questionnaire data was acquired mainly through e-mail and paper, filling out.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

This work was supported by the Tianjin Planning Leading Group Office of Philosophy and Social Sciences under Grant no. TJYY19-010.

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