

## Article

# Individual and Village Level Factors Affect Farmers' Satisfaction with Sustainable Rural Development Practices: Evidence from Guangdong Province in China

Xiaojuan Zhang  and Zhengxi Yang \*

School of Public Management, South China Agricultural University, Guangzhou 510642, China

\* Correspondence: lawyeryzx@scau.edu.cn

**Abstract:** Farmers are the most important stakeholders in the sustainable development of rural areas. Studying farmers' satisfaction with sustainable rural development (SRD) practices can help us to understand how to mobilize farmers' enthusiasm and initiative, such that they can play a major role in SRD. This study aimed to identify the factors influencing farmers' satisfaction with SRD practices. Based on the survey data of 599 farmers in 57 villages in the Guangdong Province, Hierarchical Linear Modelling (HLM) was used to identify the influencing factors of farmers' satisfaction with SRD practices in Guangdong Province at the individual and village levels. This study found that there was spatial heterogeneity in farmers' satisfaction with SRD practices in the Guangdong Province, and factors at the individual level and village level jointly affected the farmers' satisfaction. At the individual level, farmers' college education, identity of Chinese Communist Party (CCP), and participation have positive predictive effects on farmers' satisfaction. At the village level, the improvement of public services, village infrastructure, and grassroots governance has a positive predictive effect on farmers' satisfaction. However, the improvement of the village living environment and the income of the village's collective economy were not significant determinants of farmers' satisfaction. The results provide practical implications for policymakers to guide farmers to actively participate in SRD practices.

**Keywords:** sustainable development; sustainable rural development; farmers' satisfaction



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## 1. Introduction

At present, sustainable rural development (SRD) around the world is facing significant challenges. The depopulation and “brain drain” of rural areas have become widespread phenomena worldwide due to the development of industrialization and urbanization that have taken place throughout the last two centuries [1,2]. By 2050, the population of Europe's urban regions is projected to increase by 24.1 million, compared to a decrease of 7.9 million in rural areas [3]. An important effect of depopulation is the sharp decline in the agricultural labour force. Since 1960, the rural labour force has declined by 73 percent in Brazil, 47 percent in China, 44 percent in Russia, 34 percent in South Africa, and 18 percent in India [4]. In developed economies, the agricultural labour force in the United States has fallen below 3% of the total labour force; in Europe it is between 15% and 30%, and Japan and South Korea are also in the low 10 to 20% range [5]. A large number of young and well-educated labourers have migrated to urban areas, and many problems have arisen in rural areas, such as a shortage of talent, insufficient human resource education, abandoned farmland [6], an ageing rural population, a decrease in birth rates [2], and poorer tax revenue and infrastructure [7]. In developing countries, due to the differences in urban and rural environmental protection measures in the process of globalization, industrialization, and urbanization, environmental pollution in rural areas is becoming increasingly serious [8]. Globally, achieving sustainable economic, social, and environmental development in rural areas has become a more arduous task.

As the largest developing country in the world, China experiences all the previously mentioned problems and challenges in rural areas, and therefore proposed a SRD strategy in October 2017. The phenomenon of rural decline in China is reflected in the sphere of economy, society, and the environment. First, there is a large economic gap between urban and rural areas. From 1978 to 2016, China's per capital GDP increased from CNY 385 to CNY 53,980, with an average annual growth rate of 13.9%. However, China's urban and rural economic development is unbalanced, and the gap is large. From 1978 to 2016, the income gap between urban and rural areas in China expanded from CNY 209.8 to CNY 23,724, the income ratio expanded from 2.57 times to 2.72 times, and the highest in 2009 was 3.33 times [9]. Second, the hollowing out of rural areas is more serious. The outflow of the rural population is very large in China. In 1995, the rural population was 859.47 million. According to the China Statistical Yearbook 2022, the rural population will decrease to 509.79 million in 2022. The outflow of rural young and middle-aged labour and elites has resulted in the ageing and feminization of the agricultural labour force [10]. Correspondingly, rural homesteads are becoming more idle and abandoned, and newly built houses are gradually expanding to the periphery of the village, resulting in the expansion of the scale of village land [11]. Third, the lack of public cultural activities in the villages leads to the emptiness of the peasants' spiritual life, as well as the weakening and indifference of interpersonal relationships [12]. Fourth, the environmental pollution in rural areas is increasing daily, including pollution from agricultural sources and domestic pollution in rural areas, as well as the penetration of urban industrial pollution into rural areas [10]. SRD is essential to maintain active local communities and avoid depopulation and degradation of rural areas. To address the dilemma of rural development, the Chinese government put forward the national strategy of rural revitalization to achieve SRD in October 2017, which proposes five aspects: prosperous industry, ecological liveability, rural civilization, effective governance, and prosperous lives.

Farmers play a dominant role in SRD, but farmers were in a passive participation position in the practice of SRD in China. Although the main body promoting SRD development includes the chief designer, public servants, village cadres, farmers, various think tanks, etc., farmers are the most important stakeholders, builders, and participants in SRD [13]. The purpose of promoting SRD is to enhance the vital interests of farmers and enable farmers to live a happy life. Farmers' satisfaction should be the only criterion for measuring the effect of SRD [14]. However, a prominent problem in SRD practices in China is that farmers' spiritual outlook has not been revitalized, and farmers' passivity leads to unsustainable rural revitalization and development [15]. With the continuous advancement of SRD practices, how satisfied are Chinese farmers with the effectiveness of SRD, and what factors affect farmers' satisfaction with SRD practices? This is an important issue that cannot be ignored in the practice of SRD. However, few published studies have been undertaken to assess farmers' satisfaction with SRD practices in the Chinese context, despite farmers' life-quality and satisfaction contributing to tackling the current depopulation and migration from rural areas. In view of the above, the purpose of this study was to identify farmers' satisfaction with SRD practices and determine factors associated with farmers' satisfaction. The results of our study can contribute to filling the gap and improving policy and its implementation of SRD in accordance with real needs in the study area.

## 2. Theoretical Framework

### 2.1. Sustainable Rural Development and Its Practical Dimensions

Sustainable development means meeting the needs of the present generation without compromising the ability of future generations to meet their own needs, according to 1987's Brundtland report. Rural development refers to the set of activities and actions of diverse actors—individuals, organizations, groups—that, taken together, lead to progress in rural areas, and has evolved from a focus initially centred on the agricultural sector to a more holistic and inclusive approach that incorporates other economic sectors, as well as the environment. Many studies have recognized that SRD can be measured through

three aspects: economy, society, and the environment [2,16]. Combined with the context of China's promotion of rural revitalization and SRD strategies, the sustainable development of rural economy, society, and the environment has the following implications [17]: (1) The economic dimension mainly lies in realizing the prosperity and development of the modern agricultural industry and improving the affluence of farmers; (2) The social dimension is mainly reflected in improving the spiritual outlook of farmers, improving the level of rural social civilization, and realizing the sustainability and low cost of rural governance effects, which can be recognized and satisfied by the general public; and (3) The environmental dimension lies in creating an ecological living environment for farmers in rural areas, which mainly includes public services such as sanitary environment, infrastructure, and medical care and education.

