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Exploring the Factors Affecting Farmers' Willingness to Cultivate Eco-Agriculture in the Qilian Mountain National Park Based on an Extended TPB Model

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Abstract: Despite many governments having actively promoted the importance of developing ecological agriculture, the participation rate of farmers remains relatively low. Therefore, exploring the factors that influence farmers to participate in agroecological cultivation is important. Here, our aim was to identify the intention to participate in eco-agriculture through an extended theory of the planned behavior model. We collected 409 samples using a systematic probability proportional sampling method in Tianzhu County, located in the Gansu section of the Qilian Mountain National Park, China. The results validated that farmers' attitudes, perceived behavioral control, and subjective norms positively influenced their intention to participate in agroecology. The extended model introduces ecological value variables; if perceived behavioral control influences willingness to participate through the mediating variable of attitude, ecological values moderate the mediating role of attitude. Agroecological development in national parks should be promoted by strengthening agroecological communication and increasing environmental awareness among farmers. Our study expands the theoretical model of planned behavior, which can help policymakers better understand the factors that influence farmers' participation in agroecological farming. It can also serve as a reference for the ecological development of agriculture in other protected areas.

Keywords: agroecological cultivation; TPB model; perceived behavioral control; subjective norm; behavioral attitude; ecological values

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1. Introduction

Agroecology, an agricultural practice that combines principles of ecology and economics to achieve a good balance between economic and ecological benefits, has been developed globally to achieve the goal of sustainable agricultural development [1]. Agroecology emphasizes the following two aspects: (1) maximally pure natural products should be used based on the natural organic links among humans, animals, plants, and soils, without the use of chemical fertilizers, pesticides, or chemical insecticides (though limited use may be permitted for the first two substances) [2], forming an ecologically self-sustaining and relatively closed material cycle; and (2) this agriculture should be self-sufficient or even prolific [3–6]. Therefore, the key practices within agroecology include adopting seed varieties suitable for local soils, combining traditional and modern agricultural techniques, reducing agrochemical use, and maintaining soil quality using biological resources [7]. Furthermore, agroecology is a broad term that includes organic farming, alternative farming initiatives, and other chemical-free farming methods [8]. According to data from the Research Institute of Organic Agriculture (FiBL), in 2020, the certified agricultural area of organic farming was 74.93 million hectares (Mha) worldwide, with Oceania, Europe, Latin America, and Asia accounting for 35.91, 17.10, 9.95, and 6.15 Mha, respectively. However, despite the recent growth in organic farming, it is still a small-scale practice [9]. Therefore, increasing the area of land subjected to agroecological farming, as well as the number

and willingness of farmers who practice ecological farming, have become key elements in promoting agroecological farming.

The development of agroecology fits well with the protected areas represented by national parks. The development of ecological agriculture in national parks can both directly avoid the impact of external pollution on crops and achieve crop protection by providing natural habitats for predatory birds and insects. Eco-agriculture does not harm local ecosystems because of the restricted use of chemical pesticides. It also helps to create ideal habitats for animal life by improving biological connections and increasing biodiversity [10]. The Qilian Mountains are an important ecological barrier in Northwestern China, an important source of water in the Yellow River and inland river basins, a priority biodiversity protection area, and one of the key ecological function areas in the country. The quality of the ecological environment in the Qilian Mountains directly affects the ecology of the surrounding areas and the stability of China's entire ecosystem. However, in contrast to the important ecological status, rich flora and fauna, and glacial resources of the region, the economic level of the region is relatively low. Furthermore, because of the limited means of earning a living, dependence on resources for survival and development has been the habitual mode of production of the region's inhabitants. Therefore, to solve the intense contradictions between ecological protection and social development in the Qilian Mountain National Park (QMNP), the choice of low-impact eco-agriculture as a breakthrough to solve the above contradictions is typical, operational, and practical, and has a model effect for other national parks. Resource endowment has allowed agriculture and animal raising to become important industries with relative advantages in the QMNP. Prioritizing agroecological cultivation in the region is practically inevitable. Because farmers are some of the most important participants in agroecological cultivation, their willingness determines the orientation of the labor force. Therefore, examining the willingness to participate in agroecological cultivation (AEW) of farmers in the QMNP and its influencing factors can help achieve the goals listed above. It can also provide a relevant sociological and psychological basis for the development of environmental policy and the achievement of sustainable agricultural development [11].

A considerable amount of the literature has examined the reasons for agroecological transition behavior and intentions [12–14]. Several typical theoretical models have been used to explain the formation of farmers' behavior and intentions to participate in agroecology, such as the theory of planned behavior (TPB) [15–17], the knowledge–attitude–practice model [18,19], the normative activation model [20], and the values–attitude–behavior (VAB) model [21,22]. Among these theoretical frameworks, the validity of the TPB model in predicting pro-environmental behavioral intentions, including agroecological practices, has been well established. However, current research using the TPB model has more often considered perceived behavioral control (PBC), subjective norms (SNs), and attitudes (ATT) separately as independent variables that influence willingness or has extended the models by adding additional variables. Relatively little research has been conducted to extend the TPB model from the perspective of interactive relationships between the variables of interest. In agroecology, limited research focuses on the impact of structural interactions between planned behavior variables on farmers' willingness to participate and extends traditional models in terms of values that moderate the relationship between attitudes and willingness.

To address these gaps, this study uses attitude (ATT) as the mediating variable to highlight the important role of structural interactions between planned behavior variables in influencing willingness to participate. Furthermore, this study extends the TPB model by introducing the variable of ecological values (EVs) and demonstrates that the introduced variables have a moderating effect on the structural interaction between planned behavior variables. The extended TPB model, which focuses on structural interactions between variables, provides new information on the psychological and social interactional factors that influence farmer participation in ecological farming. From a practical perspective, this study has important implications for the diffusion of eco-agriculture in China, especially in

national parks. It also helps alleviate the "vicious circles" between economic and ecological degradation in the national parks [23,24].

2. Literature Review and Research Hypotheses

2.1. Literature Review

Farmers are the primary participants in agricultural production activities and the starting point for the transition to agroecological cultivation. Their AEW affects both the agroecological process and the ultimate direction of China's agricultural development. To date, researchers have mainly investigated the factors affecting farmers' AEW from the following two perspectives: (1) Farmers are the direct operators and participants in agricultural production activities. Therefore, the effects of subjective factors related to farmers (e.g., demography, livelihood, awareness, and risk) on their AEW or production and management decisions have garnered attention from researchers [25–27], particularly in agroecological cultivation. Jin et al. (2015) found that age, education level, and access to technical training were the main factors that affected farmers' tendency to use fertilizers and pesticides [28]. Guo et al. (2022) demonstrated that production efficiency was directly affected by farmers' cognition of resources and the environment, and it could also be indirectly affected by green production willingness and behavior [11]. Based on survey data obtained from 119 ecological farms, Jiao et al. (2021) found that the level of human capital was the principal factor that affected the green development of ecological farms [29]. According to Zhang et al. (2020), the greater the family's farming acreage, the smaller the family size, and the higher the level of off-farm employment, the more inclined the farmers will be to reduce the excessive use of fertilizers in the agricultural production process [30]. Through an empirical analysis using the Heckman two-stage model, Lv et al. (2021) revealed that risk aversion led to rigid fertilizer application behavior in farmers and that it not only increased the likelihood of farmers overusing chemical fertilizers but also considerably increased the extent of their overuse [31]. Khan and Damalas (2015) found that education and training were important factors that deterred cotton farmers in Pakistan from using chemical pesticides [32]. Ashrit and Thakur (2021) used logistic regression analysis to show that farming experience, education, and awareness are important factors in improving farmers' knowledge, and a high level of knowledge increases the likelihood of farmers adopting sustainable agricultural practices [33]. (2) Agricultural production activities are activities undertaken by farmers on production elements (e.g., land). They are affected by external objective factors, such as natural resource conditions, technology, and policies. Hijbeek et al. (2019) found that farmers' use of organic inputs was affected by soil and climatic conditions [34]. By surveying rural households in China, Wu et al. (2018) found that farm size is a major factor affecting pesticide use intensity on farms in China. Statistically, for every 1% increase in farm size, fertilizer and pesticide use per hectare decreases by 0.3% and 0.5%, respectively ($p < 0.001$) [35]. Expanding the scale of ecological agriculture, as well as promoting successful ecological agriculture experiences among farmers, can lead to the promotion of farmers' participation in the development of ecological agriculture [36]. Based on data obtained from 3680 farmers in China via a long-term panel dataset of 31 provinces of China from 2000 to 2012, Hu et al. (2022) found that farmers' willingness to pay for and implement new technologies was positively correlated with farm size [37]. He et al. (2020) introduced two variables: "interpersonal trust" and "institutional trust", to examine the determinants of farmers' willingness to pay to use crop straw as biogas. They found that the cost and benefit trade-offs of the straw return-to-field program, logistical and technological convenience, and trust factors considerably affected farmers' willingness [38]. Schiller et al. (2020) described how ecological agriculture in Nicaragua demonstrates that strong guarantee policies play an important role in promoting the development of ecological agriculture [39]. Using coffee farming in Vietnam as an example, Nguyen and Drakou (2021) applied a rooting theory approach to explore the effects of climate change perception, farmers past behavior, and social trust on the adoption of ecological farming practices by farmers [40].

