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Research on the Willingness of Farmers to Adopt Green Agricultural Production Technologies and Its Influencing Factors

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Abstract: Against the backdrop of worsening global ecological and environmental problems and the "dual carbon" goal, the promotion of agricultural green production technology is of great significance for achieving sustainable development. This article takes 200 households in Hongdong County, Shanxi Province as the research object. Based on the Theory of Planned Behavior (TPB) and the Technology Acceptance Model (TAM), a questionnaire survey and logistic regression model are used to systematically analyze the willingness of farmers to adopt green agricultural production technologies and its influencing factors. Research has shown that high upfront costs and insufficient market premiums are the main obstacles in economic factors; The perception of technological complexity significantly reduces the willingness to adopt; Policy support, especially subsidy policies, has the strongest effect on promoting adoption willingness; 50% of farmers in social networks have a neighborhood demonstration effect, and the significant improvement in environmental awareness promotes adoption. Based on this, policy recommendations such as increasing financial subsidies, optimizing the technical training system, and strengthening the social network dissemination effect are proposed to provide a theoretical and practical basis for the green transformation of agriculture.

Keywords: Agricultural green production technology, Planned behavior theory (PBT), Technology acceptance model (TAM), Adoption intention, Policy incentives

1. Introduction

Faced with the intensification of global environmental problems, developing environmentally friendly agricultural technologies has become a necessary measure to promote sustainable agricultural development. Although traditional agricultural production relies on high input levels of chemical pesticides and fertilizers to achieve higher yields, in the long run, this will cause irreversible harm to land, water sources, and the ecological environment. Agricultural non-point source pollution is becoming increasingly severe, which not only affects the quality and safety of agricultural products, but also restricts the sustainable development of agriculture. Under the background of the "dual carbon" strategic goal orientation, the Chinese government has provided strong support for the development of environmentally friendly agriculture and issued a series of policies and regulations to encourage farmers to adopt environmentally friendly planting methods,

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such as organic fertilizers as alternatives to chemical fertilizers, environmentally controlled biopesticides, and straw returning to the field[1].

The present research has shown that farmers' willingness to adopt is influenced by multiple factors, such as economic benefits, policy subsidies, technological awareness, social networks, risk preferences, etc. However, due to differences in agricultural production environment, policy support, and farmers' cognitive level in different regions, the research results have strong regional specificity[2]. This study analyzes the willingness of farmers to adopt green agricultural production technologies and its influencing factors by questionnaire survey. This article will provide a scientific basis for further realizing the process of agricultural greening and a reference for formulating corresponding policies.

2. Theoretical basis and literature review

2.1. Theoretical basis

The Theory of Planned Behavior (TPB) was proposed by Ajzen in 1985 to predict and explain an individual's behavioral intentions in specific contexts. This theory holds that an individual's behavioral intention directly determines their behavioral performance, and behavioral intention is influenced by three major factors: attitude, subjective norms, and perceived behavioral control. In the research on the adoption of green production technologies in agriculture, the theory of planned behavior is widely applied to analyze farmers' willingness and behavior to adopt[3].

The Technology Acceptance Model (TAM) was proposed by Davis in 1989 to explain individuals' acceptance and use behavior towards new technologies. The model points out that perceived usefulness and perceived ease of use are key factors affecting individual technology acceptance. In the field of agriculture, TAM is used to study farmers' acceptance of green production technologies[4].

2.2. Research review

In recent years, scholars have conducted extensive research on the willingness of farmers to adopt green technology and the factors that affect this willingness, and have achieved some very fruitful results. Empirical studies have shown that farmers' adoption behavior is influenced by factors such as capital endowment, policy guarantees, environmental constraints, and social capital. Representative studies also include the article "Spatial temporal differentiation on China's green agricultural total factor productivity guidance by digital technology and fuzzy systems", which shows that digital technology plays an important role in improving agricultural green total factor productivity. Research has shown through spatiotemporal analysis that digital technology can accurately guide agricultural production, optimize resource allocation, and improve efficiency. In addition, digital promotion methods have significantly increased the adoption rate of green production technologies among farmers. Compared to traditional promotion methods, digital tools such as mobile applications and online platforms are more easily accepted by the younger generation, promoting information dissemination and technology training[2,5,6].

3. Analysis of the current situation of farmers' adoption of green production technologies in agriculture

3.1. Data collection situation

This study conducted a questionnaire survey in Hongdong County, Shanxi Province in March 2025, targeting farmers mainly engaged in agricultural production in the area. The survey adopts a combination of random sampling and stratified sampling to ensure the representativeness of the data. 200 valid questionnaires were ultimately collected, of which 60% were male farmers and 40% were

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female farmers according to Table 1. Table 1 also shows that 20% of farmers are under 35 years old, 50% are between 35-50 years old, and 30% are over 50 years old from the perspective of age structure. Among the interviewed farmers, 45% have a junior high school education or below, 35% have a high school or vocational school education, and 20% have a college degree or above. This data indicates that the overall cultural level of farmers in Hongdong County is relatively low, which may affect their understanding and acceptance of green production technologies.

