Study on Formation Mechanism of Farmer Production Consumption Ecologization——Empirical Analysis Based on TPB Model

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Abstract Ecological transformation of production consumption is an effective channel of establishing ecological agriculture mechanism. In this paper, based on TPB (Theory of Planed Behavior), using factor analysis and regression analysis, empirical test on formation mechanism of farmer production consumption ecologization behavior transformation is conducted. Research results show that behavior attitude, subjective norm and control cognition of farmer production consumption ecologization have significantly positive influences on behavior response of farmer production consumption ecologization. Among them, power of behavior attitude is farmer's economic rationality and ecological rationality; power of subjective norm is system norm, government guidance and social pressure; power of control cognition is policy judgment and ability perception. Finally, for the analyzed conclusions, policy suggestions are proposed from many aspects, which could provide reference effect for guiding farmer production consumption ecologization and establishing rural eco-civilization.

Key words Farmer, Production consumption, TPB model, Action mechanism, Ecological behavior

1 Introduction

The effect of consumption on economic and social development is significant increasingly. People more emphasize the velocity and number of production but lack effective analysis and assessment on anti-subsidy of distribution and consumption link. When farmer's total income could not meet the demand of his production and living consumption, farmer often adheres to the principle of giving priority to production consumption[1]. At present, farmer's production consumption manner in China is unreasonable, which mainly shows as high resource input and non-sustainable production[2]. According to the statistics, direct economic loss caused by unreasonably consuming mulching film is more than 15 million yuan[3]. Therefore, it has an important realistic meaning for solving rural resources and environment constraints and accelerating rural eco-civilization construction to transform rural existing production consumption manner and realize production consumption ecologization. Farmer production consumption ecologization is an important component of consumption ecologization. The researches of consumption ecologization by domestic scholars start very early, which mainly concentrates in following aspects. Firstly, definition. Scholars generally explain consumption ecologization as a kind of rational consumption behavior, which indicates that people regulate his own behavior in consumption activity by the opinion and method of ecology[4]. From the angle of ethics, Zeng Jianping thinks that ecological consumption manner should be "moderate" at consumption amount, "appropriate" at consumption content and

"achieved" at consumption property. From the angle of environmental science, Jia Libin et al. think that ecological consumption manner is a kind of sustainable consumption manner on the basis of scientific knowledge on the finiteness of earth resource reserve, environmental capacity and ecological carrying capacity. From the angle of sociology, Liao Caimao thinks that consumption ecologization is a kind of directional change of consumption mode and culture[5]. Secondly, for consumption ecologization formation factors, domestic scholars' opinions are diverse[5]. Wang Junxiang thinks that human irrational attitude and unreasonable development of resource could cause that consumption exceeds resource's tolerance range, forming ecological destruction[6]. Wen Xinmin et al. think that low productivity and social psychology met by non-essential need could cause non-ecological consumption[7]. Yang Yan et al. think that government intervention lagging, imperfect basic public service facilities and lagged consumption culture are objective causes for the formation of consumption model in rural region[8]. Jia Libin emphasizes the active effects of propaganda guidance, policy control and technology progress on ecological consumption. The research of Zhu Hongge shows that cognition degree of ecological consumption, trust level on environmental label, policy propaganda and implementation degree, perceived degree of goods quality all have significant influences on residents buying ecological friendly goods[9]. The research of Liao Caimao also shows that transformation of consumption concept, enhancement and promotion of law and system construction of consumption ecologization have active effects on consumption ecologization. Foreign literatures rarely mention consumption ecologization, and the foreign researches on ecological consumption tend to quantitative analysis and empirical analysis[10]. By summarizing the existing research literatures, domestic researches on consumption ecologization mainly start from the macro aspect, and there are fewer literatures

using empirical method to study rural farmer production consumption ecologization. On this basis, taking Hubei as sample site, based on TPB, related data are excavated deeply, and empirical analysis on farmer production consumption ecologization behavior is conducted to optimize farmer production consumption behavior and enhance rural eco-civilization construction.

