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Farmers' Willingness to Participate in Voluntary Field Water Management Greenhouse Gas Emission Reduction Projects Based on a Context–Attitude–Behavior Framework

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Abstract: The development of the greenhouse gas (GHGs) voluntary emission reduction market has created a new way for all agricultural GHGs emission reduction projects. Figuring out how to drive farmers to participate in the market is the key to the development of the agricultural voluntary emission reduction project mechanism. Current research on farmers' participation in voluntary emission reduction projects has mostly been conducted from the perspective of the economic, social, and ecological benefits of the project and lacks research on analyzing farmers' willingness to participate in combination with specific GHGs operational mechanisms. To find out how the operational mechanism of the field water management voluntary emission reduction (FWMVER) projects influences farmers' willingness to participate in the project, this study constructed the attitude–context–behavior theoretical framework to consider the FWMVER operational mechanism. Based on the survey data of 789 rice farmers in GuangXi, China, the structural equation model (SEM) was adopted to analyze the impact of social networks, social trust, social norms, profit expectations, cost expectations, and satisfaction with the government in relation to the farmers' willingness to participate in FWMVER projects. Results showed that social networks, social trust, social norms, profit expectations, cost expectations, and satisfaction with the government had significant impacts on the willingness of farmers to participate in FWMVER projects. Satisfaction with the government can effectively regulate the profit expectations and cost expectations for farmers to participate in the FWMVER projects. Policy implications were proposed based on analytical results to advise local governments to develop agricultural carbon finance, to improve public services in agricultural production, and to encourage establishing non-governmental organizations in rural areas involved in voluntary agricultural GHGs emission reduction projects.

Keywords: context–attitude–behavior; social network; social trust; social norms; profit expectation; cost expectation; satisfaction with government

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1. Introduction

A huge amount of greenhouse gas (GHGs) emissions from human activities in the last few decades has caused severe global warming, which poses threats to the sustainable development of human society. Studies have shown that agricultural production accounts for 14% of global anthropocentric GHGs emissions [1]. According to the Committee on Climate Change (CCC) in the UK, the emission rate of agricultural GHGs is accelerating day by day [2], and it was estimated that direct GHGs emissions from agriculture will rise by up to 30% if additional, related emissions such as fuel utilization by farm machinery, fertilizer production, and land use change are included in the estimates [3]. Therefore, how to reduce agricultural GHGs emissions has become a global concern. The signing of the Kyoto Protocol laid the foundation for the clean development mechanism (CDM), which has created conditions and provided an ecological compensation market mechanism for developing countries to develop low-carbon agriculture and agricultural GHGs emission

reduction projects to participate in the international carbon market. Currently, more and more voluntary GHGs emission reduction projects in renewable energy development and forestry carbon sinks have been developed in developing countries [4]. However, the share of agricultural voluntary GHGs emission reduction projects in the international carbon trading market is still relatively low. According to the website of the United Nations Framework Convention on Climate Change (UNFCCC), as of 31 June 2022, among the 7853 registered CDM projects, energy projects accounted for 75.3%, while agricultural projects accounted for only 2.3%. Agricultural voluntary GHGs emission reduction projects involving the interests of many farmers could be the main reason for agricultural GHGs emission reduction projects occupying such a low proportion of the projects [5]. Hence, the willingness of farmers to participate in voluntary GHGs emission reduction projects is critical.

Some studies have shown that a project's profit has a significant impact on farmers' participation in GHG emission reduction projects. The income brought by the REDD + project was the core determinant of farmers' willingness to participate in the project, and low-income families in developing countries were more concerned about the cost of participating in the project [6,7].

The degree of community harmony has a significant impact on farmers' participation in decision-making regarding forest carbon sinks [8]. In fact, farmers' participation in GHGs emission reduction projects is a collective action in line with Ostrom's theory of public pond resource governance. It should be analyzed from the perspective of the community rather than engaging farmers separately and emphasizes the impact of government rules and actions on the implementation of carbon emission reduction projects [9].

Some scholars pay more attention to the dispute between fairness and efficiency caused by GHG emission reduction projects. Equity has been an essential concern in many carbon market projects since project developers often prioritize efficiency over equity [10]. Carbon market projects are often limited by project funds and operation over short periods of time. Developers need to engage farmers quickly and inexpensively, which may compromise the equity objectives of reaching the relatively poor in the community and ensuring that farmers' voices are included in the process [11]. However, some scholars believe that the interest distribution of GHG emission reduction projects should not only focus on distribution fairness but should also emphasize distribution efficiency. To maximize incentives, different compensation mechanisms should be designed for farmers with different needs [12].