2.2. Research Hypotheses

Ajzen's TPB was developed based on the theory of reasoned action [41]. The TPB emphasizes that an individual's specific behavior is determined by their behavioral intentions, which are affected by three variables: SNs, ATT, and PBC [42]. The TPB provides an excellent theoretical framework for explaining rational decisions and plays a dominant role in theoretical behavior research. The theory has also been extensively applied in studies that examine the behavior of farmers and their willingness to implement certain practices (e.g., farmers' willingness to adopt agricultural technology [43–45], make decisions to diversify agricultural production [46], reduce their use of fertilizers and pesticides [47,48], and conserve water [49]. These studies have provided basic theoretical support for this study. Based on previous studies, EVs were further discussed, and their role in the effects of variables related to planned behavior on the AEW of farmers in the QMNP was analyzed and examined.

2.2.1. Impact of the TPB Variables on Farmers' AEW

PBC is the perception of people's ability to perform a certain behavior [42]. Expanding on ecological agriculture, PBC refers to farmers' subjective evaluation of the difficulty of technologies related to agroecology, along with their objective evaluation of the difficulty of attaining technologies and material resources related to ecological farming. Whatever the level of difficulty of a new technology, its potential adopters need to invest effort and time into understanding it and determining whether it is useful for them [50]. When a person perceives that they have substantial control over a behavior, this perception motivates the person to engage in that behavior [51]. Thus, people's confidence in their ability to engage in a behavior has a positive effect on intention [15]. This view extends to agroecological cultivation. When farmers self-determine that they cannot control the difficulty of obtaining technologies and material resources related to agroecology, they are likely to feel intimidated by the prospect of participating in agroecological cultivation, which is detrimental to their motivation to undertake this farming practice. In contrast, when farmers determine by themselves that they can control the difficulty of obtaining technologies and material resources related to agroecology, they may be more motivated and willing to participate in agroecological practices. Thus, our first hypothesis (H1) was as follows:

H1. *PBC has a positive effect on farmers' AEW in the QMNP.*

As individuals can be viewed as nodes that comprise a social network, their behavior affects the entire social network but is also influenced by the nodes within the social network. Therefore, social norms exert a marked impact on individuals' behavioral decisions, particularly their pro-environmental behavior [51–55]. Li et al. (2020) showed that SNs were important factors driving the adoption of sustainable production technologies in agriculture. Hunecke et al. (2017) showed that trust in institutions facilitated the adoption of irrigation technology in viticulture, thus promoting innovation in agriculture [56]. Yadav and Pathak (2017) showed that the preference of family or friends for organic food promotes individual purchases of environmentally friendly agricultural products [57]. In agricultural production activities, farmers' production decisions are often influenced by the opinions of family members, neighbors, friends, and government groups. Based on their influence on individuals' decisions and behavior, SNs can be subdivided into two categories [58]: (1) descriptive norms; in this study, the opinions of neighbors and relatives were used as an observed variable of descriptive norms to examine their effects on farmers' AEW; and (2) injunctive norms, which reflect, to some extent, the expectations of society regarding individual behavior. Therefore, in this study, government subsidies for participation in agroecological practices and the intensity of government regulation were used as observed variables of injunctive norms. The more farmers identify with and trust SNs, the more

positive their attitude, and the more willing they are to participate in agroecology, and vice versa. Our second hypothesis (H2) was as follows:

H2. *SNs have a positive effect on farmers' AEW in the QMNP.*

ATT represents an individual's positive or negative attitude toward a behavior [42], and positive attitudes increase the likelihood that a behavior will be produced [59]. Li et al. (2021) showed that positive attitudes favor the adoption of improved agricultural systems by farmers, and this positive relationship was similarly supported in other agricultural practices [60,61]. In this study, ATT represents an individual farmer's subjective view and evaluation of agroecological cultivation and development in the QMNP. When farmers in the QMNP agree that participation in agroecological practices can bring them comprehensive economic, social, and ecological benefits (e.g., increased income and improved technology for their individual purposes, as well as improved ecological and environmental conditions and consumer health from the societal perspective), they will have a natural affinity for agroecological practices and thus adopt a supportive attitude or view toward agroecological cultivation and development in the region. This can increase their motivation to actively participate in agroecological practices, encouraging them to transform their willingness into action. When farmers do not perceive that agroecological cultivation and development can bring them manifold comprehensive benefits or believe that participation in agroecological practices leads to economic, social, and ecological losses, they will naturally adopt a rejective attitude or view toward agroecological cultivation and development in the region. Our third hypothesis (H3) was as follows:

H3. *ATT has a positive effect on farmers' AEW in the QMNP.*

2.2.2. ATT's Mediating Impact

The traditional TPB theory suggests that the three variables mentioned above independently influence behavioral intentions. However, many researchers have also suggested that causal relationships between variables related to planned behavior should be explored. For example, Han et al. (2020) argued that there is a relationship between SNs and ATT. In their discussion of the choice intentions for green hotels, they state that SNs influence the formation of customers' intentions to visit green hotels through attitudes [59]. The notion that there is a correlation rather than an independent relationship between SNs and ATT has been supported in the literature elsewhere [51]. Similarly, the view that PBC may have a positive effect on ATT has been supported by other authors [60]. The conclusion that ATT mediates the pathway between PBC and SNs to influence willingness to participate has also been supported by some studies. For example, when Cao et al. (2022) studied the willingness to sort garbage in rural tourism destinations based on an extended TPB, they demonstrated that SNs and PBC indirectly influence the willingness to participate in garbage sorting through the mediating role of behavioral ATT [61]. When extended to agroecological cultivation, PBC, SNs, and ATT directly affect farmers' AEW; furthermore, PBC and SNs indirectly affect farmers' AEW through their ATT. However, the more restrictive the injunctive norms or the more attractive the social norms facing farmers, the more positive their attitude toward participation in agroecology. In contrast, the more farmers understand the feasibility and result of participation in agroecological practices, the more confident they are in controlling the outcome of participation, and the more likely they are to adopt a positive and optimistic attitude toward participating in agroecological cultivation [62]. Therefore, our fourth hypothesis (H4) was developed:

H4-1. *ATT plays a mediating role in the process wherein PBC influences farmers' AEW in the QMNP.*

H4-2. *ATT plays a mediating role in the process wherein SNs influence farmers' AEW in the QMNP.*