2　Theoretic basis and research hypothesis

Theory of Planed Behavior (TPB) is a typical model studying attitude behavior, and has very good reveal effect on individual behavior decision-making process. Liu Yuwei[11] uses TPB to verify the applicability of TPB in green consumption behavior aspect. Li Zhicheng *et al.* [12] use TPB model to predict the behaviors of consumers under e-commerce environment. Based on TPB model, Zhou Lingqiang *et al.* construct whole model explaining and predicting the spontaneous environmental responsibility behavior wills of tourists[13]. TPB proposed by Ajzen[14] could provide reference for studying ecologization transformation of farmer production consumption in this paper. In addition, it is also found that consumption attitude of consumer, social environment state and psychological variable are important factors affecting consumption ecologization transformation by literature review[9, 15−17]. Hence, theoretic framework and research hypothesis are proposed by combining TPB theory and literature review.

2. 1　Behavior response of farmer production consumption ecologization　Farmer production consumption ecologization behavior response indicates that farmer changes his production consumption behavior to respond to ecological consumption theory in agricultural production activity, thereby reaching the purpose of environmental protection. In this paper, macro definition of farmer production consumption ecologization behavior is conducted firstly. It shows as the behavior linking with ecological consciousness and ecological environment, which is involved in farmer production consumption process. From the microscopic point of view, farmer is a special group, with the most frequent touch with natural environment, and his production consumption behavior and living and consumption habits formed in many years cause very great influence on production and living environments, which often wastes a large number of available resources[18]. When farmer as producer, farmer's behavior mainly shows as supply behavior[19]. Farmer's production consumption ecologization behavior is a series of supply behaviors showed in ecological production of farmer individual[20].

2. 2　Behavior attitude of farmer production consumption ecologization　Farmer production consumption ecologization behavior attitude indicates farmer's views and preferences on production consumption ecologization transformation behavior. He Aizhong *et al.* think that caring attitude of rural consumer on environment and pollution perception degree significantly affect ecological consumption behavior[21]. The research on sustainable consumption behavior by Yang Zhi *et al.* shows that behavior attitude is the most major factor affecting sustainable consumption behavior

intention[22]. It is found that when farmer has better evaluation and active view on production consumption ecologization behavior, the response degree to ecologization transformation behavior is higher. Additionally, Zhao Yongke thinks that economic factor affects the selection of farmer production consumption. Guan Aihua thinks that farmer's production manner is affected by survival rationality, such as living environment[23]. On this basis, the hypothesis 1 is proposed (H$_1$): behavior attitude of farmer production consumption ecologization has significantly positive effect on ecologization behavior response.

2. 3　Subjective norm of farmer production consumption ecologization　Subjective norm generally indicates that individual could receive pressure from the outside world when making decision, which reflects the influence of the outside world on individual decision making. Subjective norm of farmer production consumption ecologization indicates that when farmer production consumption ecologization transformation behavior is conducted, maybe there is outside influence from government, company and family. Due to farmer's special labor resource endowment condition, it is easy to be affected by external factors when farmer conducts production input. Wang Mingxiang thinks that rural infrastructure, system norm and technology extension could affect farmer's consumption desire and way[24]. Ng. TL finds that farmer's production management behavior is related to social pressure[25]. On this basis, the hypothesis 2 is proposed (H$_2$): subjective norm of farmer production consumption ecologization has significantly positive effect on ecologization behavior response.

2. 4　Control cognition of farmer production consumption ecologization　Control cognition indicates the difficulty degree and controllable ability of self cognition in individual decision-making behavior. Control cognition of farmer production consumption ecologization indicates behavior control ability of conducting ecological production consumption according to the grasped resource and opportunity and perceived difficulty when farmer makes decision of ecological production consumption. The research of Yao Zengfu verifies that both production ability and national policy judgment are influence factors of control cognition[10]. Frank thinks that different farmers show different behavior modes under different self qualities and perceptions on external environment[26]. On this basis, the hypothesis 3 is proposed (H$_3$): control cognition of farmer production consumption ecologization has significantly positive effect on ecologization behavior response. Overall, theoretic model in this paper could be obtained (Fig. 1).

