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Drivers of Farmers' Intentions to Use Eco-Breeding: Integrating the Theory of Planned Behavior and the Norm Activation Model

Xingdong Wang,^{1*} Pan Lu²

(1. School of Economics and Management, Jiangxi Rural Revitalization Strategy Research Institute, Jiangxi Agricultural University, Nanchang, 330045, People's Republic of China; 2. School of Economics and Management, Jiangxi Agricultural University, Nanchang, 330045, People's Republic of China)

Abstract

Ecological breeding (eco-breeding) is a systematic ecological farming method for the benefit of the environment and human health, but farmers have adopted this method only to a lesser extent. The main objective of this study was to examine the factors that influence farmers' intentions to use eco-breeding methods. The study model was a combined application of the theory of planned behavior (TPB) and the normative activation model (NAM) to investigate the intentions of 527 Chinese farmers to engage in eco-breeding practices. Structural equation modeling analysis revealed that although the farmers' intentions to adopt eco-breeding practices was influenced by both self-interested and altruistic motives, self-interested motives had a greater impact on the farmers' choices. Furthermore, favorable attitudes had the greatest effect on the farmers' intentions to implement eco-breeding, while past habits had no statistically significant effect on the intentions. Nonetheless, past habits significantly influenced attitudes and perceived behavior control in the combined model. In addition, the findings indicated that awareness of consequences had a significant effect on personal norms and the attribution of responsibility. Overall, the findings demonstrate the good efficiency as well as comprehensiveness of the integrated TPB-NAM in explaining the farmers' intentions to engage in eco-breeding practices. This study increases our understanding of the factors influencing the farmers' adoption of eco-breeding practices and helps to promote the adoption of eco-breeding in rural areas while providing a basis for the development of eco-breeding policy interventions.

Keywords: Waterfowl production; Eco-breeding practice; Farmers' behavior; Jiangxi; Hubei; Yunnan

^{1*} Xingdong Wang (1979 -), male, Doctor of Management, Associate professor (wxd_email@126.com;18170825663), researching in marketing, consumer behavior, rural consumption, farmer behavior.

² Lu Pan (1997 -), female, postgraduate (1486776429@qq.com), researching in marketing, consumer behavior, rural consumption, farmer behavior.

Introduction

Waterfowl production is a traditional form of livestock production that poses a serious threat to the environment and public health (Wang and Xu et al. 2018; Lam and Fry et al. 2019). Farmers can further improve the vitality of waterfowl production and reduce environmental pollution by adopting eco-breeding models (Sundrum 2001; Tilman and Clark 2015). Hence, increasing the willingness of farmers to use eco-breeding models could reduce the harm to the environment (Röös and Mie et al. 2018). In recent years, governments have been actively promoting eco-breeding methods to protect the environment and improve agricultural efficiency (Gomiero and Pimentel et al. 2011). For example, Iran actively promotes integrated pest management, and the United States restricts the use of chemicals in agriculture, etc. (Floress and García De Jalón et al. 2017; Rezaei and Safa et al. 2019). The Chinese government has also vigorously promoted eco-breeding policies (Yang 2021), but the expected results have not been achieved, and the farmers' willingness to adopt ecological breeding practices is relatively low (Zeng and Zhang et al. 2019). Eco-breeding practices are closely dependent upon farmers' willingness (Vasquez and Foditsch et al. 2019), and it is necessary to explore in depth the mechanisms that affect the adoption of eco-breeding practices by farmers. This exploration will help the government develop reasonable policies and adopt appropriate incentives to increase the enthusiasm of farmers.

Many scholars have conducted in-depth studies on the intentions of farmers to adopt eco-breeding practices. Recent studies have been focused on either self-interested motives or altruistic motives (Park and Ha 2014; Hu and Cheng 2016; Floress and García De Jalón et al. 2017). In terms of self-interested motivation, the theory of planned behavior (TPB) proposed by Ajzen (1991) is considered as a rational choice model that mainly considers the comparison of cost effectiveness and benefits (Botetzagias and Dima et al. 2015; Chen 2016; Gao and Wang et al. 2017), ignoring the roles of irrational and altruistic motives in shaping behavior (Roy and Rabbanee et al. 2016). Therefore, TPB is not sufficient to effectively explain the generation of pro-environmental behavior (Ahmad and Kim et al. 2020). The normative activation model (NAM) was proposed by Schwartz (1981) as a classical model to explain pro-environmental behavior, with more emphasis on the importance of morality (Onwezen and Antonides et al. 2013; Kim and Seock 2019; Nordfjærn and Rundmo 2019). The practice of eco-breeding by farmers is a pro-environmental behavior that can be seen as a mixture of self-interest and altruism (Price and Leviston 2014; Liu and Sheng et al. 2017; Tang and Liu et al. 2021). This study integrates the structure of TPB and NAM and adds interrelationships between past habits and intentions to enhance the predictive power of the proposed framework for explaining

farmers' intentions to use eco-breeding practices.

