Research on Citizen's Willingness, Behavior and Influencing Factors in Digital Rural Governance ——Based on SEM-ANN Model

Xiaolong Qiu *, Keke Zhou
*e-mail:qiuxl1015@163.com,e-mail: 1072348717@qq.com

School of Management, Jiangsu University Zhenjiang, China

Abstract: Digital rural construction is not only the strategic direction of rural revitalization, but also an important content of digital China. Based on the research data from some areas in northern Jiangsu Province, this paper constructs a logical framework to influence citizens' willingness to participate in digital rural governance and governance behavior according to the Theory of Planned Behavior (TPB) and MOA model, and uses a hybrid analysis method that combines structural equation modelling (SEM) and artificial neural networks(ANN) to explore the paths of each variable and analyze the relative importance of each influencing factor. The study shows that behavioral attitude, digital literacy, opportunity and subjective norms all have positive influences on citizens' willingness to participate and governance behavior, with behavioral attitudes having the greatest degree of influence and opportunities having a significant impact on governance behaviour. Therefore, we propose some policy suggestions to vigorously promote the digitization of governance concepts, improve digital literacy in all directions, and optimize the institutional mechanism of digital rural governance.

Keywords: digital rural governance; citizen participation; SEM-ANN model; influencing factor

1 INTRODUCTION

As of June 2022, the number of rural Internet users in China reached 293 million, and the Internet penetration rate in rural areas reached 58.8%, an increase of 1.2 percentage points from December 2021 [1]. With the rise of Internet technology, new generation of digital technology represented by big data, artificial intelligence, Internet of Things, cloud computing and block-chain are accelerating penetration into agriculture and rural areas, and digital empowerment for rural revitalization has become a new development trend. Digital technologies are widely used in government services, precision poverty alleviation, agricultural development and other fields, and have become a key force of shaping a new mode of rural governance.

In the rural governance system of China, villagers' participation is one of the core elements of digital rural construction, and promoting villagers' participation in rural digital governance is an important element in realizing rural revitalization. Big data embedded in rural governance effectively solves the problems of single supply, low-quality and inefficiency of rural public services [2]. However, the perfect system and mechanism of villagers' participation has not

ICICA 2022, December 02-04, Chongqing, People's Republic of China

DOI 10.4108/eai.2-12-2022.2328019

been established yet, and the problems of digital divide and digital exclusion also reduce villagers' initiative and enthusiasm for rural digital governance, resulting in digital rural governance to fall into the trap of "surface digitization".

In the context of rural governance digitization, the issue of citizen participation has attracted the attention of more and more scholars. Su Lanlan and Peng Yanling [3] studied citizens' willingness to participate in rural governance in terms of rural digital literacy and elite identity. Li Tianlong and Jiang Chunyun [4], on the other hand, studied the influence mechanism of digital governance participation in rural areas of high-quality farmers from the perspective of information literacy, in which the satisfaction government service and the value of government information played an important role. Shen Feiwei and Du Fang [5] studied the participation of the elderly in the construction of digital villages from the perspective of inclusive governance, and made suggestions for resolving the dilemma of the "digital divide" among the elderly and improving their digital participation.

In summary, most of the current research on citizen participation in digital rural governance has focused on discussing the influence of citizen 's digital capabilities and identity on participation in governance, and lacks holistic thinking and research. Therefore, based on TPB theory and MOA model, this paper uses structural equation model (SEM) and artificial neural network (ANN) to study the influencing factors of citizens' willingness and governance behaviour in digital rural governance, with a view to providing a theoretical basis and reference for improving citizens' enthusiasm to participate in digital rural governance and promoting the construction of rural digital governance system.

2 THEORETICAL FOUNDATIONS AND RESEARCH HYPOTHESES

2.1 Theoretical foundations

Theory of Planned Behavior (TPB) is a theory to explain the process of individual decision-making behavior based on Expected Value Theory. Its core idea is that behavioral willingness is the most direct factor affecting individual behavior, and will be affected by attitudes, subjective norms and perceived behavior control. Among them, behavioral willingness refers to the motivation of individuals to perform a specific behavior, while attitude refers to the positive or negative feelings that individuals maintain about the behavior, subjective norms are the social pressure that individuals feelings to adopt a specific behavior, and perceived behavioral control is the ease or difficult of individuals performing a certain behavior. In recent years, this theory has been widely used in the field of citizen participation in environmental governance, agricultural governance, community governance, etc., which provides a strong theoretical basis and a comprehensive research perspective for this paper to study the public willingness in digital rural governance.

