

Research on the Mechanism and Optimization Path of Agricultural Internet of Things Practice based on Structural Equation Model

Ting Wu^{1, *}, Yishan Xiao¹, Ying Zhang²

¹School of Economics, Anhui University of Finance and Economics, Bengbu, 233030, China

²School of International Economics and Trade, Anhui University of Finance and Economics, Bengbu, Anhui 233030, China

* Corresponding Author

Abstract: Agricultural Internet of Things (IoT) technology is the cornerstone of China's comprehensive implementation of rural revitalization strategy, which has a profound impact on China's rural construction and modernized and intelligent agricultural industry, and is an important driving force to promote the change of "three rural areas". This study takes Anhui Province as an example, and obtains accurate data on the application mode of agricultural IOT and the assessment level of modern agriculture development through relevant surveys, and uses SEM structural equation model to hypothesize and verify the mechanism model of agricultural IOT in modern agriculture. Then the current problems of agricultural IoT development are proposed according to the model, and finally specific policy suggestions are proposed from three levels: government, enterprises and farmers to promote agricultural IoT development and rural revitalization.

Keywords: Agricultural Internet of Things, Modern agriculture, Rural revitalization.

1. Introduction

In recent years, all over the country have continued to focus on accelerating the transformation of new agricultural information and the construction of new digital countryside systems, promoting the realization of a new generation of information technology development and deep penetration and integration with agricultural production and business methods, and the development and level of smart agriculture technology is constantly improving. [1] With the continuous penetration of Internet of Things information technology in various fields in China, the construction of smart agriculture is unable to leave the support of Internet of Things technology. Internet of Things (IoT) is mainly refers to the real-time tracking and collection of data information through various communication devices and facilities and information processing technology and can be accessed through various possible networks to achieve the ubiquitous connection of things and things, things and people, to achieve a highly intelligent sensing, identification and management of objects and processes in the environment [2]. Agricultural IoT, on the other hand, is an IoT that can be displayed in real time by various instruments or participate in automatic control as a covariate of automatic control [3]. In the macro direction, agricultural IOT information technology has an important leading role in the development of informationization in China's agricultural field, changing the traditional way of planting agriculture and promoting intelligent and refined planting agriculture [4]; in the micro scale, it can help human beings to cognize, manage and control various elements, processes and systems in agriculture in a more detailed and dynamic way, greatly enhancing human beings' knowledge of the life essence of agricultural plants and animals It can greatly improve human's cognitive ability of the nature of life of agricultural plants and animals, dynamic and intelligent regulation of complex agricultural ecosystems, and the ability to deal with agricultural emergencies [5]. Agricultural IoT

technology provides a solution for countries around the world to liberate and transform traditional agriculture into modern agriculture that is compatible with the development level of modern society.

China's smart agriculture is in a historic opportunity period of development, and the use of information technology has become a necessary way to solve and promote the development of modern agriculture. China's "Fourteenth Five-Year Plan" on the digitalization of agriculture, agricultural machinery intelligent guidelines and guiding policies for the development of this field brings good prospects, "Internet of things + agriculture" is the inevitable trend of China's agricultural development. Restrictions on the level of agricultural development across the country, the type of development varies, resulting in the development of modern agricultural IOT technology around the current stage there are different outstanding problems such as weak infrastructure, supporting mechanisms are not perfect, the standard system is not mature, agricultural IOT technology development, promotion, application is facing a lot of challenges.

Based on the above reasons, this paper firstly proposes a theoretical model and research hypothesis to construct the mechanism of the role of agricultural IOT in promoting the development of modern agriculture; and then prices the research method, including questionnaire design, sample data collection and model testing, to provide the theoretical basis and mechanism analysis for the optimal path of application, development and promotion of agricultural IOT technology in order to better promote the development of smart agriculture.

2. Theoretical Model and Research Hypothesis

2.1. Theoretical Model

The rural revitalization strategy proposed by General

Secretary Xi Jinping in the report of the 19th National Congress calls for adhering to the priority development of agriculture and rural areas, accelerating the modernization of agriculture and rural areas according to the general requirements of prosperous industry, ecological livability, civilized countryside, effective governance and affluent living, and becoming an inevitable choice to effectively resolve the major social contradictions in rural areas. The rural revitalization strategy is a major innovation in the theory and practice of modern rural development. Its goal is summarized as "five major constructions", and industrial prosperity is an important foundation for economic construction, focusing on resource integration, industrial cultivation, economic transformation and income growth. As a key technology in the agricultural industry, agricultural Internet of Things plays an important role as the "engine" of rural revitalization.