In this study, we investigated farmers' intentions to adopt waterfowl eco-breeding practices by using the TPB-NAM integrated model in both the economic and social value dimensions. Specifically, we investigated 1) applying the integrated TPB-NAM to explain farmers' intention to adopt eco-breeding practices, 2) exploring the causal relationship between the TPB and NAM structures, and 3) examining realistic ways for waterfowl farmers to adopt eco-breeding practices from the perspectives of self-interest and altruism. To achieve these objectives, in the following section, we review the literature and hypothesize the relationships between the variables. Section 3 presents the methodology. Section 4 presents the estimation results. Section 5 provides a discussion of the results. Finally, implications for policy are presented.

Theoretical Framework and Hypotheses Development

The Theory of Planned Behavior (TPB)

TPB, as proposed by Ajzen (1985, 1991), is an extension of the theory of reasoned action, which explains a person's reasons for choosing indicating a certain behavior mainly in terms of costs and benefits (Montaño and Kasprzyk 2015; Conner 2020). This theory suggests that behavioral intentions are determined by three main factors: attitudes (ATT), perceived behavioral control (PBC), and subjective norms (SN). TPB is used as the most popular social psychological theory to explain the behavior of individuals in numerous domains (Gao and Zhang et al. 2017); hundreds of researchers have investigated or applied TPB to predict behavior in areas such as health and environmental sustainability (Sussman and Gifford 2019).

According to TPB, ATT is the degree to which an individual has a favorable or unfavorable evaluation of a particular behavior (Ajzen 1991). Usually, positive ATT encourage individuals to take action (Chen 2017). Compared to other TPB variables, ATT toward behavior most significantly influences a person's behavioral intention (De Groot and Steg 2007; Chen 2016). Thus, ATT can be considered as a potential determinants of an individual's intentions to implement pro-environmental behaviors (Chuang and Chen et al. 2018; Rezaei and Safa et al. 2019). Farmers intend to use eco-breeding practices only if they believe that these practices are useful and beneficial and give them positive results. Thus we present the following hypothesis:

H1: A favorable ATT toward eco-breeding practices positively predicts the intention to engage in eco-breeding.

PBC is defined as the perceived ease or difficulty of performing a particular behavior (Ajzen, 1991). It depends heavily on weighing the costs and benefits, including financial costs,

effort, and time in the process of performing the act (Shi and Fan et al. 2016). Thus, the higher the individual's PBC, the stronger the willingness to perform a behavior, in this case "higher" means a greater perceived ease (Gao and Zhang et al. 2017). Similar conclusions were reached by Gao and Wang (2017) in research on individual's energy-saving behavior. This fact can be extended to farmer's eco-breeding practices. When they believe they have the relevant knowledge, skills, and resources to use eco-breeding practices under their control, they are more likely to form the intention to participate in these practices. Therefore, the following hypothesis is proposed:

H2: A high PBC of using eco-breeding practices positively influences the intention to use those practices.

SN refers to perceived pressure from significant others to perform certain kinds of behaviors (Ajzen 1991). In other words, individuals usually prefer to align themselves with the expectations of significant organizations or people (Shi and Fan et al. 2016). Thus, the perception of highly relevant SN from significant others can increase an individual's intention to perform a specific behavior (Gao and Zhang et al. 2017). Arli and Tan (2018) confirmed this view in his study of the intentions to purchase green products. Farmers are more likely to use eco-breeding practices if they perceive that they are under social pressure to do so. Based on this, the hypothesis is formulated:

H3: The SN of using eco-breeding practices positively affects the intention to use those practices.

In addition to the aforementioned hypotheses, which are focused primarily on the relationship between intention and the focal structure of TPB (i.e., ATT, PBC, and SN), the results of other studies suggest that past habits reinforce the predictive role in behavioral intention (Høie and Moan et al. 2010; Leung and Chen 2017; Abadi 2018). Past habits are psychological construct, rather than simply past behavioral frequency (Verplanken and Orbell 2003), which are defined as automatic or unconscious reactions to future behaviors (Honkanen and Olsen et al. 2005). That is, farmer's past habits are generated by frequency and satisfactorily pairing behaviors with the execution of relevant eco-breeding practices. Past habits has been shown to influence intention regardless of TPB variables (Huitu 2015). However, Ajzen (1991) suggested past habit is not sufficient, and some scholars have argued that past habit plays an important role in the influence of PBC on decision-making (Sommer 2011). Furthermore, the predictive power of attitudes should be diminished if people have past habits (Trafimow 2000), and conversely, ATT should be good predictors of intention when people do not have a habit of

exhibiting a behavior (Huitu 2015). Evidence from other scholars supports the relationship between past habit and intention, ATT, and PBC (Dean and Raats et al. 2012; Leung and Chen 2017; Chen and Cao et al. 2019). Because farmer's intentions regarding the adoption of eco-breeding are influenced by past habits, we added past habit to TPB as a theoretical structure for the study of farmers' intentions to adopt eco-breeding practices. In this regard, the following hypotheses are proposed:

H4: Past habits positively affects ATT toward participation in eco-breeding.

H5: Past habit is positively related to PBC of participation in eco-breeding.

