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Semantic Web-Based Structural Equation Modeling and Mediating Effects Are Used to Investigate Key Factors

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ABSTRACT

Land desertification is the key contradiction restricting the sustainable development of Chinese society. Farmers and herders' behavior in desert management is particularly important for the smooth development of the desertification control project. Although farmers and herders express willingness, they do not engage in desert management behavior. The research through random sampling survey analyzes survey data from 572 farmers and herders in the Kubuqi Desert region of Inner Mongolia using structural equation modeling and mediation analysis, based on the TPB. The aim is to understand the paradoxical willingness and behavior of farmers and herders to participate in desert management. The study found that farmers and herders' willingness to participate is a crucial factor that influences their behavior. The authors suggest cultivating a sense of ecological responsibility and strengthening ecological education to guide the behavior of farmers and herders towards more sustainable practices.

KEYWORDS

Desert Management, Deviant Behavior, Farmers and Herders, Mediating Effect Model, Structural Equation Model

INTRODUCTION

Desertification is a severe ecological and environmental problem in China, with 257.37 km^2 of desertified land area and 168.78 km^2 of sandy land area, accounting for about 1/6 of the national land area (Ministry of Ecology and Environment of the People's Republic of China, 2022). Desertification not only leads to the deterioration of the ecological environment and poverty in sandy areas, but also poses a significant threat to the national economy and sustainable social development. These facts are supported by data from China Ecological Environment Bulletin (2021). The prevention and control of desertification is a crucial issue that must be addressed in building a sustainable ecological civilization system for society. It is a significant accomplishment and will continue to be so for centuries to come. To effectively combat desertification and improve the environment in sandy areas, it is crucial to understand the motivations and actions of farmers and herders in participating in desert control efforts. Encouraging their participation not only helps curb land desertification,

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but also has the potential to increase the income of farmers and herders, making it a practical and significant approach to improving the quality and efficiency of the sand industry.

Although the governance achievements of the Kubuqi Desert are commendable, the foundation of the Kubuqi Desert is not stable, and the areas that have initially been controlled may still experience desertification. The desert governance of farmers and herders in the Kubuqi Desert area is still not complete due to the influence of local ecological environment governance policies and mechanisms, the development of forestry and sand enterprises, and the degree of farmers and herders' participation in desert governance. There is still a long way to go on the road of promoting the governance of Kubuqi Desert.

This paper proposes a theoretical analysis framework for farmers' and herders' willingness to participate in desert management and behavioral deviation based on the theory of planned behavior. The framework introduces ecological emotion as a latent variable and uses survey data from 572 farmers and herders in the Kubuqi sand area of Inner Mongolia to select a structural equation model. In this study, we examine the impact of farmers' and herders' willingness and behavioral deviations, while also exploring the moderating role and interaction of these indicators in the influence paths. As the micro subject of desert management, the willingness and behavior of farmers and herders in desert management directly affect the sustainability of desert control projects. This study takes the Kubuqi Desert area in Inner Mongolia as an example to study the willingness and behavior of farmers and herders in desert management, which has important strategic significance for the comprehensive management, sustainable development, and ecological civilization construction of China or similar Kubuqi Desert areas. The study will make a new contribution to the realization of China's transformation into an ecological civilization power in the new era.

RELATED WORK

Willingness and Influencing Factors

According to academic research, willingness is considered a crucial factor that often determines an individual's decision-making process and subsequent behavior. However, it has been observed that the attitude towards receiving behavior also plays a significant role in actual behavior generation (Zhang et al., 2023; Guo et al., 2021). According to recent studies (Galván et al., 2022; Ilyas et al., 2022; Teragni & Pons 2022), farmers' behavior choices may not always align with their initial intentions due to subjective norms and other factors. This means that there may be a certain degree of deviation between farmers' intentions and their actual behavior, or that obstacles may arise during the process of translating intentions into actions. The relationship between willingness and behavior has evolved significantly. Willingness was used to guide practical decision-making. However, it now involves theoretical integration and empirical analysis of alternative behaviors (Singh, 2018).

Intention and Action Are Incompatible

Current research on farmers' participation intention and behavior has primarily centered around land transfer (Gao et al., 2022; Zhu et al., 2022; Lin et al., 2022; Li et al., 2022). Green production behavior (Ren et al., 2022; Chang et al., 2021; He et al., 2023; Huang et al., 2023).Domestic waste treatment (Zhou et al., 2022; Xu et al., 2020; Zheng et al., 2022).Scholars have contributed to the analysis of factors influencing willingness, behavior, and deviations in various fields such as large-scale livestock (He 2020; Han et al., 2022) and poultry breeding, technical services, and technology adoption (Huang et al., 2022; Gao et al., 2022; Ren et al., 2022; Ren & Zhong, 2022; Yang et al., 2020). Wen et al. (2019) subdivided farmers' resource endowment based on different factors, while Liu et al. (2017) and Shi & Zhang (2022) primarily focused on studying the differences in farmers' willingness and behavior from the perspective of resource endowment heterogeneity.

Application of SEM to Behavioral Research

Previous studies have identified a new approach to analyzing the logical structure and hierarchical relationship of emotional factors through the use of explanatory structure models. Scholars such as Zhan (2022) and Zemmouchi-Ghomari (2021) have contributed to this area of research.

There is still a lack of systematic research about farmers' and herders' desire and behavior regarding desert governance, and current research on desert control is given priority over natural science research, social economy and human sciences research; management technology research is given greater priority, while micro main body research is given less. Current literature offers theoretical backing for examining the willingness and behavior of farmers and herders. Nevertheless, there is room for additional work in developing a theoretical framework and scrutinizing the behavioral mechanisms. Limited research has been conducted on the theoretical analysis of farmers' and herders' willingness and behavioral deviance. Previous studies have mainly explored variables such as behavioral attitudes, subjective norms, and perceptual behavioral control, while neglecting psychological factors. Additionally, research assumptions have mostly treated influencing factors as independent variables, without considering their interactions. Consequently, there is a need for further investigation in these areas. In the study of willingness and behavior deviation, the research hypotheses mostly focus on independent variables, lacking interaction analysis among influencing factors.

