

Article

Willingness of Farmers to Transform Vacant Rural Residential Land into Cultivated Land in a Major Grain-Producing Area of Central China

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Abstract: A large amount of cultivated lands in China is occupied by vacant residential areas, thereby wasting land resources and placing local food security at risk. Therefore, transforming vacant rural residential land back to its previous form is urgently required to maintain the amount of cultivated land and guarantee food security. We comprehensively analyzed the willingness of farmers to participate in vacant residential land transformation and determine the factors that influence such willingness, including the awareness of farmers about their rural residential environment, their knowledge of residential land-use policies and their awareness of the consequences of such transformation. A detailed survey was conducted amongst 252 farmers owning vacant residential lands in central China. Amongst these farmers, 75, 87 and 90 were entirely, partly and not living on farming, respectively. Only half of these farmers were willing to transform the vacant residential land, whilst those farmers who were partly living on farming were less willing to participate in the transformation than those who were entirely and were not living on farming. The factors that influence the willingness to transform varied across different types of farmers. Farmers who were not and were partly living on farming were significantly affected by their awareness of their rural residential environment, their knowledge of residential land-use policies, the length of residential land vacant time and their household income. Those farmers who were partly living on farming were also influenced by the number of vacant residential plots they possessed. Farmers who were entirely living on farming were significantly affected by their knowledge of the residential land-use policies, the number of vacant residential plots they possessed, their awareness of the consequences of land transformation and their family size. Results indicate that farmers are anxious about vacant residential land loss and that a communication gap is observed between them. Therefore, along with the communication between farmers and the government, the publicity and transparency of the rural residential land-use policies must be improved to eliminate the communication gap, relieve the anxiety of farmers, and increase the willingness to transform their vacant residential lands.

Keywords: vacant residential land; survey; awareness; knowledge

1. Introduction

Population increase and economic growth have resulted in a sharp increase in food demand worldwide [1,2]. This phenomenon is particularly evident in developing countries [3,4]. According to the latest estimation by the Food and Agriculture Organization (FAO), by 2050, population increase and economic growth will require a 70% increase in global food production and approximately

100% more in developing countries compared with the levels in 2009 [5]. The high demand for food imposes a high risk on food security at the global level. Governments, the World Bank, FAO and other non-governmental organizations (NGOs) have implemented measures to solve these issues. Intensive usage and extension of cultivated lands are the two main means to solve these issues. However, intensive usage of cultivated land results in land degradation [6], loss of biodiversity because of pollution [7] and over use of chemicals [8,9]. Meanwhile, extending cultivated land is a viable option. The global cultivated land has increased by 12% in the past 50 years [5]. This increase has resulted in the loss of grassland or woodland and eventual changes in the natural environment [10,11]. Cultivated land reclamation from abandoned construction land is a sustainable measure, particularly in less-developed countries, such as China and India, where resources disordered exploitation, economic growth and city sprawl have resulted in large masses of abandoned construction land [4,12,13].

The urbanization rate in China increased from 17.9% to 54.8% between 1978 and 2014 and is predicted to increase to 60% in the next five years [14]. Furthermore, the area of construction land increased by 294.1% between 1990 and 2012, and the rural population decreased by 23.7% [15]. However, the area of rural construction land has not decreased but has instead expanded rapidly with a decreasing rural population in recent years [16]. The area of rural residential land increased by 100,000 ha, and the rural residential land per capita increased from 193 m² to 230 m² from 1996 to 2008 [17]. Meanwhile, a large number of the rural population is migrating to urban, with more than 120 million migrants per year in China [17,18]. These migrants possess residential and cultivated land in rural areas. They are included in Chinese rural residence registration and are still identified as farmers [19]. Given that farmer migrants work and live in urban areas, their residential lands are vacated yearly. Farmers who live inside villages tend to construct new houses at the edge of the villages for convenient transportation and leave their previous residential lands inside the villages. This phenomenon is referred to as “hollowed village” [20]. The city sprawl and hollowed village occupied a large amount of cultivated land. This scenario poses a threat to cultivated land supply and food security in China by leaving only 9% of the world’s cultivated land as the source of food for approximately 20% of the global population. Chinese hollowed village reclamation focuses on transformation to cultivated land; it differs from village reclamation in other countries. For example, Botswana allocates vacant lands in villages to residential plots [21], and Senegal and America reconstruct villages into new settlements [22,23].

Therefore, the Chinese government and authorities have implemented multiple public policies to guarantee cultivated land supply for sustainable development. To increase its cultivated land supply by 16,000 km², China launched the “Law of Land Administration of the People’s Republic of China” (1987, 2004), “Property Law of the People’s Republic of China” (2007) and the “National Land Consolidation and Rehabilitation Plan” in 2012 [24,25]. By restricting residential land application, residential land ownership (“one residential land for one household” and “residential land belongs to village collective”) and reclaiming “hollowed villages”, Chinese government attempted to guarantee cultivated land.

Numerous studies have been conducted to alleviate “hollowed villages” and ensure cultivated land supply. Li et al. (2014), Crecente et al. (2002) and Miranda et al. (2006) suggested that the consolidation of rural residential land could alleviate “hollowed villages” and protect cultivated land [26–28]. Calculating the land consolidation potential [29], exploring the reconstruction patterns of rural settlements [30] and exploring policies to maintain cultivated land [31] have been intensively studied by researchers.

