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Research Article

Research on the Impact and Utility of Rural Revitalization Big Data Service on Farmers Based on Integrated Technology Acceptance Model

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The integrated technology acceptance model was proposed in 2003 and has been gradually applied in many fields since then. At present, the promotion of agricultural big data has achieved initial results, and a number of agricultural big data practice demonstration projects have been formed. For example, Shandong Province supports the establishment of the "Big Data Platform of Bohai Granary Science and Technology Demonstration Project," which includes four modules of data collection, mining and analysis, monitoring and early warning, and decision-making service. It is characterized by the diversity of massive data sources, the integration of historical and real-time data, and multifactor comprehensive analysis and decision making. However, farmers, as an important service subject of agricultural big data platform, do not have strong willingness to participate. In the era of big data, it is still difficult for farmers to obtain data information and services, and their ability to obtain, screen, and use data is poor. Therefore, it is of great practical significance to effectively improve farmers' willingness to adopt and use agricultural big data. Based on the integrated technology acceptance model, this study analyzed the impact of big data service of rural revitalization on farmers. Firstly, the basic content of integration technology acceptance theory was analyzed, and the research hypothesis was proposed based on this theory. After that, the questionnaire survey was used to empirically analyze the impact of big data service on farmers. Reliability and validity test, correlation test, goodness of fit test, and path system test were carried out on the analysis results to prove the factors that affect farmers' behavior and attitude of using big data.

1. Introduction

In the context of slowing global economic growth, digital economy can play a role in promoting industrial efficiency. Therefore, digital economy has gradually become the focus of many industries to improve their competitiveness [1, 2]. In the digital economy, big data, as the core element, plays an important role in improving industrial relations, innovating business models, and promoting industrial integration [3]. The continuous evolution and all-round innovation of emerging technologies have accelerated the deep integration with various economic and social fields. Integrated technology acceptance model is driving digital transformation and upgrading of agriculture, industry, and services, and it also triggered changes in the business form of related industries and fields and the adjustment of the industrial structure [4]. Science and technology are the primary productive forces. In the long run, the development of country's agricultural and rural farmers will ultimately depend on science and technology [5]. Agricultural technology service is an important link of transforming agricultural science and technology achievements into productive forces. Scholars at home and abroad have paid attention to the research on agricultural big data. Especially after 2015, the research achievements have been constantly enriched, such as the introduction of the concept and connotation of agricultural big data and the discussion on the technical realization and application prospect of agricultural big data platform. Based on the perspective of big data application, Weigel et al. [6] conducted in-depth analysis and discussion on how big data can solve the problems of agricultural production and operation. Based on the technical perspective, Lv [7] believed that multiple linear regression and other data mining technologies could clarify the relationship between numerous variables, so as to improve the utilization rate of big data for rural revitalization. Ge and Li [8] analyzed different open-source big data mining technologies based on the characteristics of spatial-temporal attributes of big data for rural revitalization and summarized the characteristics of big data systems suitable for agricultural needs. Zhao et al. [9] designed a data analysis platform for fine agriculture based on users' demand for agricultural big data platform application services and introduced the architecture and function services of the data platform in detail. Agricultural technology service has always been concerned and valued, taking science and technology as the fundamental way to realize the sustainable and stable development of agriculture [10, 11]. The Chinese government will substantially increase input in agricultural science and technology, continue to maintain the strategy of developing agriculture through science and education, further break through the existing institutional obstacles, and better promote the leap-forward development of agricultural science and technology [12]. In 2020, the scale of the digital economy exceeded 3.315 billion yuan, accounting for 35.11% of the total GDP. Combining it with big data when promoting rural industries can give birth to more new models and drive the development of production-oriented agriculture into demand-oriented agriculture [13]. Farmers are the basic unit of rural economy and the service object of big data. Therefore, in the context of implementing the rural revitalization strategy, giving play to the service role of big data will also have an impact on farmers by improving their ability to obtain and apply information and increasing their income [14].