THEORETICAL FRAMEWORK AND RESEARCH HYPOTHESIS

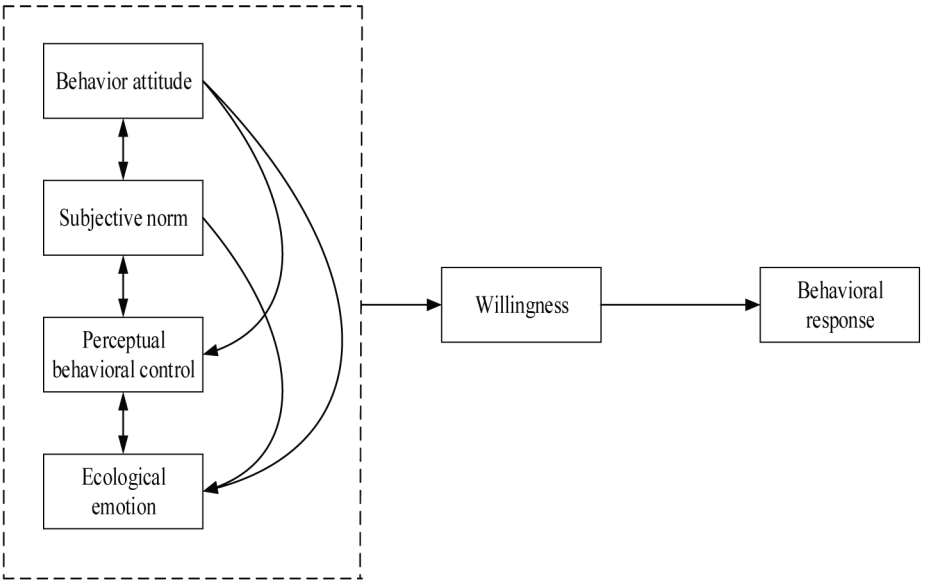
Theoretical Framework

The theory of planned behavior (TPB) is a well-known theory in social disciplines that focuses on the relationship between behavior and attitudes. According to this theory, attitudes and intentions play a direct role in determining one's response behavior. In addition to behavioral attitudes, external factors such as subjective norms, perceptual behavioral control, and ecological emotions have a significant impact on actual behavioral response. According to Wang (2023) and Maskari (2018), behavioral attitudes are influenced by subjective norms, perceived behavioral control, and emotional factors within the ecological context. The internal and external relationships between farmers' and herders' intention and behavior of desert governance are complex and changeable. Therefore, when analyzing the contradiction between farmers' and herders' intention and behavior of desert governance, it is important to clarify the formation mechanism of the transformation of farmers and herders' intention of desert governance to behavior. The mature framework of the TPB for analyzing individual value cognition, intention choice, and behavior response is helpful to solve the problem of contradiction between farmers' and herders' intention and behavior of desert governance, and it can effectively guide farmers and herders to carry out desert governance behavior. According to the TPB, human decisions are believed to be influenced by behavioral attitudes, subjective norms, perceptual behavioral control and ecological emotions. However, the literature suggests that this relationship between human will and behavior is not always consistent. Farmers, for example, may be influenced by these factors when making decisions about their behavior. The theoretical framework of planned behavior posits that these four factors work together to shape an individual's behavioral cognition. According to Gyau et al. (date), individual cognition has a positive relationship with willingness to act and behavioral decisions. The theoretical framework of the paradox of farmers' and herders' willingness to participate in desert management is based on the logic of cognitive judgment→willingness to choose→ behavioral response.

Research Hypothesis

The influence of behavioral attitudes on farmers' and herders' willingness to deviate from their usual behavior is a topic of interest.

Figure 1. Classical model of planned behavior theory



For this study, behavioral attitude refers to the level of psychological satisfaction a farmer derives from the outcome of their behavior. A positive and strong behavioral attitude increases the likelihood of intentional choices being transformed into behavioral responses. In the context of desert management, the behavioral attitude of farmers and herders can be understood as their evaluation of the favorable or unfavorable outcomes of participating in such management. This includes factors such as the level of support for governance, perceptions of governance security, and expectations of risk. If farmers and herders have a positive perception of and behavioral evaluation towards participating in desert governance, it will result in positive behavioral attitudes. Conversely, negative perception and behavioral evaluation will lead to negative behavioral attitudes. The strength of these attitudes will determine the level of support from the surrounding community towards their behavioral responses. Additionally, greater perceived social pressure, subjective norms, and perceived behavioral control will further reinforce these attitudes. Behavioral attitudes, subjective norms, and perceived behavioral control are distinct indicators that are interrelated and independent. According to Bondori et al. (2021), the level of support that farmers and herders receive during the participation process is directly proportional to their perception of safety and their willingness to act. The relevant theory suggests that farmers and herders are rational economic agents whose implementation of desert management behavior is influenced by the goal of minimizing risk expectations. This can be used as a critical factor in judging their behavioral attitudes. This article proposes that the participation of farmers and herders in desert governance is influenced by their behavioral attitude, governance support, governance security perception, and risk expectation goals. When these factors align, intentional choices are transformed into behavioral responses. However, when the behavioral attitude is inconsistent with these factors, it hinders the transformation of intention to behavior. The article presents a hypothesis based on this premise.

H1a: This study suggests that behavioral attitudes have a positive impact on the willingness of farmers and herders to participate in desert management, which in turn influences their behavioral responses.

H1b: Additionally, these attitudes also positively influence the subjective norms of farmers and herders.

H1c: As well as their perceptual and behavioral control over farming and herding households.

H1d: Furthermore, the study proposes that behavioral attitudes can positively influence the ecological emotions of farming and herding households.

Influence of Subjective Norms on Deviation of Farmers' and Herders' Willingness and Behavior

Subjective norms, as defined in this study, pertain to the social pressure that farmers and herders experience when adopting a particular behavior. The more significant the social pressure, the more likely they are to translate their willingness to participate into actual behavior. In the context of desert management behavior, subjective norms refer to the expectations and evaluations of influential individuals or organizations in the lives of farmers and herders regarding their implementation of such behavior. These norms are shaped by normative beliefs, which are influenced by two main dimensions of social factors: directive norms and model norms, as described by Nhi & Le (2022). Both the government and village committees play a significant role in regulating the behavior and willingness of farmers and herders in China. Due to the country's collectivist culture, individuals in rural areas are often more inclined to conform to group norms and are influenced by the ideas, attitudes, and behaviors of those around them, including their neighbors and media campaigns (Hu et al., 2022). When it comes to desert management, farmers and herders tend to be influenced by their relatives, family members, and the people in their surrounding neighborhoods. The level of support they receive from these individuals, as well as the strength of the village committee organization, call and media propaganda, can impact their subjective norms and willingness to participate in desert management governance. Ultimately, the stronger the support and subjective norms, the greater the likelihood of converting willingness into actual behavior. The article proposes a hypothesis that states that as the subjective norms become stronger, the farmers and herders perceive implementing their behaviors as more difficult, become more aware of the surrounding ecological environment, and experience more profound ecological emotions.

H2a: Subjective norms can have a negative impact on the willingness of farmers and herders to participate in desertification prevention efforts, potentially leading to deviation from desired behaviors.

H2b: This study found that subjective norms have a positive impact on the perceptual and behavioral control of farmers and herders.

H2c: Subjective norms can have a positive impact on the ecological emotions of farmers and herders.

Effect of Perceived Behavioral Control on Farmers' and Herders' Willingness to Deviate From Behavior

Perceptual behavioral control (PBC) is a term used to describe the perceived ease of achieving a particular behavior by farmers and herders. This perception is influenced by factors such as resource endowment, external environment, and behavioral capacity, and is divided into two dimensions: perceived intensity and perceived beliefs (Chai et al., 2022). In the context of desert management, PBC can be understood as the self-evaluation of farmers' and herders' ability to participate in desert management, including their perception of economic and ecological benefits, as well as policy satisfaction. The level of education among farmers and herders is directly proportional to their perceptual and behavioral control. However, during the research process, the actual education level of farmers and herders may not be a significant factor. Instead, they tend to make rational

judgments based on factors such as time, energy, and income. When farmers and herders have a clear understanding of the time, economic benefits, and ecological benefits of participating in desert management, their ecological emotions become more pronounced, leading to stronger behavioral responses and a greater willingness to implement the necessary measures. The strength of implementation is dependent on the perception of economic benefits, ecological benefits, policy cognition, and policy satisfaction by farmers and herders. A higher perception of these factors will result in a stronger willingness to participate and increased activity in implementing the desired behavior. The article proposes the hypothesis that the stronger the implementation, the higher the likelihood of converting will into behavior.

H3a: Perceptual-behavioral control has a positive influence on the willingness of farmers and herders to participate.
H3b: Perceptual and behavioral control has a positive impact on the ecological emotions of agro-pastoralists.