2.2.3. EVs and Their Moderating Impact

Both attitudes and values are abstract expressions of social cognition; attitudes are positive or negative evaluations of specific behaviors or issues in terms of affect, whereas values are broader, stable, and general expressions of social cognition [63,64]. The TPB model, based on the assumption that affective attitudes follow general cognitive attitudes (or beliefs) [65], ignores the influence of environmental values on specific behavioral attitudes and behaviors [66–68]. Therefore, the VAB model, which considers values as antecedent variables influencing behavioral attitudes or other psychological factors [69,70], has also received increased attention from researchers. The introduction of values is important when predicting pro-environmental behavioral attitudes and intentions [71–73]. Environmental values are the stable and enduring dispositions or perceptions of individuals toward environmental protection or a particular environmental behavior [71]. Self-interest, collectivism, and EVs are the main components of environmental values [72,74]. EVs are often considered important factors that can promote environmental behavior [75]. Therefore, the introduction of EVs and the use of the VAB model to extend the TPB model can help to more accurately capture the important factors that influence individuals' behavioral intentions. The VAB model examines the hierarchical structural relationship between values and attitude [76,77], and to some extent ignores that the influence of attitudes and variables on planned behavior or behavioral intentions is also moderated by individual values. Therefore, in this study, we introduce the variable of values when examining the factors that influence farmers' AEW and break the causal chain between values and attitudes in the VAB model to innovatively examine the moderating effects that can occur with values. Individuals with high EVs are likely to be more ecologically concerned and to have relatively positive attitudes toward pro-environmental behaviors consistent with their values (e.g., participation in ecological agriculture). Furthermore, these attitudes are stable. Thus, farmers with high EVs can weaken the influence of difficulties they may encounter when participating in ecological farming or external social norms on their own attitudes toward participation in ecological farming [75,78,79]. Accordingly, EVs were further introduced as moderating variables for the effects of PBC and SNs on farmers' ATT in this study. Our fifth hypothesis (H5) was as follows:

H5-1. *EVs negatively moderate the effect between farmers' PBC and ATT in the QMNP; that is, the higher the level of farmers' EVs, the weaker the effect of PBC on ATT.*

H5-2. *EVs negatively moderate the effect between farmers' SNs and ATT in the QMNP; that is, the higher the level of farmers' EVs, the weaker the effect of SNs on ATT.*

In the above analysis, both farmers' PBC and SNs affect AEW through the mediating mechanism of ATT. However, high EVs can inhibit the effects of both PBCs and ATT. This inhibitory relationship may also exist between SNs and ATT. Combined with these discussions, EVs may play a moderating role in the front-end mediating mechanism of farmers' PBC–ATT–AEW; that is, there may be a moderated mediation effect. Similarly, EVs may play a moderating role in the front-end mediation mechanism of farmers' SNs–ATT–AEW. Therefore, our sixth hypothesis (H6) was as follows:

H6-1. *EVs negatively moderate the mediating effect of PBC on AEW through ATT; that is, the higher the farmers' EVs in the QMNP, the weaker the mediating effect of PBC on the farmers' AEW through ATT.*

H6-2. *EVs negatively moderate the mediating effect of SNs on AEW through ATT; that is, the higher the farmers' EVs in the QMNP, the weaker the mediating effect of SNs on the farmers' AEW through ATT.*

3. Study Design

3.1. Study Area

Among the counties and districts involved in the QMNP, approximately 70% of Tianzhu County's land is located within the QMNP; thus, most of the land is restricted from development. In addition, Tianzhu County has a much higher density of people involved in agriculture than other counties and districts within the national park area. Therefore, the study of farmers' willingness to participate in agroecology in Tianzhu County, Wuwei City, Gansu Province, which is located in the QMNP, reflects the serious contradictions and conflicts between conservation and development faced by protected areas worldwide, and is therefore urgent and typical.

3.2. Data Sources

The data used in this study were obtained through an investigative survey of farmers in the 10 townships in Tianzhu County located in the QMNP in December 2021. The data collection and processing process can be divided into three main steps: determining the sample size, conducting the survey, and determining the number of valid questionnaires.

Before the survey, the sample size was statistically analyzed to determine a statistically suitable sample size:

$$N = \frac{{Z_\alpha}^2 \pi(1-\pi)}{\Delta^2} \quad (1)$$

where N represents the required sample size; Z represents the required confidence level; π represents the percentage occurrence of a state or condition; and Δ represents the percentage maximum error required [80].

Based on Equation (1), and assuming a confidence level of $\alpha = 0.05$; a critical value of the normal distribution table = 1.96; an overall probability, π, reaching a maximum value of 0.5; and a sampling error range controlled within 5%, the required sample size (N) in this study was at least 384.

After the sample size was determined, a three-stage sampling method was used to select the final sample. First, the 10 townships (towns) located in the QMNP were the primary sampling units. Second, the secondary sampling unit 'village' was selected from the primary sampling unit using systematic probability-proportional sampling (PPS). In the sampling process, the proportion of secondary sampling units was determined based on the zoning principles of the QMNP and the population engaged in agriculture in each township within the QMNP. Of the secondary sampling points, the areas classified as core area townships accounted for approximately 20% of the agricultural population in the QMNP Tianzhu County area, whereas the areas classified as general control area townships accounted for approximately 80% of the agricultural population in the QMNP Tianzhu County area. Therefore, out of the 25 secondary sampling units, 5 belong to the core area, whereas 20 belong to the general control area. Finally, in the third stage, the three-level sampling unit 'people' was determined using a random sampling method, where everyone had an equal chance of being selected. During the survey, 18 individuals were randomly selected from the list of villagers in the selected secondary sampling unit 'village' as the final individuals for the survey.

A total of 450 questionnaires were distributed for this study. At the end of the sampling, due to refusals to participate in the study and invalid questionnaires, 409 valid questionnaires were retained. Thus, the questionnaire administration efficiency was 90.89%, meeting the minimum sample size requirement for the study.

3.3. Measures

The questionnaire comprised two main parts: personal demographic information and measurement of variables relevant to the study. The design of measurement questions on each dimension, such as TPB variables and willingness to participate, was informed by existing research. The AEW, ATT, PBC, SNs, and EVs of farmers in the QMNP are latent variables and therefore need to be characterized using certain observed variables. A

five-point Likert scale was used to measure the AEW, ATT, PBC, SNs, and EVs of farmers in the surveyed area (where "1" meant "strongly disagree" and "5" meant "strongly agree"). The relationship between variables is shown in Figure 1.

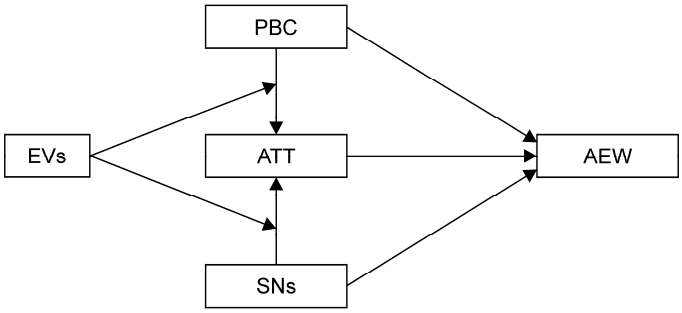


Figure 1. Conceptual model. PBC, perceived behavioral control; EVs, ecological values; ATT, attitude; AEW, willingness to participate in agroecological cultivation; SNs, subjective norms.

3.4. Research Method

Structural equation modelling (SEM) is an important research method used to study the structural relationship between unobservable variables. Farmers' AEW is an unobservable variable, and SEM can reflect the variables that affect AEW as latent variables. The equations used in SEM are as shown in Equations (2)–(4):

$$X = \Lambda_X \xi + \delta \tag{2}$$

$$Y = \Lambda_Y \eta + \varepsilon \tag{3}$$

$$\eta = B\eta + \Gamma\xi + \zeta \tag{4}$$

where X is an exogenously observed variable (i.e., each measurement item corresponding to ATT, PBC, or SNs in this study); Λ_X is the factor loading of X; ξ is an exogenous latent variable (i.e., ATT, PBC, or SNs in this study); δ is the measurement error of the exogenous variable; Y is an endogenously observed variable (i.e., each measurement item corresponding to farmers' AEW); Λ_Y is the factor loading of Y; η is an endogenous latent variable (i.e., farmers' AEW); ε is the measurement error of the endogenous variable; B and Γ are both path factors (B is the relationship between the endogenous latent variables and Γ denotes the effects of the exogenous latent variables on the endogenous latent variables, that is, the effects of ATT, PBC, and SNs on farmers' AEW, respectively); and ζ is the error term of the structural equations.

