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Study on the Influence of Farmers' Participation in Desertification Control Activities: Integration of Theory of Planned Behaviour and Norm Activation Theory

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The issue of karst desertification in southwestern China represents a critical ecological challenge that impedes the sustainable development of the nation's economy. Despite its significance, there remains a paucity of research examining farmers' involvement in desertification control from a social psychology perspective. Drawing upon the Theory of Planned Behaviour (TPB) and the Norm Activation Theory (NAT), this study proposes a comprehensive model to investigate farmers' participation in anti-desertification efforts. Utilizing survey data from 348 participants, the study evaluates the efficacy of the proposed model. Findings indicate that the model is effective in elucidating farmers' engagement in desertification prevention, as influenced by environmental risk perception, subjective norms, and perceived behavioural control. Additionally, personal norms function as partial mediators, positively correlating with environmental risk perception and the normative theory concerning farmers' roles in combating desertification. Notably, the model designed for assessing farmers' participation improves the conceptual model's explanatory power by 12.4 percent. The theoretical framework, termed Responsible Action Theory, identifies personal norms and environmental risk perception as pivotal variables within the model. Consequently, government agencies involved in desertification prevention should emphasize moral norms and develop public education programs that convey ecological information pertinent to desertification processes.

Keywords: Farmers, Desertification Control, Theory of Planned Behaviour, Norm Activation Theory.

Introduction

Desertification is a landscape phenomenon characterized by vegetation degradation, exposed bedrock, and a reduction or complete loss of land productivity due to various factors (Dai et al., 2017; Wang, Li, & Li, 2003). It has emerged as a significant ecological challenge that hampers the sustainable development of China's economy (Wu et al., 2011). The processes and causes of desertification are multifaceted, encompassing both natural forces and social influences. Among the key contributors is high-intensity farming, which has overstressed the land's capacity to sustain population density over many years, particularly in southwestern of China (Cheng et al., 2010; Li et al., 2016). Thus, farmers are not only crucial stakeholders in the environmental issues associated with desertification but also principal actors in addressing the challenges posed by this phenomenon (Bekele & Drake, 2003).

Hence, it is imperative to further motivate farmers and enhance their enthusiasm for participating in desertification control efforts (Yu & Li, 2015). While existing research predominantly focuses on engineering and technological solutions to desertification, there is a notable lack of exploration into the social psychological aspects of this issue. To address this gap, the present study, grounded in the TPB and NAT, aims to comprehensively evaluate the activation of moral, behavioural, normative, and control beliefs. This approach seeks to provide a thorough understanding of farmers' participation in desertification control.

Literature Review and Research Hypotheses

The TPB was put forward by Ajzen (1991), and posited that individual behaviour is primarily determined by behavioural intention. The respective model postulates that attitudes towards the behaviour, subjective norms, and perceived behavioural control influence behaviour indirectly through their impact on the behavioural intention. TPB has proven to be a significant theoretical model for examining factors affecting individuals' pro-environmental behaviours, including sustainable travel (Chuang, Chen, & Chen, 2018), environmental conservation among university students (Effendi et al., 2020), pro-environmental behaviour among university staff (Aziz et al., 2021), pro-environmental behaviour among rural campers (Moghimehfar, Halpenny, & Walker, 2018), recycling (Cheung, Chan, & Wong, 1999), and water conservation (Trumbo & O'Keefe, 2001), among others. This study extends the application of TPB to investigate farmers' participation in desertification control. It is hypothesized that the level of farmer involvement in desertification control is influenced by their attitudes toward the behaviour, the social norms related to it, and their perceived ease of implementing desertification countermeasures.

According to the Norm Activation Theory proposed by Schwartz (1977), moral norms play a critical role in guiding individual behaviour. This theory emphasizes the importance of variables such as awareness of consequences, the attribution of responsibility for these consequences, and the internalized norms that influence

individual actions. Personal norms refer to the ethical standards held by individuals that motivate them to perform or abstain from specific behaviours. Awareness of consequences is defined as an individual's recognition that their actions can have positive or negative impacts on others, while responsibility attribution involves the extent to which individuals assign blame or accountability for their behaviour. This theory has been widely applied in studies on positive behaviour change, including pro-environmental behaviour on social media platforms like Twitter and Facebook (Li & Fang, 2022) and Snapchat, pro-environmental consumer behaviour (Setiawan, 2021), sustainable farming (Savari et al., 2023), and environmental commitment behaviours.

