Article

Social Capital, Crop Specialization and Rural Industry Development—Taking the Grape Industry in Ningling County of China as an Example

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Abstract: Village-level social capital is an important factor to promote rural revitalization, but it is often ignored by existing researches. Based on the field investigation on 357 grape industry villages in Ningling County of Henan Province, decomposed village social capital into three dimensions (social network, social norm and social trust), this paper aims to discuss how village social capital influences rural industry development by promoting crop specialization. Results showed that the social network affects the transmission of grape planting information and technology. The richer the social network, the faster the diffusion of grape planting and the faster the realization of crop specialization. However, different types of social network play different roles. Social norms affect whether villages participate in grape production decisions. Proper risk awareness and efficient and reliable social organization services can help village farmers participate in grape planting and improve the level of crop specialization. Social trust affects the scale and duration of grape planting in a village; that is, the higher the level of social trusts, the higher the degree of crop specialization. In short, social capital can effectively promote the rapid cultivation of superior crops, enhance the specialization level of agricultural production and drive the coordinated development of upstream and downstream industries, thereby promoting the development of rural industries. This study emphasizes that, in the process of rural revitalization, developing countries should consider the social environments of different regions, fully mobilize the power of local social capital and develop reasonable and feasible technology popularization, adoption and implementation programs.

Keywords: social capital; rural revitalization; crop specialization; China

1. Introduction

Many villages in many countries around the world are facing recessions [1], low standards of living, natural conditions unsuited to farming, limited income earned from agricultural activity and poor outfitting in social and technical infrastructure, which lead to a large number of farmers' migration away from rural areas [2,3], leaving abandoned or declining settlements [3,4], and the trend of recession in the rural areas of China is particularly obvious [5,6]. Similarly to the "rural renaissance" proposed by many countries [7–9], the Chinese government has put forward a rural revitalization strategy in response to the massive loss of the rural population and the sluggish rural economy, aiming to achieve the goals of "advanced production, a comfortable living standard, a civilized lifestyle, clear and tidy villages, and effective governance". Research and practice have proved that economic factors play a crucial role in rural vitalization [10]. Thus, a prospering rural economy is considered to be the premise of rural revitalization. However, we how to implement this?

Agriculture is the basic industry of rural economy; it can not only provide raw materials such as grain, fruits and vegetables but also provide diversified food and agro-tourism ecological products. Studies have confirmed that specialization contributes to agricultural economic growth significantly [11,12], on account of which the Chinese government is implementing a new urbanization strategy and a series of land system reforms to promote large-scale, specialized, clustered and modern agriculture. However, China's existing household management mode and ultra-small-scale agricultural production caused by farmland fragmentation restrict the upgrading of agricultural industries [13]. According to the research, it is a fait accompli that China's small-scale peasant economy has existed for a long time [14]. Therefore, the Chinese government has introduced a series of policies to promote the development of the regionalization and agglomeration of agricultural production in some regions [15]: for example, changing the business model and implementing the separation of ownership, management rights and contract rights and so on. However, this phenomenon only appears in a few regions and has not yet been widely spread. Small farmers still form the main body of China's agricultural production [16], and fragmentation and decentralization are still the main business models of China's agriculture [17]. In the context of "small farmers in a big country", how can we further promote the regionalization and large-scale expansion of agricultural production and form regional crop specialization so as to promote the improvement of agricultural production efficiency and the development of modern agriculture? Currently, from such perspectives as economics and management, scholars believe that we should devote ourselves to transforming the scattered product market into a centralized large-scale market [18], government subsidies [19], integration into large-scale agricultural organizations [20], improvement of the mechanization level [21], land consolidation [22], but the implementation effect is not satisfactory [22–24]. According to the endogenous growth theory, the fundamental motivation of regional development lies in the region itself. Some scholars believe that farmers are both the main body of rural industry development and the beneficiaries of rural revitalization [25]. If hundreds of millions of farmers' enthusiasm, initiative and creativity are mobilized to participate in the same agricultural production project consciously and actively, the implementation effect will be more guaranteed [25]. However, how to make large-scale dispersed farmers actively participate in the same type of crop planting to form regional specialization patterns still requires in-depth discussion.

Studies have shown that social capital promotes farmers' adoption of the same production technology and production models by strengthening communication and cooperation among farmers, transforming professional knowledge into easy-to-understand language and overcoming the limitations of promotion times, distance, culture and knowledge level [26,27]. By promoting rural land transfer [28], social capital promotes the cluster development of regional industries [29,30] and changes the forms of rural land use. However, previous studies have focused on the role of social networks in farmers' participation in agricultural projects and the adoption of production technologies and ignored other dimensions in the composition of social capital, such as social norms and social trust. Previous studies have focused on farmers, while ignoring the formation of social capital at the village level, thus underestimating the role of village governments in crop specialization and rural revitalization. In fact, in China, a village is the smallest administrative unit that constitutes a village area, and the village collectively owns the ownership of land in the village area [31] and has the principal competence in external affairs, and information sharing and action direction among the villagers are highly consistent. It can be seen that most of the existing studies on social capital focus on farmer or region level, while there are few studies on small-scale village level. However, village-level social capital plays a leading role in crop specialization and industrial revitalization in Chinese villages. Then, how do we define village-level social capital? What role do its different dimensions play in crop specialization? How does social capital promote the development of rural industries by influencing crop specialization? The solution of these problems is of great significance to the formation of regional agricultural specialization and rural revitalization in China.

To this end, taking the grape industry in Ningling County of China as an example, based on the field survey data of 357 villages and adopting the Logit regression model and least square regression model, this paper offers comprehensive analysis on how village-level social capital affects crop specialization in traditional Chinese agricultural areas and further affects the development of rural industries.

2. Theoretical Hypotheses and Indicator Selection

2.1. Theoretical Hypotheses

The study of social capital was first undertaken in the field of sociology where the focus was on the importance of relationships between individuals based on the premise of "trust" and "cooperation", and within groups with the organization's accumulative actions as the core [32]. In the late 1970s, "social capital" began to be widely applied in academic research after being put forward as a clear concept. However, the multi-dimensional nature of social capital makes its measurement methods diverse. For example, the World Bank proposed cohesive social capital, bridging social capital and connected social capital [33]. Collier divided social capital into government social capital, which is dominated by rules, and civil social capital, which is dominated by beliefs and organizations [34]. Krishna believed that social capital included formal institutional capital and informal relational capital [35]. Nahapiet et al. classified social capital by using external social relations, trust among internal members and members' understanding of the organization's collective goals [36]. Uphoff divided social capital into structural social capital and cognitive social capital from the perspective of performance [37]; the former consists of specific elements such as norms and rules in social organizations, while the latter is embodied in abstract concepts such as trust and values. Onyx et al. mainly focused on three dimensions: community participation, community organization and trust [38]. Narayan's measurement classification added living in harmony, daily interaction, general rules, etc., based on the work of Onyx [39]. Chinese scholar Liu Guoliang divided social capital into the social capital network, network difference, social participation and trust [40]. Pei Zhijun in his research further divided it into six aspects: universal trust, normative trust, formal network, informal network, shared vision and social support [41]. Lu Huiling et al. studied the impact of rural social capital on farmer income in three dimensions: trust, norms and social network [42]. Wang Tianqi and Huang Yinghui added reciprocity, participation and social capital cultivation [43]. Some scholars divided social capital into homogeneous social capital and heterogeneous social capital according to the nature of relations. In conclusion, in the process of measuring social capital, the measurement index system is often not fixed due to the limitations of research purpose and content, but the indexes of different measurement dimensions are essentially similar and fuzzy, and the measurement is mainly carried out in three aspects: social network, social norms and social trust. As such, village social capital is defined as the sum of social connections formed by villagers in a village based on the common perception and trust of other social individuals under the constraints of local social norms. It can be decomposed into three dimensions, social network, social norm and social trust, and proposes research hypotheses regarding its impact on crop specialization.

