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Study on Farmers' Willingness to Maintain the Sloping Land Conversion Program in Ethnic Minority Areas under the Background of Subsidy Expiration

Chen Chen [1], Hui Xiao [1], Qiuju Wang [2] and Liqun Wang [1,*]

[1] School of Economics and Management, Beijing Forestry University, Beijing 100083, China
[2] Chinese Academy of Forestry, Beijing 100091, China
* Correspondence: wlq@bjfu.edu.cn

Abstract: The sloping land conversion program (SLCP) is one of the most important payment for ecosystem services (PESs) in the world, as direct stakeholders and the final implementers of the SLCP, farmers' willingness to maintain the achievements is the basis for the consolidation and sustainable operation of the SLCP. Based on a survey of 975 farmers in Hunan Province, Gansu Province, and the Ningxia Hui Autonomous Region, this study used the elastic net model to accurately select the influencing factors of farmers' willingness to maintain the SLCP and the logit model to measure these factors. Finally, combined with the interpretative structural model (ISM), we further analyzed the hierarchical structure of each significant influencing factor. The main results are as follows. Firstly, off-farm employment, whether the head of the household is a village cadre, labor number, land area, income level, subjective norms from the organization, altruistic rationality, active ability, and policy perception had significant and positive impacts on farmers' willingness to maintain the SLCP. In contrast, whether the head of the household is an ethnic minority and the expiration of the SLCP subsidy had significant and negative impacts on farmers' willingness to maintain the SLCP. Secondly, the factors affecting farmers' willingness to maintain the SLCP are at different levels, being both independent and interrelated. Among them, the deep-rooted factors are whether the head of the household is an ethnic minority, the expiration of the SLCP subsidy, the labor number, and whether the head of the household is a village cadre. Based on the above results, government departments should broaden the income channels of farmers in ethnic minority areas, strengthen the publicity to maintain the SLCP in ethnic minority areas, and improve the SLCP's follow-up policy to enhance the farmers' willingness to maintain the SLCP and ensure the program's sustainability.

Keywords: ecosystem service; SLCP; subsidy policy

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1. Introduction

As the payment for ecosystem service (PES) with the largest investment scale, the widest coverage, and the highest participation of farmers in the world, the Sloping Land Conversion Program in China (SLCP, also known as the "Grain for Green" or "Returning Farmland to Forest Program") has made remarkable ecological, economic, and social achievements, since its implementation in 1999 [1–3]. In the past 20 years, China has returned a total of 34.33 million hectares of farmland to forests, accounting for more than 4% of the global greening area in the same period. However, the remarkable achievements brought by the SLCP also bring new tests and challenges to the consolidation of these achievements and the follow-up work of the program. Previous studies have shown that only 59.5% of farmers have a clear willingness to maintain the achievements of the SLCP in survey samples from 17 provinces, municipalities, and autonomous regions in China [4]. Maintaining the achievements of the SLCP holds great significance for whether the program can continue to provide ecological, economic, and social benefits (The People's Republic of China: Opinions of the CPC Cen-

tral Committee and the State Council on Comprehensive Advancement of Rural Vitalization and Speed Up the Modernization of Agriculture and the Countryside, http://www.moa.gov.cn/xw/zwdt/202102/t20210221_6361863.htm, accessed on 13 September 2022). Therefore, it is necessary to explore how to consolidate the achievements of the SLCP and promote the sustainable operation of the SLCP.

As participants and implementers of PESs [5], farmers' willingness to maintain the achievements of such programs is the basis for the consolidation and sustainable operation of PESs [6–8]. Since the implementation of the SLCP in China, farmers' willingness to maintain its achievements has attracted wide attention from the academic community [9–11]. Most studies on the influencing factors of farmers' willingness to maintain the SLCP are from the perspectives of farmers' age, gender, education level, labor number, employment situation, income level, ecological perception, and subjective norms, and they have reported a large number of useful findings, but there are still the following areas to be improved.

First, at present, the first round of the subsidy policy of the SLCP has largely expired in China. Farmers may adjust their livelihood and land use strategies if they lose the subsidy income, thus making their willingness to maintain the achievements uncertain. This uncertainty makes it difficult to effectively guarantee the sustainability of the program after the subsidy expires [12,13]. Therefore, it is very important to pay attention to farmers' willingness to maintain the achievements of the program after the subsidy expires to consolidate the achievements and the establishment of long-term mechanisms for the SLCP. However, the existing literature has mainly focused on farmers' willingness to maintain the SLCP during the first or new round of the subsidy period, and few studies have focused on the impact of the expiration of the first round of subsidies on farmers' willingness to maintain the SLCP.

Second, China's ethnic minority areas are mostly located in ecologically fragile areas and contiguous poor areas targeted by the SLCP, which occupy an important position in the SLCP [14]. Due to the constraints of natural conditions and other development elements, as well as the comprehensive influence of ethnic characteristics in terms of cultural customs and the production mode [15,16], the adjustment of livelihood strategies is more difficult for ethnic minority farmers than for Han farmers, and they are more dependent on land income [17]. This difficulty may lead to decisions that are not conducive to maintaining the achievements of the SLCP. Therefore, it is very important to focus on and study farmers' willingness to maintain the SLCP in ethnic minority areas, in order to understand the real needs of ethnic minority farmers promptly and carry out follow-up targeted policies for SLCP design. However, the ethnic characteristics of farmers are mostly ignored in the current literature on the willingness to maintain the SLCP, and empirical studies on farmers in ethnic minority areas are still relatively scarce.

In addition, a review of the literature shows that most studies on farmers' willingness to maintain subjectively selected variables based only on the existing theory and the convenience of data acquisition and fail to use an objective method to select variables before the regression analysis, which may lead to the consideration of too many influencing factors in the model and low precision of the model's estimation. Moreover, after the regression analysis, most studies stop discussing the influencing factors of significance and lack an in-depth excavation of the hierarchical structure among the influencing factors.