Since the SRD strategy was proposed in 2017, China has carried out intensive, wide-ranging, and effective practices around the sustainable development of the rural economy, society, and the environment. The report of the 19th National Congress of the Communist Party of China stated that the requirements of China's SRD strategy were the "20-character policy" of "prosperous industry, liveable ecology, civilized rural customs, effective governance, and prosperous life". All 31 provinces (autonomous regions and municipalities) in China have established leading groups for the implementation of the SRD strategy, and all provincial-level SRD strategic plans have been issued. A series of relevant action plans have been formulated and issued in various regions, including promoting the revitalization of rural industries, carrying out a three-year action plan to improve the rural living environment, and strengthening and improving rural governance [18]. The report also shows that the key tasks of China's SRD strategy have achieved remarkable results, and rural revitalization has achieved a good start.

At the village level, the practices carried out in SRD strategy in China mainly include the following five aspects [19]: (1) In terms of environmental remediation, the three-year action of "Three Cleanups" (cleaning up village roadways, production tools, and building materials; cleaning up the weeds, debris, and accumulated garbage in front of and behind houses and village roadways; cleaning up ditch, pond, river, and river silt, floating), "Three Demolition" (demolition of dilapidated houses, abandoned pigs and cattle stalls and open-air toilet huts; demolition of random and illegal buildings; demolition of illegal and illegal commercial advertisements, signboards, etc.), "Three Rectifications" (rectification of littering and littering; rectifying the disorderly discharge of sewage; rectifying the disorderly connection of electricity, television and communication lines) have been implemented, and rural areas have been promoted to realize livestock and poultry enclosures. (2) In terms of rural infrastructure construction, the roads leading to townships and administrative villages have been hardened, the comprehensive collection, transportation and disposal of rural domestic waste have been realized, and the "toilet revolution" in rural areas has been promoted. (3) In terms of village governance, the "three openness" of rural party affairs, government affairs, and finance were implemented, and rural civilization construction activities were actively carried out. (4) In terms of rural public services, the quality and level of supply of public services such as rural medical care, education, and culture were actively improved. (5) In terms of rural economic development, the project of "one village with one product, one town with one industry" has been proposed and implemented, and rural land transfer and the development of characteristic agricultural industries have been actively promoted.

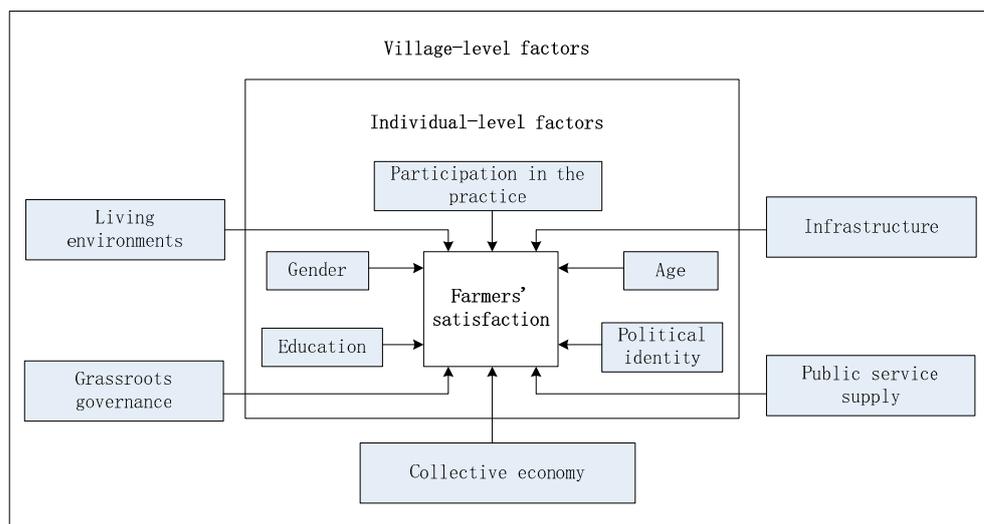
## *2.2. Satisfaction with the Sustainable Rural Development Practice*

Farmers' satisfaction is a concept that applies the theory of customer satisfaction to agricultural and rural policies and the supply of rural public goods. Customer satisfaction is a concept in marketing and is generally considered to be a mental or emotional reaction to the quality of a product or service [20]. Many studies favour a cumulative transactional view of customer satisfaction; that is, customer satisfaction is a comprehensive evaluation of the customer's long-term purchase and consumption experience of goods or services [21].

It is a comprehensive evaluation of the past, present, and future performance of product or service providers, reflecting the current and long-term performance of the enterprise [22]. The theory of customer satisfaction was gradually applied to the field of rural public policy and rural public goods to study farmers' satisfaction with government policies and their implementation effects, as well as the supply of rural public goods. Because the main consumers of rural policies and rural public goods are farmers, in the context of rural research, customer satisfaction can be called farmers' satisfaction [23]. Implementing agricultural and rural policies does not mean that policies can be fully and effectively adopted and promoted. Only agricultural and rural policies with better implementation effects can fully play their role [24]. Farmer satisfaction is an important way to evaluate the effect of agricultural and rural policy implementation. The effect of agricultural and rural policy implementation is largely reflected in the supply quality and level of rural public goods. Farmers are the most important users of rural public goods; therefore, not only should they have a say in the expression of public goods demand and investment decisions, but farmers' satisfaction with the supply of rural public goods is also an important indicator to measure the effectiveness of rural public goods supply [25].

### 2.3. Factors Influencing Farmers' Satisfaction with Sustainable Rural Development Practices

Although farmers play a dominant role in the practice of SRD in China, few studies have focused on farmers' satisfaction with SRD policies and their implementation effects. Providing a comprehensive image of farmers' satisfaction with SRD practices requires highlighting the factors that influence it. Synthesizing the existing research, various factors that may influence farmers' satisfaction had been tested, such as farmers' age, gender, party members, education, and participation, as well as the improvement of rural public production, living conditions, and the environment [20,24,26–37]. We find that the discussion of the factors affecting farmers' satisfaction in the existing research can be categorized into two levels. One is the level of farmers' individual factors, and the other is the village-level factors. We discuss in detail how individual and village level factors may affect farmers' satisfaction with SRD practices, as illustrated in Figure 1.