This paper examines factors influencing farmers' participation in desertification control, using the TPB and NAT. TPB suggests that behaviour is influenced by attitudes, perceived social norms, and self-efficacy (Ajzen, 1985; Shah, Rabari, & Patel, 2022). In contrast, NAT posits that behaviour is driven by moral considerations, which arise from the perception of consequences and a sense of responsibility (Neamah et al., 2022; Schwartz, 1977; Tanjung et al., 2022). Both theories converge on the premise that rationality and morality significantly influence human actions (Hajar et al., 2023; Nivette et al., 2021). Several studies have effectively combined TPB and NAT to explain social behaviours. Aligba & Fusch (2017), for instance, integrated these theories to investigate the entrepreneurial motivations of young people, demonstrating that the combined framework offered strong explanatory power. Similarly, Shanka & Gebremariam Kotecho (2023) applied TPB and NAT to predict residents' compliance with COVID-19 prevention measures, showcasing the high predictive utility of the integrated model. Consequently, this study adopts TPB and NAT as its theoretical framework to examine the rational and ethical decision-making processes of farmers in the context of desertification control.

The application of TPB to predict farmers' participation in desertification control in this study is justified by its proven predictive efficacy in understanding individual behaviours related to environmental protection (Bamberg, Ajzen, & Schmidt, 2003; Street, 2023). Prior research has demonstrated that extending TPB enhances its explanatory power, particularly in contexts involving pro-environmental actions (Bird et al., 2018; Hamilton, van Dongen, & Hagger, 2020). For instance, Maleksaeidi & Keshavarz (2019) incorporated perceived threats of intensive agriculture into the TPB framework, revealing that such threats significantly motivated farmers' intentions to conserve biodiversity. Cognitions play a crucial role in the TPB model, with behavioural intention serving as a precursor to actual behaviour, which is directly influenced by TPB constructs (Muthuswamy & Nasrulla, 2023; Rhodes & Blanchard, 2006). Self-observation measurements have been recommended as independent variables in the literature due to their functionality (Alshehri, 2024; Amin & Chewning, 2015; Khatatbeh et al., 2024; Wu et al., 2017). Consequently, this study does not employ behavioural intention but instead evaluates enhanced farmer involvement in desertification control using two independent variables and one dependent variable derived from the TPB model: subjective norms, perceived behavioural control, and actual behaviour. Within the NAT model, three variables—risk perception, personal norms, and individual behaviour—are employed to assess the influence of moral considerations on farmers' participation in desertification control. This research distinguishes itself by integrating the TPB and the NAT to predict the level of farmers' participation in combating desertification. In the context of desertification control, environmental risks associated with desertification may serve as significant antecedents to individual and subjective norms among farmers. Consequently, integrating TPB and NAT offers a more comprehensive framework for accurately describing and predicting compliant social behaviour. Although TPB does not inherently include NAT within its structure, Figure 1 illustrates the proposed research model that incorporates both theories to enhance predictive accuracy.

H1: The findings show that aspects of the TPB -perceived behavioural control, subjective norms, and attitudes have a positive association with farmers' engagement in the fight against desertification.

H2: Norm Activation Theory Study shows that there is a positive relationship between NAT (compliance with farms' desertification control behaviour, personal norms, environmental risk perception.

H3: Hypothesis 2 posited that the integrated model would have a higher ability in predicting farmers' participation in desertification control than TPB and NAT.

As hypothesized, the findings indicate that the integrated model demonstrates greater explanatory power in predicting farmers' participation in desertification control compared to the use of TPB or NAT alone.