3.5. Statistical Description

3.5.1. Personal Demographic Information

The personal demographic information obtained from the survey were statistically analyzed according to the following three aspects (Table 1): (1) Gender. Among the 409 respondents who returned valid questionnaires, 297 (ca. 72.6%) were male and 112 (ca. 27.4%) were female respondents. (2) Age. The ages of the respondents ranged from 22 to 75 years, with a mean age of 50.01 years. Most respondents were in the age group of 51 to 60 years (173; ca. 42.3%), followed by the age group of 41 to 50 years (109; ca. 26.7%), with the fewest respondents in the age group of 30 years and younger (18; ca. 4.4%). These age characteristics were consistent with the current distribution and work situation of the main labor force in rural areas. However, they also reflected that the young and middle-aged labor force is currently small in rural areas and that people in this group leave rural areas to study or work elsewhere. This finding suggests that the data obtained from the survey are representative. (3) Distribution of education level. Among the respondents, 231 (ca. 56.5%) were educated at an elementary school level or lower, 138 (ca. 33.7%) at junior high school level, 27 (ca. 6.6%) at high school or secondary vocational school level, 13 (ca. 3.2%) at university or tertiary vocational school level, and none at master's level or higher. This

finding shows that the level of education of farmers in the QMNP area is still relatively low, which is consistent with the current education situation in China's rural areas.

Table 1. Descriptive statistics.

Variable	Description	Number	Percentage (%)
Number of Respondents		409	100
Gender	Male	297	72.6
	Female	112	27.4
Age	21–30	18	4.4
	31–40	63	15.4
	41–50	109	26.7
	51–60	173	42.3
	>60	46	11.2
Education level	Elementary school and lower	231	56.5
	Junior high school	138	33.7
	High school or secondary vocational school	27	6.6
	University or tertiary vocational school	13	3.2
	Master's and above	0	0

3.5.2. Study Variable Information

The study variable information obtained from the survey were statistically analyzed according to the following five aspects (Table 2): (1) The mean value of each question measuring farmers' AEW is greater than 3, indicating that farmers in the study area are biased toward participating in ecological agriculture, but there is still much room for increasing farmers' AEW. Reducing farmers' willingness to use external inputs, such as pesticides and fertilizers, is an important breakthrough in increasing farmers' AEW. (2) Increasing the availability of material and technical means for farmers to develop agroecology is conducive to achieving the goal of maintaining soil nutrients and fertility in a closed-loop system in the study area, thus reducing farmers' dependence on external inputs. (3) Farmers have a more positive attitude toward participating in organic farming. However, analysis of the questions that make up this dimension shows that promoting the development of agroecology to improve farmers' incomes and skills is an important way to change farmers' attitudes toward agroecology in a more positive direction. (4) Farmers are strongly influenced by social norms. Government subsidies have a strong influence on encouraging farmers' participation in ecological agriculture. (5) The level of farmers' EVs is relatively high, but there is still considerable scope for improvement.

Table 2. Reliability and convergent validity (CV) tests.

Dimension	Measurement Indicator	Code	Mean	Standard Deviation	Factor Loading	Cronbach's α	CR	AVE
AEW	I will reduce my use of pesticides.	AEW1	3.29	1.176	0.892	0.849	0.852	0.600
	I will reduce my use of chemical fertilizers.	AEW2	3.31	1.145	0.920	–	–	–
	I will reduce my use of herbicides.	AEW3	3.56	1.106	0.694	–	–	–
	I will recover and reuse agricultural waste.	AEW4	3.66	0.874	0.527	–	–	–
PBC	It is easy to obtain organic fertilizers from nearby sources.	PBC1	3.57	0.963	0.747	0.728	0.737	0.485
	It is easy to recover agricultural waste.	PBC2	3.61	0.766	0.731	–	–	–
	It is easy to learn and adopt new technologies related to agroecology.	PBC3	3.44	0.911	0.602	–	–	–

Table 2. *Cont.*

Dimension	Measurement Indicator	Code	Mean	Standard Deviation	Factor Loading	Cronbach's α	CR	AVE
ATT	Agroecology can generate higher income.	ATT1	3.67	0.904	0.715	0.807	0.812	0.519
	Agroecology can reduce environmental pollution.	ATT2	4.11	0.753	0.714	–	–	–
	Agroecological products are better for human health.	ATT3	4.47	0.686	0.722	–	–	–
	Participation in agroecology can improve one's own skills.	ATT4	3.79	0.847	0.730	–	–	–
SNs	I will consider the opinions of my family when deciding whether to participate in agroecological cultivation.	SNs1	3.82	0.889	0.770	0.800	0.801	0.505
	I will consider the opinions of my neighbors when deciding whether to participate in agroecological cultivation.	SNs2	3.70	0.860	0.807	–	–	–
	I will consider the extent of government subsidies when deciding whether to participate in agroecological cultivation.	SNs3	4.05	0.772	0.667	–	–	–
	I will consider the intensity of government supervision of the ecological environment when deciding whether to participate in agroecological cultivation.	SNs4	3.79	0.768	0.576	–	–	–
EVs	Ecology is more important than economics.	EV1	3.79	0.758	0.643	0.776	0.781	0.545
	A good ecological environment is the basis of economic income.	EV2	3.84	0.695	0.810	–	–	–
	Protection should be the prerequisite for development in the QMNP.	EV3	3.79	0.758	0.752	–	–	–

Notes: PBC, perceived behavioral control; ATT, attitude; SNs, subjective norms; AEW, willingness to participate in agroecological cultivation; EVs, ecological values; CR, composite reliability; AVE, average variance extracted.

4. Results

4.1. Reliability and Validity Tests

Before empirical testing, the reliability of this portion of the questionnaire data was examined to determine the stability and reliability of the results. The IBM SPSS 24.0 software was used to test the reliability and validity of the 18 observed variables, including AEW and its influencing factors. Tables 2–5 summarize the results.

Table 3. Fornell–Larcker discriminant validity (DV) test results.

	EVs	AEW	SNs	ATT	PBC
EVs	0.738	–	–	–	–
AEW	0.663	0.775	–	–	–
SNs	0.587	0.581	0.711	–	–
ATT	0.696	0.624	0.595	0.720	–
PBC	0.609	0.586	0.546	0.613	0.696

Notes: Each diagonal element is the square root of the convergent validity (CV) (i.e., average variance extracted (AVE)) of the corresponding dimension, and each lower triangular element is the Pearson correlation coefficient for each dimension. EVs, ecological values; AEW, willingness to participate in agroecological cultivation; SNs, subjective norms; ATT, attitude; PBC, perceived behavioral control.

Table 4. The HTMT matrix.

	EVs	AEW	SNs	ATT	PBC
EVs	1.000	0.688	0.582	0.683	0.616
AEW	0.688	1.000	0.600	0.678	0.621
SNs	0.582	0.600	1.000	0.611	0.530
ATT	0.683	0.678	0.611	1.000	0.610
PBC	0.616	0.621	0.530	0.610	1.000

Table 5. HTMT discriminant validity (DV) test results.

Factor A	Factor B	HTMT	BootMean	BootSE	BootLLCI	BootULCI
EVs	AEW	0.688	0.686	0.041	0.602	0.761
EVs	SNs	0.582	0.582	0.056	0.468	0.686
EVs	ATT	0.683	0.682	0.041	0.595	0.759
EVs	PBC	0.616	0.617	0.053	0.514	0.720
AEW	SNs	0.600	0.599	0.047	0.501	0.687
AEW	ATT	0.678	0.677	0.039	0.596	0.748
AEW	PBC	0.621	0.621	0.046	0.528	0.711
SNs	ATT	0.611	0.609	0.049	0.508	0.695
SNs	PBC	0.530	0.528	0.056	0.417	0.631
ATT	PBC	0.610	0.609	0.052	0.501	0.700

(1) A Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity were performed on the observed variables. The KMO value was 0.904, which was higher than the minimum standard value (0.5). Bartlett's test of sphericity was significant at the 1% level. These findings suggest the variables were not correlated with each other and were suitable for factor analysis. Cronbach's α coefficient of each latent variable was above 0.7, indicating the relatively high reliability of the model and high internal consistency of each latent variable.

(2) The maximum-variance method was used to perform a factor rotation analysis. Five common factors were extracted. The cumulative explained variance was 67.19%, exceeding the standard value (60%). The factor loading between each dimension and the measurement indicator ranged from 0.5 to 0.95, meeting the relevant requirement.