The amount of carbon credit compensation, contract term, and property rights status have significant impacts on farmers' willingness to participate in carbon sink projects. Farmers show positive attitudes towards participation in carbon sink projects and trading when they receive more compensation or plans for bequeathing forest land to their descendants [13–15].

Nowadays, with the intensification of global warming, ecological awareness has a profound impact on farmers' participation in GHG emission reduction projects [16].

For rice-farming agriculture, by taking reasonable field water management strategies, GHGs (mainly methane, in this case) emissions could be effectively reduced. Therefore, voluntary agricultural GHGs emission reduction projects are also important contributors to peak carbon dioxide emission and carbon neutrality. Currently, China's voluntary agricultural GHGs emission reduction projects related to field water management are still in their infancy and are more difficult than those of the forest carbon sink projects. It is believed that one of the key challenges in developing these projects is the farmer's skepticism of crop yield insurance for changing from conventional farming patterns to new scientific farming patterns. Moreover, successful execution requires intensive training and technical support, which are both quite costly [17]. To our knowledge, researches on influencing factors of Chinese farmers to participate in FWM voluntary GHGs emission reduction projects are very limited.

According to the above literature review, most of the current research about farmers' participation in carbon-related forestry and agricultural GHGs emission reduction projects focused on economic benefits, social benefits, and ecological benefits of projects,

ignoring the impact of the operational mechanism of voluntary GHGs emission reduction projects on farmers' willingness. To find out how the operational mechanism of FWMVER projects influences farmers' participation willingness, the attitude-context-behavior theoretical framework based on FWMVER operational mechanism was built to study farmers' willingness to participate in projects. The SEM structural equation model was used to analyze the questionnaire survey data of Guangxi Yongning, Wuming, Long'an, Mashan, Shanglin, Pingguo, Du'an, and other regions that plan to carry out FWMVER projects, and the analysis results were discussed, and then the research conclusions were drawn, and policy implication was also proposed.

The manuscript was organized as follows: after summarizing the state-of-the-art research progress on farmers' participation in forestry and agricultural GHGs emission projects and proposing objectives of this study (Section 1); the theoretical framework and research hypothesis were proposed in Section 2; then, the materials and research methods were presented in Section 3; afterward, empirical results and analysis were detailed in Section 4; and discussion was provided in Section 5; finally, conclusions and implications were drawn in Section 6.

2. Theoretical Framework and Research Hypothesis

2.1. Analysis of the Operation Mechanism of the FWMVER Project

This study used textual analysis to analyze the operational mechanism of FWMVER projects by referring to the UNFCCC-EB small-scale CDM project methodology AMS III.AU: Methane emission reduction by adjusted water management practice during rice cultivation. Based on 20 successful development cases of FWMVER projects registered in the independent emission reduction VCS mechanism, the characteristics of the operational mechanism of FWMVER projects were summarized in Table 1.

Table 1. FWMVER projects operation mechanism characteristics.

Operational Mechanism Elements	Characteristics
Farmers	1. Each project covers from 10,000 to 30,000 farmers; 2. Farmers are required to provide ditches to conduct intermittent flooding; 3. Farmers participating in the project need to sign an agreement on sustainable rice planting; 4. Farmers shall sign an agreement with the sponsor to participate in the project by taking the administrative village as the unit.
Local government	1. Organize and coordinate famers to participate in project; 2. Provide techniques of intermittently flooded method; 3. Construct High Standard Farmland Project; 4. Provide grain subsidies
Village committees	1. Responsible for collecting opinions from the respective locals and villages; 2. Formulate village rules and regulations to urge farmers participating in the project to carry out irrigation.
Project crediting period	The crediting period of all projects will be using a 7-year, twice renewable crediting period, for a combined total project crediting period of 21 years
Infrastructure	With the project, the rice fields are equipped with controlled irrigation and drainage facilities such that intermittently flooded method can be conducted

Source: Verra official website.

It can be found from Table 1 that FWMVER projects involve a large number of farmers. In the same village, almost all the farmers participating in the project are relatives and neighbors. Village committees will also formulate village rules and regulations to encourage farmers to participate in the project to carry out scientific irrigation. The project credit period lasts for 21 years, and all economic factors are variable. Local government plays a leading role in the project that need to organize and coordinate farmers to participate in the project.

2.2. Theoretical Framework

Behavior decision theory is an important theoretical framework for studying individual behavior decisions. The Lewin behavior model is a basic theory for understanding individual behavior, which points out that individual behavior is the product of interaction between the individual and the environment, and summarizes and sorts out various factors affecting behavior [18]. Guagnano's attitude-context-behavior theory further expanded Lewin's research. According to this theory, environmental behavior is the result of the interaction between individual environmental attitude variables and the context factors. They believed that the consistency of will and behavior requiring will-controlled conditions, and opportunity and context variables were the objective prerequisites of behavior, and behavior was the result of the interaction of attitude variables and environment variables [19].