H6: Past habit is positively related to the intention to participate in eco-breeding.

The Norm Activation Model (NAM)

NAM is a model developed by Schwartz (1977) to explain altruistic and environmental behaviors or intentions and is widely used in a variety of pro-social and pro-environmental domains (Bamberg and Möser 2007; Onwezen and Antonides et al. 2013; Wang and Wang et al. 2019). Examples pertaining to farmers include the choice of travel methods (Park and Ha 2014), recycling behavior (Zhang and Zhang et al. 2014), and ecological farming by farmers (Rezaei and Safa et al. 2019). The model suggests that the activation of a personal norm (PN) depends on two elements: awareness of consequences (AC) and attribution of responsibility (AR) (Schwartz 1977). PNs are the self-expectations of individuals to perform specific behaviors in specific situations and include internalized social norms and a sense of moral obligation. AC involves the positive or negative effects that individuals are aware that their behavior can have, and AR indicates individual's sense of responsibility for the consequences of their behavior (Schwartz 1977).

NAM assumes that when people are aware of negative impacts on the environment (i.e., AC), they tend to take responsibility for the negative consequences (i.e., AR), and thus AC and AR activate PNs to motivate individuals to exhibit certain behaviors or intentions to mitigate negative effects (Kormos and Gifford et al. 2015; Møller and Haustein et al. 2018). In addition, it is important to emphasize that people who are not aware of the impact of their actions on the environment are not likely to be held responsible for the consequences (Liu and Sheng et al. 2017). In other words, an individual's AC is an important antecedent to AR (Rezaei and Safa et al. 2019). By applying the concept of NAM to the act of using eco-breeding, we can see that if farmers feel that they are responsible for the results of practicing eco-breeding and are aware of the positive consequences, they will have a moral obligation to use these practices to protect

others and the environment. This sense of obligation in turn leads to a strong intention to engage in eco-breeding practices. In summary, based on the assumptions of NAM and the preceding discussion, the following hypotheses are proposed:

H7: PN will positively affect farmer's intention to engage in eco-breeding practices.

H8: AC will positively affect PN in eco-breeding practices.

H9: AR will positively affect PN in eco-breeding practices.

H10: AC will positively affect AR in eco-breeding practices.

Proposed Research Model

Based on the preceding literature review and hypotheses development, a conceptual model that combines the constructs of NAM and TPB is proposed (Fig 1) to explain the intentions of Chinese farmers to adopt eco-breeding practices. The model is designed to test the association between the endorsement of TPB and the intention to adopt eco-breeding practices. In addition, PN, predicted by AC and AR, was postulated as predictor of farmers' intentions to adopt eco-breeding practices because AC predicts AR.

Methodology

Measures

The questionnaire consisted of two parts. The first part obtained basic information about the respondents, including age, gender, education, and annual household income. The second part measured potential variables related to TPB-NAM to explore the farmer's intentions to implement eco-breeding. We mainly obtained the original measurements for this study from Ajzen (2006), Rezaei and Safa et al. (2019), Verplanken and Orbell (2003), and Han (2014). On this basis, we invited foreign experts from academia and researchers familiar with relevant research topics to review the questionnaire and assess the clarity and rationality of the items. In the prediction review, experts identified problems such as repetitive items, vague sentences, and unreasonable design in the questionnaire, and the final questionnaire was formed through revision. All items were anchored by 1 "do not agree at all" and 5 "strongly agree". The exact wording of the statements used in all scales is reproduced in the Table 1.

Participants and Procedure

Because China is the largest waterfowl producer, accounting for more than 75% of the world's waterfowl rearing (Sumarmono 2019), we randomly selected three provinces, Jiangxi,

Hubei, and Yunnan, from 21 major waterfowl-producing provinces in China according to the National Waterfowl Industry Technology System (NWITS). As shown in Fig 2, Jiangxi Province, located in southeastern China, has many lakes, well-developed water systems, and a long history of waterfowl breeding and is one of the dominant production areas of the national waterfowl industry. Hubei Province is a well-known waterfowl production province in central China, which is also famous for its unique waterfowl-processing products. Yunnan Province, located in southwestern China, has a warm climate; lush aquatic plants; and abundant fish, shrimp, and aquatic insects and other invertebrates, providing good habitat and food conditions for waterfowl, and is one of the important waterfowl conservation areas in East Asia.

To investigate the farmers' willingness to adopt eco-breeding practices, we carried out in-person interviews during the period of May-October 2020, randomly selecting 550 waterfowl farmers with a two-stage sampling procedure. We selected a total of 11 counties—six in Jiangxi, three in Hubei, and two in Yunnan—based on the ratio of waterfowl production values in the three sample provinces.³ Within a sampled county, we selected 50 waterfowl farmers randomly in the second stage. We recruited trained native interviewers to visit each participant to conduct the survey, offering a gift (a telephone card worth RMB 20) to encourage cooperation.⁴ Moreover, we kept responses anonymous to encourage respondents to express their true opinions. This survey resulted in 527 usable questionnaires after the removal of 23 invalid entries.