The first dimension is the social network, which mainly refers to the relationships among actors in a group [44]. In this paper, it refers to the degree of contact between farmers and different actors in the village before participating in grape planting. It mainly contains two elements: the "connection relationships" among different nodes, such as connection subject, connection frequency, etc.; and the "infective material" that flows along the connection relationships, such as information, ideas, emotions, culture, etc. [45]. Through the connection mechanism, the social network transmits information, technology and knowledge to different nodes; provides farmers with job opportunities; finances channels; and provides access to information for assistance, such as an informal system to provide security for households and reduce the sensitivity of households relative to risk so smallholders can share risk through social networks to mitigate the inhibitory

effect of risk on households' planting [46], ultimately affecting the overall behavior and choice of the region [47]. Most Chinese villages are "acquaintance societies" formed by generations of families, and the farmers have established a complex and stable relationship network with each other through geography, kinship and industry. When a village changes its land use mode, selects a certain crop and obtains considerable economic benefits, it plays the central role of a node, which transmits and spreads that land use mode to other villages [48] and then influences the land use behavior of other farmers in the region influences the change in crop specialization degree [49]. Research studies confirm that households with more connections were more likely to adopt a range of new technologies, such as ploughs, varieties, inputs, orchards, afforestation, grazing land rehabilitation and so on [50]. Therefore, to some extent, the social network is the spatial diffusion network of the crop planting information and provides a signal for crop planting structure adjustment. On this basis, Hypothesis 1 is proposed:

H1. *The denser the social network, the higher the crop specialization degree*.

The second dimension is social norms, which refers to the standards of behavior that members constituting a specific society should follow together. Under the restrictions of such standards, people form specific behavior patterns [51], which are various, including customs, religious beliefs, moral norms, business air, social trust, laws, regulations, etc. [52]. Some scholars divide social norms into descriptive social norms, imperative social norms and individual norms [53,54]. They describe how individual actions are influenced by the behavior or opinions of others in the same social group. Under the social relations structure of China's rural areas, the production activities of farmers are mostly carried out on the basis of geographical relationships, and their behaviors are inevitably affected by the social norms in the village. Empirical studies have shown that a farmer's decision is influenced by what other farmers think of the scheme, farmers are more likely to join planting when they are informed that a large number of farmers performed planting likewise in their social group. For example, social norms have a direct impact on farmers' behavior of organic fertilizer application and crop variety adoption [52], and social norms can stimulate farmers to adopt cultivated land protection behaviors by affecting their related value cognition, risk confidence and skills [55]. When new crop planting technology spreads to a village, the common value orientation of the villagers will become the decision-making basis of whether the village "follows the trend". Particularly in the case of limited knowledge, farmers' planting structure adjustment is more likely to be affected by local culture and production habits. On this basis, Hypothesis 2 is proposed:
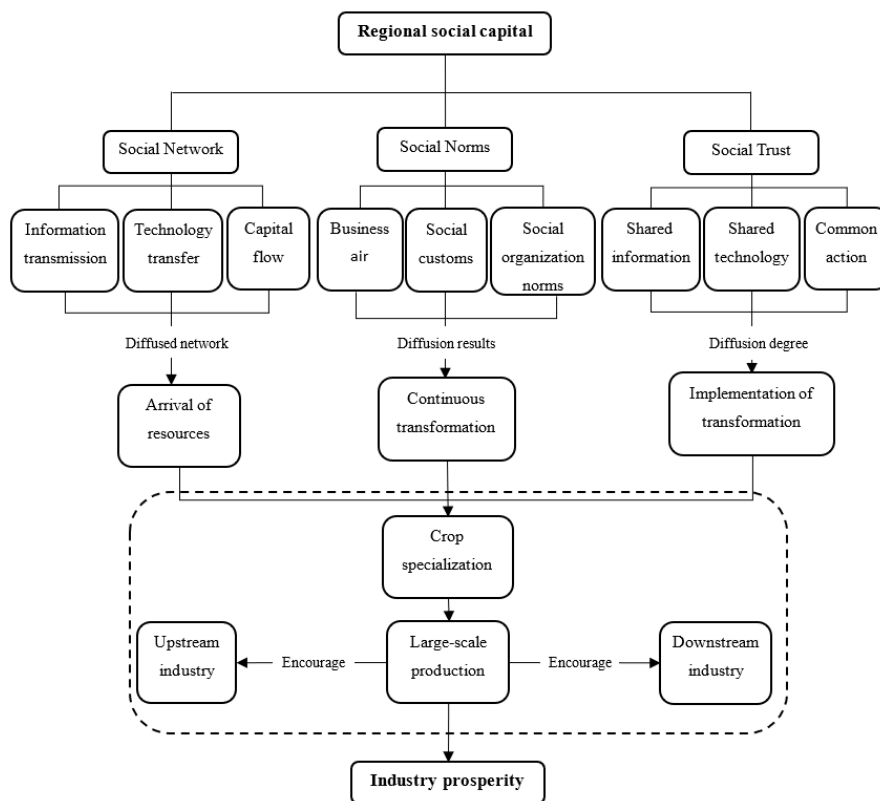
H2. *Social norms have an important impact on the decisions of farmers in villages regarding crop specialization*.

The third dimension is social trust, which is the product of the social culture and social system, and it can help people avoid inefficient non-cooperative traps and reduce free-riding problems by increasing communication and facilitating social exchange [56] and then effectively reducing transaction costs and facilitating cooperation among people [57]. Scholars have attempted to classify it in two dimensions: One dimension is interpersonal trust; it refers to the trust between people. Another dimension is institutional trust, such as the government and the legal system [58]. In this paper, it refers to the trust of villagers in various policies and different actors. The farmers' social trust determines the extent to which they are willing to give credit or act on the advice of others [59]. Whether the farmers in the same area persist in the same land production mode may have a great impact on the recipients themselves and their surrounding environment [60]. Therefore, a high level of social trust among villagers is conducive to the establishment of a cooperative environment of mutual trust and more frequent communication in the village, and this can in turn promote crop specialization through social exchanges such as the sharing of information and technical experience. On this basis, Hypothesis 3 is proposed:

H3. *The higher the level of social trust, the more conducive it is to the improvement of crop specialization*.

Social capital, including social network, social trust and social norms, is gradually formed in the long-term co-production and living process of rural households in China. Villagers abide by social norms, cherish the collective reputation of their village and interact with each other through complex networks of social relations. Once a certain crop is planted by the villager of a village and appears in the farmland, its planting technology, market benefits and other information will be transmitted to other farmers in the village and other surrounding villages through social networks. When the first farmer who produces the crop succeeds, other farmers will select the planting time and scale based on local social norms and their trust in the first farmer's experimental results. As the number of households and villages participating in that crop's planting increased, the number of follow-up households and villages increased. Thus, repeatedly, the planting scale and scope of that crop planting continue to expand. The large-scale planting of primary agricultural products stimulates the industrial division of labor; thus, its related upstream and downstream industries gradually appear in the region, and the industrialization development will be formed. However, social capital has the characteristics of geographical embeddedness and uneven spatial distribution [61,62]. As the Chinese saying goes, "habits differ from those within 100 li, customs differ from those within 10 li", which shows that there are differences in the social network structure, content of social norms, level of trust, etc., in different regions. Therefore, with the increase in the distance from the initial planting place, information decays, social trust decreases, social norms change, and the number of villages and planting scale both decrease until zero. Thus far, the phenomenon of regional crop specialization and industrialization with fuzzy boundaries has been formed under the influence of social capital (Figure 1). Hypothesis 4 is proposed:

H4. *Social capital in specific regions promotes industrial prosperity through crop specialization.*

Figure 1. Logical relationships among village social capital, crop specialization and industrial revitalization.