3　Data source and statistic analysis

3. 1　Data source　The used data were obtained by investigation in Hubei Province during July − August, 2014. To meet the equilibrium of sample distribution, 6 regions with different terrains and topographic features were selected, and 260 copies of questionnaires were collected, in which 248 copies of questionnaires were recovered, with recovery rate of 95. 3% . In effective samples, the investigated household heads were dominated by male, accounting

for 66.7%. It illustrated that male was still dominant in traditional retail farmers, and farmer's age was elder, and farmer of 40 – 60 years old accounted for 63.1%. At education degree, 96.7% of investigators were under high school and technical secondary school. Generally speaking, education degree was lower. In addition, household feature showed that average household population was 5 persons, and farming income was dominant in family income source, while non-farming income accounted for 8.9%.
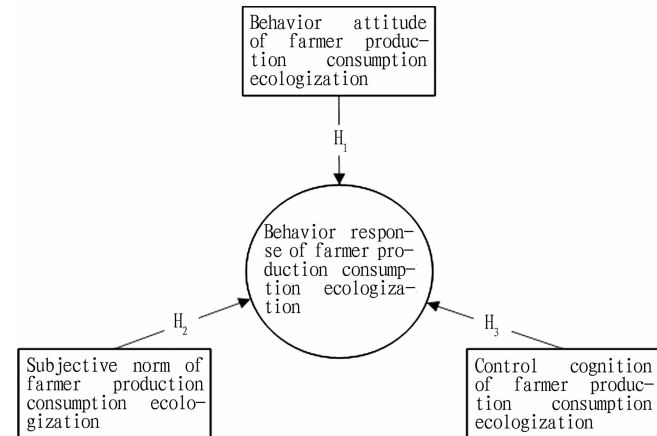

Fig. 1   Research model

3.2   Establishment of the model   To better study the influence factors of farmer production consumption ecologization response behavior, linear regression method was used in this paper. Linear regression is common method of describing the relationship between explanatory variable and multiple interpreted variables[27]. Hence, general multivariate regression model could be established:

$$Y = \beta X_i + \mu_i$$

Here, Y was dependent variable, namely farmer production consumption ecologization response behavior; X was independent variable, namely behavior attitude (X_1), subjective norm (X_2) and control cognition (X_3) of farmer production consumption ecologization; β was factor coefficient.

3.3   Variable description   According to related literatures and TPB, taking farmer production consumption ecologization behavior response as dependent variable, 23 measurement items were selected. Using Likert 5-score metering table, in the measurement of behavior attitude and subjective norm, according to agreement degree, assignment definition was conducted from "1" to "5". "1" was very disagreement, and "5" was very agreement. In the measurement of control cognition and production consumption ecologization behavior response, according to the perception degree, assignment definition was conducted from "1" to "5". "1" was the lowest perception degree, while "5" was the highest perception degree. Table 1 was meaning and descriptive statistics of specific variable.

Table 1   Variable meanings and descriptive statistics

Potential variable	Dimension	Measured item	Mean	Standard deviation
Behavior attitude (ATT)	Value rationality	Not only economic interest but also ecological production (AAT1)	4.04	1.268
	Economic rationality	Acceptance degree of ecological input fee (ATT2)	3.06	1.073
		Whether it is necessary to input fecal sewage facility (ATT3)	3.77	1.228
		Constructing comprehensive treatment facilities for livestock and poultry manure (ATT4)	3.66	1.002
	Survival rationality	Influence degree of agriculture on rural eco-environment (ATT5)	2.94	1.003
Subjective norm (SN)	Technical support	Inputting ecological treatment technology of excrement (SN1)	1.85	0.891
		Waste resource utilization technology (SN2)	3.04	0.871
	System planning	Farmer consuming organic fertilizer (SN3)	3.20	0.865
		Constructing infrastructure input (SN4)	3.13	0.931
	Social pressure	Government valuing eco-environment (SN5)	3.83	1.292
		Scale farmer valuing environmental pollution (SN6)	3.85	1.112
		Retail farmer valuing eco-environment (SN7)	3.25	1.116
Control cognition (PBC)	Ability perception	Understanding degree of ecologization by farmer (PBC1)	3.48	1.197
		Input of ecological production training (PBC2)	2.23	1.371
	Policy incentives	Satisfaction degree of ecological subsidy policy (PBC3)	2.79	1.118
		Perception of eco-environment supervising behavior (PBC4)	2.70	0.870
	Environmental perception	Participation degree of afforestation (PBC5)	3.18	0.948
		Participation degree of ecological agriculture development (PBC6)	3.16	0.903
		Perception degree of beautiful village project (PBC7)	3.30	0.956
Production consumption ecologization transformation (BEH)	Environmental consumption behavior	Input degree of ecological fertilizer (BEH1)	3.78	0.984
	Risk consumption behavior	Farmer insurance input degree (BEH2)	3.64	0.977
		The degree of willing to pay ecological production fee (BEH3)	2.04	1.016
	Comprehensive consumption behavior	Using degree of ecological agriculture mode (BEH4)	3.87	0.878