The MOA model, proposed by Macinnis and Jaworski in 1989, is mainly composed of three major elements: motivation, opportunity, and ability. This theory suggests that the combined effect of individual intention or motivation, ability and external constrains induce the generation of individual behaviors [6]. Motivation refers to the willingness, interest and desire

to perform a behavior (this paper replaces motivation with willingness to participate), opportunity refers to external environmental factors that can facilitate or inhibit individual behavior, and ability is manifested by the knowledge and skills that an individual possesses to perform a behaviour. In recent years, this model has been gradually applied to community governance, social governance and other aspects. Su Na [6] showed that the public's behavioral attitudes, opportunities and ability to participate in social security governance positively affect willingness to participate in governance.

2.2 Research hypotheses

According to TPB theory and MOA model, this paper combines with citizen's participation in digital rural governance practice from six dimensions: behavioral attitude, subjective norms, opportunities, digital literacy, willingness to participate and governance behavior. Based on the theoretical framework of TPB, villagers' willingness to participate is influenced by behavior attitude and subjective norms. Meanwhile the sense of identity, political efficacy, attachment to villages and other villagers' cognitive concepts will have an impact on the willingness to participate, which in turn directly affect the actual behavior of participation in rural digital governance. Based on this, this study proposes the following hypotheses:

H1: Attitude positively affects willingness to participate.

H2: Subjective norm positively influence willingness to participate.

H3: Willingness to participate positively impacts governance behavior.

Based on the MOA model, villagers' willingness (i.e. motivation) to participate in rural digital governance is influenced by opportunities and abilities. Digital infrastructure constructions, digital skills training resources and policy supports provide opportunities and channels for villagers to participate in governance. Digital literacy is an important factor affecting the villagers' willingness to govern, and continuous improvement of villagers' digital literacy will promote villagers' participation in rural governance[7],while some rural vulnerable groups will be free from the digital rural construction system due to technical exclusion[2].Based on this, this study proposes the following hypotheses:

H4: Opportunity positively affects willingness to participate.

H5: Digital literacy positively impacts willingness to participate.

H6: Opportunity positively impacts governance behavior.

H7: Digital literacy positively influences governance behavior.

In summary, the research model constructed in this paper is shown in Fig1.

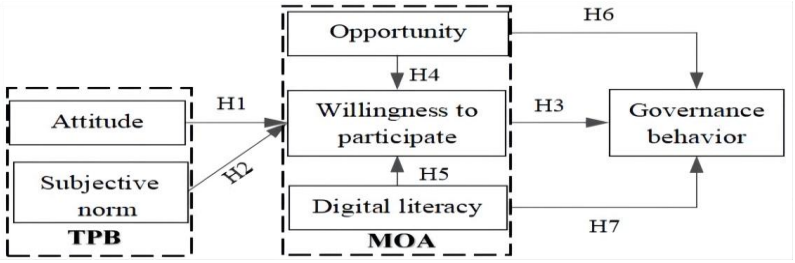

Figure 1. Diagram of the research model

3 RESEARCH DESIGN

3.1 Questionnaire design and data collection

This paper uses Likert five-point scale for questionnaire design. After consulting to expert and referring to the literature of scholars such as Su Lanlan [4], Li Tianlong [5], a total of 6 potential variables and 20 observed variables were selected.

The data in this paper comes from a field investigation of the research group in some areas of northern Jiangsu Province from July to August 2022, with Shuyang County and Sucheng District in Suqian, Feng County in Xuzhou and Donghai County in Lianyungang, all of which were digital rural pilot areas in Jiangsu Province, selected as the survey areas. A total of 410 questionnaires were distributed, and 368 valid questionnaires were finally collected, with a response rate of 91.8%. The sample composition was similar in proportion to the sample size in each survey area, with a slightly higher proportion of males among respondents(52.8%), the largest number of people aged 31-45(48.1%), and the largest proportion of high school/junior college education (57.1%).

3.2 Scale reliability and validity

In this paper, the reliability and validity of 20 observed variables were tested by SPSS24.0 to determine the stability and reliability of the results. Cronbach's α values for each variable in the scale were considered acceptable if it more than 0.7, while those above 0.8 were considered to have a good reliability. The KMO value fluctuates between 0 and 1, with larger KMO values indicating better factor analysis.