Based on the above analysis, this study, based on cross-sectional data of 975 farmers in Hunan Province, Gansu Province, and Ningxia Hui Autonomous Region, which are typical multiethnic areas with compact communities, used the elastic net model to accurately select the influencing factors of farmers' willingness to maintain the SLCP. Then, the logit model was used to measure the influencing factors. Finally, combined with the interpretative structural model (ISM), we further analyzed the hierarchical structure of each significant influencing factor. The conclusion and policy enlightenment will provide an important reference basis for consolidating the achievements of the SLCP, improving the follow-up policy, and promoting the reform of PESs.

In summary, the potential contributions of this paper and the reasons for its uniqueness are as follows. First, it addresses a different research background. In contrast to earlier studies on farmers' willingness to maintain the SLCP during the subsidy period, this paper takes the first round of subsidies' actual expiration as the background. It incorporates the expiration of subsidy as one of the influencing factors into the research framework, and explores and identifies the potential factors that may affect farmers' willingness to maintain the SLCP. Second, it broadens the research object. This paper takes farmers in ethnic minority areas as the research object, which enriches the empirical research on the farmers' willingness to maintain the SLCP. Third, it enhances the research's depth. In this paper, the elastic net model is first constructed to select the influencing factors. Then, the logit model is used to measure the selected influencing factors, and the ISM model is used to further analyze the hierarchical structure of the significant influencing factors to provide reasonable suggestions for policy making and consolidate the achievements of the SLCP.

2. Literature Review and Variable Selection

Research on farmer economies and the growth of agriculture and rural areas is heavily based on the decision-making of farmers. In reality, the different decision-making behaviors of farmers directly or indirectly affect the basic direction of agricultural development and the macro policies in rural areas to different degrees, and their willingness has an important predictive effect on behavior [18]. The academics have, therefore, been very focused on farmers' willingness as a key component of the research on farmers' behavior. Among them, there are some relevant theories and empirical analyses of farmers' willingness to protect the ecological environment. The SLCP that started in China at the end of the last century is an important PES, with a large investment scale and a high participation of farmers. The consolidation of the achievements of the SLCP has been highly concerned by the government and academic circles [9–11]. Therefore, farmers' willingness to maintain the SLCP has become a significant and persistently contentious issue in academics. The theory of reasoned action, farmer behavior theory, and the theory of planned behavior are generally considered the theoretical bases for exploring the influencing factors of farmers' willingness to maintain the SLCP [10,19]. Specifically, the factors that affect farmers' willingness to maintain the achievements of the SLCP can be divided into objective factors and subjective factors: on the one hand, farmers' willingness to maintain the SLCP is usually a rational choice, based on the actual objective situation. The characteristics of the head-of-household, resource endowment characteristics, and participation situation significantly affect farmers' willingness to maintain the achievements [11,20]. On the other hand, according to the theory of planned behavior and the existing literature, subjective psychological factors, such as subjective norms (SNs), attitude toward behavior (AB), and perceived behavioral control (PBC), can act on farmers' willingness to maintain the achievements through external pressure and internal drive [10,21].

2.1. The Characteristics of the Head-of-Household

Women tend to think cautiously, avoid risks as much as possible in their actions, and maintain the achievements of the SLCP [4]. The land production and operation of elderly farmers are limited by the farmers' age and physical strength, and they prefer to realize the ecological and economic value of land through PES [22]. Due to the constraints of production mode, language, transportation, and other objective factors, it is difficult for ethnic minority farmers to achieve nonagricultural employment after participating in the SLCP, which makes them less enthusiastic about maintaining the achievements of the SLCP. The higher the educational level of the household head, the stronger the intention of adopting pro-ecological behavior [23]. Health status determines whether farmers are physically restricted, which has a direct impact on their willingness to maintain the achievements of the SLCP [24]. Farmers with off-farm employment are more likely to eliminate traditional agricultural operations and land path dependence and have stronger SLCP achievements [25]. As important supervisors of the smooth implementation of the

SLCP policy, village cadres are better able to respond to the call of the government and play a leading and demonstrating role in maintaining the achievements of the SLCP [19].

2.2. Resource Endowment Characteristics

The larger the labor force is, the more income sources there are, and the more likely a farming household is to maintain the achievements of the SLCP [26]. The larger the land area is, the stronger the intention to maintain the achievements of the SLCP [27]. Farmers with higher income levels generally have enough funds to cope with the corresponding costs of maintaining the achievements of the SLCP, so they are more inclined to adopt pro-environmental behaviors [28].

2.3. The Situation of Participation in the SLCP

The economic benefits generated by SLCP tree species belonging to ecological forests are usually low, and farmers have a low willingness to maintain the achievements of the SLCP [29]. The larger the scale of the farmland returned to the forest, the higher the sunk cost of policy withdrawal or default, and the stronger the willingness to maintain the achievements of the SLCP [30]. The expiration of SLCP subsidies makes farmers unable to continue to obtain income incentives from the SLCP, thus weakening their willingness to maintain SLCP achievements.

2.4. Theory of Planned Behavior

Subjective norms (SNs) refer to the social pressure farmers feel when implementing decisions. The greater the demonstration effect of relatives and neighbors in implementing forest protection behaviors is, and the stronger the organization and call of the government are, the more active the subjective norms of farmers and the stronger their willingness to implement forest protection behaviors [31]. Attitude toward behavior (AB) refers to the subjective judgment of farmers after they evaluate the implementation of a specific behavior. If farmers evaluate afforestation actions favorably (based on either an altruistic or egoistic rationality), their attitude toward the behavior will be positively driven, thus promoting their positive willingness [32]. Perceived behavioral control (PBC) refers to farmers' self-perception of how difficult it is to implement a specific behavior. If farmers believe that they have sufficient capacity and are in a positive policy environment, the stronger the perceived behavioral control is, and the stronger they intend to voluntarily engage in conservation initiatives [21].