2.2. Indicator Selection

According to the above analysis, social capital measurement indexes were selected in the following three aspects (Table 1):

(1) Measurement index of social network. The social network has multi-dimensional characteristics such as kinship relationships, geographical relationships and industry relationships. The indexes used by different scholars differ greatly, such as the frequency of going out [63], number of friends and relatives [64], amount of gift spending [65], etc. By referring to previous studies and combining the survey's data, the communication frequencies among all the farmers in the village and among ordinary farmers, relatives and friends, merchants, scientific research institutions, cooperatives, leading enterprises and government organizations before planting a crop were selected to measure the social network index level of the village (the assignment method is shown in Table 1).

(2) Measurement index of social norms. Affected by cultural customs, planting habits, social structure, etc., the farmers in different villages take different main factors into consideration in selecting a crop type to plant, thus forming unique social norms. The degrees to which a village household be affected by different factors when making the decision to plant a different crop, such as business air (e.g., risk culture, laborious traditions, thrifty habits, efficiency consciousness, innovation milieu and market environment), social customs (e.g., thrifty habits, farming habits and farming taboos) and social organization norms (e.g., service mode of technical associations, service level of cooperatives and cooperation of leading enterprises) were taken as the measurement index of social norms. According to the respondents' perception, scoring and assignment can be made using the Likert 5-grade scale with reference to previous studies [66].

(3) Measurement index of social trust. Social trust is generally divided into two broad categories: generalized trust and particularized trust [67]. However, according to the division of trust objects, social trust includes interpersonal trust and institutional trust [68]. In view of the great role of the Chinese government in rural economic development, this paper adopts the classification standard of the latter. The interpersonal trust measurement index in this paper mainly includes the trust of neighbors, highly skilled personnel, entrepreneurs, highly educated people, family members, etc., while the institutional trust mainly refers to the trust of all the farmers in the village towards the industrial policy, agricultural technology extension policy, etc.

Table 1. Determinants of village social capital.

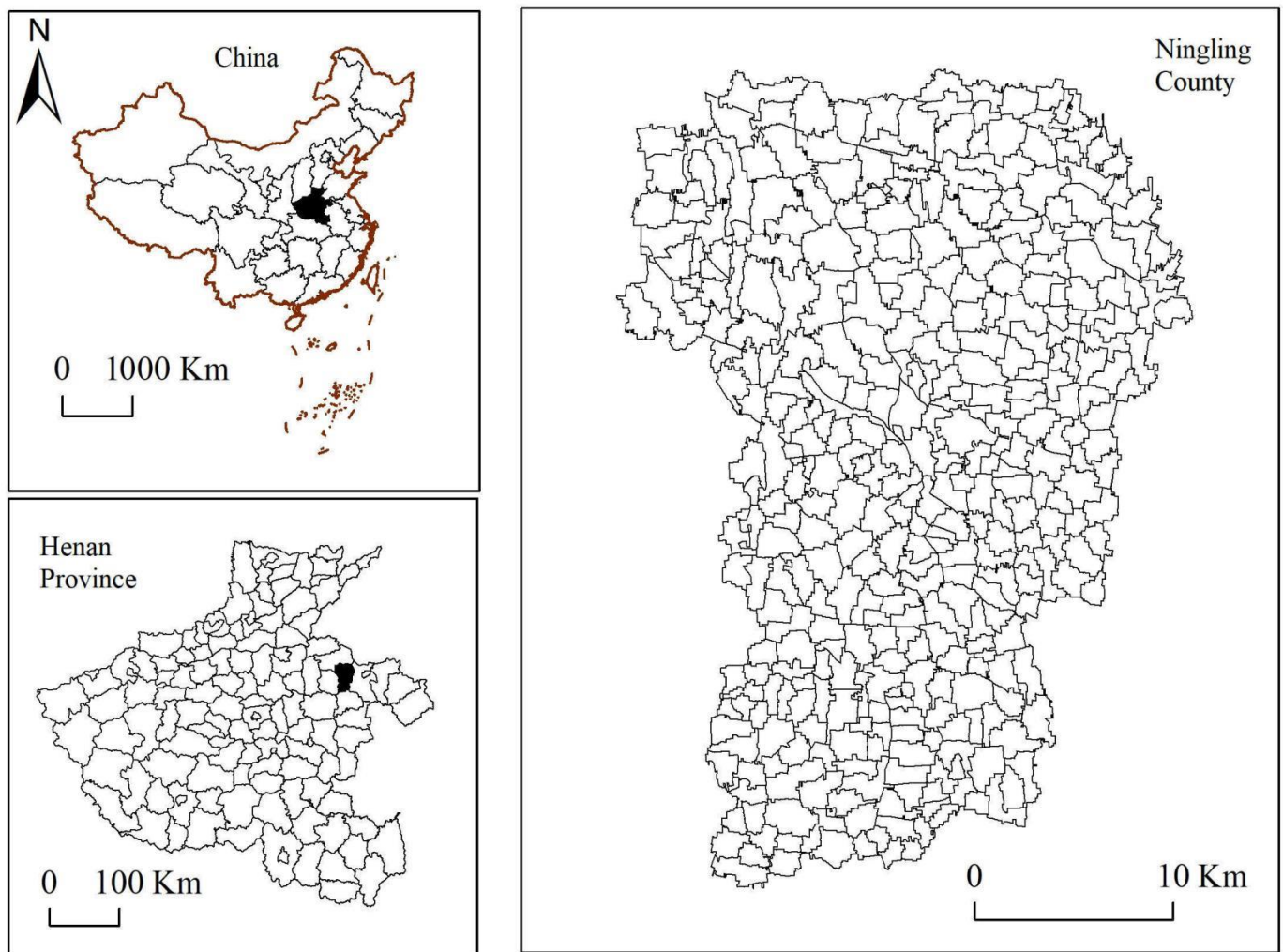| First-Level Index	Second-Level Index	Third-Level Index	Explanation *
Social network	Homogeneous social network	Frequency of communication with farmers in other counties	For the degree of contact intimacy of farmers in village and different behavior subjects before participating in crop planting, 1 represents very low contact frequency and 5 represents very high contact frequency based on the Likert scale method. For planting villages, the score is their social network value of the year before participating in crop planting; for non planting villages, the score is their current social network value.
		Frequency of communication with non-village farmers in the county	
		Frequency of communication with farmers in village	
	Heterogeneous social network	Frequency of communication with vendors	
		Frequency of communication with customers	
		Frequency of communication with research institutions	
		Frequency of communication with cooperatives	
		Frequency of communication with leading enterprises	
		Frequency of communication with county government	

Table 1. *Cont.*

First-Level Index	Second-Level Index	Third-Level Index	Explanation *
Social norms	Business air	Risk culture	For the level of farmers affected by local business air, social customs and social organization norms when considering whether to plant new crops, planting scale and planting duration. According to Likert scale, 1 means very low influence and 5 means very high influence
		Laborious traditions	
		Profit-oriented concept	
		Efficiency consciousness	
		Innovation Milieu	
		Market environment	
	Social customs	Thrifty habits	
		Farming habits	
		Farming taboos	
	Social organization norms	Service mode of technical associations	
		Service capabilities of farmer cooperatives	
		Cooperation mode of leading enterprise and farmer	
Social trust	Institutional trust	Industrial policy	For the trust of villagers in various policies, 0 means complete distrust and 10 means complete trust.
		Agricultural technology extension policy	
		Information sharing policy	
		Rural financial policies	
		Infrastructure construction capability of government	
		External publicity capability of government	
	Interpersonal trust	neighbors	For the farmers' perception and trust in different behavior subjects, 0 is lowest and 10 is highest.
		Highly skilled personnel	
		Entrepreneurs	
		Well-educated people	
		Family relatives	
		Managers	
		surrounding villages' households	

* Scoring is determined according to the perception of cadres staying in the village long-term.