Despite many previous studies on this topic, no study considered the willingness of farmers, who are the most important agents in this process, to participate in the implementation of these policies. Understanding farmers’ awareness of the rural residential environment, knowledge of residential land-use policies, awareness of the consequence of transformation and willingness to participate in vacant residential land reclamation is critical to the effective implementation and management of these policies. The different factors that affect the willingness of farmers to cooperate

must also be considered. Therefore, this study aims to: (1) quantify the awareness of the rural residential environment, knowledge of residential land-use policies, awareness of the consequence of the transformation and willingness to participate in the vacant residential land transformation of farmers in three groups; (2) identify the factors that affect farmers' willingness to participate in vacant residential land transformation; and (3) provide recommendations for public policies that revolve around vacant residential land transformation.

2. Materials and Methods

2.1. Description of the Study Region

This study was conducted in four counties (Wenxian, Xinzheng, Xihua and Guangshan) of Henan Province in a major grain-producing area of central China (110°21'E–116°39'E, 31°23'N–36°22'N) (Figure 1). The region is located in midstream and downstream of the Yellow River and covers an area of 1.78×10^6 km². It has a temperate climate, with mean annual temperatures ranging from 15.7 °C to 12.1 °C and annual precipitation ranging from 532.5 mm to 1380.6 mm. Its main crops include grain, corn, cotton, soybean and peanut.

We selected these counties distributed from the northwest to the southeast of Henan Province, which is amongst the 13 grain-producing provinces of China [32] (Table 1). These counties were selected as representatives of the province according to various socioeconomic conditions. Amongst the counties, Wenxian has the highest population density (906 persons/km²) which is two times that of Guangshan (434 persons/km²). However, the cultivated land per capita in Wenxian is the lowest, only 7.1 acres [14]. Xinzheng has the highest per capita disposable income (2510 USD) in 2015 and urbanization levels (62.1%), which are about two times that of Xihua (1220 USD, 34.9%). With the rapid development of the economic, the conflict between the demands for construction land and cultivated land in this region presents a key issue for the local governments.

Table 1. Attributes of the study sites.

Sample Region	Counties	Situation	Population Density (Persons/km ²)	Per Capita Disposable Income (USD)	Cultivated Land per Capita (Acres)	Urbanization Rate
A	Wenxian	112°51'E–113°13'E; 34°52'N–35°2'N	906	1960	7.1	44.5%
B	Xinzheng	113°35'E–113°44'E; 34°33'N–34°39'N	756	2510	8.0	62.1%
C	Xihua	114°5'E–114°43'E; 33°36'N–33°39'N	770	1220	8.4	34.9%
D	Guangshan	114°31'E–115°10'E; 31°37'N–32°11'N	434	2210	9.6	35.6%

China implements the household contract responsibility system on cultivated land. Farmers have no ownership of the cultivated land, but they have contracting rights. To protect the benefits of farmers and improve the production of cultivated land, the central government of China proposed maintaining contracting rights and encouraged transforming the right of management [33]. Some farmers take on other jobs because the income from contracted cultivated land is limited. The income from cultivated land has become part of the total family income, and some of them even transfer the right of management to others. Thus, based on the literature [2,34] and pre-surveys, we classified the farmers into those who were entirely (EL farmers), partly (PL farmers) and not live on farming (NL farmers) according to the degree of relation between the farmers and cultivated land. The NL farmers who are working and residing in urban areas yet still possess residential and cultivated land in rural areas and are included in Chinese rural residence registration were still identified as farmers.