Data Analysis

We used the Statistical Package for the Social Sciences 21.0 (SPSS) as statistical software to perform structural equation modeling (SEM) for evaluating the proposed model and hypotheses.⁵ Before proceeding to the main analysis, we examined the normality of each variable in the model to determine whether the data met the normality assumption of the maximum likelihood estimation. We performed the main statistical analysis in two stages. First, we performed confirmatory factors analysis (CFA) to verify the reliability and validity of all

³ According to the survey data of NWITS in 2019, the ratio of Jiangxi, Hubei, and Yunnan waterfowl integrated production values is about 6:3:2.

⁴ Interviewers explained every item in the questionnaire for respondents so that they could understand the meaning of each item. The whole process took about 45 minutes for each respondent.

⁵ A desirable goal of a sample size is to have a 20:1 ration for the number of participants to the number of model parameters (Suhr, 2006); the ration in this study is 27.7:1, which meets the requirement of a sufficient sample size.

measured variables and the fit of the measurement model to the data. After evaluating the measurement models, we performed SEM to access the proposed model and research hypotheses.

Results

Participants' Profile

As shown in Table 2, the sample is dominated by male participants ($n = 352$, 67.0%). The average age of the respondents was about 50 years old ($SD = 14.69$), and most of the respondents ($n = 473$, 90.1%) had completed junior high school or below. The annual household income of most respondents ($n = 380$, 72.3%) was around RMB 20,000–100,000, and the average number of poultry stock was 5083.98 ($SD = 26041.04$) in 2019. According to the China Statistical Yearbook 2019, China's population has a relatively low level of education, with a per capita disposable income of 32,189 yuan, and about 71.2% of the total population is aged 15–64 (National Bureau of Statistics of China, 2020). All these above indicators suggest that these samples are to some extent representative of the Chinese population.

As shown in Table 1, in the constructs of PBC, the mean values of ATT (3.84) and SN (3.58) were relatively high, whereas the mean value of PBC was low (2.89). These findings show that most respondents had a favorable attitude and high personal norm related to the willingness to engage in eco-breeding practices. However, they did not perceive enough control to use eco-breeding properly. This may be because they did not have the required funds and skills to change the current situation. In the constructs of NAM, the mean scores of PN (3.53), AR (3.72), and AC (3.68) were relatively high, and these findings suggest that respondents felt morally committed to using eco-breeding practices. Also, they showed a relatively high intention (3.71) to engage in eco-breeding practices.

We conducted least significant difference analysis to examine whether there was any significant difference in responses across the three different provinces. No significant difference in the participants' profiles or measured constructs was found at $p < 0.05$. Thus, we combined data from the three provinces in all analyses that followed.

Common Method Deviation

Common method bias (CMB), as a covariate property, can be potentially biased and can even lead to misleading research conclusions. To ensure that common method bias did not distort the results of this study, we conducted a Harman one-way test to analyze the severity of homoscedastic errors during the analysis of the empirical data (Podsakoff 2003). According to

the results of the exploratory factor analysis in SPSS, the variance explained by the unrotated first principal component was less than 50%, indicating that the CMB of the study was not serious (Sun and Wang et al. 2015; Bai and Wang et al. 2019).

Reliability and Validity

We performed CFA using analysis of moment structures to evaluate internal consistency reliability, convergent validity, and discriminant validity. To assess the fit of the model, various indices were used in the present research, including Chi-square (χ^2), degree of freedom (df), tucker-lewis index (TLI>0.9), comparative fit index (CFI>0.9), and root mean square error of approximation (RMSEA<0.08). Initially, the measurement model fit well with the data overall ($\chi^2 = 361.08$, $df = 131$, $\chi^2/df = 2.76$, $CFI = 0.97$, $TLI = 0.95$, $RMSEA = 0.06$). In addition, the combined reliability of the seven latent variables in the model ranged from 0.78 to 0.89, exceeding the minimum recommended 0.70 (Fornell and Larcker 1981; Shin and Im et al. 2018). As described in Table 3, all standardized factor loadings of the measurement model were greater than 0.7, indicating the high internal consistency of the scale, and the average variance extracted (AVE) values of the latent variables were greater than 0.5, indicating good convergent validity of the scale (Hair and Gabriel et al. 2014).

In terms of discriminant validity, the scale is considered to have good discriminant validity if the arithmetic square root of each latent variable's AVE is greater than the correlation coefficient between latent variables (Fornell and Larcker 1981). As shown in Table 4, the absolute values of the correlation coefficients of most latent variables are less than 0.5, and the correlation coefficients are smaller than the arithmetic square root of the mean square deviation of the corresponding AVE, so the scale is considered to have good discriminant validity.