In summary, the following possible factors that affect farmers' willingness to maintain the SLCP achievements were selected through literature review and theoretical analysis (Table 1).

Table 1. Variable selection of farmers' willingness to maintain the SLCP.

Independent Variable (Influencing Factor)	Dependent Variable	Study Region	Research Object	Researchers
Gender	Land reconversion willingness of the SLCP	17 provinces (municipalities, autonomous regions), China	Farmer households	Chen et al. [4]
Age	The participating willingness of the filter strip program	Michigan, United States	Agricultural landowners	Yeboah et al. [22]
Ethnic	—	—	—	—
Level of education	Pro-ecological intentions after ecological rehabilitation	Loess Plateau region of China	Farmer households	Deng et al. [23]
Health status	Land reconversion willingness of the SLCP	17 provinces (municipalities, autonomous regions), China	Farmer households	Chen et al. [24]
Off-farm employment	Maintaining the willingness of the SLCP	Xinjiang Autonomous Region, China	Farmer households	Zhang [25]

Table 1. *Cont.*

Independent Variable (Influencing Factor)	Dependent Variable	Study Region	Research Object	Researchers
Village cadre	The participating willingness of the SLCP	Yunnan Province, China	Farmer households	Jin et al. [19]
labor number	Cropland abandonment behavior of the SLCP	Anhui Province, China	Farmer households	Zhang et al. [26]
land area	The participating willingness of the SLCP	Inner Mongolia Autonomous Region, China	Farmer households	Guo et al. [27]
Income level	Pro-environmental behavior intention	Liaoning Province, China	Farmer households	Tang et al. [28]
Tree species	Maintaining the willingness of the SLCP	Chongqing, China	Farmer households	Yu [29]
Scale of the SLCP	Land reconversion willingness of the SLCP	Shaanxi Province, China	Farmer households	Ren and Li [30]
Expiry of SLCP subsidy	—	—	—	—
SNs (Subjective Norms)	Forest conservation intention	Chaco, Argentina	Landholders	Mastrangelo et al. [31]
AB (Attitude toward behavior)	Tree planting behavior	Malawi	Smallholder farmers	Meijer et al. [32]
PBC (Perceived behavioral control)	The intention to restore native areas	Brazil	Landowners	Lima and Bastos et al. [21]

3. Methodology

3.1. Data Source and Variable Measure

We have selected Hunan, Ningxia, and Gansu provinces in China as the study areas of this paper. Hunan, Ningxia, and Gansu provinces are all located in China's key ecological function areas with many ethnic minorities. Hunan Province is located in the Yangtze River Basin (southern region), which is divided in the SLCP, while Ningxia Province and Gansu Province are located in the Yellow River Basin (northern region), which is divided in the SLCP. According to the China 2022 Regional Statistical Yearbook, Hunan Province has a GDP of 4606.31 billion yuan and a per capita disposable income of 18,300 yuan for farmers. Ningxia Hui Autonomous Region has a GDP of 452.231 billion yuan and a per capita disposable income of 15,300 yuan for farmers. Gansu Province has a GDP of 1024.33 billion yuan and a per capita disposable income of 11,400 yuan for farmers. The three regions were selected as the study areas for the following reasons. First, as the key regions in the implementation of the first round of the SLCP, these three regions have areas of 1.44 million hectares, 0.86 million hectares, and 1.90 million hectares cumulatively account for 14.11% of the total area of the first round of the SLCP (National Forestry and Grassland Administration, http://www.forestry.gov.cn/main/134/index.html, accessed on 13 September 2022). Second, in addition to Han individuals, these regions are inhabited by many ethnic minorities, mainly Hui, Miao, Dong, and Tujia, making them typical multiethnic areas with compact communities. Third, relative poverty is still prominent in these three regions, and the risk prevention and control situation of returning to poverty is severe [33].

We surveyed from July to August 2021 and used the multistage random sampling method. First, all counties (cities or districts) in Hunan Province, Gansu Province, and Ningxia Hui Autonomous Region were divided into three levels, according to per capita income: high, medium, and low. A total of 1–2 counties (cities or districts), where typical ethnic minorities live in compact communities (the sample counties (cities or districts) are Zhongfang county, Zhijiang county, Yuanling county, Guzhang county, and Huayuan county in Hunan Province; Yuanzhou district, Pengyang county, and Xiji county in Ningxia Hui Autonomous Region; Maiji district, Jingning county, and Zhuanglang county in Gansu

Province), were randomly selected from each group, and 2–3 townships (towns) in each sample county (city or district) were selected by the same standard. Then, 1–3 villages were randomly selected in each sample township (town), and 20–30 farmers were randomly selected in each sample village. Considering the farmers' level of education, the questionnaires were completed through household interviews. The investigators who conducted these interviews were either trained master's or doctoral students. Overall, 1040 questionnaires were distributed, and ultimately, 975 valid questionnaires were obtained after the eliminating of those with missing key information and irrelevant content. The effective response rate of the questionnaires was 93.75%. In addition, to further improve the accuracy of the Logit model and weaken the endogeneity caused by some variables that are difficult to quantify (such as hydrological conditions, geographical factors, agricultural production habits, and institutional characteristics), this paper introduces the village dummy variable to control the differences at the village level. The dummy variables for all villages were 0 or 1, and the first village was used as the reference group. Based on the analysis of literature review and variable selection, the definition, measurement, and expected direction (the expected direction is based on literature review and theoretical analysis to predict the influence direction (positive, negative, or uncertain) of each variable on the farmers' willingness to maintain the SLCP before empirical regression) are shown in Table 2.

Table 2. Descriptive statistics of the variables.