2. Construction of Integrated Technology Acceptance Model

2.1. Integrated Technology Acceptance Theory. The development basis of integrated technology acceptance theory includes PC utilization theory, motivation theory, innovation diffusion theory, planned behavior theory, rational behavior theory, technology adaptation theory, social cognition theory, and so on [15]. With the development of the theory, some scholars systematically described the theory and proposed the core construct of integrated technology acceptance theory, and the independent variables include performance expectancy, effort expectancy, social influence, and facility condition, and the moderating variables include voluntary use, experience, age, and gender [16].

The integrated technology acceptance model is shown in Figure 1.

In Figure 1, ① performance expectancy refers to the degree to which an individual believes that using the system or technology will help him improve his work performance; ② effort expectancy is the ease of use of the system; ③ social influence refers to the degree of influence of social group on individual behavior; ④ facility condition is the degree to which an individual thinks an organization and technical infrastructure support the use of the system [17]. According to Figure 1, it can be seen that there is a positive correlation between individual use behavior and behavior intention. If the behavior intention is strong, the possibility of user behavior will be high. In addition, the individual's social influence, effort expectancy, and performance expectancy will also affect the behavior intention and then further affect the user behavior. In the analysis of the impact of big data service on rural revitalization on farmers, the integrated technology acceptance theory is applied to analyze the impact of various variables on farmers' behavior.

According to the integration technology acceptance model, there is a highly positive correlation between the willingness to adopt and the use behavior, and the stronger the willingness to adopt, the higher the possibility of the actual action. The three main variables of individual performance expectation, effort expectation, and social influence jointly affect adoption intention, and convenience conditions directly lead to the emergence of use behavior. In addition, many scholars' empirical studies show that information quality and perceived cost have a significant impact on the willingness to use new information technology. Therefore, in this study, two variables, information quality and perceived cost, are introduced to test the key influencing factors of willingness to use big data and behavior of rural revitalization in a more comprehensive and reliable way.

2.2. Research Hypothesis. Based on the integrated technology acceptance model, the behavior intention of farmers to rural strategic big data services will have an impact on their user behavior. Among them, farmers' behavior intention refers to their attitude towards rural strategic big data service, which can be divided into positive attitude and negative attitude [18]. The meanings of variables in the integrated technology acceptance theory are as follows: facility condition refers to the degree of support generated by technical equipment, organization, and environment that farmers experience in the process of enjoying services; social influence refers to the influence of farmers who have used rural strategic big data services on farmers who have not used rural strategic big data services; effort expectancy refers to the energy and time that farmers need to pay when learning rural strategic big data technology [19]; performance expectancy refers to farmers' belief that rural strategic big data service will improve their work performance, reflecting farmers' recognition of rural strategic big data service.

Therefore, the utility hypothesis of the impact of big data service of rural revitalization on farmers based on the integrated technology acceptance model is as follows:

H1: performance expectancy has a positive impact on farmers' behavior intention to rural strategic big data service.

H2: effort expectancy has a positive impact on farmers' behavior intention to rural strategic big data service.

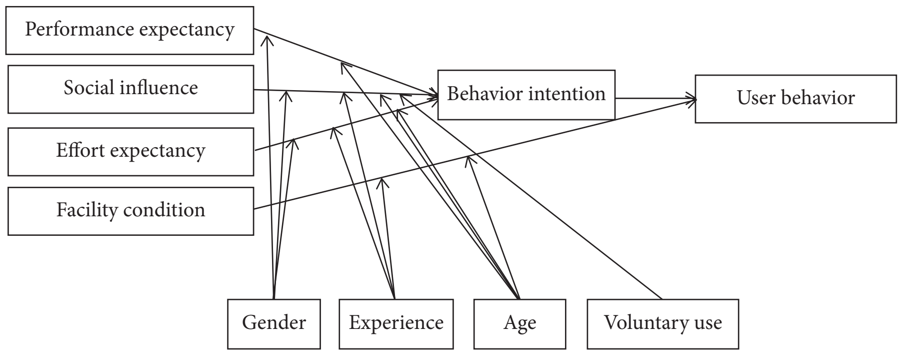

Figure 1: Integrated technology acceptance model.