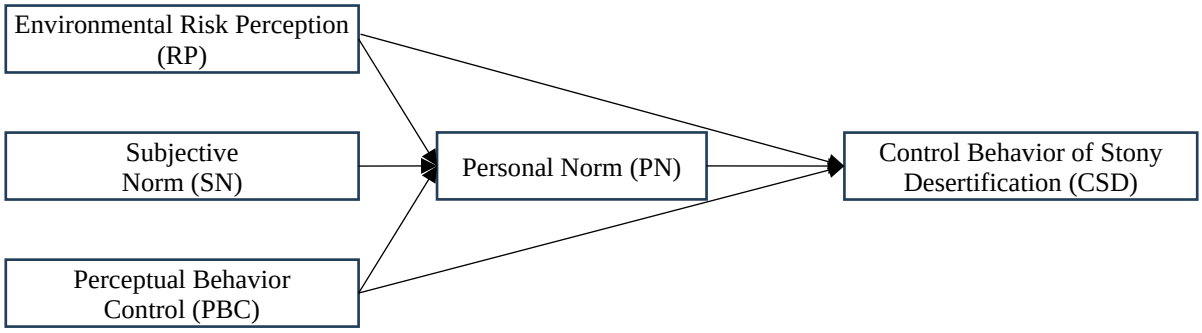

Figure 1: The Integrated Model of TPB and Norm Activation Theory.

Research Subjects and Research Methods

Farmers in Bijie City, Guizhou Province, China, were selected as the target population for this study due to the region's severe impact by desertification and its status as having the largest area under control in China, making it a representative and significant sample. According to the 2021 Statistical Yearbook of Bijie City, the total permanent resident population was 361,700, all of whom are considered farmers. The sample size was determined using Yamane's (1973) formula, resulting in a required sample size of 399 respondents. To account for potential invalid questionnaires, an additional 10% of the total sample size was added, following the guidelines of Israel (1992), expanding the sample to 438 individuals. This study employs a quantitative research approach to assess the relative degree of the constructed variables using a 5-point Likert scale. The questionnaire items were developed based on a comprehensive review of relevant literature. Responses are rated from 1 to 5, labelled as "strongly disagree," "disagree," "neither agree nor disagree," "agree," and "strongly agree." The questionnaire is structured affirmatively; the first section collects demographic information such as gender, age, education level, and income, while the second section measures variables based on the TPB. This section evaluates farmers' perceived factors influencing their intention to participate in desertification control, including subjective norms, perceived behavioural control, and perceived environmental risks. The specific items used for measurement are outlined in the accompanying table. To ensure the validity and reliability of the survey data, reliability analysis and validity testing are conducted, followed by a correlation analysis of the variables using the Statistical Package for the Social Sciences (SPSS 19). Further analysis involves constructing a Structural Model (SM) and performing Confirmatory Factor Analysis (CFA) using SPSS software to validate the hypotheses and assess the model's fit.

Results and Data Analysis

Descriptive Statistics of Research Subjects

Table 1 presents the descriptive statistics of the research participants, showing a relatively balanced gender distribution. Age distribution was fairly even: 12.8% were 18 years old, 19.2% were 18-30, 15.3% were 31-40, 16.4% were 41-50, 18.3% were 51-60, and 18% were over 60 years old. The educational attainment of the participants was generally low, with 80.5% having completed junior high school, vocational school, or lower levels of education. The economic income of the participants' families was predominantly low, with 85.4% earning below 5,000 Yuan annually. Table 4 presents the mean scores of the survey scale variables related to farmers' participation in the desertification control research model. The mean scores were as follows: environmental risk perception (RP) of desertification at 3.5485, subjective norms (SN) at 3.5647, perceived behavioural control (PBC) at 3.3658, personal norms (PN) at 3.8166, and desertification control behaviour (CSD) at 3.8370. These findings suggest that the participating farmers generally demonstrated a willingness to engage in desertification control efforts.