Variable Type	Variable	Definition	Measure	Mean	Standard Deviation	Expected Direction
Dependent variable	SLCP maintenance willingness	Whether to maintain the SLCP	1 = willing, 0 = unwilling	0.521	0.498	
Farmer characteristics	Gender	Farmer's gender	1 = male, 0 = female	0.868	0.339	−
	Age	Farmer's actual age in 2021	Actual numerical value	56.141	11.374	+
	Ethnic	Farmer's ethnicity	1 = ethnic minority, 0 = Han	0.272	0.386	−
	Level of education	Farmer's number of years of education	Actual numerical value	6.243	3.753	+
	Health status	Self-assessment of health status	1 = healthy, 0 = unhealthy	0.704	0.457	Uncertain
	Off-farm employment	Whether the household has an off-farm employment	1 = yes, 0 = no	0.499	0.500	+
	Village cadre	Whether the head of the household is a village cadre	1 = yes, 0 = no	0.087	0.392	+
Resource endowment characteristics	labor number	Number of household members in the labor force	Actual numerical value	2.732	1.246	+
	land area	The actual area of cultivated farmland (mu)	Actual numerical value	13.378	18.747	+
	Income level	The sum (logarithmic) of annual household income	Actual numerical value	9.812	2.588	+

Table 2. *Cont.*

Variable Type	Variable	Definition	Measure	Mean	Standard Deviation	Expected Direction
The situation of participation in the SLCP	Tree species	Tree species of the SLCP	1 = economic forests, 0 = ecological forests	0.238	0.426	+
	Scale of the SLCP	The actual area of the SLCP (mu)	Actual numerical value	8.114	11.672	+
	Expiry of SLCP subsidy	Whether the subsidy has expired	1 = expired, 0 = unexpired	0.691	0.462	−
SN	Subjective norms from the individual	Frequency of communication with relatives and neighbors	1 = low, 2 = relatively low, 3 = neutral, 4 = relatively high, 5 = high	4.112	0.921	+
	Subjective norms from the organization	Strength of SLCP publicity from the government	1 = low, 2 = relatively low, 3 = neutral, 4 = relatively high, 5 = high	3.558	1.368	+
AB	Egoistic rationality	The improvement in family life, due to the SLCP	1 = not obvious, 2 = relatively not obvious, 3 = neutral, 4 = relatively obvious, 5 = obvious	3.324	1.029	+
	Altruistic rationality	The improvement in the ecological environment, due to the SLCP	1 = not obvious, 2 = relatively not obvious, 3 = neutral, 4 = relatively obvious, 5 = obvious	4.316	0.956	+
PBC	Active ability	Master the skills of managing and protecting the SLCP	1 = low, 2 = relatively low, 3 = neutral, 4 = relatively high, 5 = high	2.111	1.464	+
	Policy perception	Satisfaction with the SLCP policy	1 = dissatisfied, 2 = relatively dissatisfied, 3 = neutral, 4 = relatively satisfied, 5 = satisfied	3.634	1.201	+
Village characteristic variables		Hydrological conditions, geographical factors, agricultural production habits, institutional characteristics, etc.	1 = reference village, 0 = other	0.342	0.458	

Among the 975 valid questionnaires, 508 responses indicated that the households were willing to maintain the achievements of the SLCP. In terms of the gender of the household head, the sample farmers were mainly male, accounting for 86.77%. Regarding the age of the head-of-household, the distribution was concentrated between 50 and 60 years old, with an average of 56.14 years old. From the perspective of ethnic characteristics, ethnic minorities accounted for approximately 27.18%. From the perspective of education level, the average length of education was 6.24 years, which indicates that most farmers have been educated in primary school or below, and the overall level of education of farmers was low. In terms of off-farm employment, nearly half of farmers had off-farm employment, indicating that most farmers choose to work nearby or out to expand their income channels. In terms of the labor number, most households had a labor force of 2~3 people, with an average of 2.73 people. In terms of the land area, the average land area was 0.89 hectares, which indicates that the farmers in the survey area have a relatively small operation scale and a relatively low degree of land intensification. In terms of the above indicators, the results of this survey are essentially consistent with previous studies and official statistical data (Economic Development Research Center of State Forestry Administration, Department of Development Planning and Fund Management of State

Forestry Administration: A report for monitoring and assessment of the socioeconomic impacts of China's key forestry programs (2017), http://www.stats.gov.cn/tjsj/tjgb/nypcgb/, accessed on 13 September 2022), indicating that the results of this survey are representative to a certain extent.

3.2. Model

3.2.1. Elastic Net Model

There are many influencing factors of farmers' willingness to maintain the SLCP. To more scientifically and accurately select the influencing factors, the elastic net model is first used. The elastic net model is the dynamic combination of the least absolute shrinkage and selection operator (LASSO) model and the ridge regression model [34], which can effectively overcome the defects of the lasso model and ridge regression model in variable compression and feature selection [35,36] and uses the L1 norm and L2 norm to select variables, combining the advantages of the two models and making the model more explanatory and predictive. The specific model formula is as follows:

$$\hat{\beta}_{Net} = argmin\left\{\sum_{i=1}^{n}\left[(y_i - b_0 - \sum_{j=1}^{q} b_j x_{ij})^2\right] + \lambda(1-\alpha)\sum_{j=1}^{q}|b_j| + \lambda\alpha\sum_{j=1}^{q} b_j^2\right\} \quad (1)$$

where y_i represents the willingness of farmer i to maintain the achievements of the SLCP; x_{ij} represents influencing factor j that affects the willingness of farmer i to maintain the achievements of the SLCP; n represents the sample size of farmers; q represents the number of influencing factors; b_0 represents the constant term in the least squares regression; b_j represents the estimated coefficient of influencing factor j; λ represents the penalty parameter ($\lambda \geq 0$); α controls the proportion of the LASSO regression and the ridge regression in the elastic net model ($0 \leq \alpha \leq 1$); $\sum_{i=1}^{n}\left[\left(y_i - b_0 - \sum_{j=1}^{q} b_j x_{ij}\right)^2\right]$ represents the error of the least squares estimate, where the smaller the error is, the more accurate the model estimation; and $\lambda(1-\alpha)\sum_{j=1}^{q}|b_j|$ represents the penalty term L1 norm of the LASSO regression, which was used to control the number of influencing factors in the model. Influencing factors with an estimated coefficient b_j of 0 were removed. $\lambda\alpha\sum_{j=1}^{q} b_j^2$ represents the L2 norm of the penalty term of the ridge regression, which was used to reduce the variance in the estimated value to improve the prediction accuracy of the model.