Influence of Ecological Emotions on Farmers' and Herders' Willingness to Deviate From Their Behavior

As the field of research continues to expand, scholars have argued that the theory of planned behavior should not only focus on individual behavior, but also on how that behavior impacts the surrounding social environment (Bagozzi et al., 2001). It is important to note that the implementation of behavior is influenced by the relationship between the behavior and the social environment. However, not all behaviors are rational in their implementation. Emotional factors, such as the level of condemnation of environmental damage, ecological dependence, and future ecological expectations, also affect the behavioral decisions of farmers and herders when participating in desert management (Al-Smadi et al., 2018). This study utilized structural equation modeling to analyze consumer purchase behavior by incorporating ecological knowledge and ecological emotions. Building on this, the paper introduces the concept of ecological emotion as a latent variable, defined as the emotional experience of farmers and herders when participating in desert management and their resulting behavioral responses. The emotional connection that farmers and herders have with the environment plays a crucial role in their willingness to participate in desert management. As their emotional attachment deepens, their willingness to participate increases, which in turn increases the likelihood of their taking action. Thus, it can be inferred that the ecological emotion of farmers and herders has a direct influence on their willingness to participate in desert management, ultimately affecting their behavioral responses. Based on this, the article proposes the following hypothesis.

H4a: The study shows that ecological emotions have a positive impact on the willingness of farmers and herders to participate in desert management, which in turn affects their behavioral responses.
H4b: The willingness of farmers and herders to participate in desert management directly impacts their behavioral responses.

METHODOLOGY

Overview of the Study Area

The Kubuqi sand area is situated in the Inner Mongolia Ordos Plateau, on the northern part of the ridge line and southern bank of the Yellow River's 'several' bay. It stretches approximately 400 km from east to west and 50 km from north to south, covering a total area of about 13,900 square kilometers. The dune morphology in the area is dominated by crescent-shaped dune chains and lattice dunes, with narrow lowlands separating them. The sandy land morphology in the hinterland is characterized by

reticulated dunes and dune chains, with many honeycomb dunes. The terrain is higher in the south and lower in the north, with many tall dunes in the desert hinterland. According to research, the mobile dunes in the desert cover an area of approximately 0.57 million hm^2, which makes up 41% of the total desert area. Semi-fixed dunes cover an area of about 0.31 million hm^2, accounting for 22.3% of the total area of the desert. Fixed dunes, on the other hand, cover an area of approximately 0.51 million hm^2, accounting for 36.7% of the total desert area. The heavy desertification area is about 0.37 million hm^2, the moderate desertification area is about 0.57 million hm^2, the light desertification area is 0.36 million hm^2, and the underserved area is 0.09 million hm^2. The desert sand areas are mainly found in Hangjin Banner, Dalat Banner, and Junger Banner.

Data Sources and Sample Characteristics

In the period from September to October 2022, the total number of farmers and herdsmen in the Kubuqi Desert area was 161,500, and the group selected was 600 households. Farmers and ranchers who are directly or indirectly connected with the desert control project in the Kubuqi Desert area were selected as the research objects. Through field interviews with the staff of the relevant departments of the grassroots government and the desert-control enterprises in the Kubuqi Desert area, the specific research area was selected by radiation, and the research sample was selected for random sampling survey or rolling sampling survey, to ensure the adequacy and authenticity of the sample size and the representative of the study area. Surveys were conducted primarily through the social survey method "one to one, face to face" house-to-house interviews to enhance the reliability of the survey data, to ensure that the investigators understood the questionnaire questions and research purposes, and to reduce the data errors caused by the investigators misunderstanding of the questions.

Considering the geographical location, desertification and desert control status of each flag county in Kubuqi Desert, Hangjin Banner, Dalat Banner and Zhunge 'er Banner were selected as the research area, and the towns, Sumu and Gacha villages in the flag county of the research area were selected as the survey samples by a random sampling method. The survey area mainly included Hangjin Banner, Dalat Banner, Zhungeer Banner, two Sumu villages and 10 Gacha villages.

A total of 572 valid samples were collected, resulting in a valid sample recovery rate of 95.33%. Table 1 presents the essential characteristics of the sample farmers, herders, and interviewees.

Figure 2. Location of the study area

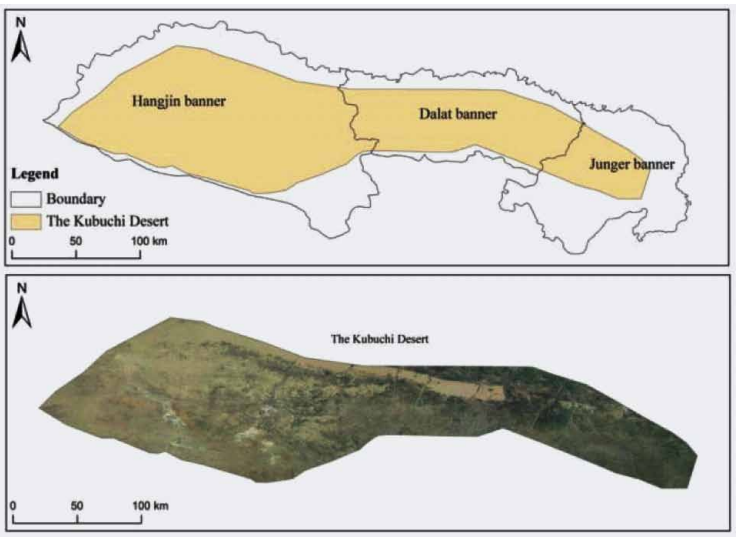


Table 1. Respondents' statistical characteristics

Indicators	Options	Number of samples (pcs)	Proportion (%)	Indicators	Options	Number of samples (pcs)	Proportion (%)
Gender	Male	341	59.6%	Health Status	Health	392	68.5%
	Female	231	40.4%		Suffering from a disease	86	15.0%
Age	10 to 20 = 1	1	0.1%		Sickly body	64	11.1%
	21 to 30 = 2	210	36.7%		Disability	30	5.2%
	31 to 40 = 3	144	25.1%	Annual net income	0~10,000RMB	11	1.9%
	41 to 50 = 4	85	14.8%		10 to 20 thousand yuan	53	9.2%
	51 to 60 = 5	47	8.2%		20,000 to 30,000 RMB	283	41.6%
	61 to 70 = 6	58	10.1%		30,000 to 40,000 RMB	156	27.2%
	≧71=7	27	4.7%		40,000 to 50,000 RMB	109	19.0%
Education level	Illiterate = 1	65	11.3%		50,000 yuan and above	5	0.8%
	Elementary school = 2	69	12.0%				
	Middle School = 3	33	5.7%				
	High School = 4	356	62.2%				
	Secondary school = 5	17	2.9%				
	College and above = 6	32	5.5%				

Based on the essential characteristics of farming and herding households and respondents, the majority were young and middle-aged males between the ages of 21 and 50. Most of the respondents had an education level ranging from elementary to high school, with only a few having received a college or higher education. While the majority of respondents were healthy and able to work, 16.3% of them were physically incapacitated. The distribution of sample farmers and herders in the remaining grades of annual household income was relatively even, except for a small number of farmers and herders with income below 10,000 yuan and above 50,000 yuan.

Research Methodology

Structural Equation Model

In the comparison and analysis of the microscopic data, structural equation modeling is a method of validation analysis that includes both measurement and structural models. This approach effectively combines factor analysis and path analysis to overcome the issue of multicollinearity among independent variables that commonly occurs in traditional econometric models (Almomani et al., 2022; Stergiou et al., 2021; Ren & Srivastava., 2022). The structural equation model can be more appropriate to study the influence path of different variables, including latent variables, on the intention and behavior inconsistency, and the role of different influencing factors can be better explored through this model. The generation of desert governance behavior of farmers and herders is determined by the influence of value cognition on intention. In the theory of planned behavior, behavioral attitude, subjective norm, and perceived behavior control are key variables that affect the value cognition of farmers and herders, and intention acts as a mediating factor in the generation of behavior and then acts on the behavior.