In the study of indicator evaluation system of modern agricultural development status, scholars have constructed a whole set of indicator evaluation system from different perspectives and using different research methods. Taking modern agricultural science and technology parks as the evaluation carrier, Zhai Huqu, Zeng Xibai, Shen Guiyin and Jiang Heping (2003) constructed an index evaluation system for modern agricultural science and technology parks using hierarchical analysis and efficacy coefficient method with five indexes of technical indexes, economic efficiency indexes, ecological efficiency indexes, infrastructure, and organizational management with weights from high to low. Yu Fengxiang (2004) constructed a modern agricultural science and technology park index evaluation system with five primary indicators of mechanism and management, demonstration and driving ability, scientific and technological ability, ecology and infrastructure construction, and overall effect, and 22 secondary indicators of development mode, relevant policies, transformation of scientific and technological ability, talent introduction and technical training. Qi Cheng (2009) used hierarchical analysis and Delphi method to select 20 specific indicators from five major aspects: material equipment, science and technology and management, labor, economic benefits, social benefits, and ecological benefits to build a hierarchical hierarchy and analyze and calculate their weights to establish an indicator evaluation system for modern agricultural development.

As for the mechanism of agricultural IoT in modern agriculture, Lian Min (2013) compares the architecture and application cases of intelligent agricultural IoT, points out that there are problems of standard system and key technology in agricultural IoT, and believes that by solving the problems, it can profoundly affect the development of modern agriculture and bring revolutionary changes. Ge, Wenjie and Zhao, Chunjiang (2014) proposed that China's agricultural IoT applications need to be closely focused on the major needs of developing modern agriculture, according to the development idea of "breakthrough at the two ends (sensing and application) and crossing over in the middle (communication and transmission)", which will play an important role in transforming traditional agriculture and developing modern agriculture [6]. According to Dou Yueying (2022), under the premise that agricultural IOT technology is developing in the direction of standardization of agricultural IOT architecture, continuous development of agricultural information sensing technology, continuous progress of agricultural information transmission technology

and continuous optimization of agricultural intelligent information processing technology, IOT has made a great contribution to the modern agricultural industry in achieving high quality and high yield, safety progress and wisdom construction with the continuous progress, upgrading and optimization of technology. greater contribution.

In summary, it is found that, firstly, although the current research on the role mechanism of agricultural Internet of Things in promoting the development of modern agriculture is mainly descriptive analysis, there is less quantitative research on it; secondly, there is no unified and more standard direction of the impact of agricultural Internet of Things on the development of modern agriculture, and we can only refer to the index evaluation system of modern agriculture and the five strategies of rural revitalization to get the factors of agricultural Internet of Things affecting the development of modern agriculture. Based on this logic, "talent", "facilities", "industry" and "ecology" are selected as the latent variables of IOT in modern agriculture. Based on this logic, we choose "talent", "facilities", "industry" and "ecology" as the latent variables of modern agriculture and "farmers' income" as the direct manifestation of modern agriculture development, and draw up the practical mechanism model of agricultural Internet of Things. The research model of this paper is shown in Figure 1.