**Figure 1.** Study conceptual framework.

At the level of farmers' individual factors, farmers' age, gender, education level, party members and participation may affect their satisfaction with SRD practices.

Research shows that the older the farmer is, the more energy he/she will devote to agricultural production, and he/she will be more satisfied with agricultural policies [26]. Similarly in relation to their lack of farming experience, younger farmers may be less satisfied with agricultural services than older farmers [20]. However, some studies have also

pointed out that as farmers get older, their physical fitness is correspondingly worse, and their participation in agriculture is relatively lower, so their satisfaction will decrease [27]. Hence, we propose that middle age positively influences farmers' satisfaction.

Compared with men, women need to take care of children and families, and it is difficult for women to have spare time to engage in non-agricultural work. Because they have a single source of income and hope to get more benefits from agricultural and rural development, this can lead to them being dissatisfied with the SRD practices [28]. The majority of the rural labour force is male, resulting in a deeper appreciation of the benefits of agricultural and rural policies and practices, which may lead to higher satisfaction of male farmers [27]. In line with this reasoning, we propose that gender has a positive impact on farmers' satisfaction; that is, males are more satisfied with SRD practices than females.

The higher the education level of farmers, the more they know about the government's investment in agricultural policies and rural construction projects [27], and the better their ability to accept government services [26], the more help they could get from relevant policies [24], and the result is that their satisfaction will be higher. Thus, we propose that education level positively influences farmers' satisfaction.

Party membership also has an impact on farmers' satisfaction. If a farmer is a member of the Communist Party of China, he will be consulted in the implementation of many projects in the countryside, and he will be more satisfied with the corresponding agricultural and rural policies [28]. In China, village cadres are usually served by members of the Chinese Communist Party (CCP). They play a leading role in the implementation of agricultural and rural policies. They are more fully aware of the advantages and functions of agricultural and rural policies, so their satisfaction will be higher [24]. Hence, we propose that being a CCP member positively influences farmers' satisfaction.

It was found that farmers are more satisfied if farmers' opinions are publicly consulted before the implementation of agricultural projects, which ensures their right to knowledge and gives them the opportunity to express their views and needs [28]. In the construction of agricultural projects, the level of farmers' participation has the highest sensitivity to the overall evaluation of the projects [29]. In the supply of rural public goods, as the direct provider and beneficiary of public goods, farmers' direct participation in public goods supply affects farmers' satisfaction [30]. Thus, we propose that farmers' participation in SRD practices positively influences farmers' satisfaction.

At the village factor level, the five major changes brought to villages by SRD practices, namely living environment, rural infrastructure, public service supply, grassroots governance, and collective economy, may affect farmers' satisfaction.

One of the important tasks of SRD practices is to enhance the appearance of rural villages, thereby improving the living environment in rural areas. To this end, the government has carried out a series of activities in rural areas, such as three clean-ups, three demolitions, three rectifications, and livestock kept in captivity. It was found that the better the rural public health, the better the living environment of farmers, and the higher the satisfaction of farmers [30]. The improvement in farmers' daily living environment brought about by agricultural projects significantly improved farmers' satisfaction with agricultural projects [27]. It is also found that village appearance has a significant positive impact on farmers' satisfaction with rural living environment governance [31]. In line with this reasoning, we propose that the improvement of the village living environment will positively influence farmers' satisfaction.

In order to comprehensively improve the infrastructure in rural areas, the government has carried out related projects such as road hardening, garbage disposal, toilet revolution, and centralized water supply in rural areas. Rural roads and drinking water are the basic public goods related to farmers' life and production. Improvements in these aspects have a positive impact on farmers' satisfaction with the investment and supply of rural public goods [23,30]. As the living environment has attracted more and more attention from the public, farmers also pay more attention to the disposal of domestic waste. The study found that the better the treatment of domestic waste, the higher the satisfaction of farmers [23].

It was also found that the toilet revolution and the improvement of garbage disposal in rural areas have a significant positive impact on farmers' satisfaction [31]. A study from Sichuan province in China found that factors such as road facilities and public toilet revolutions in rural infrastructure were the main factors affecting farmers' satisfaction [32]. Hence, we propose that the improvement of village infrastructure will positively influence farmers' satisfaction.

SRD practices in China are committed to improving rural public services, so as to make up for the shortcomings of farmers' livelihoods and reduce the gap between urban and rural basic public services. In practice, the basic public services for farmers have been improved from the aspects of bus services, medical services, government services, and public cultural services in rural areas. Improvements in rural traffic conditions brought about by agricultural projects can significantly increase farmers' satisfaction [27]. Research also shows that rural medical and health conditions and public services provided by village committees and the government were the most important factors affecting farmers' satisfaction with rural public services [23]. With the continuous improvement of farmers' income level, farmers have a higher level to meet the needs of their own spiritual life. Therefore, cultural and recreational activities in rural areas had a certain degree of influence on farmers' satisfaction [30]. Thus, we propose that the improvement of village public service supply will positively influence farmers' satisfaction.