Modeling Comparisons

To test the robustness of the model, we conducted a modeling comparison. The results of the modeling comparisons are presented in Table 5. First, we tested the original TPB model, and the results showed that the TPB-based predictors explained 59% of the variance in the farmers' behavioral intentions. Second, we tested the expanded TPB model, and approximately 61% of the variance in farmers' behavioral intentions was explained by the expanded TPB combination. Third, we tested the standard NAM, and 41% of the variance in the farmers' behavioral intentions was contributed by the NAM-based predictors. Finally, we tested the combined model, and the results showed that the combined model performed well in predicting the farmers' behavioral intentions. Approximately 66% of the variance in farmers' behavioral

intentions was explained by the predictors of the expanded TPB and NAM. All four models had acceptable fits, but the integrated model outperformed the other models in predicting the farmers' behavioral intentions.

Structural Equation Modeling (SEM)

We demonstrated the criteria of reliability and validity by the measuring model, which laid the foundation for analyzing the structural model. We used structural equations to assess the goodness of fit of the theoretical framework, and the results showed that the theoretical model proposed in this paper matched the measured data ($\chi^2 = 503.78$, $df = 136$, $\chi^2/df = 3.70$, $CFI = 0.95$, $TLI = 0.93$, $RMSEA = 0.07$). $RMSEA$ met the criterion of less than 0.08 (Browne & Cudeck 1993), while the other fitness indices (e.g., CFI and TLI) were higher than the recommended criterion of close to 0.9 and higher (Bagozzi and Yi 1988).

The findings from SEM are displayed in Fig 3, Hypotheses 1, 2, and 3 proposed relationships among the original constructs established in TPB. Results showed that ATT ($\beta = 0.50$, $p < 0.001$), PBC ($\beta = 0.13$, $p < 0.001$), and SN ($\beta = 0.21$, $p < 0.001$), were all significant predictors of the intention to adopt eco-breeding practices. Next, findings indicated that past habit positively influenced farmers' attitudes ($\beta = 0.53$, $p < 0.001$) toward adopting eco-breeding practices as well as PBC ($\beta = 0.61$, $p < 0.001$). Hence, Hypotheses 4 and 5 were supported. Hypothesis 6 was also evaluated. The results of the study indicated that the effect of past habit on farmers' intention ($\beta = 0.04$, $p > 0.1$) to adopt eco-breeding practices was not significant. Therefore, Hypothesis 6 did not pass the test. However, the path from individual norms to the farmers' intention to adopt eco-breeding practices was statistically significant, supporting Hypothesis 7 ($\beta = 0.15$, $p < 0.01$). Finally, the original variables of NAM, AC ($\beta = 0.41$, $p < 0.001$), and AR ($\beta = 0.43$, $p < 0.001$) had a positive effect on PN ; and AC ($\beta = 0.75$, $p < 0.001$) had a significant effect on individual AR . These results supported Hypotheses 8, 9, and 10.

Discussion

Owing to the lack of research on farmers' ecological approaches to waterfowl breeding, in this study we aimed to gain a comprehensive understanding of farmers' intentions to adopt eco-breeding practices by constructing the TPB-NAM model. We found that self-interest and altruistic motives play important roles in the formation of farmers' intentions to choose eco-breeding practices, which was consistent with the previous studies (Floress and García De Jalón et al. 2017; Shin and Im et al. 2018). However, the degree of salience of the two motivations

varied across research contexts. In the current study, we found that although both self-interest and altruistic motives influenced farmers' intention, self-interested motives were the more dominant influencing factor. This finding suggests that the farmers' intentions to adopt eco-breeding practices were driven by both economic and social effects and that the farmers' intentions were more likely to be influenced by economic effects.

As expected in H1, H2, and H3, ATT, SN, and PBC are determinants of the intention to choose eco-breeding practices. The results suggest that farmers with good attitudes and more resources and abilities, and who perceive more social pressure, are more likely to choose the eco-breeding practices. This finding is consistent with the research of Rezaei and Safa (2019) on the intentions of farmers to adopt integrated pest management. However, the relative importance of the influencing factors varied. In the current study, ATT had the greatest influence on farmers' intentions to choose eco-breeding practices.

The current findings suggest that although H6 was supported for the initial expansion of TPB, the effect was not statistically significant in the integrated TPB-NAM model. The main reason for this situation may be attributed to the effect of past habit in the TPB-NAM integrated model. More precisely, the results suggest that past habits do not directly influence intention (H6) but instead influence intention indirectly through ATT (H4) and PBC (H5). This suggests that the effect of past habit on farmers' intentions to use eco-breeding may be absorbed by ATT and PBC. In this regard, similar findings were reported by Leung and Chen (2017).

PN is influenced by AC and AR, as hypothesized in H8 and H9. The effect of AR on PNs is greater than the effect of AC. In addition, as expected in H10, personal AC has a significant positive effect on AR. This can be interpreted as AR partially mediating the relationship between AC and PN, consistent with the findings of NAM based on empirical evidence (Zhang and Geng et al. 2017; Wang 2019). Thus, farmers' PNs can be activated as they recognize the negative consequences of ecological degradation when eco-breeding is not adopted or by feeling responsible for the negative consequences.