3.2.2. Logistic Model

Since it is impossible to directly observe the willingness of farmers to maintain the achievements of the SLCP, this paper uses the item "whether you are willing to maintain the achievements of the SLCP" to represent the variables, based on the practice of existing literature [11]. Therefore, the logit model is selected to empirically analyze the influencing factors. The specific model formula is as follows:

$$y_i = logit(p_i) = ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \sum_{j=1}^{q}\beta_j x_j + \varepsilon \quad (2)$$

where p_i represents the probability of the willingness of farmer i to maintain the achievements of the SLCP; β_0 represents the intercept term; β_j represents the estimated coefficient of influencing factor x_j; q represents the number of influencing factors; and ε represents the random error term.

3.2.3. Interpretative Structural Model (ISM)

To further investigate the hierarchical structure among the significant influencing factors of farmers' willingness to maintain the SLCP, ISM was introduced in this paper, and a hierarchical structure chart was constructed. ISM is an effective tool for exploring

the hierarchical structure between various factors in a system [37]. The specific analysis process is described below.

First, an adjacency matrix R between factors is constructed. It is assumed that there are K factors that significantly affect farmers' maintenance willingness to maintain the SLCP, S_0 represents farmers' willingness to maintain the SLCP, S_i (S_j) represents significant factor i (j), and element r_{ij} in adjacency matrix R is defined based on Equation (3):

$$r_{ij} = \begin{cases} 1, \ S_i \ is \ related \ to \ S_j \\ 0, S_i \ has \ nothing \ to \ do \ with \ S_j \end{cases} \quad (i = 0, 1 \ldots, k; j = 0, 1 \ldots, k) \tag{3}$$

Second, the reachability matrix M between the factors is determined. The formula is as follows:

$$M = (R + I)^{\lambda+1} = (R + I)^{\lambda} \neq (R + I)^{\lambda-1} \neq \ldots \neq (R + I)^2 \neq (R + I) \tag{4}$$

where I represents the unit matrix, and $2 \leq \lambda \leq k$, and the Boolean operation rule is used in the power operation of the matrix.

Third, the level of each factor L_i, reachable set $P(S_i)$, and predecessor set $Q(S_i)$ are determined. The formulas are as follows:

$$P(S_i) = \left\{ S_i \middle| m_{ij} = 1 \right\}, Q(S_i) = \left\{ S_i \middle| m_{ji} = 1 \right\} \tag{5}$$

$$L_i = \{ S_i | P(S_i) \cap Q(S_i) = P(S_i); i = 0, 1, \ldots, k \} \tag{6}$$

where $P(S_i)$ represents the set of factors corresponding to the column of all matrix factors 1 in row S_i; $P(S_i)$ represents the set of factors corresponding to the row of all matrix factors 1 in column S_i; and both m_{ij} and m_{ji} represent factors in the reachable matrix.

Finally, after determining the highest level L_1 and its influencing factors based on Equation (6), the factors in each level are determined from high to low. Based on the factor order of L_i, the reordered reachable matrix M^* is obtained, so that the corresponding factors are at the same level. The hierarchical structure of each influencing factor can be obtained by connecting the factors at the same and adjacent levels with directed arrows.

4. Model Estimation Results

4.1. Selected Results of the Elastic Net Model

In this paper, the samples were randomly selected and divided into a training set and a test set, at a ratio of 7:3. The elastic net model was constructed to select the influencing factors of the willingness to maintain the achievements of the SLCP selected above, and then the accuracy of the model was verified through comparison with the relative error prediction results of the training set and test set of the LASSO and ridge regression models.

4.1.1. The Coefficient Path

The coefficient path can directly reflect the selection of variable coefficients in the model. Figure 1 shows the coefficient path of the willingness to maintain the SLCP. Figure 1a is the coefficient path for the selected variables as a function of the norm, and Figure 1b is the coefficient path for the selected variables as a function of λ. It can be seen from the figure that, as the norm decreases (or λ becomes larger), the number of influencing factors included in the model gradually decreases, and that unimportant variables are filtered out, while important variables are retained.