Therefore, the intention acts as a mediating factor in the generation of behavior. Thus, the mediation effect model is more appropriate to study the contradiction between farmers' and herders' desert governance intention and behavior. The structural equation model is typically expressed in matrix equation form:

$$\eta = \Lambda\eta + \Gamma\delta + \gamma \tag{1}$$

This paper presents a theoretical framework based on the theory of planned behavior and uses structural equation modeling to test the relationship between endogenous and exogenous latent variables. The endogenous latent variables are denoted as vector η, while the exogenous latent variables are denoted as vector δ. Matrices Λ and Γ represent the structural coefficients among the latent variables, while matrix γ represents the residual term of the structural equation. The study focuses on the participation of farmers and herders in desert management in the Kubuqi Desert area.

Intermediate Effect Model

With the advancements in statistical theory and analysis software, the mediation effect model has gained popularity in the fields of psychology and sociology. To test the mediation effect of models, three primary analysis methods are commonly used: the product distribution method, the confidence interval method (bootstrap), and the Markov Monte Carlo (MCMC) method (Fang et al., 2012; Singh & Gupta, 2022; Choi et al., 2021). The product distribution method assumes that the two variables follow a normal distribution and establishes critical values based on the product distribution for interval estimation and testing. The bootstrap method is commonly used in statistical inference to represent the sample population. It involves extracting repeated samples with replacement from the given data. These samples are then sorted based on their values. By calculating the 2.5th and 97.5th percentiles of these samples, a 95% confidence interval can be obtained. This confidence interval is used to test the model. If the confidence interval does not include 0, it indicates that the product of coefficients is significant. On the other hand, the MCMC method is a Bayesian statistical approach that incorporates Markov chain into the Monte Carlo model. This allows for dynamic simulation and random sampling of the sampling distribution (Wen & Ye., 2014). Pek and Mac Callum (2010) discovered that the utilization of the bootstrap method can enhance the testing power of latent variables, particularly when the data reliability of a structural equation model is above 0.9. Consequently, the researchers opted to employ the bootstrap method in order to examine the mediating effect between farmers and herders' willingness to participate in desert governance and their deviation in behavior.

Descriptive Statistics of Measurement Indicators

This study examines the paradox of farmers' and herders' participation in desert management by analyzing their behavioral attitudes, subjective norms, perceptions, behavioral control, ecological emotions, willingness to participate, and behavioral responses. The study identifies two patterns of paradox: the first is the willingness to participate without actual behavioral response, and the second is the actual behavioral response despite the lack of willingness to participate. In our survey of farmers and herders, we did not find any instances of 'no willingness but behavior.' Therefore, when we refer to the paradox of willingness and behavior in this paper, we are only discussing the phenomenon of 'willingness but no behavior' among farmers and herders who express a desire to participate in desert management but do not follow through. The individuals expressed their willingness to participate in afforestation and cooperate with sand control enterprises through land transfer or employment, but have not yet taken any active steps towards these actions.

Based on the previous theoretical model of planned behavior, latent variables such as behavioral attitudes (x1 to x3), subjective norms (x4 to x7), perceived behavioral control (x8 to x11), ecological affect (x12 to x14), willingness to participate (x15 to x17), and behavioral responses (x18 to x20) cannot be measured directly. Therefore, the Likert scale method was used to measure observed variables, and the initial questionnaire was tested and modified to result in a formal questionnaire (as shown in Table 2).

Table 2. Basic statistics of variables and sample reliability analysis

Latent variable	Observed variables	Definition	Average value	Standard Deviation
Behavioral attitude (B.A.)	Governance support x 1	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.70	0.91
	Governance Security Awareness x2	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.88	1.00
	Risk expectations x3	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.74	0.94
Subjective Specification (S.N.)	Neighborhood impact degree x4	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.35	1.11
	Village Council advocates participation x5	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.34	1.16
	Village Council publicity degree x6	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.34	1.10
	Media impact degree x7	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.40	1.13
Perceptual Behavioral Control (PBC)	Perceived economic benefits x8	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.42	1.19
	Perception of eco-efficiency x9	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.36	1.21
	Policy Awareness x 10	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.23	1.14
	Policy satisfaction x 11	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.39	1.14
Eco-Emotion (E.A.)	Condemnation of ecological damage x12	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.55	0.98
	Degree of ecological dependence x 13	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.54	0.95
	Future ecological expectations x14	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.49	0.96
Intention to participate (B.I.)	Willingness to plant trees x 15	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.54	0.95
	Application for cooperation with sand control enterprises in the form of land transfer x16	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.49	0.98
	Application for cooperation with sand treatment enterprises on an employment basis x 17	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.48	0.93

continued on following page

Table 2. Continued

Latent variable	Observed variables	Definition	Average value	Standard Deviation
Behavioral Response (B.R.)	No afforestation behavior x 18	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.40	1.14
	No initiative to cooperate with sand control enterprises in the form of land transfer x19	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.31	1.05
	No initiative to cooperate with sand treatment enterprises in the form of employment x 20	Particularly vague=1,Relatively vague=2,Generally understood=3,Relatively understood=4,Particularly understood=5	3.30	1.05

MODEL RESULTS AND ANALYSIS

Reliability and Validity Tests of the Model

The reliability of farmers' and herders' willingness to participate in desert management and behavioral paradox was tested using SPSS 26.0 software. The Cronbach's Alpha method was used to measure the overall Cronbach's coefficient of the observable variables, which was 0.888, indicating outstanding reliability. The scale reliability was good, with alpha values of each structural variable ranging from 0.776 to 0.912. The subjective norm had an alpha value higher than 0.9, indicating high reliability of the questionnaire research data. Refer to Table 3 for more information.

The structural equation model has high requirements for the reliability, validity and convergent validity of empirical data. When using the structural equation model, the paper uses SPSS software to test the preliminary reliability and validity of the model and the convergent validity of the model; confirmatory factor analysis was carried out for the convergent validity of the measurement model. Only when the fit of the measurement model reached the acceptable standard could further evaluation of the structural model be performed. The standardized factor loadings for all dimensions were above 0.7. The component reliability was higher than 0.8, and the average variation extraction was also greater than 0.5. The above results were in line with the criteria verified by Hairetal and Fomelletal. Therefore, the model had good convergent validity. In this paper, the challenges and difficulties in the construction of structural equation model were overcome through the conventional methods specified above.

The study conducted tests on the models to evaluate their convergent validity (refer to Table 3). The standardized factor loadings of all constructs were found to be above 0.7, with component confidence values exceeding 0.8 and mean-variance extraction values over 0.5. These results met the criteria established by previous studies conducted by Hairetal and Fomelletal, indicating that the model has strong convergent validity.

The study analyzed the comprehensive data of the model and removed certain terms. Table 4 shows that the corrected terms and total correlation were greater than 0.5, and the squared multiple correlations were also greater than 0.5. After removing the terms, the alpha value of the Cronbach coefficient was more reliable, indicating that the model passed the reliability test and can be studied further.