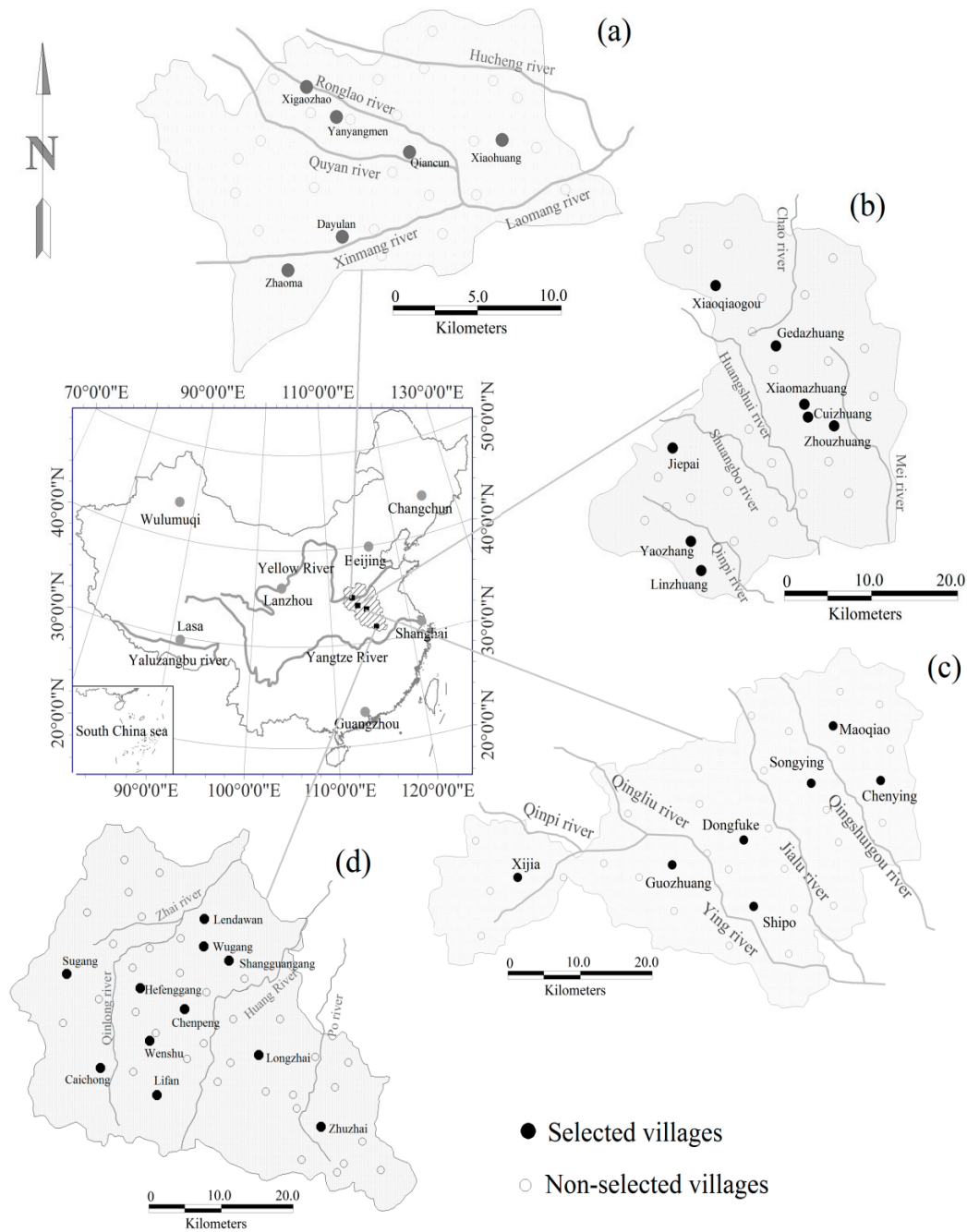


Figure 1. Location of the study area: Wenxian (a); Xinzheng (b); Xihua (c); and Guangshan (d).

2.2. Data Collection and Questionnaire Design

The survey was conducted from August 2015 to September 2015. The samples were selected following the cluster sampling method [35]. We selected four counties (Wenxian, Xinzheng, Xihua and Guangshan) in Henan Province, randomly selected 32 villages in these counties (6, 8, 7, and 11 villages in Wenxian, Xinzheng, Xihua and Guangshan, respectively) and interviewed more than 10 households in each village randomly (Table 2). These interviews were conducted with 442 farmers, amongst whom 163, 159, and 130 were EL, PL and NL farmers, respectively. Around 75 (46.0%) EL farmers, 87 (61.0%) PL farmers, and 90 (69.2%) NL farmers have vacant residential lands. One family member aged over 18 years was interviewed in each household. The NL farmers were interviewed over the phone because they do not reside in the villages, whilst the remaining farmers were interviewed face to face.

Table 2. Survey sites.

Sample Region	Counties	Villages	Types of Farmers		
			Entirely Living on Farming (<i>n</i> = 76)	Partly Living on Farming (<i>n</i> = 87)	Not Living on Farming (<i>n</i> = 90)
A	Wenxian	Qiancui, Yanyangmen, Zhaoma, Xigaozhao, Dayulan, Xiaohuang	18	17	18
B	Xinzheng	Cuizhuang, Gedazhuang, Xiaomazhuang, Yaozhang, Linzhuang, Xiaoqiaogou, Zhouzhuang, Jiepai	13	19	37
C	Xihua	Dongfuke, Xijia, Songying, Maoqiao, Shipo, Chenying Guozhuang	20	25	16
D	Guangshan	Lengdawan, Wugang, Shangguangang, Sugang, Hefenggang, Chenpeng, Wenshu, Longzhai, Caichong, Lifan, Zhuzhai	24	25	19
Sum			75	87	90

Except the willingness of the farmers, the questionnaire contained 22 items that were grouped into four categories: the socioeconomic characteristics of the participants (nine items), the awareness of farmers about their rural residential environment (ARRE) (four items), their knowledge of residential land-use policies (KRP) (three items) and their awareness of the consequences of vacant residential land transformation (ACT) (five items) (Table 3).

Table 3. Items on awareness of the rural residential environment, knowledge of residential land-use policy and awareness of the consequence of the transformation.