According to Guagnano's attitude-context-behavior theory, it is supposed that farmers would decide to participate in the FWMVER projects according to the context of the projects and their own attitudes. Based on the analysis of the operational mode of the FWMVER projects, the theoretical framework of farmers' attitude-context-behavior to participate in the FWMVER projects is proposed, and relevant elements of the theoretical framework are classified into three dimensions: social context, economic context, and attitude.

The social context refers to the social environment in which farmers decide where the FWMVER projects are located. According to the social embeddedness theory, individual behavior is always embedded in the social structure, and the social environment will affect farmers' decision-making [20]. The behavior of farmers' participating in FWMVER projects is restricted by independent factors emphasized by economics and the embedded factors emphasized by sociology. Autonomous factors are the preconditions for behavior generation, and embedded factors promote or restrict farmers' participation in the project through their social environment [21]. The FWMVER projects would involve a large number of rural people. Farmers are usually mobilized to participate in the project on a village basis. Each natural village has its own customs and neighborhood relations. In a"acquaintance society" based on kinship and geography in rural China, farmers' behavior will be affected by customs and neighborhood relations.

According to social cognitive theory, individual cognition and behavior are formed in a certain social environment, which is affected and regulated by the social environment. Social capital formed by geographical, blood, and industrial ties reflects the social environment conditions of individuals to a certain extent [22]. Here we use three aspects of social capital to describe the social context. A social network is the family network of farmers, and social trust is based on blood and neighborhood relations, and social norms are the provisions of village rules and regulations on irrigation water.

The economic context is the profit that farmers can obtain and the cost that they need to pay when they participate in the projects. As the project would last for 21 years, both the profit and cost elements of the project are variable in the long-term economy [23], and the economic profits and costs of farmers' participation in the projects can only be presented in the expected form, hence, the economic context can be described by the expected profit variables and the expected cost variables.

The attitude of farmers towards the government has an important impact on their willingness to participate in the FWMVER projects. The successful development of the FWMVER project usually depends on the organization and coordination of farmers to participate in the project by the local government. The framework elements of the above analysis were shown in Table 2.

Table 2. Dimension-Variable-Connotation Framework elements of FWMVER projects.

Dimension	Variable	Connotation
Social context	Social network	The project covers a vast rural area and rural population
	Social trust	Farmers participate in the project based on trust in relatives, neighbors, and village officials
	Social norms	Formulating village rules and regulations to urge farmers participating in the project to carry out irrigation
Economic context	Profit expectation	Since the project is 21 years long, in the long-term economy, the benefits and cost elements of the project are variable, and the economic benefits and costs paid by farmers participating in the project can only be presented in the expected form
	Cost expectation	
Attitude	Satisfaction with government	Government can successfully coordinate and organize farmers to participate in FWM project construction and water control management depends on farmers' satisfaction with government
Behavior	Farmers' participation willingness	Farmers' willingness to participate in FWMVER projects

Source: Verra official website.

2.3. Theoretical Assumptions

2.3.1. Impact of Social Network, Social Trust, and Social Norms

The social network is the relationship bond formed by long-term interaction among farmers. In rural areas where government technology extension services are insufficient, social networks could play an important role in farmers' behavioral decisions due to their high density and short propagation path [24].

Social trust refers to the shared expectation of people to behave wisely and, when necessary, mutual benefits in their interactions with others. This shared expectation could create strong and stable relationships among people [25]. Based on the embeddedness theory, trust is regarded as a property of social relations between people and plays an essential role in social interactions. If participants care about their own social reputation, social trust tends to lead participants to produce more collective behavior [26].

Social norms can effectively curb opportunistic behaviors such as "free riding" and avoid the "prisoner's dilemma" [27]. In rural acquaintance society, farmers are more concerned about the public opinion of others and the maintenance of their interpersonal relationships, and often consciously follow the informal norms in the village. Compared with formal norms of rigid constraints, informal social norms can constrain farmers' behavior from the psychological level, and promote farmers to consciously choose rational behavior that meets social expectations. Studies have shown that agricultural areas with degraded soil are more likely to adopt protective tillage measures such as straw returning to the field [28]. Generally, in an agricultural area with soil degradation, farmland management measures such as straw returning to the field are more likely to become regional informal social fouls. Based on the above analysis, the following hypotheses are proposed:

H1a: *Social networks have prominent impacts on farmers' willingness to participate in FWMVER projects.*

H1b: *Social trust has a significant effect on farmers' willingness to participate in FWMVER projects.*

H1c: *Social norms show a significant impact on farmers' willingness to participate in FWMVER projects.*

2.3.2. Impact of Profit Expectation and Cost Expectation

Individuals as rational people would take the pursuit of maximum benefits as the goal of behavioral decision-making. The expected profit from participating in ecological service projects is higher than the cost input, which is the premise for farmers to participate in ecological service projects [29]. Loaiza et al. believed that effective economic incentives in carbon objects must cover two aspects: one is cash profit, that is current profit; the second is sustainable profit, that is, future profit. The current profit must make up for the loss of farmers' abandonment of agricultural production, and cover ecological compensation for environmental protection and other profit subsidies related to forestry. The sustainable profit emphasizes sustainable access to the three types of profit [30].

Economic profit factor is the decisive factor for farmers to participate in green production projects [31]. Rational farmers will comprehensively consider the changes in costs and benefits brought by participating in the FWMVER projects, and make decisions based on the benefits of participating in the projects. The economic benefits of FWMVER projects are mainly carbon emission reduction transactions. With the implementation of China's carbon neutral strategy, the price of the China Certified Emission Reduction (CCER), which is China's domestic GHGs voluntary emission reduction mechanism, has been increasing currently (Figure 1). This trend also improves the economic benefit expectation of farmers with FWMVER projects on carbon trading emission reduction.

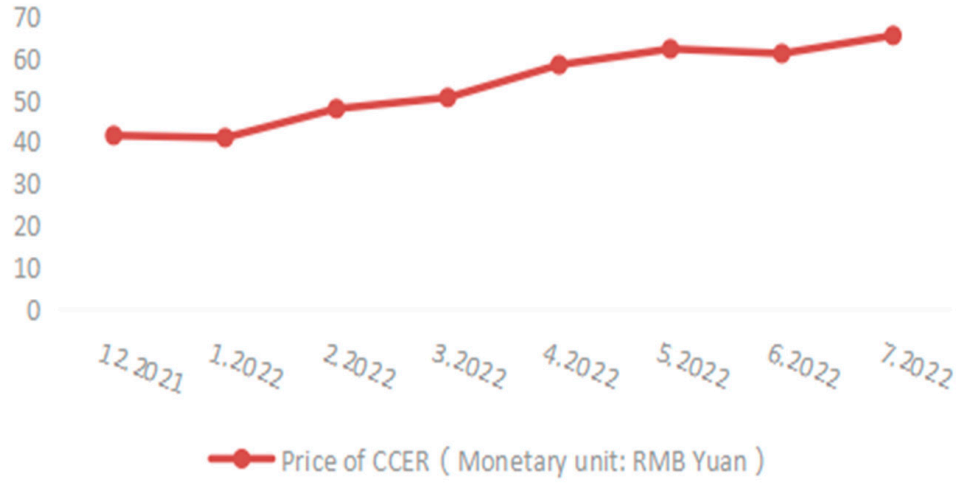

Figure 1. Price trend of CCER from December 2021 to July 2022. Source: Fudan University Sustainable Development Research Center.

On the other hand, the main goal of the implementation of FWMVER projects is to change the water management mode of traditional farmland. Southern regions in China are rich in water resources, accompanied by a low irrigation water tariff [32], resulting in the weak water-saving awareness of local farmers. When irrigation water is abundant and available for free or low price, farmers are more inclined to irrigate liberally to save labor, material resources, and management input cost [33].

The rice planting mode from flood irrigation to fine water management mode will inevitably require more labor and production materials. Moreover, in China's rural areas, because of the decline in economic benefits of rice planting, most rural laborers would prefer working in cities as migrant labourers, or to plant more profitable commercial crops. Farmers participating in the FWMVER project should give up the opportunity to grow other commercial crops or to work in cities. If the benefits of participating in the FWMVER project do not meet expectations, the opportunity cost will increase [34]. Higher construction costs and labor costs will also prevent farmers from participating in voluntary FWM emission reduction projects.