(3) The composite reliability (CR) of the questionnaire items was tested. CR is primarily used to reflect the level of the internal consistency of measurement indicators in the dimension of a certain latent variable. The higher the CR value, the higher the internal correlation among the measurement indicators in the dimension and vice versa. Research has shown that the CR value should be greater than 0.7 [81]. The test results in Table 2 reveal a CR value greater than 0.7 in each dimension, indicating a strong internal correlation among the measurement indicators aggregated in each dimension.

(4) The convergent validity (CV) of each questionnaire item was tested using the average variance extracted (AVE). Validity is used to reflect the actual degree to which each measurement indicator measures a latent variable. The AVE of a latent variable is used to reflect the variance of an indicator variable explained by the latent variable. An AVE value greater than 0.5 indicates that each measurement indicator measures the latent variable to a high degree; the variable is thus considered to have a high level of validity [82]. As shown in Table 2, except for the AVE value for PBC (0.485), the AVE values in all dimensions were above 0.5, meeting the relevant requirement and demonstrating a high level of validity for each dimension.

(5) The discriminant validity (DV) was tested for each dimension. As noted by Fornell and Larcker (1981), if the square root of the CV (i.e., AVE) of a latent variable is greater than the correlation coefficient between the rest of the latent variables, then DV is present between the latent variables [82]. As shown in Table 3, each diagonal element was the square root of the CV (i.e., AVE) of the corresponding latent variable and had a value higher than the correlation coefficient between the rest of the latent variables, demonstrating a high level of DV between the dimensions of the scale. The other measure for DV is the heterotrait–monotrait (HTMT) ratio of correlation, as proposed by Henseler [83,84]. As shown in Tables 4 and 5, the HTMT value is less than 0.85 and the bootstrap confidence interval does not contain a value of one, indicating that the dimensions have a good DV.

A combination of the analyses presented above revealed that the scale data had high reliability and validity and could be subjected to structural equation model (SEM) analysis.

4.2. Goodness-of-Fit Test

The IBM SPSS Amos 24.0 software was used to test the goodness of fit of the model. The model goodness of fit can be examined based on the fit index (c^2/df), similarity indices (GFI), adjusted GFI (AGFI), Tucker–Lewis index (TLI), and comparative fit index (CFI), and badness-of-fit indices (root-mean-square error of approximation (RMSEA) and normalized root-mean-square residual (SRMR)). Table 6 summarizes the goodness-of-fit test results for the model corresponding to each index with AEW as the explained variable. The test result corresponding to each of the fit, similarity, and badness-of-fit indices was within the reasonable range of the index, indicating the high goodness of fit of the tested model.

Table 6. Goodness-of-fit indices for the structural equation model (SEM).

Index	c^2/df	SRMR	RMSEA	GFI	AGFI	IFI	CFI	TLI
Reference value	≤3	<0.08	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9
AEW test value	2.842	0.0524	0.067	0.927	0.895	0.942	0.942	0.927
Model evaluation	Ideal	Ideal	Ideal	Ideal	Relatively ideal	Ideal	Ideal	Ideal

Notes: c^2/df, fit index; SRMR, normalized root-mean-square residual; RMSEA, root-mean-square error of approximation; GFI, similarity index; AGFI, adjusted similarity index; IFI, incremental fit index; CFI, comparative fit index; TLI, Tucker–Lewis index.

4.3. Analysis of Path Relationship Test

Table 7 and Figure 2 show the results of the path relationship test results using SEM, and the test results are assumed to support the corresponding research hypotheses: (1) The normalized path coefficient for the effects of PBC on AEW was 0.280, suggesting that the significance test was passed at the 1% level. A positive correlation was also evident between the test results, supporting the corresponding research hypothesis (i.e., H1). (2) The normalized path coefficient for the effects of SNs on AEW was 0.234, suggesting that the significance test was passed at the 1% level. A positive correlation was also evident between the test results, supporting the corresponding research hypothesis (i.e., H2). (3) The normalized path coefficient for the effects of ATT on AEW was 0.318, suggesting that the significance test was passed at the 1% level. A positive correlation was also evident between the test results, supporting the corresponding research hypothesis (i.e., H3).

Table 7. Path relationship test results.

Hypothesis	Path	Non-Normalized Coefficient	Standard Error (SE)	Z-Value	Significance Level	Normalized Coefficient	Hypothesis Result
H1	PBC→AEW	0.164	0.042	3.892	***	0.280	Support
H2	SNs→AEW	0.235	0.069	3.422	***	0.234	Support
H3	ATT→AEW	0.245	0.057	4.267	***	0.318	Support

Notes: *** indicates significance at $p < 0.001$. PBC, perceived behavioral control; AEW, willingness to participate in agroecological cultivation; SN, subjective norm; ATT, attitude.

4.4. Analysis of the Mediating Effect

This study used bootstrapping in AMOS to test for mediation effects. Bootstrapping is a resampling method that creates a sampling distribution to estimate standard errors and create confidence intervals. Bootstrapping has two advantages: first, it can calculate the magnitude of the mediation effect; second, it relaxes the requirement that the sampling distribution be normal, which can avoid the high class I error rate due to violation of the normal distribution [61,85]. Therefore, the use of the bootstrap method to test the mediation effect has been supported and accepted by many studies [38]. In this study, at

a 95% confidence interval (CI), bootstrapping was used to sample the data 1000 times to examine whether ATT plays a mediating role in the paths in which PBC and SNs influence the AEW. The results in Table 8 reveal the following. (1) ATT played a mediating role in farmers' PBC and AEW. The bias-corrected and percentile tests yielded 95% CIs of [0.037, 0.130] and [0.033, 0.124], respectively, neither of which contained zero, suggesting the presence of a mediation effect. The test results support the research hypothesis H4-1. ATT played a partial mediator role for PBC: 69.5% of the effect of farmers' PBC on their AEW was direct, whereas the remaining 30.5% was transferred through ATT, which acted as a mediator variable. (2) ATT similarly played a mediating role in the relationship between farmers' SNs and AEW. The test results support the research hypothesis H4-2. ATT played a partial mediating role in the same way for SNs: 66% of the effect of farmers' SNs on their AEW was direct, whereas the remaining 34% was transferred through ATT, which acted as a mediator variable.