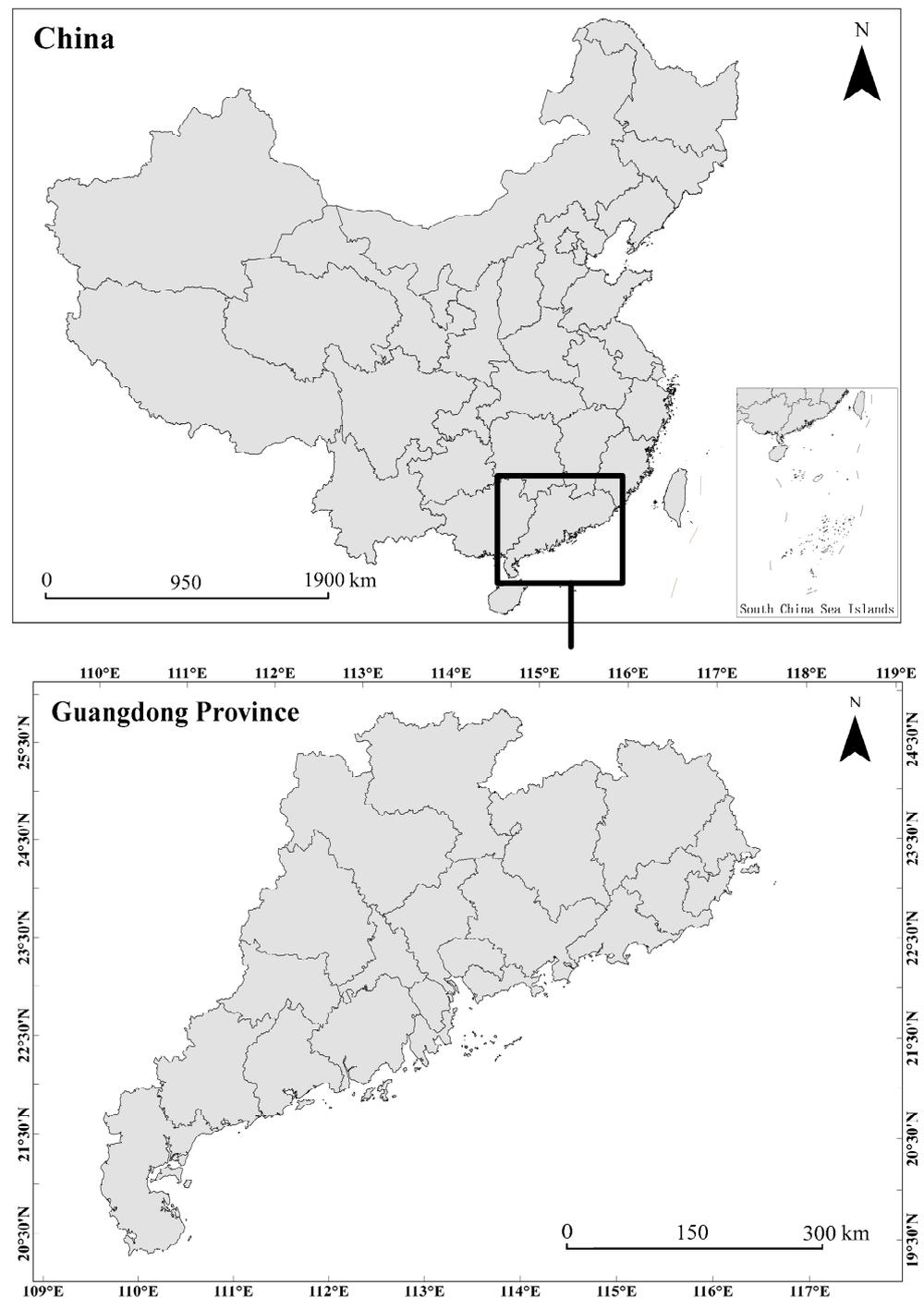
An important goal and task of the SRD practices in China is to improve the governance capacity of rural areas and achieve effective rural governance. Grassroots agencies such as township governments and village-level autonomous organizations are key participants in rural governance, and their effectiveness in implementing policies affects farmers' satisfaction [31]. The government should increase publicity efforts and use various forms such as radio, banners, and brochures to increase the publicity of SRD and its significance, so as to strengthen farmers' recognition of SRD practices and ensure the lasting and stable governance effect [33]. The openness, fairness, and transparency of village grassroots governance have an important impact on farmers' satisfaction. In a study in the Shandong Province in China, it was found that the transparency of management funds at the village level was not high, and 76.31% of the respondents were dissatisfied with the township administration or village self-governance [34]. Similarly, in the process of the government's management of agricultural projects, publicizing the budget before implementation and soliciting farmers' opinions will increase farmers' satisfaction [28]. Hence, we propose that the improvement of village grassroots governance will positively influence farmers' satisfaction.

Developing and strengthening rural collective economy is the economic requirement of SRD strategy in China. Research shows that the development of the village collective economy in different regions of China is unbalanced, and the phenomenon of polarization is serious [35]. Since China has not yet established a public financial system covering villages, the village-level collective economy plays a very important role in ensuring the normal operation of rural grassroots organizations, providing rural public goods, and increasing farmers' income [36]. A village with a developed village collective economy has a strong ability to provide rural public works and public welfare undertakings, which may increase farmers' satisfaction [37]. In line with this reasoning, we propose that the scale of the village collective economy may have a positive impact on farmers' satisfaction.

### 3. Materials and Methods

#### 3.1. Study Area

The Guangdong Province in South China was selected for the current study area. The Guangdong Province has a total area of 179,725 km<sup>2</sup> and lies between latitudes of 20° N–25.5° N and longitudes of 110° E–117° E, as shown in Figure 2. According to the 2021 population census, the Guangdong Province had a population of 126.84 million, with 25.37% residing in rural areas [38].



**Figure 2.** Map of study area.

To implement the SRD strategy proposed by the state, the Guangdong Province has successively issued the “Guangdong Provincial Party Committee and Guangdong Provincial Government’s Implementation Opinions on Promoting the Rural Revitalization Strategy” and “Guangdong Province’s Implementation of the Rural Revitalization Strategic Plan (2018–2022)”. The policy document stated that in accordance with China’s “20-character policy” requirements of “prosperous industry, livable ecology, civilized rural customs, effective governance, and prosperous life”, realizing the revitalization of industry, ecology, culture, organisation, and talent should be the focus of promoting SRD. The key tasks for promoting SRD include actively improving the integration level of urban and rural infrastructure, equalization of urban and rural public services, and high-quality and stable

poverty alleviation. Statistics show that by 2020, the Guangdong Province made significant progress in promoting SRD [39]: the province's ability to coordinate agriculture-related funds increased by 35 times to CNY 13.3 billion; the rural living environment significantly improved; and the per capita disposable income of relatively poor households with labour capacity in the province reached CNY14,331, a year-on-year increase of 21%.

### 3.2. Sampling and Data Collection

In China, most regions implement the “city leading county” system. In addition to directly managing urban areas, the city's regime also manages the vast rural areas through its counties. Therefore, in most cases, the administrative level from province to village is “province–city–county (district)–town (street)–village”. At the village level, there is a distinction between administrative villages and natural villages. An administrative village is the management scope of villagers' self-governance by villagers' committees established in accordance with the Organic Law of Villagers' Committees. It is a grassroots mass self-government unit in China. It usually consists of one large or several smaller natural villages. A natural village is a village formed by farmers living together in a natural environment for a long time. In China, it is not a social management unit, and corresponds to the concept of an administrative village. In this study, the study village refers to the ‘administrative village’.

In order to ensure the scientific basis and rationality of the sampling, we selected 6 cities from 21 prefecture-level cities in the Guangdong Province, 4 towns (streets) in each city, and 2 administrative villages in each town (street). From April 2020 to December 2020, 131 natural villages out of 57 administrative villages in Guangdong Province were sampled. For each administrative village surveyed, 10–15 farmers were randomly visited to conduct a household survey. Then, the investigators completed the questionnaire based on the responses of the farmers. A total of 610 farmers were surveyed in the 131 natural villages. In total, 11 questionnaires were excluded from the sample because of incomplete questionnaires, and 599 valid questionnaires were received.