The applicability of the six latent variables of the model was tested using SPSS 26.0. Principal components analysis was used to reduce the dimensional data set, resulting in a KMO test value of 0.844 and a chi-square statistical value of Bartlett's sphere test with a significant probability of 0.000, indicating full compliance with the feasibility criteria of principal components analysis. Additionally, the model was analyzed using the factor analysis method to extract characteristic factor values greater

Table 3. Reliability and convergent validity analysis of the measurement model

Configuration	Index	Estimate	S.E.	C.R.	PLabel	C.R.	AVE	Cronbach's α	CITC
BA	x1	1.000				0.857	0.668	0.809	0.861
	x2	1.036	0.064	16.192	***				0.786
	x3	0.975	0.060	16.266	***				0.802
SN	x4	1.000				0.916	0.732	0.912	0.867
	x5	0.977	0.039	25.320	***				0.838
	x6	0.880	0.038	23.072	***				0.822
	x7	1.082	0.034	31.519	***				0.894
PBC	x8	1.000				0.851	0.589	0.820	0.756
	x9	0.914	0.054	16.820	***				0.797
	x10	0.771	0.051	15.003	***				0.760
	x11	0.853	0.051	16.586	***				0.756
EA	x12	1.000				0.870	0.691	0.844	0.820
	x13	0.915	0.050	18.333	***				0.811
	x14	0.998	0.051	19.473	***				0.862
BI	x15	1.000				0.850	0.654	0.776	0.816
	x16	1.045	0.074	14.100	***				0.823
	x17	0.906	0.067	13.562	***				0.786
BR	x18	1.000				0.875	0.700	0.829	0.829
	x19	1.048	0.062	17.014	***				0.836
	x20	1.024	0.060	16.985	***				0.845

Note: ***, **, * indicate significant at 1%, 5% and 10% statistical levels, respectively.

than 1. Based on the results presented in Table 5, all extracted values of the measurement variables were found to be greater than 0.6, indicating their strong influence. Additionally, none of the question items had a value lower than 0.2, suggesting that there is no need to delete any items. As a result, it is safe to proceed with the follow-up study.

Extraction Method: Principal Component Analysis

Structural Equation Model Analysis

The overall fitness of the structural equation model was tested and the results are presented in Table 6. The fitness metrics obtained from the structural model test are within the recommended values, indicating that the theoretical model is acceptable.

Table 7 presents the results of hypothesis testing, including the structural relationships between the latent variables and the estimates of their standardized path coefficients. The path coefficients are significant at the 1% confidence level. Amos 24.0 software was used to draw the model diagram of each latent variable and observed variable, and the actual not standardized and standardized path coefficients of the model were shown in Figure 3 and Figure 4.

Analysis of Mediating Effects

This academic paper presents a re-estimation of the standard errors and confidence intervals of the indirect effects of the bootstrap method for reliance intervals. The validated data results are displayed

Table 4. Total item statistics

Structure	Title item	Squared multiple correlations	CITY	Clone Bach Alpha after deleting items
B.A.	x1	0.525	0.556	0.884
	x2	0.668	0.601	0.882
	x3	0.669	0.675	0.883
SN	x4	0.742	0.700	0.879
	x5	0.654	0.623	0.878
	x6	0.614	0.586	0.880
	x7	0.783	0.616	0.879
PBC	x8	0.532	0.576	0.880
	x9	0.645	0.773	0.883
	x10	0.597	0.633	0.885
	x11	0.647	0.697	0.882
EA	x12	0.570	0.800	0.882
	x13	0.526	0.689	0.883
	x14	0.579	0.653	0.884
BI	x15	0.610	0.755	0.886
	x16	0.628	0.689	0.886
	x17	0.699	0.577	0.886
BR	x18	0.535	0.578	0.880
	x19	0.676	0.659	0.884
	X20	0.691	0.533	0.881

in Table 8, revealing the confidence intervals of the direct effects of behavioral attitudes on willingness to participate as [0.020, 0.261] and [0.021, 0.267], respectively. Additionally, the paper also provides the confidence intervals of the indirect effects as [0.007, 0.106].The study found that the confidence interval of the direct effect of subjective norms on the willingness to participate in desert management falls between [0.021, 0.182] and [0.209, 0.248]. Additionally, the confidence interval of the indirect effect falls between [0.006, 0.076], which indicates that the direct effect of subjective norms on the willingness of farmers and herders to participate in desert management is statistically significant, as it does not contain 0. The study found that the confidence intervals for the direct effect of perceptual behavior control on willingness to participate were [0.032, 0.232] and [0.046, 0.306] for farmers and herders, respectively. Additionally, the confidence interval for the indirect effect was [0.009, 0.099], which excluded 0, indicating that the direct effect of perceptual behavior control on farmers' and herders' willingness to participate in desert management was significant. The study found that the direct effect of ecological emotion on willingness to participate had confidence intervals of [0.032, 0.232] and [0.046, 0.306] for farmers and herders, respectively. This suggests that the impact of perceptual behavior control on their willingness to participate in desert management was significant. The study found that the direct effect of ecological emotions on farmers' and herders' willingness to participate in desert management was significant, with confidence intervals ranging from 0.020 to 0.254 and 0.023 to 0.282. Additionally, the indirect effect of ecological emotions on willingness to participate was also significant, with confidence intervals ranging from 0.007 to 0.107 and not

Table 5. Common factor variance of re-scaled variables

Title item	Initial	Extraction
x1	1.0000	0.741
x2	1.0000	0.73
x3	1.0000	0.705
x4	1.0000	0.805
x5	1.0000	0.787
x6	1.0000	0.721
x7	1.0000	0.869
x8	1.0000	0.712
x9	1.0000	0.708
x10	1.0000	0.609
x11	1.0000	0.625
x12	1.0000	0.768
x13	1.0000	0.735
x14	1.0000	0.792
x15	1.0000	0.702
x16	1.0000	0.732
x17	1.0000	0.653
x18	1.0000	0.798
x19	1.0000	0.623
X20	1.0000	0.676

Table 6. Results of the overall model fitness test

Evaluation Indicators	Recommended Value	Model Fitted Values	Results
CMIN/DF	<3.0	2.477	Ideal
RMSEA	<0.08	0.051	Ideal
GFI	>0.9	0.938	Ideal
AGFI	>0.8	0.918	Ideal
PGFI	>0.5	0.710	Ideal
NNFI	>0.8	0.929	Ideal
IF	>0.8	0.957	Ideal
CFI	>0.8	0.956	Ideal

containing 0. Overall, the study concludes that ecological emotions, along with other factors such as behavioral attitudes, subjective norms, perceptual and behavioral control, impact farmers' and herders' willingness to participate in desert management. The indirect effects of Prodclin2 are significant and are fully mediated by the procedure for calculating the trust interval of the indirect effect, as provided by MacKinnon (Su-Tzu, 2017).

Table 7. Hypothesis testing results

Research Hypothesis	Relationships	Path factor	Conclusion
Behavioral attitudes positively influence farmers' and herders' willingness to participate in desert management	BA→BI	0.137***	Support
Behavioral attitudes can positively influence the subjective norms of farmers and herders	BA→SN	0.260***	Support
Behavioral attitudes positively influence the perceptual-behavioral control of farmers and herders	BA→PBC	0.294***	Support
Behavioral attitudes can positively influence the ecological emotions of farmers and herders	BA→Ee	0.196***	Support
Subjective norms positively influence farmers' and herders' willingness to participate in desert management	SN→BI	0.102***	Support
Subjective norms can positively influence the perceptual and behavioral control of farmers and herders	SN→PBC	0.352***	Support
Subjective norms can positively influence farmers' and herders' ecological emotions	SN→EA	0.280***	Support
Perceived behavioral control positively influences farmers' and herders' willingness to participate in desert management	PBC→BI	0.130***	Support
Perceptual behavioral control positively affects agro-pastoralists ecological emotions	PBC→EA	0.339***	Support
Ecological emotions positively influence farmers' and herders' willingness to participate in desert management, which in turn affects behavioral responses	EA→BI	0.130***	Support
Farmers' and herders' willingness to participate in desert management will have a direct impact on their behavioral response	BI→BR	0.353***	Support

Note: ***, **, * indicate significant at 1%, 5% and 10% statistical levels, respectively.