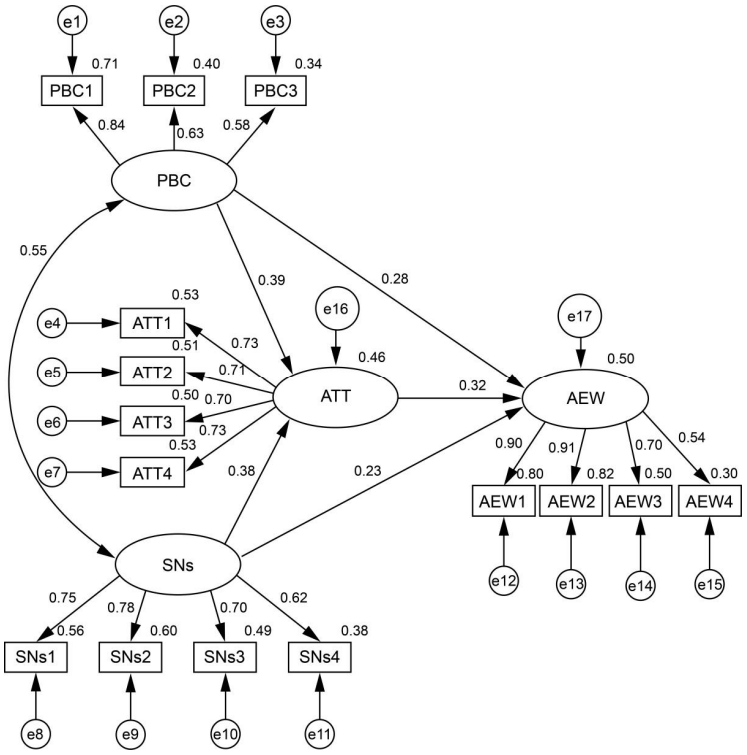


Figure 2. Paths in the model and normalized estimates. Notes: PBC, perceived behavioral control; ATT, attitude; SNs, subjective norms; AEW, willingness to participate in agroecological cultivation; PBC1, "It is easy to obtain organic fertilizers from nearby sources"; PBC2, "It is easy to recover agricultural waste such as straw"; PBC3, "It is easy to learn and adopt new technologies related to agroecology"; ATT1, "Agroecology can generate a higher income"; ATT2, "Agroecology can reduce environmental pollution"; ATT3, "Agroecological products are better for human health"; ATT4, "Participation in agroecology can improve one's own skills"; SNs1, "I will consider the opinions of my family when deciding whether to participate in agroecological cultivation"; SNs2, "I will consider the opinions of my neighbors when deciding whether to participate in agroecological cultivation"; SNs3, "I will consider the extent of government subsidies when deciding whether to participate in agroecological cultivation"; SNs4, "I will consider the intensity of government supervision of the ecological environment when deciding whether to participate in agroecological cultivation"; AEW1, "I will reduce my use of pesticides"; AEW2, "I will reduce my use of chemical fertilizers"; AEW3, "I will reduce my use of herbicides"; AEW4, "I will recover and reuse agricultural waste such as straw"; EV1, "Ecology is more important than economics"; EV2, "A good ecological environment is the basis of an economic income"; EV3, "Protection should be the prerequisite for development in and around the QMPN." e1 to e15 represent the measurement error of the measurement indicator.

Table 8. Bootstrapping test results for the mediation effect.

Path	Point Estimate	Product of Coefficient		Bootstrap 1000 Times 95% CI			
				Bias-Corrected		Percentile	
		SE	Z-Value	Lower	Upper	Lower	Upper
			Indirect effect				
PBC→ATT→AEW	0.072	0.022	3.273	0.037	0.130	0.033	0.124
SNs→ATT→AEW	0.121	0.038	3.184	0.062	0.217	0.056	0.207
			Direct effect				
PBC→AEW	0.164	0.042	3.905	0.077	0.252	0.079	0.253
SNs→AEW	0.235	0.066	3.561	0.114	0.373	0.111	0.372
			Total effect				
PBC→AEW	0.236	0.045	5.244	0.154	0.338	0.148	0.333
SNs→AEW	0.356	0.062	5.742	0.245	0.486	0.244	0.482

Notes: PBC, perceived behavioral control; ATT, attitude. AEW, willingness to participate in agroecological cultivation; SNs, subjective norms.

4.5. Analysis of Moderating Mediation Effects

To determine the presence of an EV-moderated mediation effect, the PROCESS program module was used to sample the data 1000 times at a 95% CI. Before testing, all variables were normalized.

4.5.1. The Moderating Effect of EVs

As shown in Table 9, the regression coefficient of the interaction term between farmers' PBC and EVs was significant ($\beta = -0.115$, $p < 0.01$), suggesting that EVs had a negative moderating effect on the relationship between farmers' PBC and ATT. This finding supports the research hypothesis H5-1.

Table 9. Test results for the mediation effect of EVs between PBC and ATT.

	Coefficient	*p*-Value	Lower-Limit CI (LLCI)	Upper-Limit CI (ULCI)	Coefficient	*p*-Value	LLCI	ULCI
Variable			Mediator (ATT)			Dependent variable (AEW)		
Constant term	0.054	0.209	−0.031	0.139	0.000	1.000	−0.077	0.077
PBC	0.270	0.000	0.181	0.360	0.306	0.000	0.218	0.394
EVs	0.358	0.000	0.267	0.448	–	–	–	–
Interaction term	−0.115	0.001	−0.184	−0.047	–	–	–	–
ATT	–	–	–	–	0.404	0.000	0.316	0.491
		R^2 = 0.354 F (3405) = 74.048 p < 0.001			R^2 = 0.373 F (2406) = 120.562 p < 0.001			

Notes: ATT, attitude; AEW, willingness to participate in agroecological cultivation; PBC, perceived behavioral control; EVs, ecological values.

As shown in Table 10, the regression coefficient of the interaction term between farmers' SNs and EVs was similarly significant ($\beta = -0.07$, $P < 0.05$), suggesting that EVs also had a negative moderating effect on the relationship between farmers' SNs and ATT. This finding supports the research hypothesis H5-2.

Table 10. Test results for the mediation effect of EVs between SNs and ATT.

	Coefficient	*p*-Value	LLCI	ULCI	Coefficient	*p*-Value	LLCI	ULCI
Variable			Mediator (ATT)			Dependent variable (AEW)		
Constant term	0.032	0.450	−0.051	0.115	0.000	1.000	−0.078	0.078
SNs	0.319	0.000	0.230	0.408	0.291	0.000	0.200	0.381
EVs	0.337	0.000	0.246	0.429	–	–	–	–
Interaction term	−0.070	0.037	−0.135	−0.004	–	–	–	–
ATT	–	–	–	–	0.401	0.000	0.310	0.491
		R^2 = 0.369 F (3405) = 78.939 p < 0.001			R^2 = 0.362 F (2406) = 115.377 p < 0.001			

Notes: ATT, attitude; AEW, willingness to participate in agroecological cultivation; SNs, subjective norms; EVs, ecological values.

For a greater visualization of the moderating effect and direction, EVs were classified into two levels, high and low, using the mean plus or minus standard deviation as a criterion, and then simple slope analysis was conducted. As shown in Figure 3, at the high EV level, the association between farmers' PBC and ATT was weaker, with a simple slope of 0.155 ($p < 0.05$). At the low EV level, the association between PBC and ATT was stronger, with a simple slope of 0.385 ($p < 0.001$). Farmers' EVs play a negative moderating role in the relationship between PBC and ATT. Farmers with high EVs are more likely to develop positive attitudes toward agroecology at lower levels of PBC than farmers with low EVs. As shown in Figure 4, at the high EV level, the association between farmers' SNs and ATT was weaker, with a simple slope of 0.250 ($p < 0.001$). At the low EV level, the association between SNs and ATT was stronger, with a simple slope of 0.389 ($p < 0.001$). Farmers with high EVs are more likely to develop positive attitudes toward agroecology at lower levels of SNs than farmers with low EVs. Farmers' EVs also play a negative moderating role in the relationship between SNs and ATT.

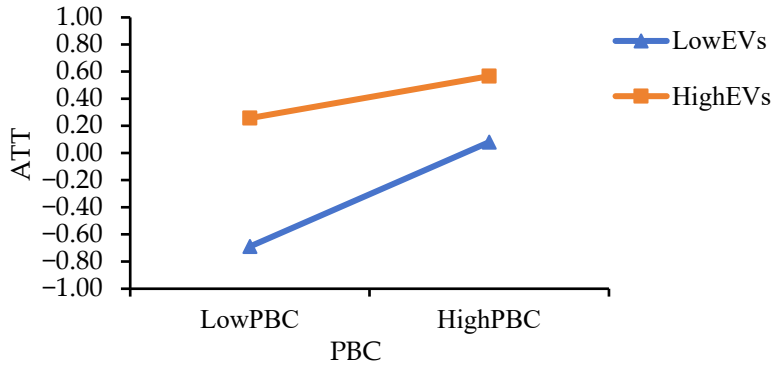


Figure 3. Moderating effects of EVs on the relationship between PBC and ATT. PBC, perceived behavioral control; ATT, attitude; EVs, ecological values.

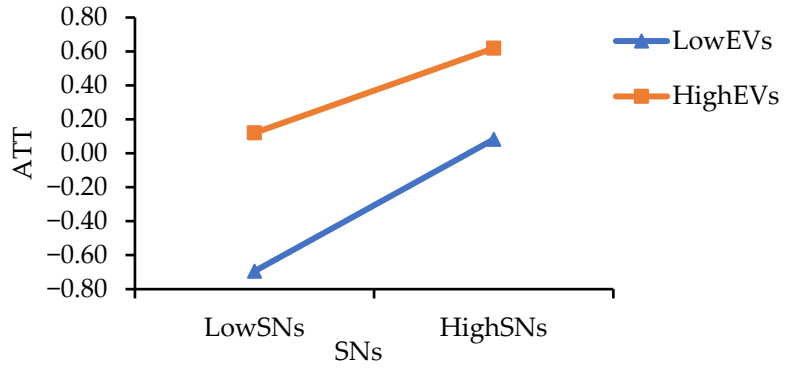


Figure 4. Moderated effects of EVs on the relationship between SNs and ATT. SNs, subjective norms; ATT, attitude; EVs, ecological values.