Conclusions and Policy Implications

The current investigation is one of the first attempts to predict farmers' intentions to use eco-breeding practices based on the TPB-NAM integrated model. The conclusions drawn from the study have important implications. On the one hand, they help improve the design reference framework for understanding the psychosocial factors influencing farmers' intentions to use eco-breeding; on the other hand, they help relevant planners and policy makers implement

various practical interventions to encourage farmers to use eco-breeding practices to reduce environmental pollution.

Interestingly, in our study, we found that farmers' intentions to adopt eco-breeding practices are driven by both self-interested and altruistic motives and that farmers' choices are more likely to be influenced by self-interest. Therefore, government policies to encourage farmers to voluntarily adopt eco-breeding practices should be based not only on farmers' social responsibility to protect the environment by means of publicity and incentives but also on the premise that farmers want to maximize their own benefits. In addition, we found that farmers with more positive attitudes toward eco-breeding had a higher willingness to participate. Hence, to achieve this goal, the government should make more effort to raise farmers' awareness of eco-breeding methods and improve the overall evaluation of production use. For example, it can encourage more social funds to participate by strengthening relevant policy support; it can also implement a two-way matching model between universities and farmers to scientifically guide farmers' production. Again, our findings suggest that practitioners with previous experience in eco-breeding have a higher ability to overcome various difficulties in using eco-breeding practices (including the lack of knowledge skills, time, and money); they also have more positive attitudes toward eco-breeding practices and have stronger intentions to use eco-breeding practices. In this regard, the government can conduct eco-breeding technology training as well as green-specific subsidy policies to increase the farmers' level of self-efficacy and the consequent impact of their intentions. Finally, our findings suggest that policy implementers can also design programs aimed at increasing farmers' general awareness of environmental problems caused by waterfowl production. This would help strengthen the farmers' sense of moral obligation to protect the environment, thus facilitating the use of the eco-breeding model.

In general, in this study, we presented an important insight about the Chinese farmers' intentions to adopt eco-breeding practices. In addition, the study is also suggestive of several areas for future research. First, because our respondents came from three provinces in China, future scholars could test the proposed research model in different contexts and compare the results with the current study. Second, the combination of various theories such as motivation theory or value-belief-norm theory is recommended so that future researchers may identify other sociological and psychological factors that might influence farmers' intentions toward eco-breeding practices. Third, we used intentions rather than actual behavior as the explained variable, so future scholars need to investigate how the different components of TPB-NAM affect actual eco-breeding practices.



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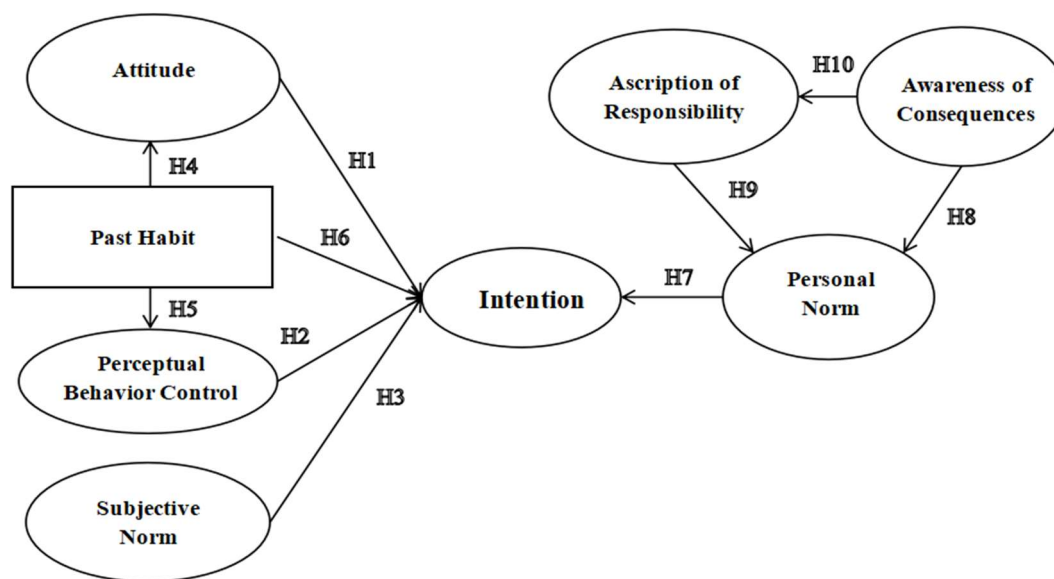