3. Materials and Methods

3.1. Study Area

Ningling County is located in the east of Henan Province, China, with convenient transportation conditions, flat terrain and a mild climate (Figure 2). Ningling County is an "agricultural county", most of its population is dependent upon agricultural economy, and its producers of agricultural are mainly smallholders. Fruit crops such as grapes and pears except traditional food crops such as wheat and corn are planted in Ningling County. In 2016, the garden fruit output reached 282,200 tons. The grape planting industry began in the 1980s. In 1990, there were only two planting villages, but after 2010, the number of planting villages increased rapidly and the planting scale continued to expand. At present, the total number of villages that have planted and are planting grapes is 111, accounting for about 1/3 of all villages in the entire county. In addition, grape retail and wholesale individual businesses, grape planting cooperatives and grape deep-processing enterprises surrounding the grape planting industry have appeared. Since 2010, the number of various subjects has increased rapidly, the pattern of grape specialization has been further highlighted and the industrialization's development momentum has been strong. It is important to note that the smallholders in Ningling County are constrained by local asset stock and access to external resources; moreover, their livelihood capital, such as natural, human, physical and financial capital, is limited. Social capital is a relatively controllable resource for farmers because it can be enhanced with increasing social connectedness, and it may also be diminished through the expansion of individualism and conflict [69]. Therefore, it is typical and representative to take the grape industry in Ningling County as an example in this study.

Figure 2. Location of Ningling County.

3.2. Data Acquisition

There were two main data sources. The first was official data, which mainly includes the following contents: (1) *Statistical Yearbook of Henan Province (2017)* and vector graph of the administrative divisions of the province; (2) population scale, arable land area, land use structure, township boundaries and village range of each village in Ningling County; (3) individual households, cooperatives and enterprises in Ningling County, and their time of establishment, scale, distribution location, scale of grape planting in the village and its changes over the years; (4) name change and village amalgamation of administrative villages in Ningling County. The second source was field survey data. With the assistance of the Ningling County government, the survey team carried out questionnaire interviews with local long-term cadres staying in 364 villages (there was a total of 364 villages in the entire county, of which 7 were zoned as development zones; thus, no statistics were acquired) of 14 townships in the county. The respondents are the elderly, veteran cadres, current leaders of the village committee, etc., who are very familiar with the village's situation. Some questionnaires are filled out by one person, if he or she knows all the information very well; some questionnaires are filled in by more than one individual to ensure the accuracy of the data or to meet the perception of most people. The questions included population size and structure, natural resource, industrial structure (planting structure), social capital at the year before grape planting, etc. All data are collected by taking the village as the unit. After verification and modification by telephone, 357 valid questionnaires were obtained with an efficiency rate of 98.1%. Before the analysis, the above
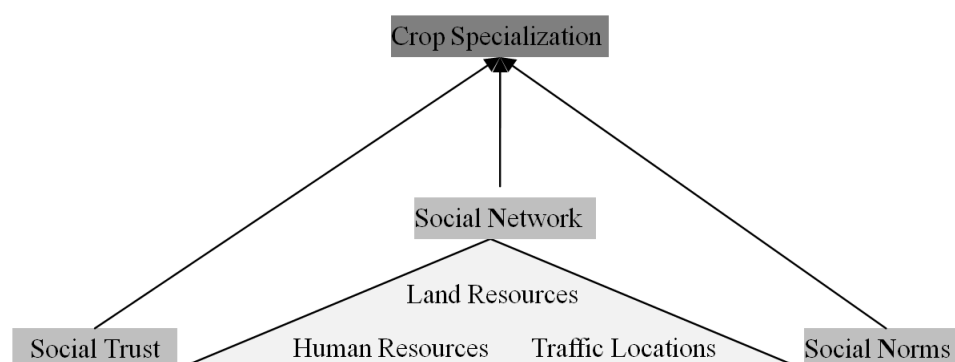
data were processed as follows: (1) when there was a discrepancy between the official data and the actual survey data in population, the actual survey data prevailed in this study in view of the high variability of population number and the lag of the official data; (2) all data were subject to non-dimensional processing using the standardized method.

3.3. Data Processing

With the exception of the social capital of social networks, social norms and social trust (Table 1), crop planting is also affected by the situation of village resources (such as human resources and land resources) and traffic location, the cultivated land area [33,70], administrative area and traffic land area of each village; the number of highly educated laborers and entrepreneurs at the year before grape planting was selected as the human resources; the Euclidean distances from each village to the diffusion source of grape planting (Yangyi Township) and the counties were selected as the traffic location. Land resources, human resources and traffic location were collectively referred to as the basic development conditions of the village area and included in the model as control variables with social capital variables as explanatory variable. For grape-growing villages, the index values were the conditions at the year before planting grapes; for non-grape-growing villages, the index values were the conditions at the time of the survey.

Social network, social norms and social trust with control variables (land resources, human resources and traffic location) constitute three sets of variables, and principal component analysis was used for dimensionality reduction. The results show that the KMO values were all greater than 0.80. Sigs were all 0.000 and the cumulative contribution rate was all greater than 60%, indicating that it was suitable for factor analysis and the effect was good. Finally, three groups of independent variables are constructed (Figure 3):

(1) Social network (includes two second-level indicators of homogeneous social network and heterogeneous social network) in combination with land resources, human resources and traffic location;

(2) Social norms (includes three second-level indicators of business air, social customs and social organization) in combination with land resources, human resources, traffic location;

(3) Social trust (includes two second-level indicators of institutional trust and interpersonal trust) in combination with land resources, human resources and traffic location.

Figure 3. Village social capital and basic conditions for crop specialization.

It is interesting to note that, in the above three indicator systems, land resources all include the village road area, cultivated land area, traffic area, canal area and administrative area of villages; human resources all include the proportion of well-educated people and the number of entrepreneurs; traffic locations all include distance of village to the diffusion source of grape planting and county seat. In this study, the score after the rotation of the maximum variance of each group of variable is taken as the variable value.

3.4. Methods

Whether to plant, planting scale, planting duration and centrality were the specific indicators for measuring the development of crop specialization in a village, which reflect whether the crop structure of the village is transformed, degree of transformation, duration of transformation and demonstration–promotion ability, respectively. With the administrative village as the analysis unit, the model was constructed with whether to plant, planting scale, planting duration and centrality as dependent variables; the indicators of social network, social norms and social trust before participating in specialized crop production in the village as independent variables; and the basic development conditions of the village as the control variable.

Model 1: For whether to plant or not, the logistic bivariate regression model was selected. The formula is as follows:

$$O = \frac{\exp(\alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n)}{1 + \exp(\alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n)} \tag{1}$$

where dependent variable O is the probability of whether grapes are planted in the village; x_1, x_2..., x_n are the independent variables; and β_1, β_2, $\ldots$, β_3 are the undetermined coefficients of logistic regression. The above formula is transformed due to the following:

$$O = \frac{\exp(x'\beta)}{1 + \exp(x'\beta)}, \ 1 - O = \frac{1}{1 + \exp(x'\beta)} \tag{2}$$

$$\text{Therefore,} \ln(O_i / 1 - O_i) = \alpha + \sum_{k=1}^{k} \beta_k x_{ki} \tag{3}$$

where $O_i = O(y_i = (1 \mid x_{1i}, x_{2i}..., x_{ki}))$ is the change probability of planting in the village when the independent variables x_{1i}, x_{2i}..., x_{ki} are a given value, in which α is the intercept term and β is the slope.