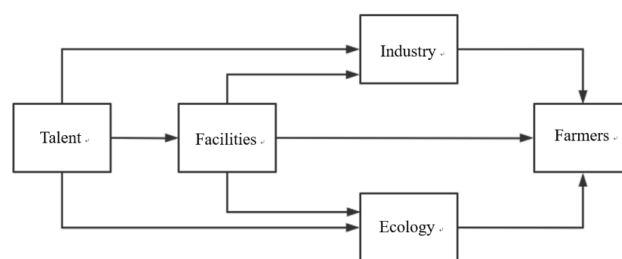


Figure 1. Study model

2.2. Basic Assumptions

2.2.1. Agricultural Iot Talents and Agricultural Industry, Agroecology

The "Fourteenth Five-Year Plan" for the modernization of agriculture and rural areas in Anhui Province points out that it is necessary to base on the self-reliance and self-improvement of agricultural science and technology, and implement a number of special projects for the revitalization of the countryside around key areas such as biological breeding, deep processing of agricultural products, prevention and control of animal and plant diseases, modern agricultural machinery and equipment, digital agriculture, and agricultural ecology and environmental protection. Vigorously cultivate agricultural science and technology talents, and implement a new round of agricultural research outstanding talents training program and outstanding young agricultural scientists program [7]. The application and development of agricultural IoT requires the introduction and cultivation of relevant professional talents, who provide policy recommendations for the application of agricultural IoT to agricultural industry and ecology through scientific and technological R&D and academic research, thus promoting the development of agricultural industry and agricultural ecology. In view of this, this paper puts forward the following hypotheses.

Hypothesis 1: Agricultural IoT talent positively affects agroecology.

Hypothesis 2: Agricultural IoT talent positively affects the

agricultural industry.

2.2.2. Agricultural IOT Talents and Agricultural Facilities

The promotion of agricultural Internet of Things needs to strengthen the training of farmers' cell phone application skills, only through training to let farmers master smart phones and the basic theory of information technology, improve the ability of farmers to use modern information technology to obtain production market information, network marketing, online payment, intelligent remote management, etc., in order to make the agricultural Internet of Things can be the whole "net move" up! [8]. It can be seen that by strengthening farmers' skills training can help farmers master agricultural IOT technology and application equipment quickly and efficiently, so that they can be put into agricultural production. In view of this, the following hypotheses are proposed in this paper.

Hypothesis 3: Agri-IoT talent positively affects agricultural facilities.

2.2.3. Agricultural IOT Facilities and Farmers' Income

Agricultural IoT application devices are intelligent and provide great convenience to farmers' production life. For example, in the process of fine farming, IoT devices can be configured to livestock, so that the owner can grasp its health status and location in real time. The owner can take the most appropriate action according to the physiological state of the livestock to maximize the benefits. In addition, the adoption of animals and plants in some public welfare activities can also be carried out more smoothly through the Internet of Things. Even if the adopted animals and plants are far away from the adopted animals and plants and cannot visit the field often, the adopter can communicate smoothly with the foster farmer through IoT and keep track of the growth of the animals and plants in detail, and this measure brings more fine income to the farmer [9]. In view of this, the following hypothesis is proposed in this paper.

Hypothesis 4: Agricultural IoT facilities positively affect farmers' income.

2.2.4. Agricultural Internet of Things Facilities, Agricultural Industry and Farmers' Income

As one of the important application directions of IoT technology, agricultural IoT plays a crucial role in the innovation of agricultural production [10]. Promoting the application of IOT technology in rural rural revitalization can help realize the application and popularization of technologies such as cloud computing, big data, mobile Internet and spatial geographic information in rural production and operation, realize industrial structure adjustment and convergence with the demand of various products as a guide, strengthen the connection between production and marketing, provide information platform and technology for the communication and coordination of various industries in rural areas, and thus help rural areas It helps various industries in rural areas to find industrial structures and models suitable for their own development, and thus promotes the optimization and upgrading of industrial structures in rural areas [11]. The optimization of industrial structure stimulates the endogenous power of agriculture and rural areas, and drives farmers to increase their income and get rich. In view of this, this paper puts forward the following hypotheses.

Hypothesis 5: Agricultural IoT facilities positively affect the agricultural industry.

Hypothesis 6: Agro-industry positively affects farmers' income.

2.2.5. Agricultural Internet of Things Facilities, Agroecology and Farmers' Income

Under the basic condition of "small farmers in a large country", "living off the sky" has greatly limited agricultural development. Agriculture has become vulnerable to natural disasters in areas where natural disasters are frequent and heavy. The development of agricultural Internet of Things and agricultural big data, the use of sensor devices to improve the monitoring and early warning, emergency prevention and control, joint prevention and control capabilities, early detection, early warning, early prevention and control, effective containment of food crop disease outbreaks and the spread of malignant spread, reduce agricultural production costs, improve competitiveness, is important to ensure the safety of food production and promote food production and harvest [12]. In view of this, the following hypotheses are proposed in this paper.