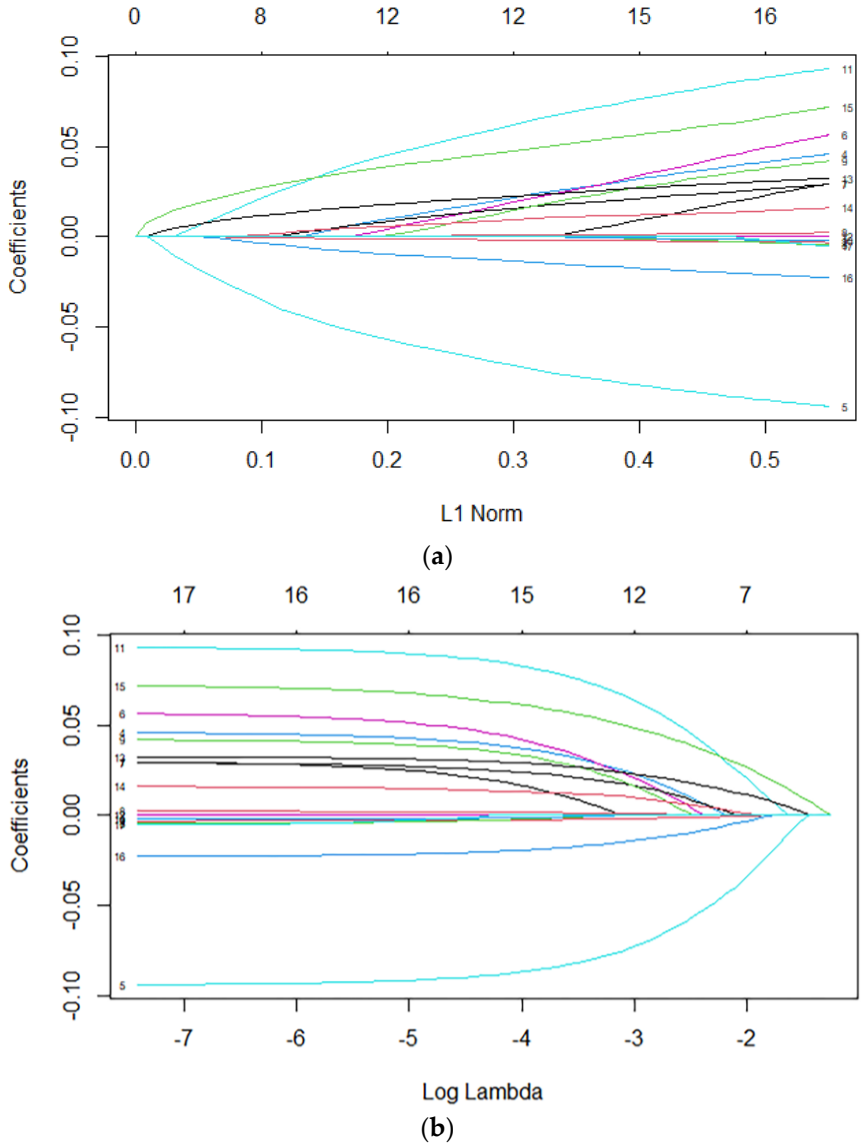

Figure 1. The coefficient path of the willingness to maintain the SLCP. (**a**) the coefficient path for the selected variables as a function of the norm. (**b**) the coefficient path for the selected variables as a function of λ.

4.1.2. Selection Results of the Influencing Factors of the Willingness to Maintain the SLCP

The elastic net model was used to select 15 variables from 19 possible factors influencing the willingness to maintain the SLCP. The selection results are shown in Table 3. To further test the accuracy of the selection results of the elastic net model results, this paper adopts the LASSO, ridge regression, and elastic net methods to predict the data of the test set and training set and calculates the relative error mean value (due to space limitations, the results are not presented). The results show that the elastic net model had the smallest error prediction, followed by the LASSO model and ridge regression model. Therefore, it is more robust to select the results of the elastic net model for analysis in this paper, and the selected variables were taken as the key factors influencing the willingness to maintain the SLCP for subsequent analysis.

Table 3. Selection results of the elastic net model.

Variable Type	Variable	SLCP Maintenance Willingness
Farmer characteristics	Gender	0
	Age	−0.002
	Ethnicity	−0.008
	Level of education	0
	Health status	0
	Off-farm employment	0.056
	Village cadre	0.021
Resource endowment characteristics	Labor number	0.017
	Land area	0.001
	Income level	0.006
The situation of participation in the SLCP	Tree species	0.017
	Scale of the SLCP	0
	Expiry of SLCP subsidy	−0.064
SN	Subjective norms from the individual	0.009
	Subjective norms from the organization	0.037
AB	Egoistic rationality	0.009
	Altruistic rationality	0.048
PBC	Active ability	0.015
	Policy perception	0.007
Cons		0.486

4.2. Regression Results of the Logit Model

Based on the selected results of the elastic net model, this paper constructs a logit model for the regression analysis to explore the influencing factors of the willingness to maintain the SLCP. After checking for multicollinearity, it was found that the variance inflation factors were all below 5, far less than the critical value of 10. Therefore, the problem of multicollinearity in the model can be excluded. The specific regression results are shown in Table 4.

Table 4. Regression results of the logit model.

Variable Type	Variable	SLCP Maintenance Willingness
Farmer characteristics	Age	−0.079 (−0.663)
	Ethnicity	−0.242 *** (3.075)
	Off-farm employment	0.365 *** (2.688)
	Village cadre	0.175 * (1.921)
Resource endowment characteristics	Labor number	0.173 *** (3.063)
	Land area	0.007 * (1.924)
	Income level	0.183 *** (6.436)
The situation of participation in the SLCP	Tree species	0.132 (0.827)
	Expiry of SLCP subsidy	−0.267 *** (−3.771)
SN	Subjective norms from the individual	0.127 (−0.293)
	Subjective norms from the organization	0.126 *** (3.567)
AB	Egoistic rationality	0.105 (1.404)
	Altruistic rationality	0.224 ** (2.433)
PBC	Active ability	0.127 *** (2.741)
	Policy perception	0.119 * (1.942)
Village characteristic variables		—
Cons		0.421 *** (3.096)
Log likelihood		−265.027
Number of obs		975
Pseudo R^2		0.254
X^2		39.24
p		0.000

Note: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$, z in parentheses.

As can be seen from the regression results in Table 4, ethnicity, off-farm employment, whether the head of the household is a village cadre, the labor number, the land area, the income level, the expiration of the SLCP subsidy, the subjective norms from the organization, the altruistic rationality, active ability, and policy perception have a significant influence on farmers' willingness to maintain the SLCP. These results are basically consistent with the conclusions of some existing research [19,21,25–27].