Model 2: Stata15.0 was used to carry out OLS and OLS+ robust standard error regression on the data, and a White heteroscedasticity test was carried out on the regression results. For models with heteroscedasticity, the weighted least square method was used to revise them repeatedly until a better fitting effect was achieved.

The ordinary least square formula is described as follows:

$$y_i = \beta_{i1} x_{i1} + \beta_{i2} x_{i2} + \ldots + \beta_{in} x_{in} + \varepsilon \tag{4}$$

where y_i is the *i*th dependent variable; x_{i1}, x_{i2}, $\ldots$ x_{in} are independent free variables affecting the ithdependent variable; β_{i1}, β_{i2}, $\ldots$ β_{in} are the undetermined coefficients of x_{i1}, x_{i2}, $\ldots$, x_{in}; and ε is the residual.

The weight of the weighted least square method is $1/\sqrt{v_i}$ (reciprocal of standard deviation). For the *i*th observed value (duration and scale of grape planting in the village, etc.), the regression equation becomes the following.

$$\frac{y_i}{\sqrt{v_i}} = \beta_{i1} \frac{x_{i1}}{\sqrt{v_i}} + \beta_{i2} \frac{x_{i2}}{\sqrt{v_i}} + \ldots + \beta_{in} \frac{x_{in}}{\sqrt{v_i}} + \frac{\varepsilon}{\sqrt{v_i}} \tag{5}$$

4. Results

4.1. Impact of Social Network on Crop Specialization

From the perspective of space, crop specialization is the process of continuously increasing the scale of crop planting and expanding the spatial distribution. According to previous studies, the realization of this process was often present in the village that has succeeded in planting first, influencing surrounding villages to gradually participate through different network channels and then forming a regional specialized production pattern. According to the statistics, the average value of the original (the year before participating in grape planting) social network index of grape planting villages in Ningling

County was much higher than that of non-grape planting villages in current, and the heterogeneous and homogeneous social network indexes of the former were 0.17 and 0.30 larger than those of the latter, respectively. Among the grape planting villages, (1) the higher the social network index at the year before grape planting, the larger the planting scale. For example, for villages with average heterogeneous social network index values of 0.287, 0.287 and 0.471, the average plant scale values were 0.001 hm^2, 0.005 hm^2 and 0.039 hm^2, respectively, and the corresponding homogeneous social network index values were also higher at 0.197, 0.197 and 0.567; (2) the higher the original social network index, the greater the influencing ability of the village, and the more conducive it is to promoting crop specialization. For example, the heterogeneous and homogeneous social network index values of villages with a centricity greater than 0 before grape planting were 0.223 and 0.217, and those of villages with centricity equal to 0 were 0.202 and 0.078; (3) the more developed the original homogeneous social network, the longer the grape planting time. In villages with planting time of more than 10 years, 5–10 years and less than 5 years, the homogeneous social network value gradually decreased to 0.413, 0.089 and 0.047.

That results can also be seen from spatial distribution map (Figure 4), in which 4.7% of grape planting villages had a homogeneous social network score higher than 2, but this proportion of non grape planting villages only 1.9%; however, the proportion of grape planting villages with a homogeneity social network score lower than −1 is 7.5%, but the proportion of non grape planting is 17.6%. These phenomena also occur in heterogeneous social capitals.
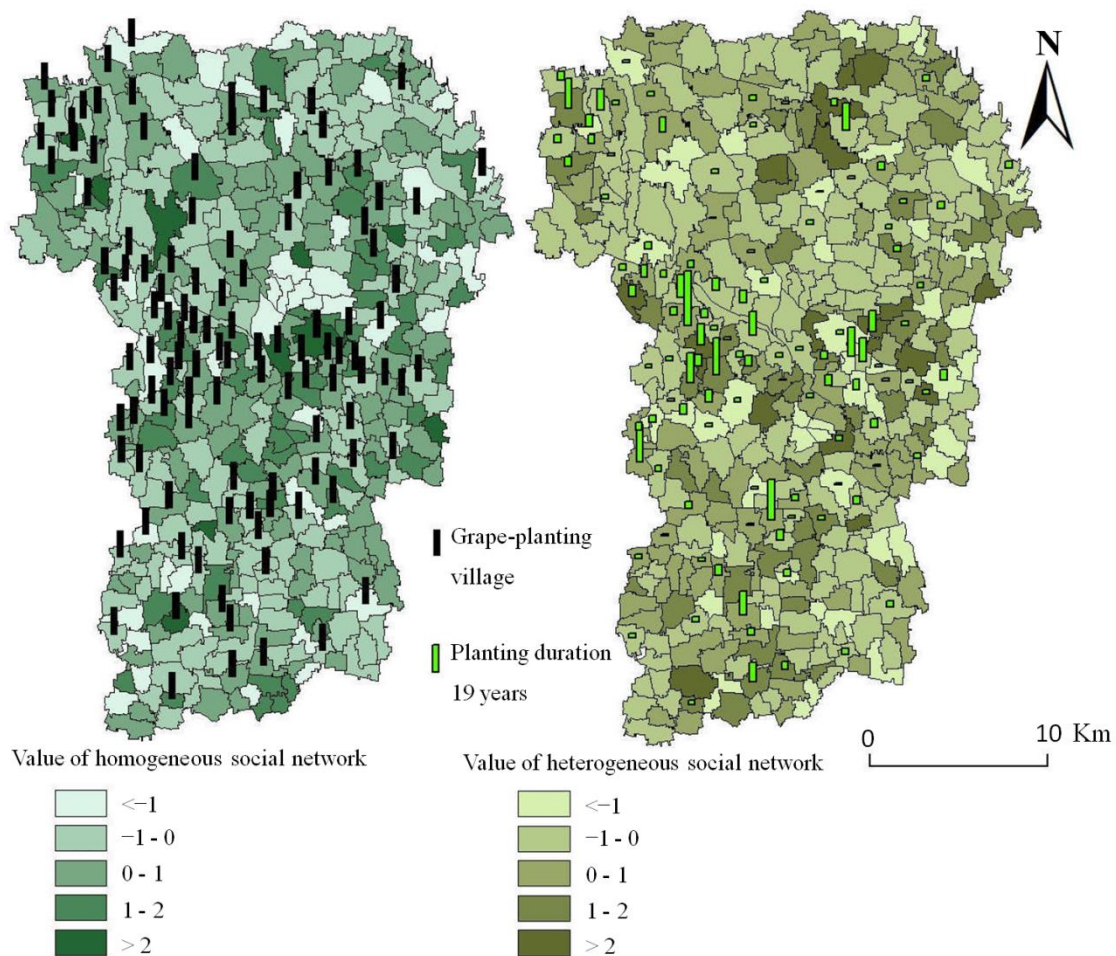

Figure 4. Spatial pattern of social network and crop specialization.