H3: social influence has a positive impact on farmers' behavior intention to rural strategic big data service.

H4: facility condition has a positive impact on farmers' user behavior intention to rural strategic big data service.

H5: behavior intention has a positive impact on farmers' user behavior to rural strategic big data service.

Cost factors will also have an impact on the use of new big data technologies, and the price, expense, and cost in the use of big data services will also affect the behavior intention of farmers. In addition, data quality will also have an impact on farmers' behavior intention to provide big data services. Therefore, two variables, which are data quality and perceived cost, are added in this study. Thus, the hypothesis is obtained:

H6: data quality has a positive impact on farmers' behavior intention to rural strategic big data services.

H7: perceived cost has a positive impact on farmers' behavior intention to rural strategic big data services.

An analysis framework based on the integrated technology acceptance model is shown in Figure 2.

3. Empirical Analysis

3.1. Respondents. This study takes representative county XX as the field visit object, household interviews had been completed from April to September 2021, and questionnaires had been distributed to 500 randomly selected respondents. According to the statistics, 500 questionnaires were collected and 496 valid questionnaires were obtained after removing 4 invalid questionnaires, with the efficiency of 99.20%. In the valid questionnaire, the basic information of respondents is shown in Table 1.

3.2. Questionnaire. In designing the questionnaire, 5-point Likert scale was used [20], and performance expectancy, behavior intention, effort expectancy, social influence, facility condition, user behavior, data quality, and perceived cost were taken as latent variables. For the assignment of variables, 1 meant completely disagree, ascending in order, and 5 meant completely agree. Based on the contents of the classical scale, the questionnaire was revised according to the data of the agricultural big data platform and the characteristics of farmers to form the final questionnaire.

3.3. Variable Results. The statistical results of potential variables and observable variables in the questionnaire based on the comprehensive technology acceptance model are shown in Table 2.

3.4. Reliability and Validity Test. The consistency degree of the questionnaire was obtained through reliability analysis, and Cronbach's alpha value was used to represent the reliability analysis results. According to statistics, Cronbach's alpha of the 8 variables of the questionnaire was significantly higher than the threshold value 0.7, indicating that the questionnaire had high reliability and met the requirements. The results of reliability are shown in Table 3.

In this study, SPSS19.0 was used for validity analysis. According to calculation, the statistical value of KMO in validity analysis results was 0.913, which was significantly higher than the threshold value of 0.7, indicating that questionnaire analysis had strong feasibility. The results of validity analysis are shown in Table 4.

3.5. Correlation Test. We determine the correlation between variables by testing the correlation coefficients of variables; after statistics, the results of the correlation test are shown in Table 5.

3.6. Goodness-of-Fit Test. In this study, the goodness of fit of the questionnaire was tested by applying the simple fit index (fit standard >0.50), the value-added fit index (fit standard >0.90), and the absolute fit index (fit standard: GFI > 0.90, RMSEA < 0.05, CMIN/DF < 3) [21], and the results of the goodness-of-fit test are shown in Table 6.

The results of the goodness-of-fit test show that the analytical framework constructed in this paper is generally well explained.

3.7. Path Coefficient Test. The results of the path coefficient test are shown in Figure 3.

The path coefficient test results show that the influence coefficients of social influence and performance expectancy