In addition, age, tree species, subjective norms from individuals, and egoistic rationality have no significant effect on the willingness of farmers to maintain the achievements of the SLCP. These results are inconsistent with the conclusions of existing research and the expectations of this paper. The following are some potential causes: (1) The majority of the sample farmers fall into the middle and older age brackets; the age gap is modest, and its impact on the model is not immediately apparent. (2) The deep-rooted tree species were dominant in the first round of the SLCP ecological forest of the sample region. Considering the high costs of manpower and money needed to completely eradicate the roots, the willingness of farmers will not be affected by whether it is ecological forest or economic forest species. (3) Most of the communication activities between traditional Chinese farmers and their relatives and neighbors occur after meals [38], and there is less information available about the SLCP, or even agriculture, leading to a weak correlation between two variables. (4) Farmers believe that the improvement in well-being, due to the SLCP, is mainly reflected in the subsidy income brought by the policy. When most of the subsidies expired, the SLCP could no longer be the sample farmers' main source of income, insensitive of farmers' willingness to maintain the SLCP, from an egoistic perspective.

4.3. Analysis Results of the ISM

Based on the logit model regression results above, S_1 represents farmers' ethnicity, S_2 represents off-farm employment, S_3 represents whether the head of the household is a village cadre, S_4 represents the labor number, S_5 represents the land area, S_6 represents the income level, S_7 represents the expiration of the SLCP subsidy, S_8 represents subjective norms from the organization, S_9 represents the altruistic rationality, S_{10} represents active ability, and S_{11} represents policy perception. Based on theoretical analysis and expert opinions, the logical relationships between the factors are determined. As shown in Figure 2, *V* indicates that the factors in the rows have direct or indirect effects on the factors in the columns. *A* indicates that the factors in the columns have direct or indirect effects on the factors in the rows, and 0 indicates that the factors in the rows and columns have no mutual effects.

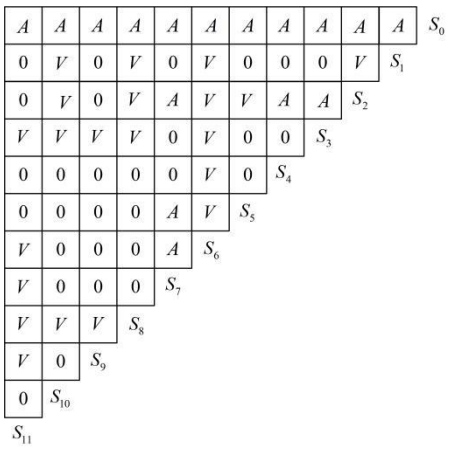

Figure 2. Logical relationship of the factors influencing farmers' willingness to maintain the SLCP.

Based on Figure 2 and Equation (3), the adjacency matrix *R* of each factor influencing farmers' willingness to maintain the SLCP can be obtained (due to space limitations, the

results are not presented here). Furthermore, based on Equation (4) and by using MATLAB software, the reachability matrix M can be obtained (Equation (7)).

$$M = \begin{array}{c} \\ S_0 \\ S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \\ S_6 \\ S_7 \\ S_8 \\ S_9 \\ S_{10} \\ S_{11} \end{array} \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \quad (7)$$

For the reachability matrix M, according to Equation (6), $L_1 = \{S_0\}$, $L_2 = \{S_{10}, S_{11}\}$, $L_3 = \{S_6, S_9\}$, $L_4 = \{S_5\}$, $L_5 = \{S_8\}$, $L_6 = \{S_2\}$, and $L_7 = \{S_1, S_3, S_4, S_7\}$ were determined. Finally, we reordered according to the above levels and obtained the reachability matrix M^* (Equation (8)).

$$M_2^* = \begin{array}{c} \\ S_0 \\ S_{10} \\ S_{11} \\ S_6 \\ S_9 \\ S_5 \\ S_8 \\ S_2 \\ S_1 \\ S_3 \\ S_4 \\ S_7 \end{array} \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \end{bmatrix} \quad (8)$$

To further observe the logical and hierarchical relationships among influencing factors, the ISM of influencing factors was obtained by using a directed arrow connection (Figure 3).

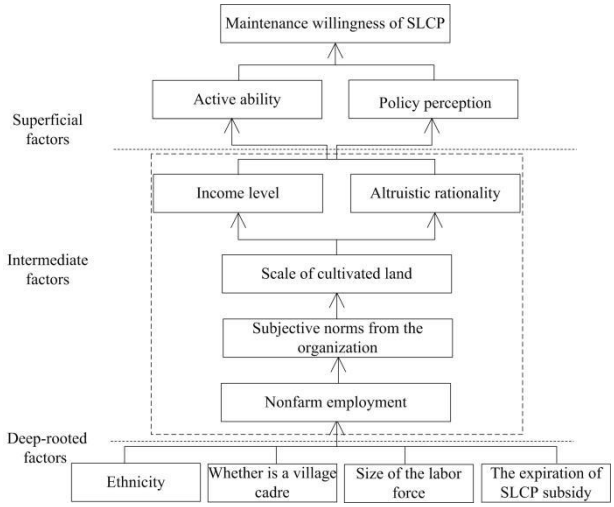

Figure 3. Interpretative structure model of the influencing factors.

5. Discussions

The ISM results show that active ability and policy perception are the superficial influencing factors; off-farm employment, subjective norms from the organization, land area, income level, and altruistic rationality are the intermediate influencing factors; whether the head of the household is an ethnic minority, the expiration of the SLCP subsidy, labor number, and the head of the household is a village cadre are the deep-rooted influencing factors. In summary, the factors affecting farmers' willingness to maintain the SLCP are at different levels, being both independent and interrelated. These results form a transmission path of "whether the head of the household is an ethnic minority, the expiration of the SLCP subsidy, labor number and whether the head of the household is a village cadre"→"off-farm employment, subjective norms from the organization, land area, income level and altruistic rationality"→"active ability and policy perception"→"farmers' willingness to maintain the SLCP". It can be seen that whether farmers maintain the SLCP depends on the driving of deep-rooted influencing factors, so it is necessary to discuss the above four deep-rooted influencing factors.