Field water management should be conducted based on the rules for developing the FWMVER projects. However, the change in farming patterns (especially water management) inevitably requires the construction of irrigation infrastructure, which would lead to high construction costs from the government and an increase in farm labor costs. Higher construction and labor cost will hinder farmers from participating in FWMVER projects. Based on the above analysis, the following assumptions are proposed:

H2a: *Profit expectation positively affects farmers' willingness to participate in FWMVER projects.*

H2b: *Cost expectation negatively affects farmers' willingness to participate in FWMVER projects.*

2.3.3. Impact of Satisfaction with the Government

Satisfaction with the government is a vital factor affecting individual behavior. When the government's behavior or work results meet public expectations, people show high satisfaction and are willing to give trust and support. When the level of satisfaction is low, the public shows some indifference and complaints about the government's work, and they may make unsupported behavioral decisions [35]. Hence, the assumption in this regard would be:

H3: *Satisfaction with the government has a noteworthy impact on farmers' willingness to participate in FWMVER projects.*

2.3.4. Moderating Effect of Satisfaction with the Government

Satisfaction with the government can affect people's economic expectations. If people trust the government and are satisfied with the government's policies, they will have high expectations for economic development [36]. If the farmers are highly satisfied with the government, they trust the government to implement the corresponding industrial rewards and subsidies for farmers to plant rice, which will enhance the profit expectation of participating in the FWMVER projects. It will also reduce the expected opportunity cost and financial cost of participating in the projects. Hence, assumptions in this regard would be:

H4a: *Satisfaction with the government has a positive effect on profit expectations.*

H4b: *Satisfaction with the government shows a negative effect on cost expectations.*

To sum up, this study analyzes the impacts of social networks, social trust, social norms, profit expectations, cost expectations, and satisfaction with the government on farmers' willingness to participate in FWMVER projects by constructing a context-attitude-behavior framework. The framework of theoretical analysis can be seen in Figure 2.

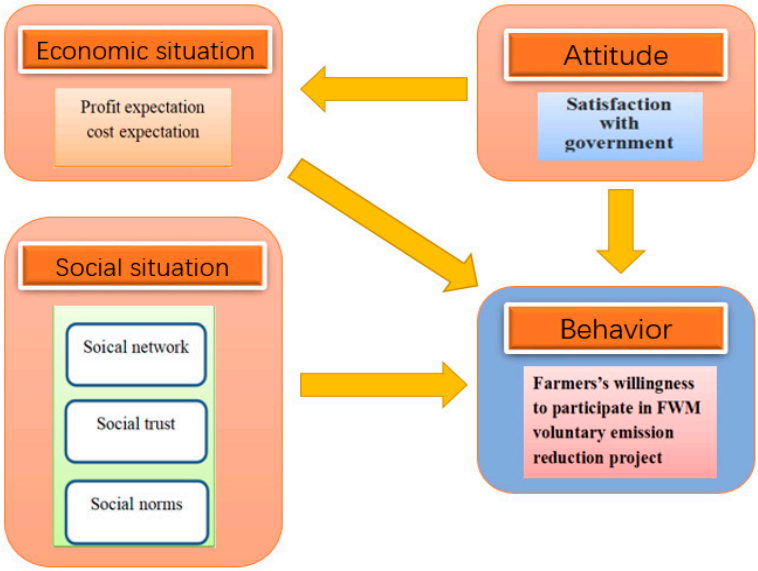

Figure 2. Framework of theoretical analysis.

3. Research Methods

3.1. Data Sources and Sample Characteristics

The data were obtained from the questionnaires of rice planting farmers in Yongning, Wuming, Long'an, Mashan, Shanglin, Pingguo, and Du'an in Guangxi Zhuang Autonomous Region in the spring of 2022. The areas mentioned above were declared out of poverty by the people's Government of Guangxi Zhuang Autonomous Region before 2020. In 2020, relevant enterprises carried out publicity on the development of FWMVER projects in the above counties. In the summer of 2021, the authors conducted a questionnaire survey on farmers' participation and willingness to the FWMVER projects in the above seven counties. This questionnaire survey adopted the method of combining stratified sampling and random sampling. In the promotion area, 3~5 towns and townships were selected from each county, and 15~25 farmers were randomly selected from each township. Household interviews were carried out to complete the questionnaire. A total of 823 questionnaires were collected in this survey, and 789 valid questionnaires were obtained after excluding the questionnaires with missing and wrong key information, with a questionnaire efficiency of 95.87%.

In order to obtain the data, this study designed a scale based on the existing literature and the FWMVER project operational mechanism. Specific indicators of the scale can be seen in Table 3.

3.2. Analysis Methods

The structural equation framework (SEM) was adopted for empirical analysis. Compared with other frameworks, the structural equation framework has the advantage of dealing with multiple latent variables simultaneously. The SEM contains usually two equations, and the measurement equation reflects the relationship between latent variables and observed variables, while the structural equation reflects the structural relationship between latent variables.