4.5.2. The Moderating Mediation Effect of EVs

In this study, the moderated path analysis method proposed by Edwards and Lambert (2007) was used to test H6 (i.e., the moderating mediation effects) [86]. The test results in Table 11 show that the indirect effect of farmers' PBC acting on farmers' AEW through ATT was stronger when their EVs were low ($\beta = 0.156$, bootstrap 95% CI, excluding zero). The indirect effect of their PBC acting on farmers' AEW through ATT was weaker when farmers' EVs were higher ($\beta = 0.062$, bootstrap 95% CI, excluding zero). Mediating effects were present in both conditions of the EVs. We also compared the results of the two mediating effects (high EV effect minus low EV effect): $\beta_{difference} = -0.093$, bootstrap 95% CI, excluding zero. As the moderating variable only moderates the first half of the indirect path, the moderating mediator is −0.046, and the bootstrap 95% CI

is [−0.0789, −0.009], excluding zero. In summary, the mediating effect of ATT on the relationship between farmers' PBC and AEW is moderated by EVs; that is, a mediating effect is moderated. Therefore, Hypothesis H6-1 was supported. These findings further demonstrate that farmers with high EVs are more likely to downplay the perceived negative consequences associated with AEW, thus voluntarily becoming practitioners of AEW. The results shown in Table 11 also reveal the following. The indirect effect of farmers' SNs acting on farmers' AEW through ATT was stronger when their EVs were low ($\beta = 0.156$, bootstrap 95% CI, excluding zero). Furthermore, the indirect effect of their SNs acting on farmers' AEW via ATT was weaker when farmers' EVs were higher ($\beta = 0.100$, bootstrap 95% CI, excluding zero). Mediating effects were present in both conditions of the EVs. We also compared the results of the two mediating effects (high EV effect minus low EV effect): $\beta_{difference} = -0.056$, bootstrap 95% CI, including zero. As the moderating variable only moderates the first half of the indirect path, the moderating mediator is −0.028, and the bootstrap 95% CI is [−0.056, 0.004], including zero. The mediating effect of ATT on the relationship between farmers' SNs and AEW is not moderated by EVs; that is, no mediating effect is moderated. Therefore, Hypothesis H6-2 was not supported.

Table 11. Bootstrapping test results for the moderated mediation effect.

Dimension	Independent Variable	Result Type	Mediation Variable (EVs)		Effect Value	SE	Bootstrap 95% CI	
							Bootstrap LLCI	Bootstrap ULCI
The first half of the indirect effect path	PBC	Moderated mediation effect	Low EVs (mean − 1SD)	−1.000	0.156	0.029	0.098	0.211
			High EVs (mean + 1SD)	1.000	0.062	0.025	0.015	0.112
			Difference		−0.093	0.035	−0.156	−0.018
	SNs	Moderated mediation effect	Low EVs (mean − 1SD)	−1.000	0.156	0.027	0.103	0.206
			High EVs (mean + 1SD)	1.000	0.100	0.026	0.051	0.154
			Difference		−0.056	0.030	−0.113	0.008

Notes: EVs, ecological values; ATT, attitude; PBC, perceived behavioral control; SNs, subjective norms.

5. Discussion

5.1. Research Implications

Over the past few decades, protected areas have experienced significant expansion, both geographically and conceptually [87]. However, with the rapid growth of the number and area of conservancies, problems such as the decline of conservancy effectiveness, the imbalance between the ecological vulnerability of conservancies and community development, and the impoverishment and marginalization of numerous communities in protected areas have emerged [88]. The Qilian Mountains are an important ecological security barrier in Western China and one of the main battlegrounds for realizing the protected area system represented by national parks in China. This study analyzed the factors influencing farmers' willingness to participate in ecological agriculture based on the suitability of ecological agriculture development and conservation sites using research data from 409 farmers in Tianzhu County, China, located within the QMNP. The study area has the following two characteristics: first, it is based on resource-orientated industries and development approaches, resulting in very limited means of livelihood for community residents; second, it is more urgent to achieve the dual goals of economic development and ecological conservation in concert. Therefore, the findings of this study are of greater reference value in addressing the long-term conflicts and contradictions between conservation and community development prevalent in protected areas worldwide. Based on previous studies, this study applies the TPB model to examine the psychological factors that affect farmers' AEW and proposes a key pathway to its increase. Furthermore, different scenarios may lead to different results in the influence relationship. Therefore, this research introduces the concept of EVs and explores a new structural relationship among planned behavior variables, EVs, and the AEW. The study extends the TPB model, expands the practice area of ecological agriculture extension, and provides conclusions with practical implications.

Our research first clarifies that the TPB model can be used as a useful research framework to explain farmers' participation in ecological farming [89,90]. Positive PBC, SNs, and ATT can improve farmers' AEW (Asadollahpour et al., 2016). First, PBC was identified as the important factor affecting farmers' willingness and intention [17,91]. Thus, the stronger the farmer's confidence in their access to material resources and technologies related to agroecology, the stronger their AEW. Consequently, improving education, popularizing relevant technologies, providing technical guidance, improving farmers' access to organic fertilizers, establishing conditions that allow farmers to recycle and reuse agricultural production waste (e.g., straw), and enhancing farmers' confidence and control regarding participating in agroecological practices can help encourage them to shift from conventional agricultural production practices to ecological production practices, consistent with previously reported findings [92–95]. Second, farmers' AEW is influenced by their neighbors and relatives, as well as by the extent of government subsidies and regulation. Relatives and neighbors who participate or are willing to participate in AEW may have a demonstrated effect on the farmers, prompting them to change their agricultural production practices, leading to an increase in their likelihood of participating in AEW [40,96]. This demonstrated the existence of the "agroecological lighthouse" effect [36] and the "peer effect" [16], i.e., individuals are not antagonistic to social and cultural influences [97]. By creating an atmosphere in the QMNP that encourages participation in agroecological practices in the area, providing an interactive platform for villagers, and increasing the scope and speed of eco-agricultural information and impacts among farmers [98,99], the involvement of farmers in AEW could be effectively increased. Furthermore, government subsidies or strict government regulations of environmental damage and non-ecological production practices can motivate farmers to engage in agroecological practices, either actively or passively. Consistent with existing studies, this implies that good institutional protection and policy are relevant for promoting the development of ecological agriculture [100,101]. Therefore, the guiding role played by the government should be exploited. Administrative means (e.g., subsidies and penalties) should be reasonably adopted to directly influence farmers' AEW. Third, farmers' AEW is influenced by their perceptions of economic, environmental, and social values, as well as their self-worth. When farmers can identify with or perceive the value created through their participation in agroecological practices, the sense of gaining value can lead them to develop a positive ATT, encouraging them to replace traditional energy-based production practices with ecological production practices in the actual production process [102–104]. Therefore, improving a farmer's sense of identifying with or gaining value through various pathways is an effective measure to improve their AEW.

Compared to the results of previous studies, the results here provide the following marginal theoretical contributions. In this study, the mediating role of behavioral attitudes is examined within the framework of an extended TPB theory. The findings of this study further indicate that it is the structural interaction among planned behavioral variables that ultimately affects farmers' AEW, and not just the role of a single factor. This structural interaction follows the findings of Cao et al. (2022) [61]. A farmer's ATT and its effect on AEW are not only the most important factors that directly affect their involvement but also indirectly affect how their PBC and SNs affect their practice of ecological agriculture [105,106]. Both PBC and SNs can positively influence farmers' AEW via direct (69.5% and 66%, respectively) and indirect paths (through ATT) (30.5% and 34%, respectively). The impact of farmers' PBC and SNs on AEW is divided into direct and indirect impact pathways, which explains, to some extent, the impact mechanism of PBC and SNs on AEW. Strong PBC and positive SNs can increase the positivity of farmers' ATT, thus positively influencing their AEW. Therefore, ATT plays a key role in influencing farmers to participate in ecological agriculture. If the farmers' ATT cannot be changed, reducing the difficulty associated with obtaining the materials needed for ecological agriculture, continuous institutional support, and the creation of a good ecological agriculture atmosphere may become less important. Therefore, increasing the level of farmers' ATT is essential to maximize the impact of SNs and PBC on the intention to participate in ecological agriculture [72,75].