The actors' decision-making mechanisms are based on the information processing process associated with the dynamic core values [39]. As "rational people", farmers' economy of the SLCP is an important factor affecting their reconversion. The expiration of the subsidy reflects that the SLCP subsidy is still a stable and important source of income for farmers in some areas [40]. After the subsidy expires, farmers may not be able to quickly transfer into the labor force, and the opportunity cost of the SLCP land will not be compensated. This has an impact on farmers' income levels, causes low recognition for the SLCP policy, and ultimately breeds resistance to preserving the SLCP's successes. In the field research, it was also found that some SLCP farmers hoped to continue to obtain SLCP subsidies by expressing their unwillingness to maintain the SLCP. In addition to improving the environment and offering policy subsidies, the SLCP can affect the agricultural production structure and productivity, to a certain extent, promote the refinement of the agricultural production mode, and achieve sustainable economic and social development [41]. According to the research of Vuong et al. [42], when the long-term significance of the SLCP is widely understood, farmers can realize important value for their survival and development and cultivate their internal consciousness of maintaining the achievements of the SLCP.

Compared with Han farmers, ethnic minority farmers usually live in mountainous areas for generations, and it is more difficult for laborers to transfer to employment [14], making them more reliant on the produce of the land, such as the planting industry. After participating in the SLCP, there is less land for planting, and it is difficult to make a living by only cash compensation income. The actors' information processing systems, mindsets, and decision-making processes are also slightly influenced by cultural values [43]. Most ethnic minority farmers have unique cultural values. To some extent, the information environment is relatively closed, and information channels are insufficient, which makes it difficult to effectively spread the publicity of the policy [15]. As a result, many ethnic minority farmers do not fully comprehend the SLCP's policy or the significance of upholding its accomplishments. Therefore, it is necessary to enhance the willingness to maintain the SLCP based on the characteristics of minority farmers and the SLCP policy.

In addition, village cadres take the lead in preserving the SLCP's accomplishments, since they are the village-level elites or "backbone groups" who participate in pertinent training, receive policy information more frequently than other farmers, and have higher altruistic motives [38]. The SLCP encourages farmer households with a large labor force to allocate surplus workers to non-farm employment [44], lessen their reliance on the land for production and living, improve their wage income, and therefore, increase their desire to sustain the SLCP's accomplishments.

Of course, this paper has significant drawbacks. First, the study conclusions of this paper are based on the minority farmers in Gansu Province, Ningxia Hui Autonomous Region and Hunan Province. However, it is still unknown whether similar research

conclusions can be drawn in other parts of China. Second, it is difficult for the cross-sectional data used in this paper to identify the dynamic impact of some time variables on farmers' willingness to maintain the SLCP. Future research should track farmers to better understand their decision-making processes and capture the dynamic impacts of time variables, in order to strengthen the validity of the research outcomes.

6. Conclusions and Policy Implications

Based on a survey of 975 farmers in Hunan Province, Gansu Province, and the Ningxia Hui Autonomous Region, this study used the elastic net model to accurately select the influencing factors of farmers' willingness to maintain the SLCP. On this basis, the logit model was used to measure the influencing factors. Finally, combined with an interpretative structural model (ISM), we further analyzed the hierarchical structure of each significant influencing factor. The main results are described as follows. Firstly, off-farm employment, whether the head of the household is a village cadre, the labor number, land area, income level, subjective norms from the organization, altruistic rationality, active ability, and policy perception had a significant and positive impact on farmers' willingness to maintain the SLCP. In contast, whether the head of the household is an ethnic minority and the expiration of the SLCP subsidy had a significant and negative impact. Secondly, the factors affecting farmers' willingness to maintain the SLCP are at different levels, being both independent and interrelated. Among them, the deep-rooted factors are whether the head of the household is an ethnic minority, the expiration of SLCP subsidies, the labor number, and whether the head of the household is a village cadre.

This paper makes the following recommendations for the government departments to consider, in order to increase the farmers' willingness to maintain the SLCP and support the sustainability and efficacy of the program. Firstly, the income channels of farmers in ethnic minority areas should be broadened. The labor service system in ethnic minority areas should be established and improved, targeted nonagricultural skills training should be carried out according to the specific conditions of rural households and their families to enhance their nonagricultural employment ability, and multiple measures should be taken to enhance their willingness to maintain the achievements of the SLCP. In addition, more ecological public welfare jobs should be provided in combination with the SLCP, and ethnic minority farmers should be guided in establishing diversified livelihood transformation strategies and helped to gradually realize the transfer to nonagricultural employment, generate income, and increase their income, thereby improving their evaluation and recognition of the policy. Secondly, the publicity to maintain the SLCP in minority areas should be strengthened. In the process of publicizing and popularizing the policies related to the consolidation of the achievements of the SLCP, attention should be given to the ethnic characteristics of farmers, and publicity and popularization strategies should be formulated in minority areas. This suggests that government departments should adopt a variety of media for multichannel, omnidirectional publicity through both the online and offline modes to complement the traditional and modern ways for ethnic minority farmers with national unique characteristics to obtain convenient information services. When minority farmers can access policy information easily, based on their needs, more of these farmers will be able to understand the importance of consolidating the SLCP, which can improve their willingness to maintain the SLCP. Thirdly, the follow-up policy of the SLCP should be improved. On the one hand, the government should appropriately extend the period of the first round of SLCP subsidies, reasonably formulate a dynamic adjustment mechanism for subsequent SLCP subsidies, and implement diversified and differentiated compensation strategies, based on farmers' actual conditions. On the other hand, eligible farmland should be included in forest ecological benefit compensation projects, and farmers should be given certain disposal rights over the rest of the farmland, with support for the development of follow-up forest industries, in order to effectively protect the interests of farmers and consolidate the achievements of the SLCP.

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