The measurement equation is as follows:

$$x = \Lambda x \xi + \delta \quad (1)$$

$$y = \Lambda y \eta + \varepsilon \quad (2)$$

The structural equation is as follows:

$$\eta = B\eta + \Gamma\xi + \theta \quad (3)$$

Equations (1) and (2) are measurement equations, where x represents the observation variable vector of endogenous latent variables and y represents the observed variable vector of the exogenous latent variable, and Λx and Λy represent the moment of the correlation coefficient between endogenous and exogenous latent variables and their respective observed variables, respectively. δ and ε are table error items. Equation (3) is the structural equation, where η is an endogenous latent variable, ξ is an exogenous latent variable, B and Γ represent endogenous potential variables and exogenous potential variables respectively. θ is the residual term of the structural equation.

Table 3. Index description and descriptive statistics.

Latent Variable	Observation Variable	Assignment	Mean Value	Standard Deviation
Farmers' willingness to participate in FWMVER project (FW)	Willingness of farmers	yes = 1, no = 0	0.667	0.472
Social network (SN)	Frequency of contact with relatives	Never contact = 1, Occasional contact = 2, General = 3, Frequent contact = 4, Frequent contact = 5	3.96	0.786
	Frequency of interaction with neighbors		4.13	0.809
	Frequency of contact with friends		4.21	0.768
Social trust (ST)	Trust in relatives	Total distrust = 1, Less distrust = 2, General = 3, More trust = 4, Very trust = 5	4.11	0.678
	Trust in neighbors		4.09	0.789
	Trust in friends		4.01	0.568
Social norms (SR)	Water saving irrigation	Totally disagree = 1, Disagree = 2, General = 3, Agree = 4, Entirely agree = 5	3.56	0.809
	Protect the ecological environment		3.79	0.763
Profit expectation (PE)	Participating in the project can obtain economic benefits	Totally disagree = 1, Disagree = 2, General = 3, Agree = 4, Entirely agree = 5	3.12	0.406
Cost expectation (CE)	Participating in the project requires more labor and fund	Totally disagree = 1, Disagree = 2, General = 3, Agree = 4, Entirely agree = 5	3.78	0.651
Satisfaction with government (GS)	Satisfied with the government's industrial reward and subsidy policy	Totally disagree = 1, Disagree = 2, General = 3, Agree = 4, Etntirely agree = 5	3.89	0.812

According to the theoretical framework, the structural equation framework Assumption paths diagram was illustrated in Figure 3.

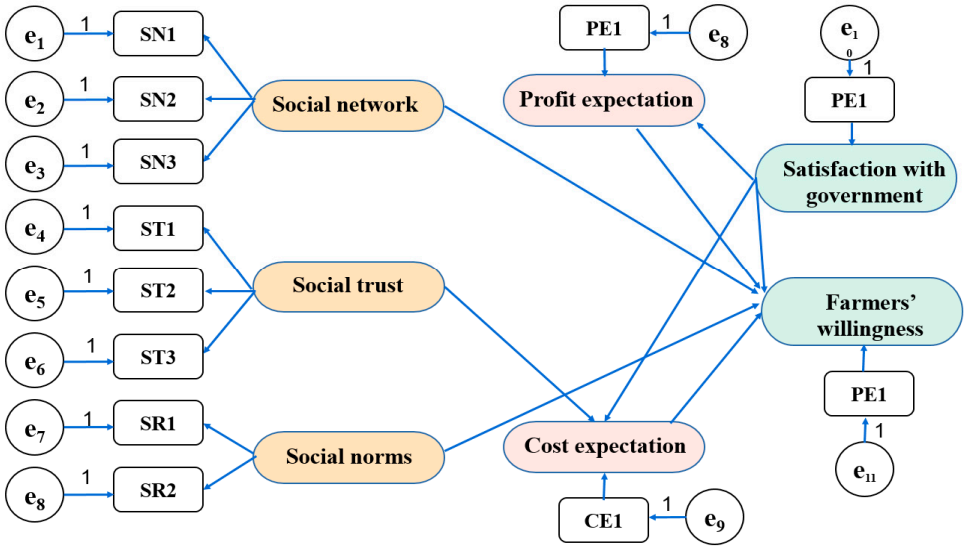

Figure 3. Assumption paths of the structural equation framework.

4. Empirical Results and Analysis

4.1. Reliability and Validity Tests

SPSS 22.0 software (IBM SPSS Inc., Chicago, IL, USA) and AMOS 25.0 software (IBM SPSS Inc., Chicago, IL, USA) were used to determine the reliability and validity of the scale. As shown in Table 4, the values Cronbach's α of all potential variables were greater than the standard value of 0.700, and the CR values were greater than 0.600, and the standardized load was between 0.600~0.900, indicating that the scale has good reliability. Ave was greater than the standard value of 0.500, kmo value was greater than the standard value of 0.7. Bartlett sphere test showed significant results, and the scale has good validity.