### 3.3. Instrument

A questionnaire and an evaluation system for a field survey were used as a data-collection tool. The interview schedule of the questionnaire consisted of three parts. Part 1 asks about the basic information of farmers, such as gender, age, education level, and political identity. Part 2 focuses on asking farmer show much they were involved in SRD practices, which was measured on a point Likert scale (1 = very low, 2 = low, 3 = intermediate, 4 = high, and 5 = very high). Part 3 is about farmers' satisfaction with SRD practices. According to the “20-character policy” (prosperous industry, liveable ecology, civilized rural customs, effective governance, and prosperous life) of China's SRD strategy, the farmers were asked to indicate their satisfaction with the work carried out by the local government according to the five aspects of SRD practices: (1) industrial prosperity, (2) ecological liveability, (3) rural civilization, (4) effective governance, and (5) affluent life. Based on what each farmer answered, the investigators completed a questionnaire on a Likert-type scale (1 = very dissatisfied, 2 = slightly dissatisfied, 3 = slightly satisfied, 4 = satisfied, 5 = very satisfied). In the field survey part, we established an evaluation system based on the SRD practices in the Guangdong Province to evaluate its implementation effect, as shown in Table 1. In this evaluation system, rural living environmental, rural infrastructure, rural public services, grassroots governance, and rural collective economy were measured with 20 points, respectively, to measure their development degree and level, with a total of 100 points. According to this evaluation system, we conducted field visits and scoring for each village where the interviewed farmers were located.

**Table 1.** An evaluation system for the implementation effect of SRD practices.

Dimension	Content	Score	Standards of Grading
Rural living environmental	Three clean-ups	5	1 point will be deducted for each of the following situations found, until all of them are deducted: (1) production tools and building materials are piled up in disorder; (2) there is accumulated garbage, weeds and debris that have not been cleaned up; (3) there are black and odorous water bodies, garbage floating objects, etc.
	Three demolitions	5	(4) dangerous houses, abandoned pig and cattle stalls that should be demolished; (5) random construction of facilities and illegal buildings; (6) illegal advertising signs, etc.
	Three rectifications Livestock are kept in captivity	5 5	(7) random garbage; (8) sewage everywhere; (9) messy wiring (10) each piece of livestock and poultry manure found in the village
Rural infrastructure	road hardening	5	2.5 points will be deducted for each unhardened road in the natural village with more than 20 households, until all of them are deducted
	Garbage disposal	5	5 points for configuring garbage collection points and disposing of garbage in a timely manner, 2.5 points for insufficient configuration, and 0 points for no configuration
	Toilet revolution	5	5 points for standard public toilets that are built and put into use, 2.5 points for those that have not been put into use or under construction, and 0 points for that have not yet started construction
Rural public services	Centralized water supply	5	5 points if the centralized water supply has been built and put into use, 2.5 points if it has been completed but not put into use or under construction, and 0 points if construction has not yet started
	Open bus	5	5 points for opening a bus service, 0 points if not
	Village health stations	5	5 points for the established village health service centre, 2.5 points for completed but not put into use or under construction, and 0 points for unconstructed construction
	Village public service platform	5	5 points for newly built or completed standardized renovation, 2.5 points for that which is completed but not put into use or under construction, 0 points for unconstructed construction
Grassroots governance	Cultural service centre	5	5 points for newly built or completed standardized renovation, 2.5 points for completed but not put into use or under construction, 0 points for unconstructed construction
	Village affairs open	10	2.5 points will be deducted for each missing item: (1) village party affairs public; (2) village administrative affairs open; (3) village financial disclosure;
	Rural civilization	10	(4) posting or hanging slogans on rural revitalization; (5) posting or hanging anti-criminal slogans; (6) posting or hanging slogans on village regulations
Rural collective economy	Income of village collective economy	20	20 points to the highest income of village collective economy (CNY 10,000). A = The highest income of village collective economy/20. Other villages' collective economy score = The income of village collective economy/A

### 3.4. Data Analysis

Descriptive statistical techniques (including frequency, percentages, mean, and standard deviation, etc.) were used to analyse the data and present the results by using HLM6.0. Hierarchical Linear Modelling (HLM) or Multilevel Analysis was used to analyse the factors affecting farmers' satisfaction at the individual level and at the village level. Combined with the related literature on farmers' satisfaction, farmers' satisfaction with the effect of rural policy practice is often formed by the combined influence of the individual attributes of farmers and the implementation effect at the village level. In regression analysis, since village-level variables have the same impact on farmers in the same village, there is a

correlation between different famers in the same village. If two different levels of variables at the farmer individual level and the village level are put into the same linear regression equation—that is, the factors at the village level are directly embedded in the regression analysis model—then the assumption that the error terms of the regression analysis must be independent will be violated. As a result, the existing independent variables cannot fully explain the variation of the dependent variable [40]. The multilayer model can separate variables at different levels and test the effect of each level and the contribution of each level to explain the difference in the dependent variable, and its application value has attracted increasing attention from scholars [41]. The independent variable in this study included those hypothesized to influence famers’ satisfaction with SRD practices. The list of explanatory variables used in the model is shown in Table 2. These explanatory variables were obtained from previous studies and based on the authors’ knowledge about this research area.

**Table 2.** Definition of variables in the farmers’ satisfaction model.

Variables	Measurement Description
Individual level factors	
Gender ( <i>GEN</i> )	Gender of farmers (0 = male, 1 = female)
Age ( <i>AGE</i> )	Age of farmers (0 = less than 49, 1 = from 50–59 years, 2 = more than 60 years)
Education ( <i>EDUC</i> )	Farmer education status (0 = primary school and below, 1 = junior school, 2 = high school, 3 = college and above)
Political identity ( <i>POLTIDEN</i> )	Farmers’ political identity (1 = CCP, 2 = Others)
Participation in the practice ( <i>PARTIPRAC</i> )	Farmers’ participation in SRD practices (1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high)
Village level factors	
Environmental remediation ( <i>ENVIR</i> )	Score the state of the living environment of the village(the evaluation method is shown in Table 1), the scoring range is 0–20
Infrastructure construction ( <i>INFRA</i> )	Score the state of the infrastructure in village(the evaluation method is shown in Table 1), the scoring range is 0–20
Public service supply ( <i>PUBSERV</i> )	Score the public service supply in village(the evaluation method is shown in Table 1), with a scoring range of 0–20
Grassroots governance ( <i>GRAGOV</i> )	Score the grassroots governance in village(the evaluation method is shown in Table 1), with a scoring range of 0–20
Collective economy ( <i>COLLECONO</i> )	Score the village’s collective economic income in 2020(the evaluation method is shown in Table 1), with a scoring range of 0–20

The null model and random-intercept model in the multilayer linear model were used to identify the impact of individual-level and village-level variables on farmers’ satisfaction.