Factors	Items	Questions
Awareness of the rural residential environment (ARRE)	Public facilities [26]	I am satisfied with the public facilities in the residential area.
	Ecological environment [36]	I am satisfied with the ecological environment in the residential area.
	Residential planning [26]	I am satisfied with the planning of the residential area.
	Traffic in the residential area [37]	I am satisfied with the traffic in the residential area.
Knowledge of residential land-use policies (KRP)	Rural residential land-use policy: "one residential land for one household" [38–41]	I know the policy "one household is only allowed to own one plot of residential land".
	Residential land belongs to the village collective [39]	I know the policy "residential land is not private property but belongs to the village collective".
	Residential land is a national welfare for farmers [42]	I know that "rural households need not spend money on residential land, because it a welfare for farmers".
Awareness of the consequence of the transformation (ACT)	Protect and save the farmland [36,41]	I believe that "transforming vacant rural residential land into cultivated land can effectively protect and save farmlands".
	Embody social equality [43]	I believe that "the transformation eliminates the doubts of the uneven numbers of plots of residential lands".
	Guarantee national food security [44]	I believe that "the transformation can guarantee national food security".
	Increase family income [43]	I believe that: "the compensation from the transformation can improve the economic condition of household".
	Newly established families can easily acquire residential land [39]	I believe that "when new families are established, they don't need to worry about not having residential land on which they can build houses".

The questionnaire items were set based on the previous literatures. Following Li et al. (2014), McLeman (2011) and Yi and Lee (2014), who found that living conditions contributed to the out-migrant of farmers [26,36,37], we used four items to measure ARRE. Following Wang et al. (2012), Sun and Fu (2012), Gkartzios et al. (2013), Long et al. (2014) and Fan and Yu(2016), who all found the land-use policies affected land-use changes, housing locations and rural housing land transition [38–42], we used three items to measure KRP. Following Tang et al. (2016) and Wang et al. (2013), Sun and Fu (2012) who argued that the expected consequences of the transformation influenced the intention of farmers to settle [39,43,44], we used five items to measure ACT (Table 3). To measure the responses, we employed a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree

and 5 = strongly agree) that could be worded differently according to the questionnaire items [45,46]. The Likert scale is widely used to measure subjective reactions, attitudes, preferences, awareness and behaviors in social analyses [18,47,48].

2.3. Data Analysis

The data from the 252 questionnaires were coded and analyzed using SPSS 19 (SPSS, Inc., Copy right: 1989–2010). The reliability analysis using Cronbach’s alpha revealed that the questionnaire variables obtained scores ranging from 0.716 to 0.817; with scores above 0.70 indicating favorable internal consistency [49]. One-way ANOVA was conducted to compare the socioeconomic characteristics, ARRE, KRP, and ACT of the participants in the three farmer groups. Afterwards, correlational and path analyses were conducted to study the key factors that influenced the willingness of farmers to transform their vacant rural residential lands into cultivated lands (WTC). Pearson’s correlation analysis was also performed to establish the relationships amongst the variables. We performed the path analysis as a supplement to separate the direct and indirect effects and measuring the relative importance of each variable. These variables may interact with one another, and such interaction offers larger contributions to the results than the individual variables. Path analysis can separate direct and indirect effects and present the relative importance of factors [50]. It is widely applied in sociology and psychology research [51,52], to investigate various topics, including water consumption [18], nutrient intake [53] and pesticide use [54].

3. Results

3.1. Socioeconomic Characteristics of the Participants

The participants have a mean age of 48.42 (± 15.21) years. Some of them have received primary education for 6.95 (± 4.06) years and 12.1% of them are illiterate. They earn an average annual household income of approximately 7590 (± 5060) USD per year. They own an average of 1.98 (± 0.45) plots of residential lands, and 1.09 (± 0.31) plots have been vacant for around 7.99 (± 5.73) years. The EL farmers are older (54.17 ± 14.46) and less educated than the PL and NL farmers. The NL farmers have a higher annual household income ($10,400 \pm 300$ USD) than the EL (4740 ± 4440 USD) and PL farmers (7190 ± 5320 USD). The NL farmers own less plots of residential land than the EL and PL farmers, but own more plots of vacant residential land. The residential land of EL farmers has been vacant for a longer time (9.25 ± 4.86 years) than those of PL (6.85 ± 5.72 years) and NL (8.03 ± 6.21 years) farmers (Table 4).

Table 4. Socioeconomic characteristics of the participants (mean \pm SD).

Socioeconomic Characteristics	Types of Farmers			Mean
	Entirely Living on Farming ($n = 76$)	Partly Living on Farming ($n = 87$)	Not Living on Farming ($n = 90$)	
Gender	1.43 \pm 0.05	1.53 \pm 0.49	1.51 \pm 0.51	1.49 \pm 0.50
Age (years)	54.17 \pm 14.46 ^a	43.24 \pm 16.92 ^c	48.57 \pm 12.17 ^b	48.42 \pm 15.21
Education (years)	5.33 \pm 4.14 ^b	7.21 \pm 4.18 ^a	8.18 \pm 3.14 ^a	6.95 \pm 4.06
Household income (USD/year)	4740 \pm 4440 ^b	7190 \pm 5320 ^b	10,400 \pm 300 ^a	7590 \pm 5060
Family size	4.47 \pm 2.15	4.50 \pm 1.67	4.24 \pm 1.49	4.40 \pm 1.76
The number of residential plots (NRP)	2.09 \pm 0.29 ^a	2.08 \pm 0.35 ^a	1.78 \pm 0.57 ^b	1.98 \pm 0.45
Total area of the residential land (m ²)	288.61 \pm 151.90	259.53 \pm 118.12	277.06 \pm 155.92	274.5 \pm 142.70
The number of vacant residential plots (NVRP)	1.03 \pm 0.16 ^b	1.10 \pm 0.34 ^b	1.14 \pm 0.35 ^a	1.09 \pm 0.31
Length of residential land vacant time (LRVT)	9.25 \pm 4.86 ^a	6.85 \pm 5.72 ^b	8.03 \pm 6.21 ^b	7.99 \pm 5.73

Notes: Gender of the participants: 1, men; 2, women. Family size: Members living in one house. Values with different superscript letters in a row indicate significant differences at $p < 0.05$, and $a > b > c$ [55,56].