Table 4. Reliability and validity test.

Latent Variable	Observation Variable	Cronbach'α	Standard Load	CR	AVE	KMO Value	Bartlett Spherical Test
Farmers' Willingness to participate in FWMVER project (FW)	Willingness of farmers	0.712	0.698	0.761	0.563	0.762	$p = 0.000$
Social network (SN)	Frequency of contact with relatives	0.802	0.701	0.812	0.612	0.807	$p = 0.000$
	Frequency of interaction with neighbors	0.789	0.763				
	Frequency of contact with friends	0.716	0.676				
Social trust (ST)	Trust in relatives	0.783	0.751	0.796	0.589	0.776	$p = 0.000$
	Trust in neighbors	0.805	0.742				
	Trust in friends	0.798	0.802				
Social norms (SR)	Water saving irrigation	0.713	0.706	0.803	0.597	0.789	$p = 0.000$
	Protect the ecological environment	0.767	0.724				
Profit expectation (PE)	Participating in the project can obtain economic benefits	0.816	0.776	0.786	0.531	0.839	$p = 0.000$
Cost expectation (CE)	Participating in the project requires more labor and fund	0.709	0.814	0.712	0.566	0.821	$p = 0.000$
Satisfaction with government (GS)	Satisfied with the government's industrial reward and subsidy policy	0.716	0.728	0.726	0.539	0.799	$p = 0.000$

4.2. Framework Fitting Analysis

AMOS 25.0 was used to test the relationships of the framework, and the goodness of fit index of the framework was obtained (Table 5). Chi-square value change CMIN/DF was 2.673, root mean square error RMSEA was 0.066, goodness of fit index GFI was 0.871, adjusted goodness of fit index AGFI was 0.867, and value added fit index IFI was 0.997. The canonical fitting index NFI was 0.922, and the comparative fitting index CFI was 0.959, which all met the requirements of the standard value. From the significance test results of relevant variables in the framework, it could be seen that the framework fit degree is good, which is also supported by empirical tests.

Table 5. Test on the structural equation framework fitness.

Index	CMIN/DF	RMSEA	GFI	IFI	NFI	CFI
Standard value	<3	<0.08	>0.85	>0.85	>0.85	>0.85
Index value	2.673	0.066	0.871	0.997	0.922	0.959

4.3. Verification of Research Hypothesis

4.3.1. Analysis of the Impact of Social Capital, Profit Cost Expectation and Satisfaction with Government on Farmers' Willingness to Participate in FWMVER Projects

It can be seen from Table 6 that social capital, social networks, social trust, and social norms show direct impacts on farmers' willingness to participate in FWMVER projects, which suggests that assumptions of H1a, H1b, and H1c are verified. Profit expectation has a significant positive impact on farmers' willingness to participate in FWMVER projects, and the path coefficient of the impact of cost expectation on farmers' willingness to participate in FWMVER projects is negative (β = −0. 213 ***) (Table 6), indicating that the cost expectation has a significant negative impact on farmers' willingness to participate in FWMVER projects; hence, assumptions of H2a and H2b are verified.

Table 6. Framework estimation results of the impact of social capital and profit expectation and cost expectation.

Route	Standardized Path Coefficient	*p* Value	Hypothetical Test
SN → FW	0.223	***	Accept
ST → FW	0.197	**	Accept
SR → FW	0.201	***	Accept
PE → FW	0.187	***	Accept
CS → FW	−0.213	***	Accept
GS → FW	0.196	***	Accept

Note: *** and ** represent the significance in the levels of $p < 1\%$ and $p < 5\%$ respectively.

4.3.2. Moderating Effect Analysis

Table 7 shows the moderating effect of satisfaction with government on profit expectation, cost expectation, and farmers' willingness to participate in FWMVER projects.

Table 7. Results of moderating effect test.

Variable	FW	FW
GS × PE	0.7528 ***	
GS × CE		−0.1501 ***

Note: *** represents the significance in the levels of $p < 1\%$.

From the test results in the first column, it can be seen that the interaction between satisfaction with the government and profit expectation exhibits a significant positive impact on farmers' willingness to participate in FWMVER projects, indicating that the positive moderating effect of satisfaction with the government on profit expectation will drive farmers' willingness to participate in FWMVER projects. Thus, H4a is verified.

The reason could be that satisfaction with the government could significantly promote farmers' expectation of obtaining subsidies for participating in projects called for by the government, and could also improve farmers' expectations of obtaining economic profit from participating in FWMVER projects.