Fig 1. Hypothesis Model

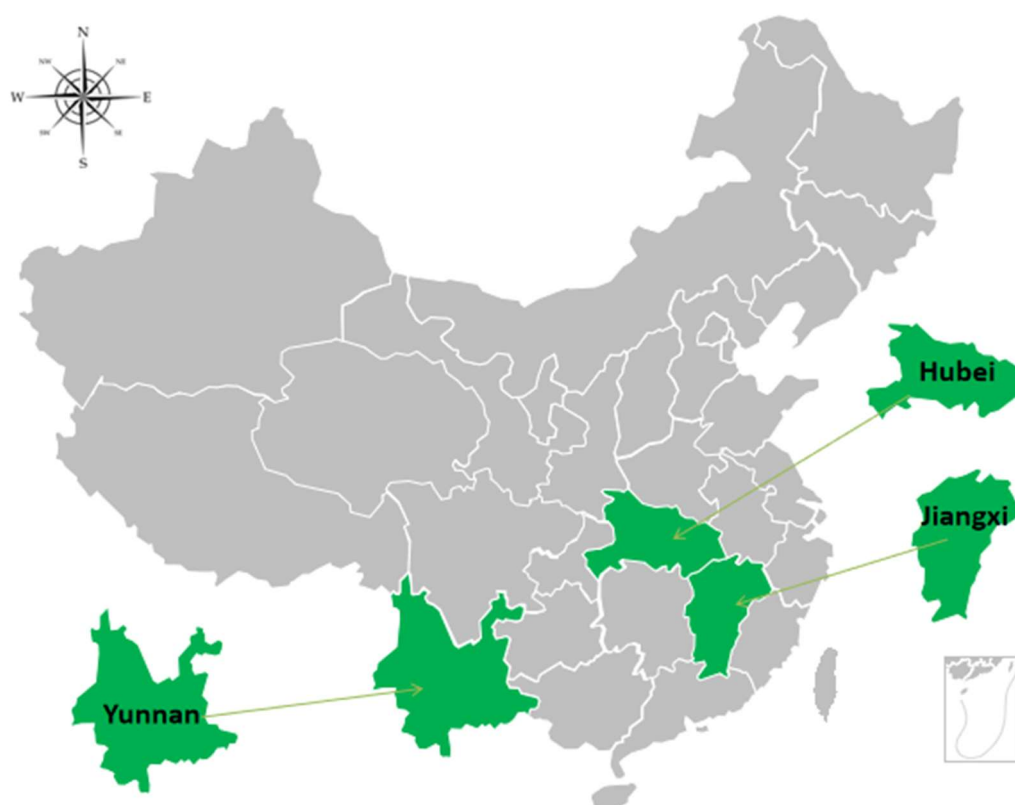


Fig 2. The Survey Area

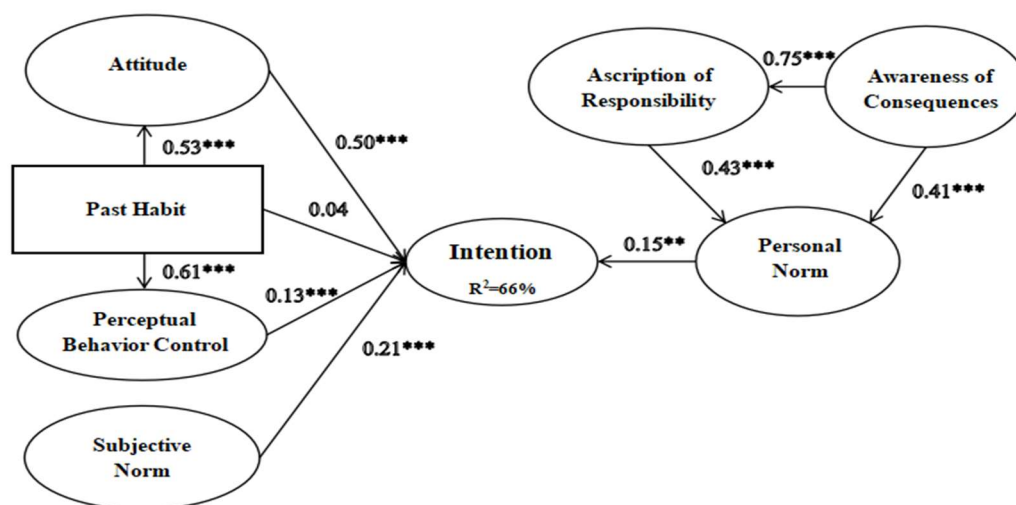


Fig 3. Structural Equations Modeling and Standardized Path Coefficients (Comprehensive Model)

Note. $p^* < 0.1$; $p^{**} < 0.05$; $p^{***} < 0.01$.

Table 1

Mean, Standard Deviation of Items and Subsections (n = 527)