Table 1: Descriptive Statistics.

		n	Percentage（%）
Gender	Male	220	50.2
	Female	218	49.8
Age	Under 18	56	12.8
	18-30	84	19.2
	31-40	67	15.3
	41-50	72	16.4
	51-60	80	18.3
	Over 60	79	18
Education Background	Primary School or Below	210	47.9
	Junior High School	143	32.6
	High School	67	15.3
	Bachelor's Degree or Higher	18	4.1
Monthly Income	1,000 Yuan or Below	102	23.3
	1001 - 3000 Yuan	150	34.2
	3,001 - 5,000 Yuan	122	27.9
	5001 - 7000 Yuan	37	8.4
	7001 - 9000 Yuan	20	4.6
	9001 Yuan and Above	7	1.6

Reliability and Validity Tests

The item coefficients of the survey scale and Cronbach's Alpha were computed to assess the internal consistency, reliability, and validity of the data. As indicated from Table 4, the statistics of the Cronbach's Alpha for environmental RP was 0.968 while that of SN was 0.918, PBC was 0.847, PN was 0.902 and CSD was 0.938. Overall, that of the theoretical framework of Cronbach's Alpha was 0.931. All Cronbach's Alpha values exceeded the threshold of 0.7, as recommended by Wenbin & Guoping (2017), indicating strong reliability and validity of the survey data. Additionally, previous research supports the increased reliability of these findings, demonstrating that motivated employees positively impact organizational performance. To verify this, the hypothesis was tested using CFA. The results indicated that all the Cronbach's Alpha coefficients for the variables in the model were within the range of 0.703 to 0.945, hence above the acceptable threshold of 0.7 suggested by a prior

study, which showed satisfactory internal consistency reliability. Discriminant validity was checked as shown in Table 3, where it can be observed that the absolute values of the correlations between latent variables were less than the square root of the AVE for each variable. This result suggests that the model expresses discriminant validity and allows deriving that the latent variables studied are distinct from one another.

Table 2: Reliability, Validity, and Confirmatory Factor Analysis of the Questionnaire Measurement Scale.

Constructs	Constructs Items	Loading	Cronbach's Alpha	CR	AVE
Environmental Risk Perception	RFP1: Desertification has a strong effect on the surrounding ecological system or environment.	0.896	0.968	0.968	0.770
	RFP2: The people living in the surrounding regions are currently experiencing precise desertification effects to an extent of fighting	0.919			
	RFP3: The impacts of desertification include heavy losses of economical and property the residents experience in terms of their means of income and crop production.	0.778			
	RLP1: Desertification causes loss of soil quality and reduced productivity of land.	0.868			
	RLP2: Desertification results in severe soil erosion	0.910			
	RLP3: Desertification cause environmental disasters such as land sliding, floods and droughts.	0.929			
	RCP1: Due to over cultivation by farmers the land turn into desertification.	0.885			
	RCP2: Desertification is caused by intense farming approaches that farmers use in agriculture.	0.887			
	RCP3: Excessive practices by farmers related to agriculture led to desertification.	0.814			
Subjective Norm	SN1: I am glad that those people whose opinion I care about want me to be involved with rocky desertification control.	0.884	0.918	0.919	0.792
	SN2: People who have expectations from me hope that I will participate in rocky desertification control activities.	0.920			
	SN3: Most of the people dear to me expect that I should participate in rocky desertification control activities.	0.864			
Perceptual Behavioural Control	PBC1: I think that I am capable of minimising the extent of the expansion of rocky desertification area.	0.815	0.847	0.849	0.532
	PBC2: I know the ample ways to deal with the problem of rocky desertification reduction.	0.792			
	PBC3: I can expand the area of plantation and afforestation if I will.	0.658			
	PBC4: I have adequate farmland on which I can feed my dependants.	0.678			
	PBC5: I have sufficient time and opportunities to engage in rocky desertification control.	0.689			
Personal Norms	PN1: I think that it is my moral responsibility to contribute to the fight against desertification no matter what others say or do.	0.877	0.902	0.903	0.757
	PN2: I believe that controlling desertification through controlled actions is the right thing to do	0.881			
	PN3: Participating in desertification control activities will make me feel good.	0.853			
Control of Stony Desertification	CSD1: In course of the next agriculture activities, I will avoid unnecessary and hasty reclamation of the wasteland	0.788	0.938	0.895	0.740
	CSD2: During the next agricultural operations, I shall refrain from actions like arbitrary walking about, chopping, and destroying top cover vegetation.	0.891			
	CSD3: During the next agricultural practices, I will effectively incorporate desertification preventative measures of the higher powers like the closing of the forest for regeneration, conversion of farmland for their afforestation and other measures to forest.	0.897			
Total			0.931		

Table 3: Discriminant Validity Test.