The regression (Tables 2 and 3) shows that the original homogeneous social network had significant influence on whether to plant grapes in the village in the future, planting scale, planting time, centrality level, etc. However, the original heterogeneous social network had no significant influence on whether to plant grapes in the village, planting duration and centrality level, but it had a profound influence on the future grape planting scale in the village. These results indicate that the social network established by the relations among family members and local farmers has a comprehensive influence on the agricultural production of the village and affects the speed, scale and future expansion trend of crop specialization. For villages with a more developed homogeneous network, the probability of participating in grape planting is greater, the planting scale is larger the planting time is longer and the influence on other villages is stronger. Moreover, for the villages with more frequent contacts with cooperatives, scientific research units, leading enterprises, etc., the probability of planting grapes on a large scale in the future is greater. Villages with rich heterogeneous social networks have close contacts with enterprises and scientific research institutions. Villagers' planting decisions may be less affected by villagers in surrounding villages, but they are more likely affected by enterprises and external market environments. Due to its good external contact network, once it participates in grape planting, its production scale is generally relatively large. In short, a rich social network provides a channel for villages to acquire and spread new planting information and technology. By influencing the type, scale and duration of crop planting, it changes the use of rural productive land and affects the pattern of crop specialization. This confirms Hypothesis 1.

Table 2. Impact of social capital on grape planting decisions in village.

Variable Type	Independent Variable	Odds Ratio	Std. Err.	Z	P > |z|	Prob > chi2	Pseudo R^2
Social network	Homogeneous social network	1.383	0.169	2.66	0.008		
	Heterogeneous social network	1.205	0.142	1.58	0.113		
	Human resources	1.380	0.163	2.73	0.006	0.000	0.094
	Land resources	1.300	0.155	2.2	0.028		
	Traffic location	0.566	0.075	−4.32	0.000		
	Constant	0.365	0.046	−7.94	0.000		
Social norms	Business air	1.202	0.147	1.5	0.132		
	Social customs	1.279	0.152	2.06	0.039		
	Social organization norms	1.04	0.123	0.33	0.742		
	Human resources	1.277	0.15	2.08	0.037	0.000	0.082
	Land resources	1.313	0.155	2.3	0.021		
	Traffic location	0.568	0.074	−4.35	0.000		
	Constant	0.371	0.046	−7.92	0		
Social trust	Institutional trust	1.384	0.175	2.56	0.010		
	Interpersonal trust	0.994	0.123	−0.05	0.960		
	Human resources	1.476	0.177	3.25	0.001	0.000	0.085
	Land resources	1.305	0.155	2.25	0.025		
	Traffic location	0.608	0.08	−3.79	0.000		
	Constant	0.369	0.046	−7.92	0.000		

Table 3. Impact of social network on grape planting status in village.

Dependent Variable	Social Network Indicators	Coef.	Std. Err	t	P > |t|	Prob > F	R²
Planting scale	Homogeneous social network	0.589 **	0.241	2.45	0.015		
	Heterogeneous social network	0.729 ***	0.24	3.05	0.002		
	Land resources	0.293	0.212	1.38	0.168	0.000	0.051
	Human resources	0.296	0.214	1.38	0.168		
	Traffic location	−0.500 **	0.194	−2.56	0.011		
	Constant	1.325	0.283	4.69	0.000		
Planting duration	Homogeneous social network	0.722 ***	0.211	3.42	0.001		
	Heterogeneous social network	0.404 *	0.211	1.92	0.056		
	Land resources	0.246	0.186	1.32	0.188	0.0000	0.101
	Human resources	0.707 ***	0.189	3.75	0.000		
	Traffic location	−0.583 ***	0.17	−3.42	0.001		
	Constant	1.975	0.249	7.95	0.000		
Centrality	Homogeneous social network	0.159 **	0.076	2.08	0.039		
	Heterogeneous social network	0.064	0.077	0.84	0.403		
	Human resources	0.041	0.069	0.59	0.552	0.276	0.017
	Land resources	−0.001	0.685	−0.02	0.983		
	Traffic location	−0.080	0.063	−1.27	0.207		
	Constant	0.213	0.088	2.43	0.016		

Ps. Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2. Impact of Social Norms on Crop Specialization

Social norms exist in people's minds, affect their behavior and are generally difficult to change (especially customs and habits). When the farmers of Ningling County make decisions on agricultural production, the villages that tend to change their planting structure generally believe that the impacts or roles of the business air, social customs and social organization norms are very important, while villages that are generally satisfied with the current situation believe that the above factors have little impact on their crop planting decisions. The factor rotation scores of the former were 0.170, 0.238 and 0.032 higher than those of the latter. Interestingly, with the increase in business air, that score is the value of the rotation of the maximum variance of risk culture, laborious traditions, profit-orieted concept, efficiency consciousness, innovation milieu and market environment; the scale of grape planting in the village first increased and then decreased, while the duration and centrality of grape planting in the village increased as a whole (Figure 5). This shows that villagers who do not care about risks or that are without any economic sense are not planning to plant grapes on a large scale, and excessive concern about risks or swaying by considerations of gain and loses are also not conducive to the regionalization of grape planting; on the other hand, villagers who plan to plant on a larger scale and for a longer period of time are generally more concerned about risk. In addition, the service quality of social organizations such as cooperatives, leading enterprises and governments has an obvious impact on the regional agricultural specialization level. They believe that efficient and reliable social organization services can stimulate their enthusiasm for production, which is conducive to crop specialization. Compared with social capital, the traffic location of village has a greater impact on the scale, duration and centrality of grape planting in the village (Table 4).
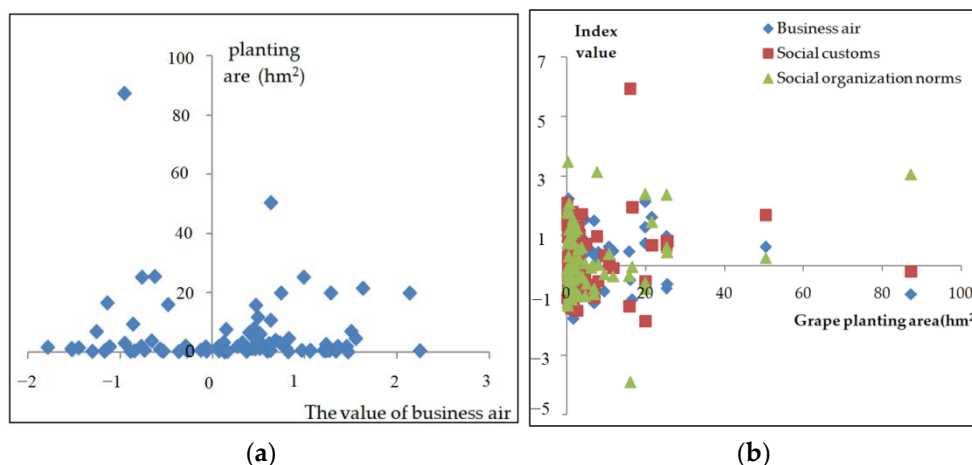
(a)　　　　　　　　　　　　(b)

Figure 5. Social norms and grape planting area of villages.

Table 4. Impact of social norms on grape planting in village.