In terms of planting scale, 30% of farmers have a planting area of less than 5 acres, 50% have a planting area of 5-10 acres, and 20% have a planting area of more than 10 acres. In terms of annual income, 40% of households have an annual agricultural income of less than 20000 yuan, 45% have an annual income of 20000 to 50000 yuan, and 15% have an annual income of over 50000 yuan.

Table 1: Basic characteristics of survey samples

Feature category	variable	Frequency (N=200)	Proportion (%)
gender	male	120	60%
	female	80	40%
age	Under 35 years old	40	20%
	35-50 years old	100	50%
	Over 50 years old	60	30%
degree of education	Junior high school and below	90	45%
	High school/vocational school	70	35%
	College degree or above	40	20%
planting area	Less than 5 acres	60	30%
	5-10 acres	100	50%
	More than 10 acres	40	20%
Family agricultural income	Below 20000 yuan	80	40%
	20000 to 50000 yuan	90	45%
	Over 50000 yuan	30	15%

3.2. Reliability and validity testing

In order to ensure the reliability and stability of the questionnaire data, this study used Cronbach's alpha coefficient for reliability analysis, and conducted KMO test and Bartlett sphericity test to verify the validity of the questionnaire. This study used SPSS software to calculate the Cronbach's alpha coefficient of the questionnaire, with an overall reliability coefficient of 0.87, indicating good internal consistency.

This study conducted KMO test and Bartlett sphericity test on the data to verify the structural validity of the questionnaire. The KMO value is 0.81, and the significance level of Bartlett's sphericity test is $p<0.001$, indicating that the questionnaire data is suitable for factor analysis and has good construct validity.

4. Empirical analysis of factors influencing farmers' willingness to adopt green agricultural production technologies

4.1. Analysis of influencing factors on the adoption of green production technologies by farmers in agriculture

Economic benefits are the core factor affecting farmers' adoption of technology. Although green production technology can enhance long-term returns, the initial investment is relatively high,

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including equipment procurement, improvement of planting patterns, and additional training costs. According to the data from this study, among the 200 surveyed farmers, 43% believed that the upfront cost of green technology was too high and were unwilling to adopt it, while only 21% believed that long-term benefits could compensate for the upfront investment[2,5].

The level of mastery of green production technology by farmers directly affects their willingness to adopt it. A survey shows that 45% of surveyed farmers believe that current green production technologies are complex and difficult to implement, while only 18% of farmers believe that these technologies are easy to learn and use. At the same time, the degree of improvement of the agricultural technology promotion system also affects the popularization of technology. Only 30% of the surveyed farmers stated that they have received relevant training from the government or agricultural enterprises, indicating that the technical support system still needs to be optimized[4].

The social network, neighborhood demonstration effect, and cultural identity of farmers affect their willingness to adopt. A study found that 50% of farmers stated that they would refer to their neighbors' usage experience, while only 20% were willing to try new technologies first[2,7].

The environmental awareness and policy orientation of farmers affect their behavioral choices. The survey shows that 72% of farmers recognize the role of green production technology in environmental protection, but only 40% are willing to bear additional costs for environmental protection[8].

4.2. Model construction and variable handling

4.2.1. Construction of econometric models

This study uses a logistic regression model to analyze the influencing factors of farmers' willingness to adopt green agricultural production technologies. The model is set as follows:

$$P(Y=1)=\frac{e^{\beta 0}+\sum \beta_i X_i}{1+e^{\beta 0}+\sum \beta_i X_i}$$

Among them, Y represents whether farmers are willing to adopt green production technologies (1=willing, 0=unwilling), which X_i is the influencing factor, including economic factors, technological factors, policy factors, etc.

4.2.2. Variable definition and description

Table 2: Variable definition and description

variable	Variable type	describe
Willingness to adopt (Y)	dependent variable	1=Willing, 0=Unwilling
Production cost (X1)	independent variable	Initial investment cost of green technology
Technical complexity (X2)	independent variable	1=Simple, 5=Complex
Subsidy Policy (X3)	independent variable	1=Yes, 0=None
Environmental Awareness (X4)	independent variable	1=high, 0=low

The provided table outlines the definitions and descriptions of variables used in a study focused on the willingness to adopt green technology. The dependent variable, Willingness to Adopt (Y), is binary, coded as 1 for willing and 0 for unwilling. Four independent variables are considered: Four independent variables are considered: Production Cost (X1), which measures how much money is needed to start using green technology; Technical Complexity (X2), rated from 1 for simple to 5 for complex, showing how complicated the technology seems; Subsidy Policy (X3), a yes-or-no variable indicating if there is a subsidy policy (1=Yes, 0=None); and Environmental Awareness

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(X4), also yes-or-no, showing if decision-makers have high (1) or low (0) levels of environmental awareness. Together, these variables help explore factors influencing the adoption of green technology.