The null model was used to test whether farmers’ satisfaction was significantly different at the village level. Its model is:

Level 1:

$$Y_{ij} = \beta_{0j} + \epsilon_{ij} \tag{1}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \mu_{0j} \tag{2}$$

$$E(\epsilon_{ij}) = 0, \text{Var}(\epsilon_{ij}) = \sigma^2; E(\mu_{ij}) = 0, \text{Var}(\mu_{ij}) = \tau_{00}; \text{Cov}(\epsilon_{ij}, \mu_{ij}) = 0.$$

A random intercept model was used to explore the effects of individual-level variables and village-level variables on farmers’ satisfaction. Its model is:

Level 1:

$$Y_{ij} = \beta_{0j} + \beta_{1j}GEN + \beta_{2j}AGE + \beta_{3j}EDUC + \beta_{4j}POLTIDEN + \beta_{5j}PARTIPRAC + \epsilon_{ij} \tag{3}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}ENVIR + \gamma_{02}INFRA + \gamma_{03}GRAGOV + \gamma_{04}PUBSERV + \gamma_{05}COLLECONO + \mu_{0j} \tag{4}$$

$$\beta_{1j} = \gamma_{10}; \beta_{2j} = \gamma_{20}; \beta_{3j} = \gamma_{30}; \beta_{4j} = \gamma_{40}; \beta_{5j} = \gamma_{50} \tag{5}$$

$$Y_{ij} = \gamma_{00} + \gamma_{10}ENVIR + \gamma_{20}INFRA + \gamma_{30}GRAGOV + \gamma_{40}PUBSERV + \gamma_{50}COLLECONO + \gamma_{01}GEN + \gamma_{02}AGE + \gamma_{03}EDUC + \gamma_{04}POLTIDEN + \gamma_{05}PARTIPRAC + \mu_{0j} + \varepsilon_{ij} \tag{6}$$

$E(\varepsilon_{ij}) = 0, \text{Var}(\varepsilon_{ij}) = \sigma^2; E(\mu_{0j}) = 0, \text{Var}(\mu_{0j}) = \tau_{00}; \text{Cov}(\varepsilon_{ij}, \mu_{0j}) = 0.$

In Equations (1)–(6):  $Y_{ij}$  represents the farmers’ satisfaction,  $X_{ij}$  is the independent variable at the individual level of farmers,  $\varepsilon_{ij}$  is the random effect at the individual level of farmers,  $\mu_{ij}$  is the random effect at the village level,  $\sigma^2$  is the variance at the individual level, and  $\tau_{00}$  is the variance at the village level.

#### 4. Results and Discussion

##### 4.1. Farmers’ Personal Characteristics

The characteristics of the 599 samples are shown in Table 3. The male sample accounted for 52.6% of the sample size, which was slightly higher than the female sample size (47.4%). Most of the interviewed farmers were over 30 years old. The educational background distribution of the interviewed farmers is relatively even with primary school, junior high school, high school, and college degree or above, among which junior high school education is the largest (36.6%). The political affiliation of the interviewed farmers is mostly the masses (85%), and 13.9% of the farmers are members of the Communist Party of China.

**Table 3.** Descriptive statistics for the sample.

Variable( <i>n</i> = 599)	Frequency	Percentage
Gender		
Male	315	52.6%
Female	284	47.4%
Age (mean = years)		
Less than 19 years	3	0.5%
From 20–29 years	46	7.7%
From 30–49 years	178	29.7%
From 50–59 years	175	29.2%
More than 60 years	197	32.9%
Education		
Primary school	165	27.5%
Junior school	219	36.6%
High school	116	19.4%
College and above	99	16.5%
Political identity		
CPC member	83	13.9%
The masses	509	85%
Other	7	1.1%

##### 4.2. Level of Farmers’ Participation in SRD Practices

Figure 3 shows farmers’ participation in SRD practices. The mean values ranges of farmers’ participation level were from 3.11 to 4.30, with an overall mean average of 3.67, indicating a high level of participation. The highest participation level of SDR practices was for receiving information on improving rural toilets (4.30 mean), followed by participating in labour or donation (4.13 mean) and participating in the “Three Clean ups”, “Three Demolition” and “Three Rectifications” (4.07 mean). These results reflect farmers’ high level of participation in SRD practices, which might influence their satisfaction.

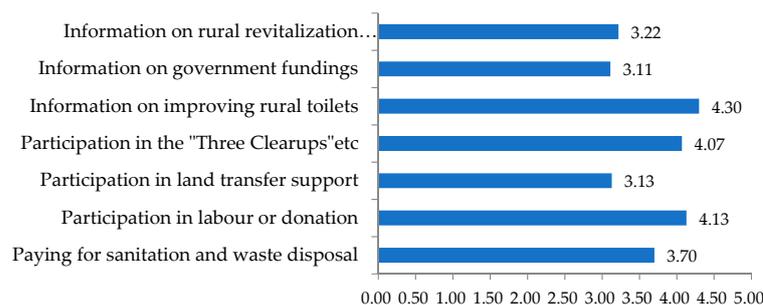


Figure 3. Farmers' participation in SDR practices.

4.3. Farmers' Satisfaction with SRD Practices

Table 4 shows farmers' satisfaction with the SRD practices. Overall, farmers' satisfaction with SRD practice is relatively high (mean 3.45; standard deviation 1.42). Details of each attribute regarding the SRD practices are provided as follows. (1) In terms of industrial prosperity, we asked farmers whether there were characteristic industries in the village, whether the land had been transferred, and whether there was any financial support such as agricultural insurance and loans subsidized by the government, in order to understand the farmers' satisfaction with the industrial prosperity of the village. The results show that farmers were moderately satisfied with the prosperity of the industry, with an overall mean average of 2.89 (Table 4). (2) In terms of ecological liveability, we conducted a survey on farmers' satisfaction with the village's sanitary environment, infrastructure and public services. The mean values of the liveable ecology ranged from 3.31 to 3.82 (Table 4), with an overall mean average of 3.63 (Table 4), indicating a high level of farmers' satisfaction. (3) In terms of civilized rural customs, we mainly asked farmers how satisfied they were with the general mood of society and public security in the village. As shown in Table 4, farmers were highly satisfied with the civilized customs based on a mean score of 3.99. (4) In terms of effective governance, we asked farmers about their satisfaction with the performance of village officials, as well as their satisfaction with the work of village party affairs, village administrative affairs, and village finance. The results in Table 4 indicate that farmers were relatively satisfied with the governance (3.51 mean). The highest satisfaction with effective governance (Table 4) was the performance of village officials (mean 3.68, SD 1.02), followed by the work of party affairs, administrative affairs, and finance (mean 3.33, SD 1.08). (5) In terms of prosperous life, we asked the farmers "whether the work done by the local government has helped to increase your family's income, and whether they were satisfied" to understand farmers' satisfaction. The findings in Table 4 show that most of the respondents had a moderate level of satisfaction, with a mean average of 2.87.