Dependent Variable	Social Norm Indicators	Coef.	Std. Err	t	P > |t|	Prob > F	R²
Planting scale	Business air	0.185	0.325	0.57	0.570	0.0003	0.068
	Social customs	0.586 *	0.332	1.77	0.078		
	Social organization norms	1.141 ***	0.344	3.32	0.001		
	Traffic location	−0.96 ***	0.321	−2.99	0.003		
	Human resources	0.522	0.342	1.53	0.128		
	Land resources	0.363	0.327	1.11	0.269		
	Constant	1.375	0.345	3.98	0.000		
Planting duration	Business air	0.400 *	0.210	1.90	0.058	0.0000	0.078
	Social customs	0.515 **	0.214	2.41	0.016		
	Social organization norms	0.344	0.221	1.55	0.121		
	Traffic location	−0.737 ***	0.206	−3.57	0.000		
	Human resources	0.504 *	0.220	2.29	0.022		
	Land resources	0.292	0.211	1.39	0.166		
	Constant	1.837	0.222	8.28	0.000		
Centrality	Business air	0.146	0.116	1.26	0.207	0.0206	0.040
	Social customs	0.035	0.118	0.30	0.767		
	Social organization norms	0.370 ***	0.122	2.99	0.003		
	Traffic location	−0.217 *	0.114	−1.90	0.058		
	Human resources	0.113	0.122	0.93	0.352		
	Land resources	−0.024	0.117	−0.20	0.839		
	Constant	0.255	0.123	2.07	0.039		

Ps. Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In subfigure (a), The abscissa is the value of business air which is the score that after the rotation of the maximum variance of business air group of variable, the ordinate is the grape planting area of smallholders. However, the ordinate is the value of business air, social customs, social organization norms which are the scores that after the rotation of the maximum variance of each group of variable, the ordinate is the grape planting area of smallholdersin subfigure (b). We can clearly observe that the relationship between the planting area and each value is an inverted "U" shape. In other words, the planting area increases and then decreases as values change.

4.3. Impact of Social Trust on Crop Specialization

Institutional trust has a significant impact on whether a village participates in planting, planting scale and planting duration. In other words, the more trust the village farmers have in the industrial policy, agricultural technology extension policy, information sharing

policy, rural financial policies, infrastructure construction capability of government and external publicity capability of government, the more active they will be in participating in crop planting, the larger the planting scale and the longer the planting duration. Moreover, the influence of institutional trust on the scale and duration of grape planting in villagers is far greater than that of interpersonal trust. This result explains why strong leadership by a local committee or local government played an important role in rural revival; a strong leadership that motivates and leads the local farmers might be decisive in some cases [5]. The trust levels of farmers in technical personnel, entrepreneurs and well-educated people have a limited impact on their participation enthusiasm, planting scale and planting duration, but the interpersonal trust level has a significant impact on the spatial diffusion of crop planting in the village. The higher the interpersonal trust level, the stronger the external diffusion ability of villages (Table 5). That is to say that the participation in the decision making of villages may be affected by the surroundings, but the production scale and duration vary depending on the situation of each village.

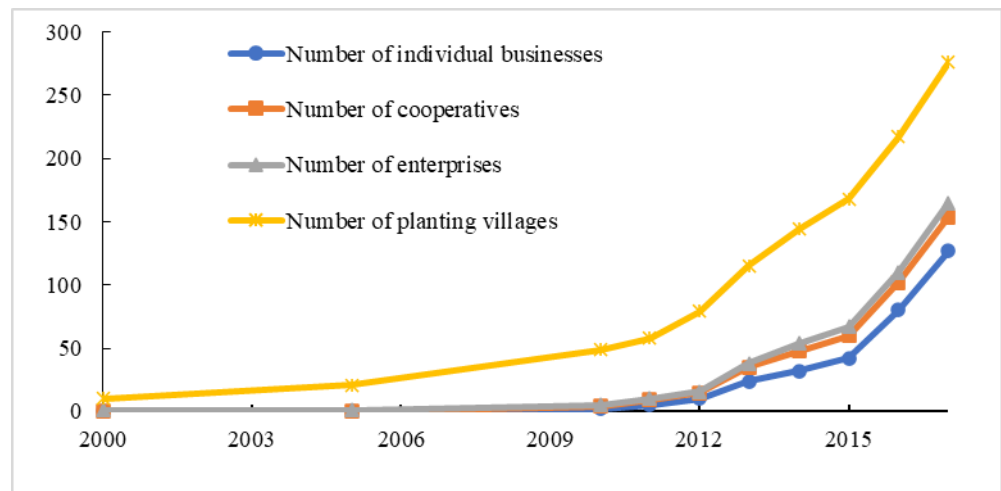**Table 5.** Impact of social trust on grape planting in village.

Dependent Variable	Social Trust Indicators	Coef.	Std. Err	t	P > |t|	Prob > F	R²
Planting scale	Institutional trust	0.636 **	0.275	2.31	0.021	0.002	0.051
	Interpersonal trust	0.512 *	0.281	1.82	0.069		
	Human resources	0.613 **	0.289	2.12	0.035		
	Land resources	0.127	0.286	0.44	0.657		
	Traffic location	−0.777 ***	0.261	−2.98	0.003		
	Constant	1.413	0.330	4.28	0.000		
Planting duration	Institutional trust	0.604 ***	0.192	3.14	0.002	0.000	0.097
	Interpersonal trust	0.341 *	0.196	1.74	0.083		
	Human resources	0.821 ***	0.202	4.07	0.000		
	Land resources	0.144	0.199	0.72	0.471		
	Traffic location	−0.616 ***	0.182	−3.38	0.001		
	Constant	1.907	0.230	8.28	0.000		
Centrality	Institutional trust	0.128	0.118	1.08	0.279	0.0181	0.037
	Interpersonal trust	0.347 ***	0.120	2.89	0.004		
	Human resources	0.162	0.124	1.31	0.192		
	Land resources	−0.051	0.122	−0.41	0.679		
	Traffic location	−0.255 **	0.112	−2.28	0.023		
	Constant	0.288	0.141	2.03	0.043		

Ps. Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.4. Crop Specialization Promotes the Development of Rural Industries

The geographic concentration and scale effect of agricultural production can promote the specialization of the upstream and downstream industries and the development of service industries, forming such advantages as increasing returns to scale, generating the agglomeration effect and accelerating the development of rural industries. In 2000, there were only nine villages engaging in grape planting in Ningling County, only one grape deep-processing enterprise and no individual industrial and commercial businesses or cooperatives engaging in grape sales and management. However, ordinary consignment points and cooperatives providing planting technology services have established. In 2005, the number of planting villages increased to 20, with the spatial distribution mainly in Yangyi Township and Luogang Town, showing a small agglomeration phenomenon. However, the number of grape enterprises, cooperatives and individual industrial and commercial businesses did not change. From 2005 to 2010, the grape planting industry grew rapidly. In 2010 alone, there were 17 new grape planting villages. At this time, the number of individual industrial and commercial businesses and grape processing enterprises increased to two. From 2011 to 2017, the regional specialization speed of the grape planting industry was rapid, and the number of villages that planted grapes in the

county increased to 111 (Figure 6). After some planting villages withdrew, the number of grape planting villages in the entire county reached 84 in 2017. During this period, there were 109 fresh grape retailers, 16 wholesalers, 7 fruit seedling sellers and technical service providers, 27 grape planting cooperatives and 11 grape processing enterprises engaging in grape juice, canned grapes and wine, and different operators were distributed in each area of the county according to their own service market objects. For example, the retail industry was more distributed throughout counties, townships and other densely populated areas, the planting cooperatives were located near the grape planting villages, and the deep processing enterprises were largely located in the technical development zone (Figure 7), forming an industrialization development pattern integrating "planting–processing–sales".