This study provides a new perspective on the research question of how planned behavioral variables affect farmers' AEW.

Our study extends the TPB model by introducing the VAB model that focuses on the relationship between individual affective attitudes and general cognitive attitudes (values, beliefs, etc.). When examining how value variables operate, we broke the logical chain of "values–attitude–behavior" in the traditional VAB model and innovatively examined whether EVs could exist as a moderating variable between other psychological factors and attitudes, rather than as an antecedent variable of individual attitudes [107]. First, in this study, we verified that farmers' EVs have a negative moderating effect on the relationship between PBC and ATT. This suggests that the higher the EVs of the farmers, the weaker the effect of PBC on ATT, whereas the lower the EVs of the farmers, the stronger the effect of PBC on ATT. The implied internal logic behind this is that when a farmer is not concerned about ecology and does not agree with its importance, they will develop positive attitudes toward ecological agriculture only when they believe they can cope with the difficulties arising from participation in ecological agriculture, whereas the more the farmers agree with the importance of ecology, the easier it is for them to ignore the difficulties they face in terms of technology and access to materials when participating in ecological agriculture and to develop a relatively positive attitude toward ecological agriculture. This negative moderating effect described above is also reflected between SNs and ATT. Therefore, when farmers do not agree that ecology is important, they will develop relatively positive attitudes toward ecological agriculture only when they have a high level of agreement with their neighbors and government policies. This is because farmers with high EVs are likely to find more reasons to have positive attitudes toward agroecology than farmers with low EVs, rather than focusing on the extent to which it can be coped with or whether there is active policy support [65,108]. However, the principle of cognitive consistency emphasizes that individuals should be consistent in their thoughts, beliefs, attitudes, and behaviors [109]. Thus, in the early stages of ecological agriculture development, when farmers face more difficulties, higher EVs will enable individuals to hold relatively positive attitudes to cope with the tension or sense of imbalance that can be caused by cognitive inconsistency. Therefore, increasing the level of EVs is important to improve farmers' attitudes toward agroecology. Second, the findings show that despite the low moderating effect, the explanation of the impact of AEW on farmers is stronger when interaction effects are considered, suggesting that we should focus on the combination between psychological factors, a view partially supported by [110]. Finally, we verified that EVs negatively moderate the first half of the indirect effect from PBC through ATT, affecting farmers' AEW; that is, a mediating effect is moderated. The higher the farmers' EVs, the weaker the mediating effect, and vice versa. This implies that for farmers with high EVs, the process and mechanism by which PBC affects their AEW through ATT will be suppressed. However, this mediated effect moderation was not supported in the path of action of farmers' SNs affecting AEW through ATT. Therefore, the improved TPB model aided in our understanding the boundary conditions under which the planned behavioral variables affect the AEW.

5.2. Managerial Implications

One of the challenges in promoting agroecology in protected areas is how to actively involve farmers in the practice. As our research has shown, farmers are more likely to participate in agroecology if their EVs, ATT, PBC, and SNs are well managed. Therefore, our research has important practical implications for policymakers in the field of agroecology in protected areas.

Of all the influencing factors included in the study, attitudes have the greatest impact and are an important mediating pathway for the other factors to have an impact on farmers' AEW. Therefore, there is a need to present farmers with a positive image of agroecology and to promote the formation of positive attitudes towards it. First, by using geographical indications (e.g., the QMNP) on agroecological products, a brand effect is formed and the

market distinction of agroecological products is improved. This can lead to a reasonable price difference between agroecological and ordinary agricultural products. This measure can allow farmers to enjoy the development dividends of agroecological practices and encourage them to voluntarily participate in agroecological cultivation. Second, promoting the positive effects of agroecology through various approaches helps to increase farmers' confidence in agroecological cultivation and development. Specifically, local governments can organize tours for farmers to visit areas with developed economies and high levels of agroecological cultivation and development. Experiencing agroecological cultivation projects and gaining relevant knowledge and experience can enhance farmers' positive attitude toward agroecological cultivation.

Our research also suggests that reducing the difficulties associated with farmers acquiring the production elements required for participation in agroecology can increase farmers' AEW. Therefore, the following measures could be considered. First, a complete agroecological chain should be created by developing complementary industries. For example, organic fertilizer production plants can be constructed in surrounding areas to transform local agricultural waste into production materials required for agricultural production and development. This measure can help farmers reduce expenses on agricultural supplies (e.g., fertilizer) as well as effectively reduce the possibility of polluting the ecological environment in the QMNP. Processing bases can also be built in surrounding areas for the refinement and thorough processing of agroecological products to enhance their value chain. Second, strengthening farmers' cooperation with research institutes is essential. For example, ecological and physical pest control technologies can be introduced and promoted to reduce the use of chemical and synthetic pesticides. Eliminating technical barriers to agroecological cultivation and improving the availability and ease of use of the technologies required for farmers to participate in agroecological cultivation can increase their AEW.

Research has also shown that the 'lighthouse effect' and the 'peer effect' need to be considered in the development of agroecology, as well as the important role of injunctive norms. Therefore, the following measures are recommended for implementation. First, the government should formulate a clear plan for agroecological development in the QMNP, introduce a series of policy measures (including financial subsidies, loan concessions, and regulatory penalties), and comprehensively exploit the forward-leading and reverse-forcing roles of policies regarding promoting local agroecological development. Second, it is necessary to actively promote farmers who began practicing AEW early and have achieved success as demonstrative examples. This will enhance farmers' acceptance of AEW in a flexible manner.

Last but not least, the extended TPB model highlights the moderating role played by EVs. Therefore, farmers' EVs should be monitored and reasonable measures to raise farmers' levels of EVs need to be adopted. This can be achieved by informing and convincing farmers of the importance of ecology and the primary responsibility of farmers in ecological governance.

6. Conclusions

Traditional agriculture based on fossil energy causes serious environmental problems and the impact is more significant in protected areas. To synergistically solve the problems of ecological conservation and economic development of protected areas, promoting farmers' participation in ecological agriculture is one of the best options. Applying an extended theoretical model of planned behavior, we attempted to investigate farmers' intentions to participate in ecological farming and the mechanism factors influencing their willingness. A valid sample of 409 farmers was collected using a systematic PPS sampling method, and using a SEM method, the following conclusions were drawn: (1) There is a positive relationship between farmers' ATT, SNs, and PBC and their AEW. (2) The partial mediating role of ATT in the process of SNs and PBC influencing AEW was also supported. (3) The introduction of EVs as a moderating variable in the planned behavior variable model was

verified to have a negative moderating effect on the relationships between PBC and ATT, and SNs and ATT, and the indirect effect of PBC on farmers' AEW through ATT was also negatively moderated by EVs. Eight of the nine hypotheses in the research model of this study were supported. This indicates that psychological factors and EVs are important determinants of farmers' AEW, and more attention should be paid to these factors in promoting ecological agriculture activities in protected areas.

7. Limitations and Outlook

In this study, we examined the effects of each variable on farmers' AEW primarily based on data obtained from a survey. However, it is possible that farmers' willingness would vary depending on the scenario. Cross-sectional survey data cannot reveal this dynamic relationship and have limitations. Future follow-up studies should focus on investigating factors affecting farmers' AEW based on panel data and dynamically depicting and understanding the path and mechanism of each variable.

There is a black box between willingness and behavior. On the one hand, willingness is a prerequisite for behavior, and the theoretical assumption that willingness determines behavior has gained more support. On the other hand, the disconnect between willingness and behavior is more common in the process of agricultural practice. The next study will focus on the consistency between willingness and behavior and the important conditions and factors that contribute to the transformation of willingness into behavior.

Farmers, as micro-individuals, have limitations in avoiding risks and grasping consumer needs. Therefore, future research should pay more attention to the effects of external environmental variables such as co-operation on farmers' willingness to participate in ecological agriculture in national parks.

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