From the test results in Column 2, it can be seen that the interaction term between satisfaction with the government and cost expectation is significantly negative, suggesting the negative moderating effect of satisfaction with the government on farmers' cost expectation. Thus, H4b is verified. The Possible reason could be that satisfaction with government has significantly promoted farmers' cooperation with the government in building high-standard farmland, reducing the expected cost of participating in FWMVER projects, which would increase farmers' willingness to participate in FWMVER projects.

5. Discussion

According to the above findings, several insights are highlighted.

(1) Acquaintance society has an important influence on farmers' willingness to participate in FWMVER projects. The analysis of the behavior should be set in the framework of acquaintance society. China's rural acquaintance society often relies on the rule of li. The rule of li is not a law, but an informal institution agreed upon by people in their interactions [37]. Informal institutions often help to promote farmers' participation in agro-environmental plans [38]. If a low-carbon informal institution is built in a rural acquaintance society, word-of-mouth reward and informal authority punishment in rural local consensus can not only significantly increase farmers' willingness to participate in agricultural carbon trading projects, but also help to reduce their expected carbon profits [39].

(2) Farmers' satisfaction with government policies has an important impact on farmers' participation in GHGs voluntary emission reduction projects. This could be closely related to the poverty alleviation plan carried out in rural areas during the year of 2015 to 2020 in China, with which the local government introduced and implemented a series of industrial subsidy policies and industrial incentives to improve the institutional trust of farmers [40], which helped to solve the problem of farmers' collective action [41]. The FWMVER project is a collective action of farmers under the leadership of the government, hence, satisfaction with government policies improves the farmers' trust in the government [42], which increases their participation enthusiasm.

(3) Profit expectation vs. cost expectation. The analysis results show that cost expectation has a more significant impact on farmers' willingness to participate than profit expectation, indicating that farmers are more concerned about the cost of participating in the project. As the FWMVER project is an agricultural ecological project with a time span of up to 21 years, in the long run, all production factors are variable. If the opportunity cost is too high and the carbon benefit is not enough to compensate for the loss, farmers' willingness to participate in the FWMVER projects would be negatively affected [43]. Current research findings also prove that agriculture and forestry carbon sequestration projects tend to be developed in areas with relatively low opportunity costs for farmers [44]. Our results are consistent with these findings.

(4) Though we've achieved some interesting results from this study, there are still some research limitations which are worthy of further research. Due to the availability of data, some other situational factors may not be considered comprehensively. Further research should consider adding more factors, such as ecological context, resource context, farmer educational level, etc. to improve the comprehensiveness and accuracy of research results.

6. Conclusions and Implications

According to these findings, this paper hereby drew the following policy implications:

This study investigated the influence of farmers' willingness or behavior on the participation in voluntary GHGs emission reduction projects by considering the operational mechanism of field water management voluntary GHGs emission reduction projects, which was ignored in previous reports. Different voluntary GHGs emission reduction projects

have different conditions and requirements, by combining the operational mechanism of GHGs voluntary emission reduction projects, we can better explore the factors that affect farmers' willingness to participate in voluntary emission reduction projects.

With this logic, the context-attitude-behavior framework was constructed based on the analysis of the operational mechanism of FWMVER projects to investigate influencing factors on farmers' participation in FWMVER projects. According to the survey data of 789 rice farmers in Guangxi Zhuang Autonomous Region, China, and the modelling results of the SEM structural equation model considering various factors on farmers' participation in FWMVER projects, it was found that social network, social trust, social norms, profit expectation, cost expectation, and satisfaction with government showed a significant impact on the willingness of farmers to participate in the FWMVER projects; and satisfaction with the government can also effectively regulate the profit expectation and cost expectation of farmers participate in the FWMVER projects. According to these findings, the following policy proposals could be proposed:

(1) The government should encourage establishing non-governmental organizations in rural areas, involved in agricultural voluntary GHGs emission reduction projects to publicize the ecological and economic benefits of agricultural voluntary GHGs emission reduction projects. Through the publicity and guidance about agricultural GHGs emission reduction projects by non-governmental organizations, a low-carbon awareness community could be built.

(2) To improve the profit expectations of farmers, the central and local governments should improve the ecological compensation and incentive policies for relevant agricultural GHGs emission reduction projects. It is suggested to develop personal carbon trading and carbon finance, realizing the long-term value of participating in voluntary emission reduction projects. Proven by practice, carbon financial forms such as carbon tickets can effectively improve the willingness of farmers to participate in voluntary emission reduction projects.

(3) Local governments should actively provide public services in agricultural production, such as building reservoirs and water conservancy facilities to reduce farmers' costs in agricultural production.

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