Table 4. Distribution of respondents according to their satisfaction with SRD practices.

	Very Dissatisfied		Slightly Dissatisfied		Slightly Satisfied		Satisfied		Very Satisfied		Mean	SD
	F.	%	F.	%	F.	%	F.	%	F.	%		
<b>Prosperous industry</b>												
Characteristic industry, agricultural insurance and loans, etc.	78	13.0	112	18.7	252	42.1	110	18.4	47	7.8	2.89	1.09
<b>Liveable ecology</b>												
Sanitary environment	13	2.2	47	7.8	104	17.4	305	50.9	130	21.7	3.82	0.93
Infrastructure	57	9.5	140	23.4	62	10.3	239	39.9	101	16.9	3.31	1.26
Public service	43	7.2	36	6.0	80	13.3	310	51.8	130	21.7	3.75	1.08
<b>Civilized customs</b>												
The general mood of society, law, and order	4	0.6	33	5.5	73	12.2	343	57.3	146	24.4	3.99	0.8
<b>Effective governance</b>												
The performance of village officials	25	4.2	55	9.2	124	20.7	277	46.2	118	19.7	3.68	1.02
Party affairs, administrative affairs, financial work	37	6.2	88	14.7	196	32.7	195	32.5	83	13.9	3.33	1.08
<b>Prosperous life</b>												
Increase the income of farmers' families	109	18.2	95	15.8	212	35.4	128	21.4	55	9.2	2.87	1.2
Overall satisfaction											3.45	1.42

#### 4.4. Factors Influencing Farmers' Satisfaction with SRD Practices

##### 4.4.1. The null Model of Farmers' Satisfaction on SRD Practices

To test the applicability of the HLM, a null model of the effect of village-level factors on farmers' satisfaction was constructed. The F test value of the model was 18,479.561 ( $p < 0.001$ ), indicating that the model passed the test. As shown in Table 5, the between-group variance (village-level) estimate of the null Model 0.0533 is larger than its standard error (0.0118), indicating that the differences in farmers' satisfaction with SRD practices largely come from differences between villages. The intra-group correlation coefficient (ICC) is 0.3784, so there is a significant difference in respondents' satisfaction among villages, and factors at the village level need to be included to explain this difference. It can be seen from the ICC value that the factors at the village level explain 37.84% of farmers' satisfaction, while the factors at the farmers' individual level explain 62.16% of their satisfaction.

**Table 5.** Multilevel modelling on respondents' satisfaction with SRD practices.

Variables	Null Model		Model 1		Model 2	
	Parameter Estimate	SE	Parameter Estimate	SE	Parameter Estimate	SE
Gender (Control group: male)			−0.0104	0.0252	−0.0034	0.0250
Age (Control group: Less than 19 years)						
From 50–59 years			−0.0085	0.0338	−0.0085	0.0336
More than 60 years			0.0017	0.0382	−0.0018	0.0378
Education (Control group: primary school)						
Junior school			0.0440	0.0321	0.0422	0.0319
High school			0.0323	0.0410	0.0311	0.0407
College and above			0.0929 *	0.0488	0.0862 *	0.0485
Political identity (Control group: the masses and others)			0.0836 **	0.0350	0.0880 **	0.0347
Participation in the practice			0.1056 ***	0.0126	0.1039 ***	0.0125
Environmental remediation					−0.0162	0.0271
Infrastructure construction					0.0656 **	0.0231
Grassroots governance					0.0503 **	0.0231
Public service supply					0.1033 ***	0.0220
Collective economy					−0.0058	0.0224
Intercept	4.4835 ***	0.0328	4.4428 ***	0.0469	4.4469 ***	0.0428
Between Groups Variance	0.0526	0.0118	0.0387	0.0091	0.0203	0.0057
Within Group Variance	0.0863	0.0052	0.0737	0.0046	0.0737	0.0046
Log likelihood		348.864		278.829		273.901
ICC		37.86%		34.43%		21.59%
Reduction ratio of variance between groups		—		26.42%		61.40%

\*  $p$  value significant at 10%. \*\*  $p$  value significant at 5%. \*\*\*  $p$  value significant at 1%. ICC = Between Groups Variance/(Within Group Variance + Between Groups Variance); Reduction ratio of variance between groups = (Between Groups Variance of Null model-Between Groups Variance)/Between Groups Variance of Null model.

##### 4.4.2. The effect of Individual-Level Factors on Farmers' Satisfaction with SRD Practices

Model 1 in Table 5 shows the impact of farmers' individual level factors on their satisfaction with SRD practices. The education levels, political identity, and participation of farmers were significant determinants of farmers' satisfaction, while the age and gender of farmers were not significant predictors.

Among the education levels of farmers, the education level of college and above has a positive relationship with farmers' satisfaction (coefficient = 0.0929,  $p < 0.1$ ), and other education levels have no significant effect. This means that people with college education and above have higher satisfaction with SRD practices. The political identity of farmers (coefficient 0.0836,  $p < 0.01$ ) has a significant positive relationship with farmers' satisfaction. That is, if a farmer's political identity is that of a member of the CCP, he will identify more with the policies of the Party and the State, and will be more satisfied with the relevant policies and practices. This finding is consistent with existing research conclusions; that is, CCP members and farmers with higher education are more sympathetic to the

government's difficulties, and thus are more satisfied with government policies and their implementation effects [42]. There is a significant positive relationship between farmers' participation in SRD practice and farmers' satisfaction (coefficient = 0.0156,  $p < 0.01$ ). This means that if farmers are more involved in SRD practice, then their satisfaction is also higher. In the existing research, empirical analysis from Yunnan, Guizhou, Hubei, and Chongqing in China shows that the degree of participation of farmers is highly sensitive to the overall evaluation of the project [28,29]. This study further verified this conclusion.

Results showed that age and gender are not significant determinants for satisfaction. With the rapid development of industrialization and urbanization in China, many rural talents have flowed into cities, and the loss of young people has resulted in the ageing of rural areas becoming more prominent [43]. By 2021, the proportion of rural permanent residents aged 60 and above in China has reached 23.99%, and the proportion of people aged 65 and above has reached 16.57%, while the proportion of urban residents in the same period has reached 18.1% and 12.6%, respectively [44]. In our survey, as shown in Table 3, only 49 respondents (8.2%) were under 30 years old, while 197 respondents (32.9%) were over 60 years old. Because there are fewer young farmers, we merged the farmers under 30 years old and middle-aged farmers in the regression analysis. We found in the survey that due to the loss of rural young adults, women and the elderly become an important force in agricultural production and rural affairs in rural areas. Consequently, the participation of older and female farmers in SRD practice is not significantly different from that of middle-aged men, and age and gender are not significant determinants of farmer satisfaction. This is consistent with the research conclusion that farmers' gender and age have no significant influence on their satisfaction in research on farmers' satisfaction with the rural public goods supply from Shanxi Province, China [23].