Subsections	Items	Mean score, standard deviation A, B, C
Intention	Would you like to adopt the aforementioned approach to eco-breeding in the coming year?	3.78±0.044 ^a
	Are you willing to take part of the land for green eco-breeding?	3.65±0.048 ^b
	Subsection mean scores	3.71±0.043^a
Attitude	Do you feel good about farming according to green eco-breeding standards?	3.78±0.039 ^a
	Do you feel meaningful about farming according to green eco-breeding standards?	3.87±0.038 ^a
	Do you think you should farm according to green eco-breeding standards?	3.87±0.039 ^a
	Subsection mean scores	3.84±0.035^b
Subjective norm	Do most of the people who are important to me think I should use green eco-breeding standards?	3.58±0.040 ^a
	Do most of the people who are important to me approve of my adopting green eco-breeding standards?	3.65±0.039 ^a
	Do most people like me take a green eco-breeding approach?	3.51±0.042 ^b
	Subsection mean scores	3.58±0.037^d
Perceptual behavior control	Do you think it is easy to implement green eco-breeding methods?	2.93±0.046 ^a
	Do you think you have technical support team, capital, etc. to guarantee the smooth implementation of green eco-breeding?	2.84±0.045 ^a
	Subsection mean scores	2.89±0.041^e
Personal norm	I would feel guilty if I didn't implement eco-breeding ways.	3.46±0.036 ^a
	My principle is to adopt eco-breeding approach.	3.58±0.039 ^b
	I believe I have a moral obligation to adopt eco-breeding practices.	3.55±0.039 ^b
	Subsection mean scores	3.53±0.034^a
Awareness of consequences	Will not adopting green eco-breeding methods cause damage to the environment?	3.74±0.038 ^a
	Will consumers be adversely affected by not adopting green and eco-breeding methods?	3.68±0.038 ^a
	Will products raised without adopting green eco-breeding methods disrupt the consumer market?	3.62±0.040 ^b
	Subsection mean scores	3.68±0.034^a
Ascription of responsibility	To reduce environment pollution, I feel it is my responsibility to adopt eco-breeding method.	3.73±0.038 ^a
	I have some responsibility for the environmental problems caused by not adopting eco-breeding methods.	3.70±0.036 ^a

	Subsection mean scores	3.72±0.035^a
Past habit	The implementation of eco-breeding standards for farming is a habit for me.	3.43±0.043^b

Note. ^a Mean scores of the items superscripted by the same English letter are not significantly different from each other.

^b Mean scores of the subsections superscripted by the same Greek letter are not significantly different from each other.

^c At the 1% level of significance based on the Chi-square (χ^2) test.

Table 2
Demographic characteristics information of the Respondents (n = 527)

Variable	Description	n	Frequency(%) /Mean (SD)	χ^2	Df	p
Gender	Male	353	67.0	60.8	1	0.91
	Female	174	33.0			
Age	Years	527	49.67 (14.69)	291.1	64	0.46
Education	Illiterate	48	9.1	217.2	5	0.01
	Primary School	135	25.6			
	Intermediate school	203	38.5			
	High school or junior college	89	16.9			
	college or above	52	9.9			
	less than 20,000	100	19.0			
Annual household income (Yuan/RMB) ^a	20,000-60,000	256	48.6	181.0	3	0.00
	60,000-100,000	125	23.7			
	more than 100,000	46	8.7			

^aNote: an average of 6.503 China Yuan equals to 1USD at the time of survey.

Table 3

Measurement Model Results

Variable	Item	Standardized factor loading	AVE	Composite reliability
Intention	INT1	0.85	0.74	0.85
	INT2	0.86		
Attitude	ATT1	0.87	0.72	0.89
	ATT2	0.84		
	ATT3	0.84		
Perceptual behavior control	PBC1	0.83	0.64	0.78
	PBC2	0.76		
Subjective norm	SN1	0.91	0.74	0.89
	SN2	0.91		
	SN3	0.75		
Personal norm	PN1	0.81	0.84	0.88
	PN2	0.87		
	PN3	0.84		
Awareness of consequences	AC1	0.76	0.64	0.84
	AC2	0.86		
	AC3	0.78		
Ascription of responsibility	AR1	0.88	0.72	0.83
	AR2	0.81		

Table 4

Results of Validity Analyses

	M	SD	ATT	SN	PBC	INT	PN	AR	AC
ATT	3.84	0.79	0.72						
SN	3.58	0.84	0.39**	0.74					
PBC	2.89	0.94	0.25**	0.32**	0.64				
INT	3.71	0.98	0.55**	0.49**	0.42**	0.74			
PN	3.53	0.78	0.35**	0.33**	0.29**	0.44**	0.84		
AR	3.76	0.77	0.31**	0.33**	0.21**	0.38**	0.38**	0.72	
AC	3.68	0.77	0.32**	0.28**	0.19**	0.37**	0.35**	0.34**	0.64

Note: ^aThe values on the diagonal are the arithmetic square roots of each latent variable, and the values below the diagonal are the correlation coefficients between the latent variables.

^b* $p < 0.05$. ** $p < 0.01$.

Table 5

Estimated Parameters and Goodness-of-Fit Indices of the Test Models (n = 527)

Path	TPB Model	Expended TPB model	NAM model	Comprehensive model
χ^2	94.51	115.96	96.92	503.78
χ^2/df	3.78	3.74	3.13	3.70
p	<0.001	<0.001	<0.001	<0.001
RMSEA	0.07	0.07	0.06	0.07
CFI	0.98	0.98	0.98	0.95
NFI	0.97	0.97	0.97	0.92
IFI	0.98	0.98	0.98	0.94
TLI	0.96	0.96	0.97	0.93
Adjusted R ² (INT)	0.59	0.61	0.41	0.66

Note: RMSEA, Root-Mean-Square Error of Approximation; CFI, Comparative Fit Index; NFI, Normed Fit Index; IFI, Incremental Fit Index; TLI, Tucker-Lewis Index; INT, Intention.