3.2. Willingness to Transform Vacant Rural Residential Lands into Cultivated Lands

Around half of the participants were willing to transform their vacant residential lands into cultivated lands, whilst the other farmers showed a negative attitude towards the transformation (Figure 2). The willingness of the NL and EL farmers is significantly higher than that of the PL farmers (Figure 3).

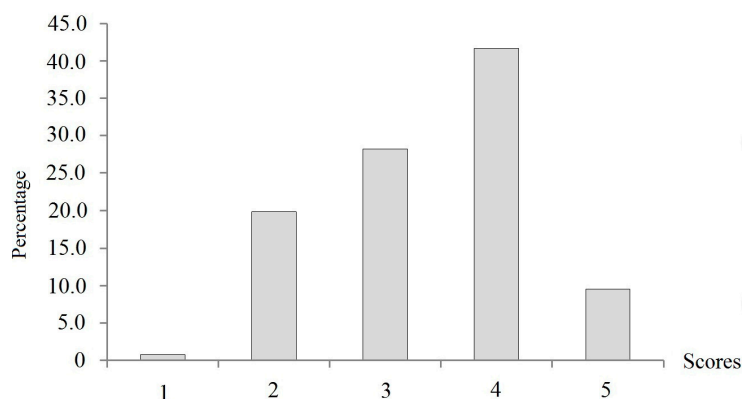


Figure 2. Proportion of the willingness of farmers to participate in the transformation. Notes: 1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; and 5 = strongly agree.

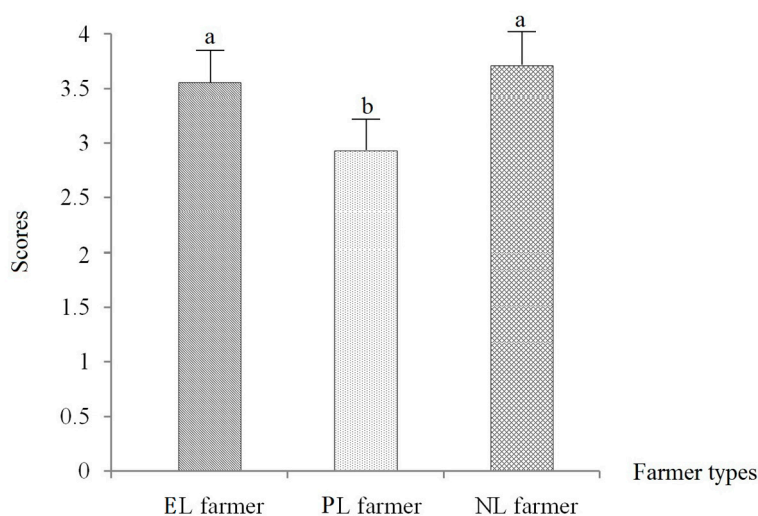


Figure 3. Willingness of different farmer types to participate in the transformation. Notes: 1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; and 5 = strongly agree. Values with different superscript letters in a row indicate significant differences at $p < 0.05$, and $a > b$ [55,56].

3.3. Awareness of the Rural Residential Environment, Knowledge of the Residential Land-Use Policies and Awareness of the Consequences of the Transformation

The participants were more satisfied with the ecological environment of rural residential lands (3.60 ± 0.88) than public facilities (3.42 ± 0.84), residential planning (3.33 ± 0.81) and traffic in the residential area (3.44 ± 0.81), particularly NL farmers (3.92 ± 0.64). However, most farmers were dissatisfied with the rural residential environment (Table 5).

The participants were unfamiliar with the rural land-use policies. The NL farmers were more knowledgeable on the policies “one residential land for one household” and “residential land belongs to the village collective” than the EL and PL farmers. The participants rarely considered rural residential land as a national welfare (Table 6).

The majority of the participants agreed that transforming vacant rural residential land into cultivated land can protect and save farmland (4.26 ± 0.80) and increase their household income (3.82 ± 0.55). However, some of them believed that such transformation could neither contribute to social equality nor guarantee national food security; these farmers were also anxious about acquiring new residential land whenever needed. The NL farmers believed that the transformation could guarantee national food security (3.61 ± 0.78); and the level of such belief was higher than that of the EL (3.01 ± 0.99) and PL (2.92 ± 1.09) farmers. The EL farmers possessed positive views toward “newly established families acquire residential lands” than NL farmers (Table 7).

Table 5. Awareness of the rural residential environment (mean \pm SD).