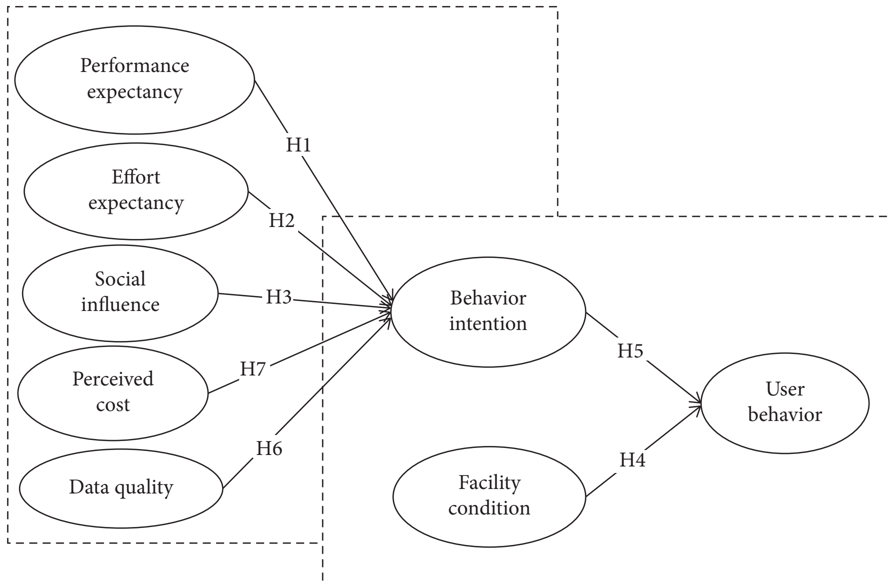

Figure 2: An analysis framework based on the integrated technology acceptance model.

Table 1: Basic information of respondents.

Attribute	Classification	Frequency	Proportion (%)
Gender	Male	215	43.35
	Female	281	56.65
Age	Aged 20 and under	13	2.62
	21–30	129	26.61
	31–40	173	34.88
	41–50	114	22.98
	Aged 51 and above	67	12.91
Education background	Junior high school and below	194	39.11
	High school	163	32.86
	Junior college	119	23.99
	Undergraduate course	19	0.38
	Master degree or above	1	3.66
Annual income	2,000 yuan or less	72	14.52
	2,001–8,000 yuan	162	32.66
	8,001–15,000 yuan	169	34.07
	15,001 yuan or above	93	18.75

Table 2: Statistical results of latent variables and observable variables in the questionnaire based on the integrated technology acceptance model.

Latent variable name	Observable variable
Performance expectancy (A)	A1: increase rural household income
	A2: save agricultural production time
	A3: more efficient access to crop information
Effort expectancy (B)	B1: understand the interaction with the platform
	B2: big data is convenient and simple to operate
Social influence (C)	C1: agricultural technology promoters recommend big data services
	C2: big data service recommended by large growers or breeders
	C3: friends recommend big data services
Facility condition (D)	D1: the network coverage in the area is good
	D2: big data service quality is high
	D3: big data services are efficient

Table 2: Continued.

Latent variable name	Observable variable
Perceived cost (E)	E1: the price of smart phone terminal is high E2: information service subscription price is high E3: the monthly rent is high E4: high traffic cost
Data quality (F)	F1: big data is easy to understand F2: the timeliness of big data is high F3: the reliability of big data is high F4: big data is highly accurate
Behavior intention (G)	G1: plan to use big data services G2: willing to use big data services frequently G3: plan to recommend big data services to other farmers
User behavior (H)	H1: help other farmers use big data services H2: has already started production through big data services

Table 3: The results of reliability.

Number of terms	Cronbach's alpha	Cronbach's alpha based on standardized terms
8	0.912	0.929

Table 4: The results of validity analysis.

Sampling adequacy of KMO metrics		0.913
Bartlett sphericity test	Approximate chi-square	4751.309
	df	177
	Sig.	.000

Table 5: The results of the correlation test.

Variable	A	B	C	D	E	F	G	H
A	1							
B	0.314	1						
C	0.409	0.396	1					
D	0.288	0.327	0.314	1				
E	0.364	0.258	0.293	0.405	1			
F	0.428	0.276	0.245	0.292	0.314	1		
G	0.369	0.247	0.283	0.364	0.299	0.307	1	
H	0.421	0.284	0.314	0.287	0.351	0.364	0.435	1

Table 6: The results of the goodness-of-fit test.