#### 4.4.3. The Effect of Village Level Factors on Farmers' Satisfaction with SRD Practices

After adding the relevant factors at the village level to Model 1 in Model 2, the estimated variance between villages dropped to 0.0203, and the variance reduction ratio reached 61.40%. This indicates that the selected village-level indicators can effectively explain the heterogeneity of farmers' satisfaction at the village level.

Public services (coefficient 0.1033,  $p < 0.001$ ), infrastructure construction (coefficient 0.0656,  $p < 0.01$ ), and grassroots governance (coefficient 0.0503,  $p < 0.01$ ) all have significant positive correlations with farmers' satisfaction. Among the factors at the village level, the improvement of public services has the highest sensitivity to the evaluation of farmers' satisfaction, and the improvement of infrastructure and rural grassroots governance were also more sensitive to farmers' satisfaction. Combined with what the research team has learned in the survey, the reason for this result may be due to the improvements and enhancements made by the government and village autonomous organizations in the construction of village infrastructure, and improvement of village governance and public services, which have brought greater convenience to farmers' daily agricultural production and life. In addition, the work in this area has fewer regulations and requirements for farmers, resulting in less dissatisfaction and higher overall satisfaction. Existing studies have shown through empirical research that the improvement of the living environment such as rural road traffic, drinking water, and garbage disposal, as well as the supply and support of rural public goods by the government and village committees, have a significant positive impact on farmers' satisfaction [23,27,28,30–34]. This conclusion was also verified in this study.

In addition, the study found that the improvement in village living environment was not a significant determinant of farmers' satisfaction. In the survey, it can be found that all rural areas have vigorously carried out the "three cleans", "three demolition", and "three remediation" activities to promote the improvement of the rural living environment. However, due to the requirements of higher-level task assessment, town cadres and village cadres have become the leading force in the improvement of the living environment in the village, while farmers are less motivated in related activities and are in a passive

position [45]. Even in the process of remediating the living environment, due to the lack of enthusiasm of some farmers, who do not wish to participate or cooperate with town and village cadres to carry out relevant work, conflicts between town and village cadres and farmers may occur, which may lead to some dissatisfaction among farmers. We believe that some satisfaction from an improved rural living environment may be offset by some dissatisfaction from conflict, and there is no direct link between environmental improvement and satisfaction.

Finally, the income of the village collective economy is not a significant determinant for satisfaction. The survey found that the collective economic scale of villages in different regions of the Guangdong Province varies greatly (the highest is CNY 68.63 million, the lowest is 0, and the median is CNY 2.5 million). The main problem faced by villages is the allocation of collective economic resources, because the more collective economy in the village, the greater the risk of village cadres seeking private benefits [30]. It was found that when villages obtain more economic resources because of policy support, it has a significant negative impact on farmers' satisfaction [46]. The dissatisfaction of farmers mainly comes from the use and distribution of funds by the village committee and the effect of village construction. The thought of "not suffering from less but suffering from the unevenness" leads to the negative effect of dissatisfaction between farmers and their neighbours, which exceeds the positive effect of the overall advantage of the village. It was also found that horizontal comparison is the top factor affecting farmers' satisfaction [32]. We believe that under the influence of the idea of "not suffering from poverty, but suffering from the unevenness", farmers' satisfaction with the development of the village's collective economy mainly comes from whether the village committee's use and distribution of funds can make the farmers feel fair and satisfied. Therefore, there is a more complex influencing mechanism between the level of village collective economic development and farmers' satisfaction with SRD practice, and there is no direct relationship between the two.

There are, however, noteworthy limitations that may affect the generalizability of the findings and that could be useful for orienting the direction of future research. For the evaluation of the implementation effect of SRD practices, although the existing five aspects were given the same 20 points, some aspects contain fewer projects (e.g., rural collective economy), which may affect the results.

## 5. Conclusions

Using the survey data of 599 farmers in 57 administrative villages in Guangdong Province, China, this study analysed farmers' satisfaction with SRD practices, analysed the influencing factors of farmers' satisfaction at the individual and village levels, and obtained the following main conclusions. (1) In general, farmers' satisfaction with SRD practices is relatively high. From the perspective of the specific areas of SRD practice, farmers were highly satisfied with rural ecological liveability, civilized rural customs and effective governance, and were moderately satisfied with the prosperous industry and prosperous life. (2) The implementation effect of SRD practices at the village level has a non-negligible impact on farmers' satisfaction. The factors at the individual level and the village level explain 62.14% and 37.86% of farmers' satisfaction, respectively. (3) At the individual level, farmers' college education, political identity, and participation in SRD practices have positive predictive effects on their satisfaction. That is, if farmers are members of the CCP, have a college education or above, and can actively participate in SRD practices, farmers will be relatively more satisfied with SRD practices. At the village level, the improvement of public services, village infrastructure, and grassroots governance in SRD practices has a significant positive impact on farmers' satisfaction. The improvement of the village living environment and the income of a village's collective economy were not significant determinants of farmers' satisfaction.

In practice, to actively mobilize farmers' enthusiasm about participation in sustainable development practice, it is necessary to increase the publicity of SRD policy and stimulate farmers' enthusiasm for participation. At the same time, to encourage farmers to obtain

more satisfaction with SRD practices, it is necessary to continue to build public service facilities such as village health stations and cultural service centres, and effectively promote the infrastructure construction of villages such as road hardening, garbage disposal, and toilet revolution. It is also important to strengthen the openness of village affairs and promote the construction of rural customs and civilization.

This study found that improvement in the village living environment was not a significant determinant of farmers' satisfaction. In the process of carrying out the improvement of the rural living environments, the corresponding incentive mechanism and restraint mechanism should be established and improved to mobilize the initiative of farmers and guide farmers in SRD practices. A more effective approach is to encourage farmers to actively participate in and become the main force of relevant practices in the SRD strategy. This paper also finds that the income of the village collective economy is not a significant determinant of satisfaction, possibly due to the idea of "not suffering from poverty but suffering from unevenness". In the process of promoting industrial revitalization and rural economic development, it is considered equally important to promote the development of the village collective economy and to optimize the collective economic distribution mechanism. The ultimate purpose of SRD practices is to ensure farmers can better enjoy the fruits of rural development and make the countryside a place where farmers can live and work in peace and contentment. In this way, we can better solve the problems of population reduction, talent shortages, abandoned farmland, and deterioration of the living environment in rural areas, and gradually help rural areas achieve sustainable economic, social, and environmental development.

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