	RP	SN	PBC	PN	CSD
RP	0.877				
SN	0.370	0.890			
PBC	0.162	0.261	0.729		
PN	0.369	0.394	0.272	0.870	
CSD	0.451	0.577	0.350	0.575	0.860

Correlation Analysis

Correlation analysis among the variables in the theoretical model was conducted using the Pearson correlation coefficient, as detailed in Table 4. The table reveals that each pair of latent variables exhibited significant correlations.

Table 4: Correlation Analysis.

Variable	Mean	PN	CSD	RP	SN	PBC
PN	3.8166	1				
CSD	3.8370	0.575**	1			
RP	3.5485	0.369**	0.451**	1		
SN	3.5647	0.394**	0.577**	0.370**	1	
PBC	3.3685	0.272**	0.350**	0.162**	0.261**	1

Validation of Research Hypotheses and Effects Analysis

The research employed SEM and Amos 26 for testing the model and analysing the data. Table 5 presents the results of the model fit analysis. All fit indices met the specified criteria. Specifically, the model showed: CMIN/DF = 2.00, RMSEA = 0.065 (which is below the threshold of 0.08), CFI = 0.953 (above the acceptable value of 0.90), TLI = 0.946 (also exceeding 0.90), and IFI = 0.953 (greater than 0.90). These results indicate that the model fits the data well.

Table 5: Fitting Test of the Research Model for Farmers' Participation in Desertification Control.

Observation Indicators	Evaluation Indicators		Model Values
	Acceptable	Good	
CMIN/DF	<5.00	<3.00	2.873
RMESA	<0.08	<0.05	0.065
CFI	[0.7, 0.9]	>0.9	0.953
GFI	[0.7, 0.9]	>.9	0.892
AGFI	[0.7, 0.9]	>.9	0.864
TLI	[0.7, 0.9]	>.9	0.946
IFI	[0.7, 0.9]	>.9	0.953

Direct Effect Test

The results of the hypothesis testing are presented in Table 6. The standardized path coefficients for the variables—such as risk perception regarding desertification, subjective norms, perceived behavioural control, personal norms, and activities undertaken to mitigate desertification—are reported as follows: 0.264 (P < 0.001), 0.182 (P < 0.001), 0.184 (P < 0.001), and 0.083 (P < 0.001), respectively. In the case of male participants, the coefficients were as follows: 0.264 (P < 0.001), 0.182 (P < 0.001), 0.184 (P < 0.001), and 0.083 (P = 0.038). For female participants, the coefficients were 0.344 (P < 0.001), 0.173 (P < 0.001), and 0.372 (P < 0.001). These factors have a direct and positive impact on farmers' personal moral norms regarding desertification. Consequently, hypotheses H1 and H2 are supported, suggesting that these variables are significant predictors of farmers' engagement in desertification control activities.

Table 6: Hypothesis Testing of the Research Model for Farmers' Participation in Desertification Control.

Paths			Std. Estimate	*SE*	C.R.	*p*	Results
RP	→	**PN**	0.264	0.045	5.315	0.000	YES
RP	→	**CSD**	0.182	0.029	4.455	0.000	YES
SN	→	**PN**	0.272	0.048	5.161	0.000	YES
SN	→	**CSD**	0.361	0.032	7.931	0.000	YES
PBC	→	**PN**	0.173	0.058	3.426	0.001	YES
PBC	→	**CSD**	0.139	0.036	3.406	0.001	YES
PN	→	**CSD**	0.372	0.036	7.955	0.000	YES

Mediation Effect Test

The findings from the hypothesis testing are detailed in Table 7. The results reveal that personal norms partially mediate and positively moderate the relationship between environmental risk perception and farmers' participation in anti-desertification efforts. Additionally, personal norms also serve as a partial mediator and exhibit a positive moderating effect on the relationship between subjective norms and farmers' involvement in desertification control, as well as between perceived behavioural control and farmers' participation in these efforts. These findings highlight the significant role of personal norms in enhancing the impact of environmental risk perception, subjective norms, and perceived behavioural control on farmers' engagement in desertification control programs.