Figure 3. Obtained model and normalized path coefficients

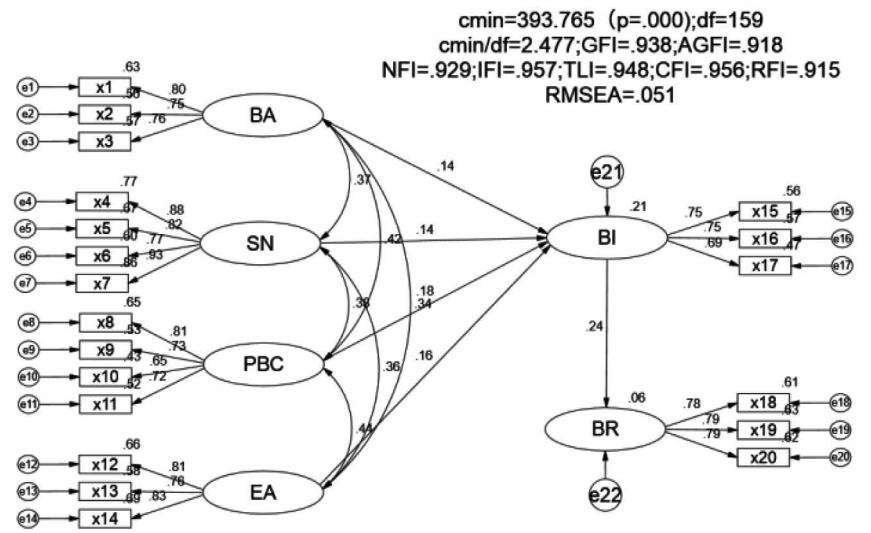


Figure 4. Obtained model and non-standardized path coefficients

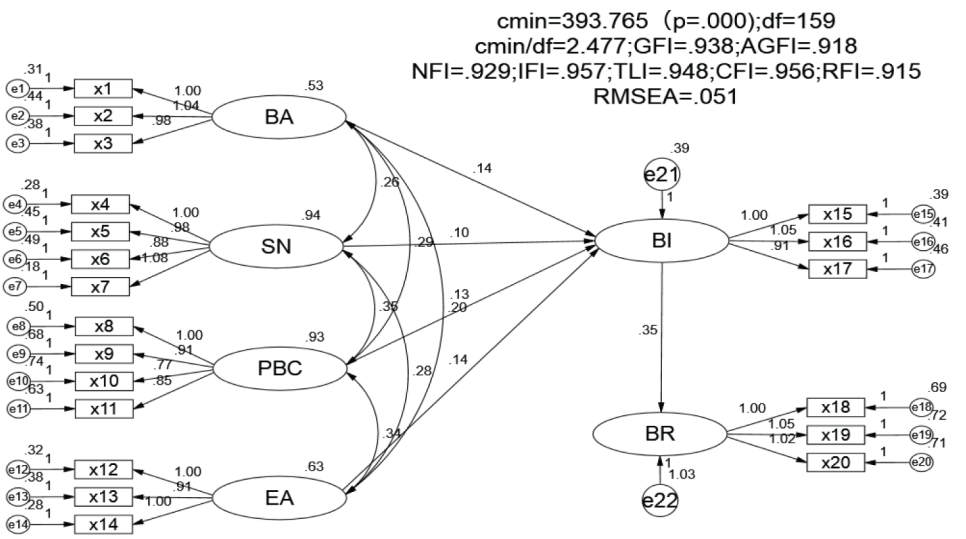


Table 8. Intermediary effect test report

Path Relationship	Estimate	Bootstrapping				MacKinnon Prodclin2	
		Bias-Corrected		Percentile			
		Lower	Upper	Lower	Upper	Lower	Upper
BA→BI	0.137	0.020	0.261	0.021	0.267		
SN→BI	0.102	0.021	0.182	0.209	0.248		
PBC→BI	0.130	0.032	0.232	0.046	0.306		
EA→BI	0.138	0.020	0.254	0.023	0.282		
BA→BI→BR						0.007	0.106
SN→BI→BR						0.006	0.076
PBC→BI→BR						0.009	0.099
EA→BI→BR						0.007	0.107

According to the mediation effect test results of residual variables, the confidence intervals of residual variables e1, e2 and e3 were [0.257, 0.350], [0.374, 0.499] and [0.320, 0.430], respectively, and the p values were 0.001, and the upper and lower intervals did not contain 0 values. All P values were 0.001, and the upper and lower intervals did not include 0 values, indicating that the residual variable of behavior attitude had a significant direct effect on it. The confidence intervals of the residual variables e4, e5, e6, e7 were [0.226, 0.335], [0.384, 0.508], [0.424, 0.552], and [0.124, 0.232], respectively, and the p values were 0.001, indicating that the residual variable of subjective norms had a significant direct effect on it. The confidence intervals of the residual variables e8, e9, e10, e11 were [0.401, 0.575], [0.595, 0.756], [0.669, 0.808], and [0.548, 0.702], respectively, and the p values were 0.001, indicating that the residual variable of perceived behavioral control had a significant direct effect on it. The confidence intervals of the residual variables e12, e13, e14 were [0.270, 0.372], [0.316, 0.442], and [0.227, 0.330], respectively, and the p values were 0.001,

indicating that the residual variables of ecological emotion had a significant direct effect on it. The confidence intervals of the residual variables e15, e16, e17, e21 were [0.328, 0.453], [0.330, 0.480], [0.391, 0.518], and [0.298, 0.487], respectively, and the p values were 0.001, indicating that the residual variable of willingness had a significant direct effect on ecological emotion. The confidence intervals of the residual variables e18, e19, e20, e22 were [0.541, 0.838], [0.572, 0.864], [0.539, 0.871], [0.858, 1.204], respectively, and the p values were 0.001, indicating that the residual variables of behavior attitude had a significant direct effect on it. The results showed that the residual variable had a significant direct effect on the observed variables in the mediating effect test between farmers and herders' desert governance intention and behavior.

The confidence intervals of governance support on behavior attitude were [0.748, 0.831], p values were 0.002, and the upper and lower intervals did not include 0 values, indicating that governance support had a significant direct effect on behavior attitude. The confidence interval of governance security perception on behavior attitude was [0.703, 0.802], and the p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that governance security perception had a significant direct effect on behavior attitude. The confidence intervals of risk expectation on behavior attitude were [0.702, 0.803], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that risk expectation had a significant direct effect on behavior attitude.

Table 9. Results of mediation effect tests of residual variables

Parameter	Estimate	Lower	Upper	P
e1	0.306 ***	0.257	0.350	0.001
e2	0.44 ***	0.374	0.499	0.001
e3	0.376 ***	0.320	0.430	0.001
e4	0.28 ***	0.226	0.335	0.001
e5	0.446 ***	0.384	0.508	0.001
e6	0.487 ***	0.424	0.552	0.001
e7	0.176 ***	0.124	0.232	0.001
e8	0.495 ***	0.401	0.575	0.001
e9	0.677 ***	0.595	0.756	0.001
e10	0.742 ***	0.669	0.808	0.001
e11	0.627 ***	0.548	0.702	0.001
e12	0.324 ***	0.270	0.372	0.001
e13	0.379 ***	0.316	0.442	0.001
e14	0.280 ***	0.227	0.330	0.001
e15	0.394 ***	0.328	0.453	0.001
e16	0.409 ***	0.330	0.480	0.001
e17	0.456 ***	0.391	0.518	0.001
e18	0.694 ***	0.541	0.838	0.001
e19	0.719 ***	0.572	0.864	0.001
e20	0.705 ***	0.539	0.871	0.001
e21	0.393 ***	0.298	0.487	0.001
e22	1.031 ***	0.858	1.204	0.001

Note: ***, **, * denote significant at the 1%, 5%, and 10% statistical levels, respectively.