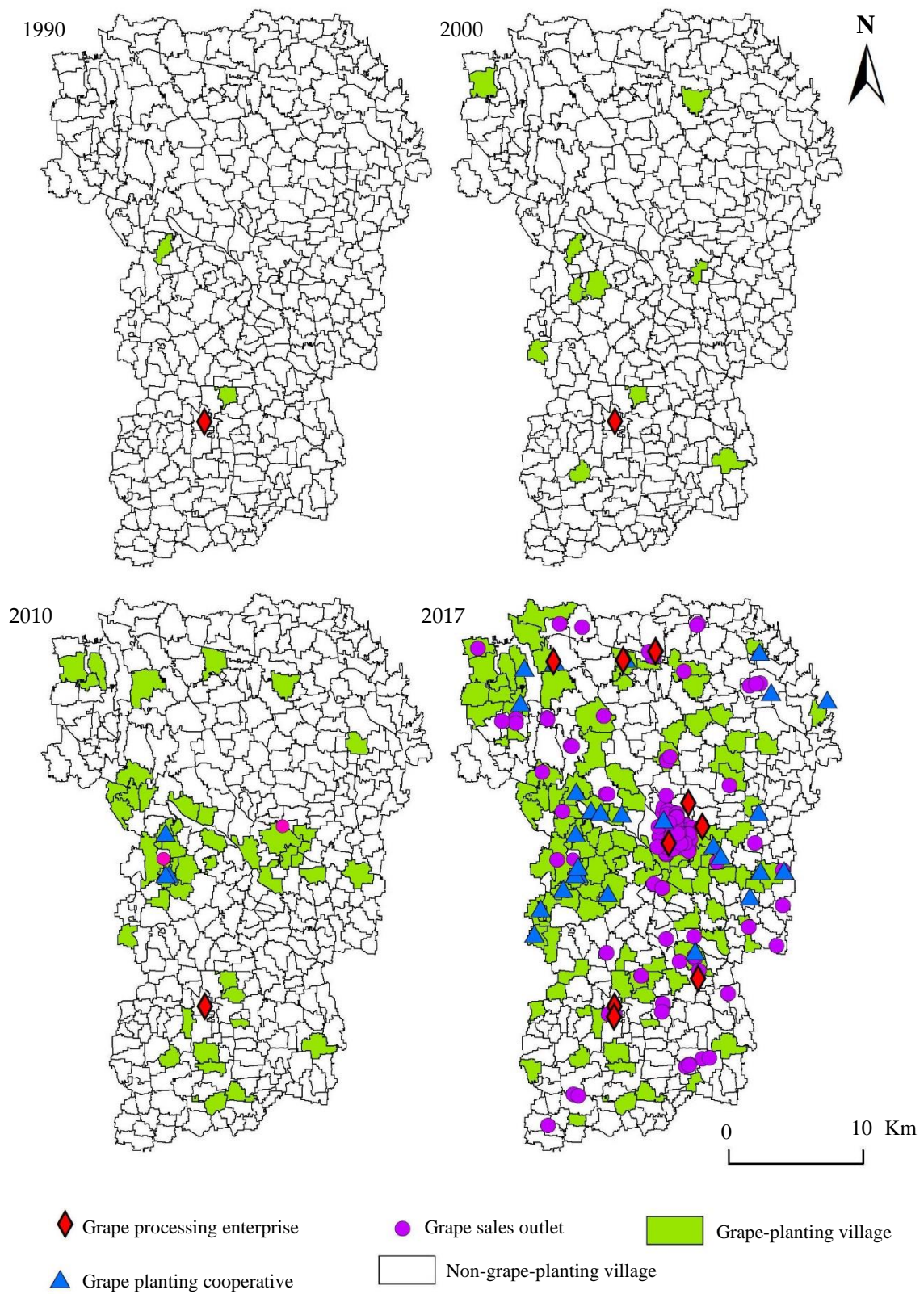**Figure 6.** Numbers of different producers at different times.

Figure 7. Locations of different producers.

5. Conclusions and Discussion

5.1. Conclusions

Based on existing studies, this study proposes a theoretical hypothesis about the interaction among social capital, crop specialization and rural industrial development. With the development of the grape industry in Ningling County, Henan Province, China, this paper analyzes how the social capital drives the development of the grape industry by promoting crop specialization using actual survey data and official statistical data, and taking the villages as the analysis units. The results show that the following: (1) for villages with a richer social network, the realization of crop specialization is faster, but different types of social network have different directions. For villages with a more developed homogeneous network, the possibility of participating in grape planting is greater, the planting scale is larger, the planting time is longer and the influence on other villages is stronger. For villages with a more developed heterogeneous social network, the possibility of planting grapes on a large scale in the future is greater. (2) Social norms have a significant impact on crop specialization. Appropriate risk awareness and efficient and reliable social organization services are conducive to crop specialization. Not caring about risk or worrying too much about risk is not conducive to the expansion of grape growing areas, and efficient and reliable social organization services are conducive to crop specialization. (3) The higher the level of social trust, the faster the crop specialization. The more trust farmers have in the government's ability, the more enthusiasm they have to participate in characteristic planting the larger the planting scale and the longer the planting time. For villages with a higher level of interpersonal trust, the external diffusion ability is stronger. In short, social capital can effectively promote the rapid promotion of superior crops, enhance the scale and specialization level of crop planting, promote the coordinated development of upstream and downstream industries, and promote the prosperity of rural industries.

5.2. Discussion

Extensive literature has a common denominator: The causes of Europe rural recessions are not natural but political and economic [2]. In view of this, Western European countries have introduced a series of policies to curb rural recession and believe that social economy institutions may be a key factor in the fight against rural recessions [71]. However, effective policies are usually built on a basis of endogenous potentials found in a region and participation of local population [72]. Policies should be designed in accordance with the local conditions, make local community feel like an essential and active part of the policy design and encourage them to be co-responsible for the challenge [73,74]. Otherwise, the role of policies will be limited [10]. In other words, Rural revitalization requires not only the support of policies and the assistance of exogenous resources but also the combination of endogenous and exogenous resources. To exapand on this, social capital will provide the greatest help for farmers to make full use of exogenous resources [75]. Although social capital is seen as an aspect of social inequality that hinders inclusive development [76], deceiving fellow villagers is not common in China because they have lived together for generations; thus, ordinary Chinese villagers generally trust their relatives and fellow villagers, regardless of whether or not the villagers are their neighbors [77]. In China, social capital plays a important role to fully ensure the participation of community members in the process of discussion and consultation and leading to a concern and joint action in land transfer and shared benefits [78].

It can be seen from this study that in the development of the grape industry in China's traditional agriculture, the social network affects grape planting information and technology transfer, social norms affect whether farmers participate in decisions about grape production, and social trust affects farmers' grape planting scale and duration, which all in turn affect the degree of crop specialization and the development trend of rural industries. However, reform and opening up and the market economy have had serious impacts on social norms, trust, integrity and social exchanges in rural China. It is also important for China's rural revitalization to figure out how to improve the degree of rural

culture by retaining rurality, how to improve the effectiveness of farmers' social exchange by establishing an integrity system of rural society as a whole, and how to improve the prosperity of social capital in villages and competitive characteristic industries in the county. According to the results of this study, although the homogenous social network can improve the current degree of crop specialization, the heterogeneous network can better improve the degree of crop specialization in the future. In the context of China's land system and the restricted red line of 1.8 billion mu of arable land, no industrial land or construction land is allowed in the arable land of village areas. Therefore, the land use pattern in the future will evolve towards a land use division of labor in which "industrial land or commercial land is concentrated in towns and villages, while villages are specialized in certain crops". Crop specialization enables the rural planting industry to obtain the benefits of the scale economy and specialization economy. The expansion of industries promotes the further strengthening of cooperation and communication among farmers, thereby increasing their social capital and further optimizing and reconstructing their crop specialization. Social capital, crop specialization and industrial prosperity promote each other and form a positive feedback mechanism. Therefore, in the rural revitalization process, competitive industry projects should be selected according to the local conditions; the social customs and institutional norms of different regions should also be considered in the process of project promotion; full play should be given to the power of regional social capital; feasible technical promotion, adoption and implementation plans should be developed. This will start a positive cycle and promote coordinated development among local social capital, division of labor, crop specialization and industrial prosperity.

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