Questionnaire Items	Types of Farmers			Mean
	Entirely Living on Farming ($n = 76$)	Partly Living on Farming ($n = 87$)	Not Living on Farming ($n = 90$)	
Public facilities	3.71 ± 0.94^a	3.39 ± 0.81^b	3.19 ± 0.75^b	3.42 ± 0.84
Ecological environment	3.54 ± 1.02^b	3.43 ± 1.04^b	3.92 ± 0.64^a	3.60 ± 0.88
Residential planning	3.72 ± 0.65^a	3.13 ± 0.83^b	3.20 ± 0.79^b	3.33 ± 0.81
Traffic of residential area	3.79 ± 0.68^a	3.36 ± 0.95^b	3.23 ± 0.67^b	3.44 ± 0.81
Cronbach's α	0.716			

Notes: The mean values of the scores in the table ranging from a scale of 1 to 5, with 1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, and 5 = strongly agree. Values with different superscript letters in a row indicate significant differences at $p < 0.05$, and $a > b$ [54,55].

Table 6. Knowledge of the residential land-use policy (mean \pm SD).

Questionnaire Items	Types of Farmers			Mean
	Entirely Living on Farming ($n = 76$)	Partly Living on Farming ($n = 87$)	Not Living on Farming ($n = 90$)	
One residential land for one household	3.33 ± 0.96^b	3.34 ± 0.97^b	3.71 ± 0.85^a	3.50 ± 0.94
Residential land belongs to village collective	3.32 ± 0.82^b	3.29 ± 0.93^b	3.59 ± 0.72^a	3.40 ± 0.83
Residential land is national welfare for farmers	3.01 ± 0.72	2.92 ± 0.93	3.00 ± 0.84	2.98 ± 0.84
Cronbach's α	0.795			

Notes: The mean values of the scores in the table used a scale ranging from 1 to 5, with 1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; and 5 = strongly agree. Values with different superscript letters in a row indicate significant differences at $p < 0.05$, and $a > b$ [54,55].

Table 7. Awareness of the consequence of transforming vacant rural residential land into cultivated land (mean \pm SD).

Questionnaire Items	Types of Farmers			Mean
	Entirely Living on Farming ($n = 76$)	Partly Living on Farming ($n = 87$)	Not Living on Farming ($n = 90$)	
Protect and save farmlands	4.24 ± 0.76	4.21 ± 0.79	4.32 ± 0.85	4.26 ± 0.80
Embody social equality	3.16 ± 0.82	2.94 ± 0.59	3.04 ± 0.91	3.04 ± 0.79
Guarantee national food security	3.01 ± 0.99^b	2.92 ± 1.09^b	3.61 ± 0.78^a	3.09 ± 1.00
Increase household income	3.86 ± 0.48	3.78 ± 0.62	3.83 ± 0.53	3.82 ± 0.55
Newly established families can easily acquire residential land	3.21 ± 0.59^a	$3.16 \pm 0.75^{a,b}$	2.92 ± 0.75^b	3.09 ± 0.72
Cronbach's α	0.817			

Notes: The mean values of the scores in the table ranging from a scale of 1 to 5, with 1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; and 5 = strongly agree. Values with different superscript letters in a row indicate significant differences at $p < 0.05$, and $a > b$ [54,55].

3.4. Relationship between Willingness to Transform Vacant Rural Residential Lands into Cultivated Lands, and the 12 Factors amongst the Three Types of Farmers

Correlation and path analyses were performed to examine the variables that affect the willingness of farmers to transform their vacant rural residential lands (Table 8, Figures 4–6). These factors varied across types of farmers. KRP, NVRP, ACT and family size strongly and directly affected the WTC of EL farmers. ARRE, KRP, household income and LRVT exerted a strong direct effect on the WTC of PL and NL farmers. The effects of these factors on the WTC of farmers were classified into direct and indirect coefficients through path analysis. Family size negatively affected the WTC of EL farmers (path coefficient = -0.207), whilst ARRE strongly and negatively affected the WTC of PL (path coefficient = -0.357) and NL farmers (path coefficient = -0.335). The other key factors significantly contributed to the WTC of these farmers. Amongst these factors, KRP was a common factor that affected the EL, PL and NL farmers (path coefficient = 0.384 , 0.222 and 0.334 , respectively) (Figures 4–6).

Table 8. Relationship between the willingness to transform vacant rural residential lands into cultivated lands and the 12 factors amongst the three types of farmers.

Factors	Types of Farmers		
	Entirely Living on Farming (n = 76)	Partly Living on Farming (n = 87)	Not Living on Farming (n = 90)
Gender	0.078	0.018	-0.019
Age (years)	-0.060	-0.001	-0.092
Education (years)	-0.003	0.001	0.075
Household income (USD/year)	-0.097	0.239 *	0.217 *
Family size	-0.266 *	-0.106	0.030
The number of residential plots (NRP)	0.150	0.168	0.075
Total area of the residential lands (m ²)	0.141	-0.207	0.024
The number of vacant residential plots (NVRP)	0.275 *	0.252 *	0.105
Length of residential land vacant time (LRVT) (years)	0.117	0.239 *	0.222 *
ARRE	0.049	-0.312 **	-0.310 **
KRP	0.366 **	0.230 *	0.235 *
ACT	0.263 *	-0.037	-0.191

Notes: ARRE denotes awareness of the rural residential environment, KRP denotes knowledge of the residential land-use policy and ACT denotes awareness of the consequences of transforming vacant rural residential lands into cultivated lands. * $p < 0.05$; ** $p < 0.01$.