Table 7: Mediation Effect Test of the Research Model for Farmers' Participation in Desertification Control.

Item	Total Effect	Mediation Effect	Direct Effect	Test Conclusion
RP=>PN=>CSD	0.234**	0.074	0.159**	Partial Mediation
SN=>PN=>CSD	0.352**	0.070	0.281**	Partial Mediation
PBC=>PN=>CSD	0.224**	0.061	0.163**	Partial Mediation

P <0.05 P<0.01

Test of the Explanatory Power of the Integrated Model

The results of the hypothesis testing, as shown in Table 8, demonstrate that the integrated model accounted for 52% of the variance in farmers' participation in desertification control (R^2 = 0.52, p < .01). This represents a 1.5% increase in explanatory power over the TPB model (R^2 = 0.505, p < .01) and a significant 12.4% improvement over the NAT model (R^2 = 0.396, p < .01) (Dao-de, 2000). These findings indicate that the integrated model offers a more comprehensive explanation of farmers' involvement in desertification control compared to the TPB and NAT models. Consequently, hypothesis H3 is supported.

Table 8: Mediation Effect Test for the Research Model of Farmers' Participation in Desertification Control.

Model	R^2
Integrated Model of TPB and NAT	0.52
TPB Model	0.505
NAT Model	0.396

Discussion

Implication to Theories

This study seeks to identify the social psychological and rational moral factors influencing farmers' participation in desertification control. To enhance predictive accuracy, the research integrated the TPB and NAT, demonstrating that these combined models accounted for over 52% of the variance in farmers' engagement in desertification control efforts. The integrated model explained a significantly higher proportion of variance in participation compared to either the TPB or NAT models individually. The study found that farmers' actions were driven by rational considerations, self-preservation, and moral persuasion concerning desertification control. The results reveal that subjective norms and perceived behavioural control were influential in shaping farmers' compliance behaviour

regarding desertification control. Notably, personal norms directly contributed to farmers' engagement in desertification prevention activities and only partially mediated the relationships between subjective norms environmental, risk perception, and perceived behavioural control, contrary to Pragle's (2004) findings that neither subjective norms nor perceived behavioural control impacts behaviour. This research uniquely integrates TPB and NAT to deepen the understanding of farmers' desertification control practices, highlighting how moral and rational factors impact their participation. The inclusion of moral dimensions increased the explanatory power by 12.4%, enhancing the overall model's efficacy.

Implication to Practitioners

This study offers substantial practical implications for government agencies and departments engaged in desertification control. The findings provide insights into strategies for increasing farmers' participation and enhancing the effectiveness of desertification control initiatives. Firstly, it is crucial to prioritize the dissemination of information and education regarding desertification and its ecological impacts. This approach will help farmers develop a comprehensive understanding of the economic and environmental risks posed by desertification. Secondly, government agencies should focus on fostering both personal and social norms related to desertification control. Encouraging the development of these norms will enhance farmers' engagement and commitment to desertification prevention efforts.

Limitations and Implications of Future Research

Although this research offers both theoretical and practical insights, it is not without limitations due to various constraints encountered by the researchers. This study was exclusively quantitative, relying on cross-sectional data collected over a relatively brief period. Such research methods may oversimplify complex social issues and potentially overlook the underlying causes of these problems. Consequently, future research is recommended to incorporate mixed methods approaches to provide a more comprehensive understanding. Despite the high representativeness of the study's geographical area and participant sample, the applicability of the findings to other desertification-affected regions and diverse entities involved in desertification control remains to be explored further.

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