The confidence intervals of neighborhood influence degree on subjective norms were [0.848, 0.902], and the p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that the neighborhood influence degree had a significant direct effect on subjective norms. The confidence interval of the village committee's claim on subjective norms was [0.784, 0.850], and the p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that the village committee's claim had a significant direct effect on subjective norms. The confidence intervals of publicity degree of village committee on subjective norms were [0.736, 0.806], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that the publicity degree of village committee had a significant direct effect on subjective norms. The confidence interval of media influence on subjective norms was [0.900, 0.949], and the p values were 0.002, and the upper and lower intervals did not contain 0 values, indicating that the media influence had a significant direct effect on subjective norms.

The confidence interval of economic benefit cognition on perceived behavior control was [0.764, 0.850], and the p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that economic benefit cognition had a direct significant effect on perceived behavior control. The confidence intervals of ecological benefit cognition on perceptual behavior control were [0.683, 0.774], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that ecological benefit cognition was directly significant on perceptual behavior control. The confidence intervals of policy cognition on perceived behavior control were [0.604, 0.698], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that policy cognition was directly significant on perceived behavior control. The confidence intervals of policy satisfaction on perceived behavioral control were [0.671, 0.764], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that policy satisfaction was directly significant on perceived behavioral control. The confidence intervals of the degree of condemnation of ecological environment damage to ecological emotion were [0.770, 0.854], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that the degree of condemnation of ecological environment damage had a significant direct effect on ecological emotion. The confidence intervals of ecological dependence on ecological emotion were [0.708, 0.807], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that ecological dependence had a significant direct effect on ecological emotion. The confidence interval of ecological responsibility on ecological emotion was [0.789, 0.871], and the p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that there was a significant direct effect of ecological responsibility on ecological emotion.

The confidence intervals of willingness to manage sand land on willingness of farmers and herders were [0.694, 0.799], p values were 0.001, and the upper and lower intervals did not include 0 values, indicating that willingness to manage sand land had a significant direct effect on willingness of farmers and herders. The confidence intervals of the variable willing to cooperate with the desertification control enterprises in the form of land transfer on the willingness of farmers and herders were [0.694, 0.810], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that the variable willing to cooperate with the desertification control enterprises in the form of land transfer had a significant direct effect on the willingness of farmers and herders. The confidence interval of the variable willing to cooperate with enterprises in the form of land transfer on the willingness of farmers and herders was [0.623, 0.746], and the p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that the willingness to cooperate with enterprises in the form of employment had a significant direct effect on the willingness of farmers and herders.

The confidence intervals of the non-sandy land management and protection behavior on the actual behavior response of farmers and herders were [0.723, 0.832], and the p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that the non-sandy land management and protection behavior had a significant direct effect on the actual behavior response of farmers and herders. The confidence intervals of the cooperation behaviors of non-land circulation and desert-

control enterprises on the actual behavior responses of farmers and herders were [0.741, 0.836], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that the cooperation behaviors of non-land circulation and desert-control enterprises had a significant direct effect on the actual behavior responses of farmers and herders. The confidence intervals of the cooperation behavior between the non-employment mode and the desert-control enterprises on the actual behavior responses of farmers and herders were [0.725, 0.840], all p values were 0.001, and the upper and lower intervals did not contain 0 values, indicating that the cooperation behavior between the non-employment mode and the desert-control enterprises had a significant direct effect on the actual behavior responses of farmers and herders. In conclusion, the direct effect of each observed variable on the latent variable was significant in the mediating effect test between the intention of desert management and the observed behavioral variables of farmers and herders.

DISCUSSION AND CONCLUSION

Discussion

Based on the theoretical framework and empirical findings, it is possible to analyze the impact of behavioral attitudes, subjective norms, perceived behavioral control, and ecological emotions on the willingness of farmers and herders to participate in desert management and the existence of behavioral paradoxes.

Table 10. Results of the mediation effect of observed variables

Parameter	Estimate	Lower	Upper	P
X1→BA	0.796 ***	0.748	0.831	0.002
X2→BA	0.750 ***	0.703	0.802	0.001
X3→BA	0.756 ***	0.702	0.803	0.001
X4→SN	0.878 ***	0.848	0.902	0.001
X5→SN	0.818 ***	0.784	0.850	0.001
X6→SN	0.774 ***	0.736	0.806	0.001
X7→SN	0.928 ***	0.900	0.949	0.002
X8→PBC	0.808 ***	0.764	0.850	0.001
X9→PBC	0.731 ***	0.683	0.774	0.001
X10→PBC	0.653 ***	0.604	0.698	0.001
X11→PBC	0.720 ***	0.671	0.764	0.001
X12→EA	0.814 ***	0.770	0.854	0.001
X13→EA	0.763 ***	0.708	0.807	0.001
X14→EA	0.832 ***	0.789	0.871	0.001
X15→BI	0.746 ***	0.694	0.799	0.001
X16→BI	0.755 ***	0.694	0.810	0.001
X17→BI	0.686 ***	0.623	0.746	0.001
X18→BR	0.782 ***	0.723	0.832	0.001
X19→BR	0.791 ***	0.741	0.836	0.001
X20→BR	0.787 ***	0.725	0.840	0.001

Note: ***, **, * denote significant at the 1%, 5%, and 10% statistical levels, respectively

The study conducted a model analysis on the willingness of farmers and herders to participate and found that the behavioral attitude had a positive impact on their willingness to participate. The direct effect of this attitude was measured at 0.14. This study found that farmers and herders are more willing to participate in desert governance when they have a positive attitude towards it. The perceived security of governance had a higher loading coefficient of 0.80 compared to other observed variables, indicating that farmers and herders prioritize security when participating in desert management. This includes signing standardized management contracts or obtaining stable land contracting rights. Although behavioral attitudes may not have a direct influence on farmers' behavioral responses, they can indirectly affect their responses through their willingness to participate. This relationship is not direct, especially when farmers and herders are faced with the decision of whether or not to respond behaviorally.

Subjective norms play a crucial role in influencing the decision of farmers and herders in participating in desert management. Figure 3 demonstrates that the loading coefficient of subjective norms on farmers' and herders' willingness to participate is 0.14. The mediating effects analyzed in Table 8 indicate that the indirect influence of subjective norms on behavior is significant, which implies that farmers and herders are likely to be influenced by social pressure when it comes to their actual actions. Therefore, the effect of indirect influence is significant. The coefficient value of media influence among the four observed variables of subjective norms is 0.93, which is significantly higher than the other variables. This finding suggests that media publicity and related personnel in the study area have a greater impact on farmers and herdsmen, possibly due to the rapid development of modern information technology and 'new media,' which has created favorable conditions for information dissemination in rural and pastoral areas. The advancement of modern information technology and new media has created favorable conditions for information dissemination in rural herding areas. This has lowered the threshold of information reception for farmers and herders, and the availability of digital, interactive, and integrated media forms have considerably broadened their information reception channels and enriched their information cognition (Gao et al., 2020; Noueihed et al., 2022). The advent of digital, interactive, and convergent media has expanded the channels through which farmers and herders receive information, leading to a richer understanding of the issues at hand. This, in turn, influences their decision-making behavior and highlights the crucial role that media plays in the effective implementation of desert management policies.