4 Model design and empirical analysis

4.1 Reliability and validity test Before factor analysis and regression analysis, reliability and validity of metering table need be detected. Seen from Table 2, reliability of each potential variable all exceeds 0.6, illustrating that each factor has better internal consistency. KMO value is more than 0.6, illustrating that it is suitable for factor analysis, and has certain reliability and validity.

Table 2 The reliability and validity test

Potential variable	Measured item	Cronbach'α(reliability)	Commonality	KMO	Bartlett's test(significance)
ATT	ATT1	0.63	0.75	0.68	227.82
	ATT2	(good)	0.54		(0.000)
	ATT3		0.75		
	ATT4		0.75		
	ATT5		0.60		
SN	SN1	0.62	0.75	0.60	421.63
	SN2	(good)	0.64		(0.000)
	SN3		0.71		
	SN4		0.71		
	SN5		0.85		
	SN6		0.89		
	SN7		0.62		
PBC	PBC1	0.61	0.50	0.73	269.31
	PBC2	(good)	0.36		(0.000)
	PBC3		0.23		
	PBC4		0.55		
	PBC5		0.59		
	PBC6		0.76		
	PBC7		0.66		
BEH	BEH1	0.72	0.72	0.68	226.02
	BEH2	(better)	0.51		(0.000)
	BEH3		0.25		
	B3H4		0.77		

Note: Commonality in the table is that after extracting principal component in factor analysis. When commonality is lower than 0.20, it shows that the measured item should be deleted. In the table, the minimum commonality value is more than 0.20, with better design.

4.2 Factor analysis To further find representative factor in the variables, the measured items with the same essence are classified into one class to extract more accurate dimension. In this paper, factor analysis of the measured item in the metering table is conducted using SPSS19.0. According to principal component analysis, Kaiser method is used when extracting factor, and the factor with the characteristic value more than 1 is retained[28]. As shown in Table 3, for behavior attitude(ATT), according to Kaiser method, two factors are extracted, and they are named as economic rationality(Fatt1) and survival rationality (Fatt2) according to load value and contribution rate. Similarly, for subjective norm(SN), three factors are extracted, and they are named as system norm (Fsn1), technical support(Fsn2) and social pressure(Fsn3); for control cognition(PBC), two factors are extracted, and they are named as policy judgment (Fpbc1) and ability perception (Fpbc2). Finally, for the analysis on farmer production consumption ecologization response behavior(BEH), one factor is extracted, which is named as comprehensive consumption behavior (Fbeh1). Thus, initial dimension division of the metering table is further modified, and the research variables and dimensions after correction are shown as Table 3. It is thought that value rationality in behavior attitude indicates choice attitude on the contraction between economic production and environmental protection, which could be generalized into economic rationality and survival rationality. Environmental perception in control cognition is farmer's cognition ability on eco-environment change caused by self consumption, which actually belongs to perception ability. Hence, dimension is revised.