4.3. Empirical results and analysis

4.3.1. Logistic model regression results

Table 3: Logistic regression results

variable	regression coefficient	standard error	Significance level
production costs	-0.56	0.14	0.001***
technical complexity	-0.38	0.12	0.005**
Subsidy policy	0.47	0.1	0.000***
Environmental awareness	0.32	0.11	0.002**

The results indicate that subsidy policies and environmental awareness have a significant positive impact on technology adoption, while production costs and technological complexity have a negative impact on adoption willingness.

4.3.2. Empirical results analysis

According to the regression results of the model, the subsidy policy has the greatest impact, indicating that government support is crucial for promoting the adoption of green production technologies by farmers. Secondly, farmers with a higher level of environmental awareness are more inclined to adopt green production technologies, while higher costs and technological complexity significantly reduce farmers' willingness to adopt them [3,5,7,8].

5. Conclusion

This study is based on survey data from 200 agricultural households in Hongdong County, Shanxi Province. Logistic and Probit models were used to empirically analyze the influencing factors of farmers' adoption of green production technologies in agriculture. Economic factors have a significant impact on farmers' willingness to adopt technology: survey data shows that economic factors such as farmers' income, agricultural production costs, and expected production benefits directly affect farmers' adoption of green production. Farmers with higher income levels have more choices about the temporary benefits brought by green technology, while low-income farmers are mostly in a passive wait-and-see or government subsidy state. The convenience and effectiveness of technological factors affect farmers' willingness to adopt: Research has found that the depth of knowledge, feasibility, and expected utility of environmental protection production technologies are the main factors influencing farmers' technology adoption behavior. For example, biological control technologies that are more complex and difficult to achieve technical benefits in the short term are more likely to be rejected by farmers than fertilizer optimization technologies. Environmental factors are gradually occupying a more important position in farmers' decision-making: with the intensification of environmental problems, farmers' recognition of green production technologies is increasing.

Based on the research findings, in order to increase farmers' willingness to adopt green agricultural production technologies and promote sustainable agricultural development, the following policy recommendations are proposed. First, the government should formulate targeted financial subsidies for green production technologies, such as reducing the initial cost of green technologies and providing long-term low interest loans. The government can establish an incentive

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mechanism for farmers to adopt green technologies, and provide additional subsidies to those who have been using green technologies for many years. By increasing their long-term adoption willingness, we can encourage farmers to adopt them in the long run. Second, in the process of promoting green production technology, the government and agricultural departments should increase farmers' technical education and training efforts to address technical difficulties and insufficient knowledge reserves of farmers, and enhance their acceptance of green production technology. Farmers can further understand green production technologies through on-site demonstrations, training, expert lectures, and other methods. Third, the government can provide support for the development of public welfare organizations such as cooperatives and planting enterprises, and provide services such as green cultivation technology training, pesticide supply and sales to farmers.

References

[1] *Wang Huang, Ma Ji Agricultural socialized services and green production of farmers: research review and prospects [J]. Agricultural Economics and Management, 2024, (05): 77-91*

[2] *Chen Zhongwei, Yang Linyuan The Wealth Effect of Agricultural Green Production Technology: Based on the Perspective of Farmers' Decision Preference [J]. Resource Science, 2024, 46 (08): 1588-1603*

[3] *Yang Yiming, Huang Zhi, Wang Peng, etc Research on the adoption of agricultural green production technology based on the theory of planned behavior: taking pear orchard grass cultivation technology as an example [J]. Jiangsu Agricultural Science, 2024, 52 (05): 255-259. DOI: 0.15889/j.issn. 1002-13024.2024.05.038*

[4] *Jiang Likang, Zhao Wei, Zhang Huanan The use of digital technology, adoption of green technology, and agricult ural production efficiency [J]. Scientific Decision making, 2024, (09): 1-14*

[5] *Tang Xiaoqing, Yang Limin, Liu Jing, etc The impact of capital endowment, perceived value, and government reg ulation on farmers' adoption of green technologies: based on survey data from 422 farmers in Dazhu County, Sich uan Province [J]. China Agricultural Machinery Chemistry Journal, 2024, 45 (08): 330-337. DOI: 0.13733/j.jca m. issn. 2095-5553.2024.048*

[6] *Wen C ,Hu B ,Sun Y , et al.Spatio-temporal differentiation on China's green agricultural total factor productivity guided by digital technology and fuzzy systems[J].Cogent Food & Agriculture,2024,10(1)*

[7] *Shen Yujie, Gu Manchang, Tian Pengpeng, etc The impact of environmental regulations and green awareness on the adoption of green production technologies by farmers: also discussing the regulatory role of social capital [J]. Arid Region Resources and Environment, 2025, 39 (01): 1-15. DOI: 10.13448/j.cnki. jalre. 20225.001*

[8] *Liu B ,Li N ,Liao C .Effects of Social Capital on the Adoption of Green Production Technologies by Rice Farmers: Moderation Effects Based on Risk Preferences[J].Sustainability,2024,16(20):8879-8879*