The α value for the total scale of this questionnaire was 0.832,including attitude(0.818), subjective norms(0.854), opportunity(0.826), digital literacy(0.793), willingness to participate(0.812), and governance behavior(0.839), and the α values of each sub-scale was greater than 0.7, indicating that the data samples had a good consistency. In the validity test, the KOM value of this study was 0.819 and the Bartlett's sphere test result reached a significant level($p<0.001$), indicating that the scale was suitable for factor analysis.

3.3 Validation factor analysis

In this paper, we performed confirmatory factor analysis on the scale data. For each potential variable, the combination reliability(CR) is greater than 0.7,and the average variance extraction(AVE) is greater than 0.5,which is within the ideal range. As shown in Table1,AVE value of each potential variable is between 0.502 and 0.583(both above 0.5), and CR value ranged between 0.715 and 0.846(all higher than 0.7), which indicates that the model has a good internal consistency.

Table 1 Factor load, combined reliability and average value of model

Variable	Questions	Factor load	CR	AVE	Variable	Questions	Factor load	CR	AVE
ATD	ATD1	0.690	0.821	0.536	SN	SN1	0.791	0.758	0.512
	ATD2	0.789				SN2	0.705		
	ATD3	0.758				SN3	0.644		
	ATD4	0.685			GB	GB1	0.688	0.846	0.526
OP	OP1	0.685	0.831	0.502		GB2	0.835		
	OP2	0.794				GB3	0.782		
	OP3	0.810				GB4	0.638		
	OP4	0.721				GB5	0.665		
	OP5	0.485			DL	DL1	0.732	0.807	0.583
WP	WP1	0.758	0.715	0.557		DL2	0.769		
	WP2	0.734				DL3	0.788		

4 EMPIRICAL ANALYSIS

4.1 Model fit test

In this paper, AMOS26.0 was used to evaluate the fit of the research model to observe the advantages and disadvantages of this model, removing paths(such as OP5 and GB5), and the final model was obtained after modification according to the modified index, and the fitting results: $\chi 2/df=2.858<0.3$, RMSEA=0.059<0.08,GFI=0.916>0.9,AGFI=0.870>0.8,NFI=0.905>0.9,IFI=0.912>0.9,CFI=0.910>0.9,TLI=0.905>0.9. Each index value meets the requirement of goodness of fit value, indicating that the sample model has a good fit.

4.2 Analysis of model results

The results of the best-fit model path coefficient estimation (Table2) show that all seven hypotheses proposed in this paper achieved significance with 95% confidence($p<0.05$), and all investigated hypotheses were valid. In addition, the R^2 value is 0.451, indicating that the research model had a good predictive power, and shown in Fig 2.

Table 2 Standardized path coefficients and hypothesis testing results

Hypothesis	Relationship	Std.	S.E.	C.R.	P	Result
H1	WP<-ATD	0.667	0.083	5.834	***	Support
H2	WP<-SN	0.585	0.054	4.817	***	Support
H3	GB<-WP	0.478	0.576	3.213	***	Support

H4	WP<-OP	0.427	0.053	3.562	0.018*	Support
H5	WP<-DL	0.596	0.080	4.899	***	Support
H6	GB<-OP	0.510	0.077	5.226	***	Support
H7	GB<-DL	0.320	0.137	1.448	0.025*	Support

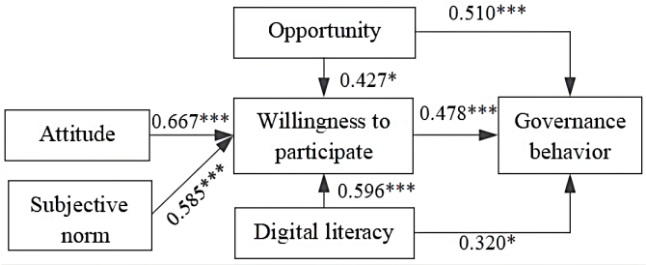

Figure 2. Modified Structural Equation Model Diagram

4.3 Artificial neural network results

In order to analyze the influencing factors of citizen's willingness to participate more deeply, we use SPSS to create an artificial neural network to quantify the importance of each factor on citizen' s willingness to participate. Combined with the above results, attitude, subjective norms, opportunities, and digital literacy were used as input neurons and willingness to participate as output neurons, as shown in Fig3.