Perceived behavioral control plays a crucial role in the implementation of desert governance behaviors by farmers and herders. When they perceive the need for more capacity and resources, they are more likely to participate in these behaviors. The willingness model shows that the load coefficient of perceived behavioral control on farmers' and herders' willingness to participate is 0.18, indicating a positive and significant effect. Furthermore, perceived behavioral control indirectly influences their behavioral responses. Among the four latent variables of perceived behavioral control, the load coefficient of perceived economic benefits is 0.81, which is significantly higher than the other observed variables. The participation of farmers and herders in desert management is largely influenced by their perception of economic benefits. This study reveals that the study area is economically disadvantaged, and the fewer factors that can be controlled to encourage participation, the less likely it is for farmers and herders to convert their willingness into actual behavior. This hinders the participation of those who are willing to contribute towards the management of the desert. According to Figure 3, the loading coefficients of ecological benefit perception and policy satisfaction are found to be slightly more significant in comparison to other perceived factors. This indicates that financial and policy publicity, as well as applicability in the study area, are the primary factors hindering the transformation of farmers' and herders' willingness to participate in the behavior.

The study shows that ecological emotion has a path coefficient of 0.16 on farmers' and herders' willingness to participate, as illustrated in Figure 3. Additionally, the load coefficients of ecological emotion on the degree of ecological condemnation, ecological dependence, and future ecological expectation are 0.81, 0.76, and 0.93, respectively. These coefficients indicate that the degree of

ecological condemnation, ecological dependence, and future ecological expectation can significantly increase farmers and herders' awareness of protecting the environment and future ecological outcomes. The mediating effect test results in Table 8 demonstrate that ecological emotion indirectly influences the response behavior of farmers and herders through their willingness to participate. The findings suggest that farmers and herders may have a subjective emotional attachment to the ecological environment, which can influence their decision to participate in desert management. This emotional attachment is often driven by their cognitive and ecological expectations, leading to potentially irrational judgments.

The results depicted in Figure 3 reveal that four latent variables – behavioral attitudes, subjective norms, perceptual behavioral control, and ecological emotion – have a mutual influence on each other. Notably, the strongest correlation exists between perceptual, behavioral control, ecological emotion, and behavioral attitude, with load coefficients of 0.44 and 0.42, respectively. The findings suggest that farmers and herders who hold a positive attitude towards participating in desert management are more likely to prepare better conditions, leading to higher perceptual and behavioral control in participating in desert management. Farmers and herders who have greater perceptual and behavioral control tend to have higher expectations for their living environment and exhibit stronger ecological emotions towards their place of residence. Additionally, their attitude and willingness to participate in desert management are more assertive. The influence of subjective norms on perceptual and behavioral control, as well as behavioral attitudes, is similar, at 0.38 and 0.37, respectively. The study suggests that farmers and herders who have stronger subjective norms are more likely to take steps towards desert management and have better perceptual and behavioral control (Muhammad et al., 2022). Additionally, those who are better prepared for desert management hope that the policy will be recognized by more people, leading to a faster promotion of the policy. The research also found that ecological emotion has a similar influence on both behavioral attitude and subjective norm, with values of 0.34 and 0.36, respectively. The strength of a person's ecological emotion correlates with their motivation to seek external information and their adherence to subjective norms. Therefore, the ecological emotion and subjective norms of farmers and herders during the desert management process have a positive mutual influence on each other.

Conclusion

This research paper analyzes the data collected from 572 farmers and herders in the Kubuqi Desert area of Inner Mongolia. The paper aims to establish the formation mechanism and empirical analysis framework of farmers' and herders' willingness to participate in desert management and behavioral paradoxes by utilizing the theory of planned behavior and structural equation modeling. The study highlights that the four latent variables have considerable impacts on each other, and all four variables have direct effects on farmers' and herders' willingness to participate in desert management. The factors of second, behavioral attitude, subjective norms, perceptual behavior control, and ecological emotion do not directly affect the behavioral responses of farmers and herders. However, they do have indirect positive effects on behavioral responses through the willingness to participate. Willingness to participate plays a crucial role in the positive relationship between behavioral attitude, subjective norms, perceptual behavior control, and ecological emotion on behavioral responses. In an ideal state, the decision of farmers and herders to participate in conservation efforts is influenced by various factors such as their behavioral attitudes, subjective norms, perceived behavioral control, and ecological emotions. Among these factors, perceived behavioral control has a relatively more significant impact on their willingness to participate. Furthermore, the variables that have a more substantial influence on farmers' and herders' willingness to participate in each dimension are governance support, media influence, perception of economic benefits, and future ecological expectations. In a natural state, the behavioral response of farmers and herders is influenced by both direct and indirect factors. The direct factor is their willingness to participate, while the indirect factors include behavioral attitude, subjective norm, perceptual behavior control, and ecological emotion. It is important to note that the

behavioral response is not solely determined by the observed variable of willingness to participate, but also by the latent variables mentioned above. Each factor has a similar level of influence on the behavioral response.

To solve the contradiction between farmers' willingness and behavior of desert governance and guide farmers and herders to implement desert governance behavior in the Kubuqi Desert area is one of the important channels to improve the income sources of farmers and herders. Guiding farmers and herders to participate in desert governance can directly increase production and income of farmers and herders, solve the employment problem of farmers and herders, reduce poverty, and bring social benefits. At the same time, the effective governance of the Kubuqi Desert area can not only bring economic benefits, but also improve the living ecological environment of the indigenous people and bring ecological benefits. The policy proposed in this paper is to respect the decision-making and interests of farmers and herdsmen, enhance their understanding of desert treatment, improve the subsidy mechanism, and provide a convenient and efficient treatment environment. By doing so, the aim is to reduce the risk perception of farmers and herdsmen and lessen their economic burden. As an authoritative propaganda organization, government departments should consider the actual difficulties and needs of farmers and herdsmen and convey accurate information to them. It is important to move away from traditional top-down lecture modes and instead utilize text messages, public accounts, professional apps, and other platforms to push information about desert management to farmers and herdsmen. This can effectively influence their behavior. To effectively combat desertification, it is important to focus on three key areas. First, efforts should be made to cultivate ecological emotions and strengthen ecological education. This will help individuals understand the harmful consequences of desertification and encourage them to change their ecological attitudes. Second, it is crucial to enhance the awareness of ecological responsibility of farmers and herdsmen and encourage them to develop a sense of ecological responsibility. The role of farmers and herders in desert management should be correctly positioned, so that they can realize their role and power as micro subjects, and then take the initiative to participate in desert management. Desert management is the responsibility of farmers. Desert governance is a complex ecosystem project, and the issuance of any policy measures is closely related to farmers and herders, so that farmers and herders realize that desert governance can not only improve the ecological environment, maintain the sustainable development of resources, but also benefit future generations. It enhances farmers' awareness of ecological responsibility, and from the perspective of micro-measures, the government can effectively stimulate farmers' and herdsmen's sense of responsibility for the ecological environment protection in sand areas and improve their emotional needs for ecological responsibility by creating the honorary titles of scientific and technological models and ecological models of desertification control. Last, it is important to guide them towards transforming their willingness to participate in desert management into actual behavior.

In terms of research scope, this paper mainly focuses on the Kubuqi Desert area in Inner Mongolia, and due to the limitation of sample area, this paper fails to analyze other desert areas. The economic development, social resources and desert governance of other desert areas are different, so the results of this study with the Kubuqi Desert area as the main sample area do not have universal significance in all regions. Therefore, in the future research, the authors' coverage of the study area should be expanded, and the study on the willingness and behavior of desert management of different farmers and herders in different sand areas of the country should be strengthened.

In this article, the selection of the structure equation model and the mediation effect model and analyses of the influence of different variables of farmers' and herders' desert management intention and behavior from effect, but the cross section data characteristics of the static analysis is not avoided; therefore, in the future studies, more strict and comprehensive analysis methods should be employed,

introducing the dynamic model research methods. This will complement the generality of research methods in the field of ecological and environmental governance, so that research methods are more representative and can better reflect scientific issues.

AUTHOR NOTE

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