Indicator category	Evaluation index	Inspection results	Moderate judgment
Simple fit index	PGFI	0.502	Good
	PNFI	0.517	Good
	PCFI	0.521	Good
Value-added fit index	IFI	0.919	Good
	CFI	0.924	Good
Absolute fit index	GFI	0.923	Good
	RMSEA	0.045	Good
	CMIN/DF	2.121	Good

on farmers' behavior intention are 0.515 and 0.868, that is, the influence of the two on the behavior intention of farmers' big data service is positively correlated, which means hypothesis 1 and hypothesis 3 are valid. The effect of effort expectancy on behavior intention is not obvious, that is, hypothesis 2 is not valid. Data quality has a positive correlation with the behavior intention of farmers' big data service, that is, hypothesis 6 is valid. There is no correlation between perceived cost and farmers' behavior intention, that is, hypothesis 4 is not valid. Facility condition and behavior intention have a positive impact on big data service usage behavior, that, is hypothesis 4 and hypothesis 5 are valid.

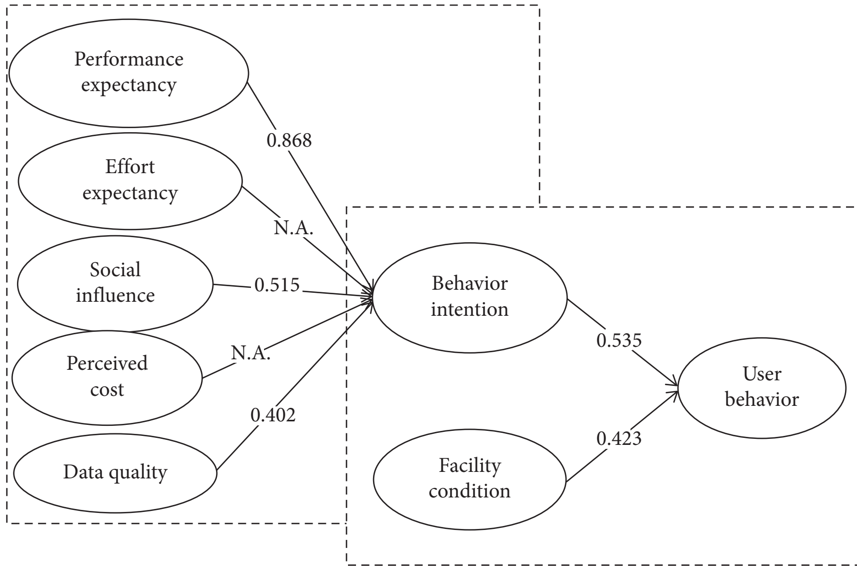

Figure 3: The results of the path coefficient test.

4. Research Conclusion

In this study, smart PLS is used to analyze data, which has the following advantages. It can solve the problem of model identification difficulty or inability caused by too many measurement indexes, non-positive definite matrix, and coefficient greater than 1. In terms of fitting, it can solve the problem of insufficient goodness of fit caused by too complex models. In addition, the software can solve the problem of parameter estimation error caused by seriously non-normal distribution of data. At the same time, based on the integration of the technology acceptance model, a connection is established between the internal beliefs, attitudes, and intentions existing in the technology acceptance model and the differences between different individuals, environmental constraints, and controllable interference factors, so as to more systematically analyze the impact of the big data service of rural revitalization on farmers. The integrated technology acceptance model combines with the characteristics of big data services and can reflect the pre-influencing factors of big data service user behavior. Through the use of agricultural big data platform, it can help farmers to obtain more accurate and timely information, manage planting, improve planting quality, and then improve their income level. Due to the social characteristics of rural areas, farmers are easily influenced by surrounding farmers in the use of agricultural big data. The higher the quality of agricultural big data is, the less time and energy farmers spend on data screening. The authenticity, effectiveness, accuracy, and timeliness of big data will help farmers' agricultural production to some extent, so the higher the data quality is, the more willing the farmers are to use big data in agriculture. At the same time, farmers are more willing to use agricultural big data when they feel that the conditions are convenient. The empirical analysis results show that facility condition and behavior intention are the key factors influencing farmers' use behavior of big data services, while data quality, social influence, and performance expectancy are the key prefactors influencing farmers' use behavior.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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