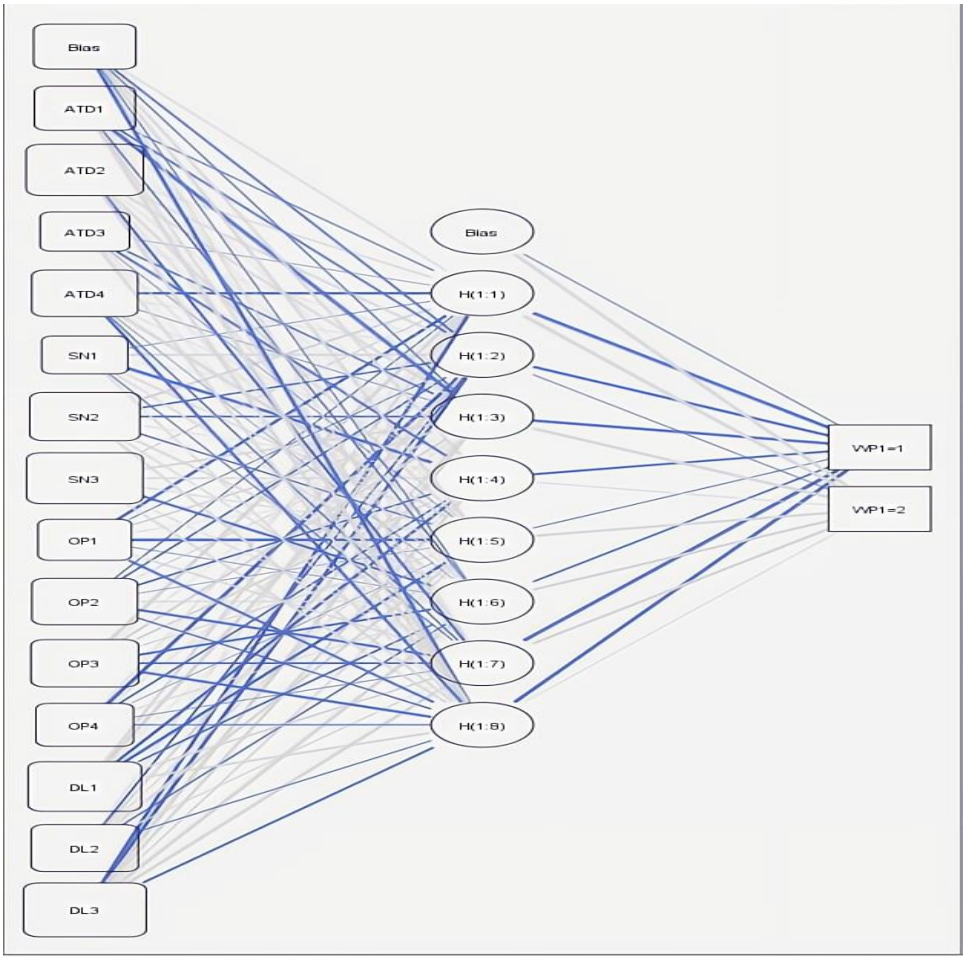

Figure 3. ANN Model Diagram

To assess the relative importance of the predictor variables, multilayer perceptron (MLP) was used for training and testing. We further utilized a cross-validated approach (ratio 80:20) to test and train the collected data to avoid over-fitting in artificial neural networks [9]. Sigmoid functions were used for the activation functions of the hidden and input layers, while the number of hidden layers was automatically generated by SPSS. In addition, we checked the goodness of fit to confirm the performance and accuracy of the artificial neural network and it was found that R^2=78.3%>45.1%, so it can be assumed that the proposed research model achieves a higher efficiency.

We showed the normalized and average importance of all predictor variables associated with neural networks in Table3. According to the sensitivity analysis, it was found that ATD2(opinions and suggestions can be timely replied by the government) is the most influential factor on citizens' willingness to participate in digital rural governance, followed by OP3(sufficient digital skills training resources), while SN2(government-supported network

inquiry) and DL3(digital social literacy) also have an important impact on residents' willingness to participate, and other factors also have different degrees of influence.