4.3 Normalization processing Normalization processing of the extracted factor is conducted according to the contribution rate after rotation, and the weight of each factor is obtained (Table 3). Data normalization processing is to eliminate magnitude effect among indexes and solve comparability problem among data. After normalization processing, each index of original data is at the same magnitude order, which is suitable for comprehensive comparative evaluation. According to the weight, comprehensive scoring model of each variable is obtained. Based on comprehensive scoring model, scientific and reliable regression analysis could be conducted.

Comprehensive scoring models are as below:

$$ATT = 0.63Fatt1 + 0.37Fatt2$$
$$SN = 0.39Fsn1 + 0.37Fsn2 + 0.24Fsn3$$
$$PBC = 0.67Fpbc1 + 0.33Fpbc2$$

Seen from comprehensive scoring model, at behavior attitude of farmer production consumption ecologization, economic rationality

and survival rationality are active factors, but economic rationality possesses greater influence. It illustrates that farmer could more value economic interest obtained from the change of production consumption behavior. When farmer finds that larger economic interest could be obtained, he is often easier to change his behavior attitude. It illustrates that system has stronger guidance and deterrence on farmer's behavior decision-making and could affect farmer's subjective norm. Active forces of control cognition are policy judgment and ability perception, and the influence of policy judgment is larger. It illustrates that farmer is affected by self perception force on policy at control cognition. If policy is implemented in place, behavior response of farmer production consumption ecologization transformation is more significant.

Table 3   Extraction factors and the normalized processing results

Variable	Factor	Characteristics value	Contribution rate//%	Name of extracted factor	Contribution rate after rotation//%	Normalized weight
Behavior attitude ATT	ATT1	2.20	44.04	Economic rationality Fatt1	42.80	0.63
	ATT2	1.18	23.64	Survival rationality Fatt2	24.88	0.37
	ATT3	0.84	16.70			
	ATT4	0.42	8.30			
	ATT5	0.37	7.32			
Subjective norm SN	SN1	2.36	33.74	System norm Fsn1	28.58	0.39
	SN2	1.60	22.89	Technical support Fsn2	27.49	0.37
	SN3	1.21	17.31	Social pressure Fsn3	17.86	0.24
	SN4	0.70	9.97			
	SN5	0.51	7.35			
	SN6	0.44	6.23			
	SN7	0.18	2.52			
Control cognition PBC	PBC1	2.50	35.76	Policy judgment Fpbc1	34.76	0.67
	PBC2	1.13	16.13	Ability perception Fpbc2	17.13	0.33
	PBC3	0.97				
	PBC4	0.86				
	PBC5	0.71				
	PBC6	0.52				
	PBC7	0.31				
Production consumption ecologization response behavior BEH	BEH1	2.25	56.22	Comprehensive consumption behavior Fbeh1	100.00	1.00
	BEH2	0.85				
	BEH3	0.64				
	B3H4	0.27				

4.4   Regression analysis   According to above comprehensive scoring model, scientific weight index is endowed on dependent variable and independent variable based on the normalized processing results. Taking farmer production consumption ecologization response behavior as dependent variable, and behavior attitude, subjective norm and control cognition of farmer production consumption ecologization as independent variables, regression analysis is conducted. As shown in Table 4, $P < 0.01$, $F = 65.52$, showing that regression model is significant at the level of 0.01. P value of regression coefficient of each variable is less than 0.1, showing that regression coefficients of all variables are significant at the level of 0.1, with obvious significance.

Table 4   Regression analysis results

Item	Regression coefficient	Standard deviation	T value	P value
ATT	0.58***	0.25	10.45	0.000
SN	0.13*	0.06	1.65	0.100
PBC	0.21***	0.07	2.87	0.005
Adj R^2 =0.48		F =65.52	P =0.000	

Note: * and *** respectively show significant level of 10% and 1%.