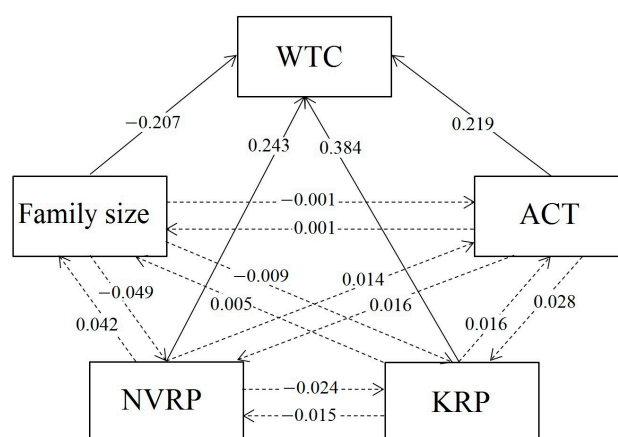


Figure 4. Results of the path analysis of factors affecting the WTC of EL farmers. The solid and dotted arrows denote the direct and indirect effects, respectively.

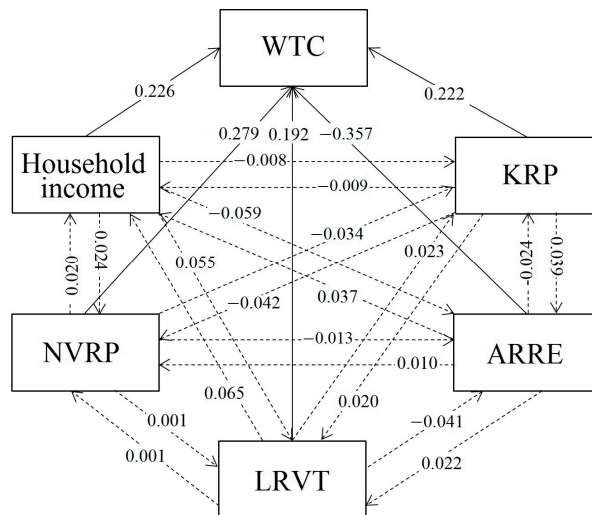


Figure 5. Results of the path analysis of factors affecting the WTC of PL farmers. The solid and dotted arrows denote the direct and indirect effects, respectively.

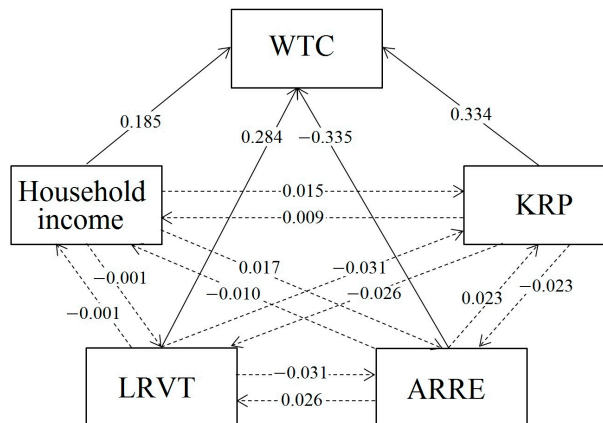


Figure 6. Results of the path analysis of factors affecting the WTC of NL farmers. The solid and dotted arrows denote the direct and indirect effects, respectively.

4. Discussion

Only around 50% of the farmers who own vacant residential lands were willing to transform their vacant residential lands into cultivated lands. Those farmers who were partly living on farming had a lower willingness to transform their residential lands than those who entirely and were not living on farming. Therefore, the willingness of farmers to transform their residential lands is dominantly influenced by their types. In this case, the differences in the characteristics of these farmers must be considered by the authorities before transforming vacant residential lands into cultivated lands.

Household income and length of residential land vacant time positively affected the willingness of farmers who were partly and were not live on farming. Over the past two decades, the farmers in China have continued to migrate to urban areas to earn high incomes [18] but have failed to convert themselves into urban citizens because of the stringent household registration system. These farmers consider permanent settlement in urban areas as a milestone that can improve their status and identity [56]. Nevertheless, the household registration system of China has changed over the years. For instance, those farmers who have purchased commercial housing may be converted into urban citizens in many cities. Meanwhile, those farmers who partly and were not living on farming yet have a high household income could be converted into citizens through purchased commercial housing and

reside in cities. The length of residential land vacant time is another positive factor for those farmers who were partly and were not living on farming. A residential land that has been vacant for a long time may not be reused by farmers. Family size negatively affected the willingness of those farmers who were entirely living on farming. Therefore, these farmers must check whether their residential land is sufficient for their families.

The number of vacant residential plots significantly affected those farmers who were entirely and partly living on farming. Those farmers who own more than one plot of vacant residential land showed a high willingness to transform their vacant residential lands. In the rural residential land consolidation experimental regions in China, to improve the enthusiasm of farmers towards the transformation, the local government provided farmers with economic compensation for their demolished residential lands [26,57]. Thus, these farmers were also informed that they would receive equivalent compensation for their transformation. Superfluous vacant residential lands are of little use to those farmers who are entirely and partly living on farming. Therefore, these farmers demand for compensation from the local government to increase their family income. Upon believing that the transformation will not harm the benefit of their household, these farmers willingly participated in the transformation [58]. Therefore, their awareness of the consequences of the transformation can improve their willingness to participate in this process.