Table 3 Independent variable importance

	Importance	Nor. imp		Importance	Nor. imp
ATD2	.183	100.0%	OP1	.066	48.1%
OP3	.176	94.8%	ATD4	.059	43.6%
SN2	.168	90.5%	OP2	.048	37.8%
DL3	.157	82.4%	DL2	.040	29.7%
ATD1	.121	73.8%	SN1	.036	26.6%
DL1	.091	62.7%	ATD3	.031	23.5%
SN3	.073	54.8%	OP4	.029	20.2%

5 CONCLUSIONS

Among the influencing factors of the willingness to participate, attitude, subjective norms, opportunity and digital literacy all have significant positive effects on residents' willingness to participate in digital rural governance, with standardized path coefficients of 0.667, 0.585, 0.427 and 0.596 respectively. Behavioral attitude is the most influential, followed by numerical literacy. Digital technology has effectively expanded the public nature of rural governance, and villagers can put forward their interests through the "cloud platform", which change the past situation of "no way to petition and no way to appeal"[7]. The governance model of "digital platform + rural governance" has achieved positive interaction between villagers and the government, and villagers' sense of political efficacy, access and satisfaction with government services have been improved. And with the increasing digitization literacy of villagers, they have a deeper understanding and support for digital governance policies, behaviors and models, further increasing their enthusiasm for participating in digital governance in the countryside.

Among the influencing factors of governance behavior, opportunity, willingness to participate and digital literacy also have significant positive effects on governance behavior, with standardized path coefficients of 0.510, 0.478 and 0.320 respectively. Opportunity has the greatest degree of influence on governance behavior, which indicates that with the improvement of rural digital infrastructures, digital competence and the development of digital skills training, villagers have more opportunities to participate in village governance and enhance their team and collective consciousness in the process of online communication. And their sense of dependence and belonging to village are also enhanced, which in turn promotes the further development of digital rural governance.

6 SUGGESTION

First, change the traditional concept of village management and promote the digital transformation of governance concept. Villagers are the main body of digital rural governance and the endogenous impetus of digital rural construction. We should break the closed conservative concepts of traditional village management, enhance the main body consciousness

and identity identity of villagers [5]. And guide them to accept new technologies and actively participate in digital rural governance through the development concept of co-governance sharing, while a team of digitally-minded talents should be cultivated to provide intellectual support for digital village governance.

Second, focus on improving digital literacy and promoting the upgrading of governance capacity. We shall incorporate the upgrading of villagers' digital capability into the overall plan of rural revitalization development, and fully mobilize the strength of multiple parties through government, school education, community training and other institutions to comprehensively improve villagers' digitization ability and effectively promote a deeper fit between the Internet technology and rural governance. So as to further promote the transformation of rural governance and narrow the "digital divide" between urban and rural areas [3].

Third, innovate the digital rural governance cooperation mechanism and promote the upgrading of governance methods. We shall actively carry out "Internet + government services" and "Internet + rural governance" to fully release the digital dividends of rural society, make full use of the Internet and other digital medias to expand villagers' participation channels, stimulate villagers' political participation awareness and initiative to participate in rural governance, enhance the democracy of villagers' autonomy in terms of breadth and depth [2], and effectively improve the level of rural governance.

REFERENCES

[1] China Internet Network Information Center. The 50th Statistical Reports on Internet Development in China [EB/OL].(2022-08-31) http://www.cnnic.net.cn/n4/2022/0914/c88-10226.html.

[2] Wang B, Sun Y.L.Big data helps modernization of rural governance. J. Macroeconomic Management,2021,07:51-57.

[3] Su L.L, Peng Y.L.Farmers' Digital Literacy, Elite Identity and Participation in Rural Digital Governance. J. Journal of Agrotechnical Economics,2022,01:34-50.

[4] Li T.L, Jiang C.Y.Mechanisms of information literacy on the participation of highly qualified farmers in rural digital governance:An empirical basis from 1280 highly qualified farmers in Northwest China. J. E-Government,2022,06:86-98.

[5] Shen F.W, Du F.Governance Limits and Optimization Strategies of Digital Countryside: From the Perspective of Governance Modernization. J. Journal of Nanjing Agricultural University (Social Sciences Edition),2022,22(04):134-144.

[6] Su N, Pang J.H.Study on the Willingness, Behavior and Influencing Factors of Public Participation in Social Security Governance: Based on TPB theory and MOA model. J. Journal of People's Public Security University of China(Social Science Edition),2022,36(06):143-150.

[7] Lei X.K, Zhang T.Digital Governance: Research on Policy Path of Public Participation in Social fine Governance. J. Theory Journal,2021,03:31-39.

[8] Khadija A, Mohammed H, Said A.S.Examining the factors influencing the mobile learning usage during COVID-19 pandemic: An integrated SEM-ANN method. J. IEEE Access, 2021,v9:102567-102578.