According to Table 4, regression equation is obtained:

Ecologization behavior response(BEH) = 0.58 × behavior attitude(ATT) + 0.13 × subjective norm(SN) + 0.21 × control cognition(PBC)

It is clear that behavior attitude, subjective norm and control cognition all enter into the equation, which is significant. It illustrates that hypotheses H_1, H_2 and H_3 are established. Via further analysis on regression equation, it is found that (i) behavior attitude has the most significant influence on farmer production consumption ecologization behavior response, and its regression coef-

ficient is 0. 58, with obvious significance. It is because that consciousness is the forerunner of human action, people have what kind of ecological concept, there is what kind of ecological behavior[29]. Government could use proper economic interest to guide farmer establishing correct ecological production consumption concept. (ⅱ) Control cognition has certain influence on farmer production consumption ecologization behavior response. In regression equation, the coefficient of control cognition is 0. 21, with obvious significance. It could be explained that it is crucial whether farmer possesses information and ability to realize ecologization transformation of production consumption. But because that farmer's culture degree is lower, he generally uses the production manner with serious resource waste. (ⅲ) The influence of subjective norm on behavior response of farmer production consumption ecologization is weaker. It is because that farmer population base of China is huge, and the difference of rural environment is larger, causing that some policies and regulations are difficult to be implemented in each household. Thence, the opinion of rural leader and demonstration effect of sci-tech model agricultural household are important.

5   Conclusions and suggestions

5. 1   Conclusions   Based on TPB, using factor analysis and regression analysis, it is verified that behavior attitude, subjective norm and control cognition of farmer production consumption ecologization have significantly positive influences on farmer production consumption ecologization behavior response. By comprehensive scoring model, active factors in the variables could be seen. Active factors of behavior attitude are farmer's economic rationality and ecological rationality; powers of subjective norm are system norm, government guidance and social pressure; powers of control cognition are policy judgment and ability perception.

5. 2   Suggestions   (ⅰ) The key is transforming behavior attitude of farmer production consumption ecologization, which also corresponds with the idea of system construction as the device and concept change as the essence. It should guide farmer using green and rational consumption in production consumption link, encourages technology input and avoids excessive blind consumption. The relevant government departments could increase intensity to propagate, popularize and spread ecological consumption to farmer, and improve scientific culture quality of farmer consciously participating in and taking sustainable development way. (ⅱ) Good and targeted system construction is conducive to improving subjective norm of farmer production consumption ecologization. Government should accelerate to make and implement the *Regulations of National Agricultural Eco-environment Protection*, thereby enhancing the influence of outside on farmer behavior decision making by law and regulation. Meanwhile, it should give positive social pressure, play exemplary roles of rural leader, sci-tech model agricultural household and government cadre, and encourage ecological consumption. (ⅲ) The key of improving farmer self control cognition ability is enhancing human capital, and improving farmer's technology ability and policy judgment and understanding ability.

It should vigorously develop and promote the advanced, applicable and ecological friendly technology, and encourage farmer to learn and input ecological technology. Government policy should be implemented deeply in each household, and village cadre could be trained periodically. (ⅳ) Equal emphasis on construction and management. Government should integrate various means and regulate policy for specification and guidance of consumption behavior at each consumption link and aspect, use fund lever to support nature protection and sustainable use of resource, thereby providing necessary condition for green development transformation. It should implement eco-agriculture construction compensation policy, and give economic compensation for farmer with very fruitful ecological agriculture construction results. It should incite micro incentive policy and macro restraint mechanism taking the eco-environment construction as the target for benign circle of farmer ecological production and consumption.

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support the formulation and implementation of agricultural technical standards, so that urban agriculture can establish more technical standards with independent intellectual property rights, enhance the core competitiveness of urban agriculture and promote the extension of value chain between urban agriculture and other industries, and gradually enhance the position of urban agriculture in the value chain, and bring about upgrade of entire industry value chain through the interactive development of urban agriculture and other industries.

4 Conclusions

The Fifth Plenum of the 17th CPC Central Committee took accelerating the transformation of economic growth mode and improving comprehensiveness, coordination and sustainability of economic and social development as main tasks, which are also internal requirement of the Outlook on Scientific Development. Through building the value chain of interactive development between urban agriculture and other industries, it is expected to promote the reasonable allocation of resources, realize the conservation of resources and increase the efficiency of resource utilization, and promote the urban agricultural input to become an effective input. In this way, it can realize the transformation of agricultural development and the innovation of financing method of urban agriculture.

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