The knowledge of residential land-use policies positively affected the three types of farmers. Different provinces adopt various residential land-use policies which are based on “the Land Administration Law of the People’s Republic of China” [59]. In Chapter IV, it demonstrated that such a law applies to the system of compensation for the use of cultivated land for other purposes as well as encourages the consolidation of the rural area to increase the area of the cultivated land. The residential land-use policies published with the same cores emphasized the “residential land belongs to the village collective”, “one residential land for one household” and “residential land is a national welfare for farmers” [60]. The Rural Residential Land Management Regulation of Henan Province illustrated these in Article 4, 12, 8, and 13. The department of land and resources of Henan Province implements such a policy in a top-down manner. Each household in register system was allowed to obtain one plot residential land with low price. In Article 4 of the Rural Residential Land Management Regulation of Henan Province, farmers have right to use the residential land, but have no right to sale the land. When the farmers violate these rules, they are then requested to dismantle the buildings attached to the lands and return the plot land to the village collective in accordance with Article 18. However, the basic level governments (county and town) do not strictly follow such policies, thereby driving some households to own one more residential land apart from their original plots.

Although the Chinese central and provincial governments constantly emphasize land-use policies, the majority of the farmers are still unfamiliar with these policies. We found that the residential lands might be vacant for years in our research areas and a communication gap exists between the farmers and the government even through Article 37 of ‘The Land Administration Law of the People’s Republic of China’ regulates that all units and individuals are forbidden to leave cultivated land unused or let it go to waste. Therefore, the publicity and transparency of the land-use policy must be improved to eliminate the communicate gap and increase the willingness of farmers to participate in the transformation.

Undeniably, the policies have important functions in controlling the sprawl of residential land. However, with the transformation of livelihood of farmers, it generated many vacant residential lands inversely. Our research confirms limitations of Article 39 of “the Land Administration Law of the People’s Republic of China” and the Rural Residential Land Management Regulation of Henan Province, because they didn’t refer to the vacant residential land reclamation. Thus, the policies must be supplemented. Transformation of residential land combines with the policies “one residential land for one household” and “residential land belongs to the village collective” would be necessary for the protection to cultivated land.

The awareness of the consequences of the transformation significantly and positively affected the willingness of those farmers who were entirely living on farming. Given that these farmers live in villages all year round, they are directly influenced by the transformation. These farmers demonstrate an increased willingness to participate in the transformation upon perceiving the benefits of such process [57].

The awareness of the rural residential environment refers to the satisfaction of farmers with their village living environment. Such satisfaction can be interpreted as a hometown complex or a belonging to the hometown. Although farmers live and work in the urban region for many years, they may come back to rural villages to spend their retirement years [61]. Therefore, such awareness negatively affected the willingness of those farmers who were partly and not living on farming. Although these two types of farmers infrequently use their residential lands, they consider the possibility of reusing such lands when they return from the urban region to the village. Improving the awareness of farmers about their urban environment may improve their sense of belonging to urban areas. Revising the household registration and social security policies in China can also enhance the sense of belongingness of farmers to urban areas.

Farmers are generally anxious about losing their residential lands and have communication gaps with their local governments (provinces, counties and towns). Although the “one residential land for one household” policy has been in effect for many decades, several rural households still own more than one plot of residential land because of the loose implementation of such policy at the local level. However, the rural residential land policy has become increasingly strict over the past years, and farmers are often limited when acquiring new residential lands for their families. In addition, the commercial housing prices in the urban areas of China have increased dramatically since 2000 to the extent that they have become unaffordable to farmers [56]. Commercial housing price is an important factor that influences the rural–urban settlement decisions of migrants [57]. Therefore, the anxiety of farmers about residential land loss is understandable. Most farmers are unfamiliar with the residential land-use policy, which is conveyed in a top-down manner. The communication gaps between farmers and the local governments have resulted in the low awareness of the consequences of land transformation. Several measures must be adopted to eliminate such anxiety, including the strict execution of the “one residential land for one household” policy whilst ensuring that each household can acquire a plot of residential land when needed. Improving the communication between farmers and local governments can eliminate the communication gaps and relieve the anxiety of farmers about their residential lands loss.

5. Conclusions

Understanding the willingness of farmers to transform their vacant rural residential lands into cultivated lands is crucial to protect cultivated land and guarantee food security in China. Only half of the farmers in this study were willing to participate in the transformation. The key factors that influence such willingness varied across different types of farmers. The unwillingness of farmers has been mainly attributed to their unfamiliarity with related policies, reluctance to change their living environment, low household income, large families, anxiety about residential land loss and their lack of communication with the government. The following interventions are proposed to increase the willingness of farmers to participate in the transformation: (1) the publicity and transparency of the rural residential land-use policy must be enhanced to provide farmers with sufficient knowledge about such policy; (2) the communication between farmers and the government could eliminate the gaps between them and to relieve the anxiety of farmers about losing their residential lands; and (3) the differences amongst different types of farmers must be considered when formulating a mechanism for transforming vacant residential lands into cultivated lands. The household registration policy and social security policies may also be revised to enhance the sense of belongingness of PL and NL farmers in urban areas and increase their willingness to participate

in the transformation. Securing the benefits of farmers from the transformation may also increase the willingness of PL farmers to participate in the transformation.

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