Hypothesis 7: Agricultural IoT facilities positively affect agroecology.

Hypothesis 8: Agroecology positively affects farmers' income.

3. Study Design

3.1. Questionnaire Design

Based on the hypothetical model obtained from the mechanism analysis and the realistic challenges of agricultural Internet of Things (IoT) obtained from the relevant literature, we designed the questionnaire of "Research on the related issues of agricultural IoT" (see Annex I for details of the questionnaire). Based on the basic principles of the questionnaire, the questionnaire was distributed online to the Internet users in Anhui Province in order to obtain real, reliable and comprehensive data. The questionnaire mainly includes the distribution and collection of the questionnaire, the statistics of the questionnaire and the analysis of the questionnaire. The questionnaire was designed using a five-point Likert scale, with 1 indicating "strongly disagree" and 5 indicating "strongly agree". The questionnaire contains 5 factors and 16 items.

3.2. Data Collection

First, the questionnaires were distributed. Through questionnaire design, the authors of this paper used web information technology to collect information, create questionnaires, distribute them and collect them. The questionnaire was created according to the mechanism of the role of agricultural Internet of Things in contributing to the development of modern agriculture and its empirical research theme. The questionnaires were distributed mainly on August 2, 2022 and August 3, 2022.

Secondly, the collection and collation of questionnaires. on August 4, 2022, the distribution of all the questionnaires for this paper was completed, and finally all the distributed questionnaires were collected and collated. Excel software was used to organize and process the relevant data. The basic questionnaire statistics are as follows: 300 questionnaires were distributed in total, 290 questionnaires were collected, and the questionnaire recovery rate was 95.7%; 290 questionnaires were carefully reviewed, and the final number of valid questionnaires was determined to be 287, and the valid questionnaire rate was 98.97%.

Table 1. Variable construction

Potential Variables	Measurement problem items
Talent (A)	A1 Further research and development of agricultural IoT requires the introduction of a large number of composite talents combining knowledge and skills A2 The promotion of agricultural IoT technology requires vocational skills training for farmers A3 The wide application of agricultural Internet of Things requires the establishment of a set of agricultural extension service system to solve technical problems for farmers
Facilities (B)	B1 agricultural Internet of things so that automated collection equipment, agricultural sensors, camera monitoring, pest monitoring and early warning and other industrial facilities and equipment conditions significantly improved B2 Agricultural Internet of Things enables remote control, full automatic control or instant detection, and other agricultural technology innovation levels to continue to improve B3 Application of agricultural Internet of Things to increase the area of machine tillage and machine sowing
Industry (C)	C1 Ability to increase the ability of agricultural products to add power and improve the quality of agricultural products C2 make rural e-commerce logistics and other forms of new models appear C3 Promote branding of agricultural products C4 Application of Agricultural Internet of Things to Improve Mechanization of Local Agriculture
Ecology (D)	D1 The application of agricultural IOT can promote the efficient use of agricultural resources and promote the development of circular agriculture D2 The promotion of agricultural Internet of Things allows farmers to improve their quality and realize the knowledge of modern farmers D3 The use of IoT in agriculture can reduce the area affected and increase the area subject to disaster
Farmers (E)	E1 The application of agricultural Internet of Things can increase farmers' income and further promote poverty alleviation and rural revitalization E2 The promotion of agricultural Internet of Things allows farmers to improve their quality and realize the knowledge of modern farmers E3 Increase willingness to use agricultural IoT and see good prospects for modern agricultural development

3.3. Descriptive Statistics of The Sample

The basic information of the 290 valid samples identified by screening is as follows: (1) gender composition: 39% are male and 61% are female; (2) age composition: the age distribution shows young characteristics, while showing that the youth group is relatively concerned and familiar with agricultural IOT and modern agriculture. Among them, users aged 18-30, under 18, 31-45, 46-60 and over 60 account for 70%, 7%, 19%, 3%, 1% respectively; (3) political outlook: members of the Communist Youth League account for 52%; CPC members account for 15%; the masses account for 23%; non-party members account for 4%; democratic parties account for 6%; (4) residence location composition: Hefei City accounts for 28%; Wuhu City accounts for 8%; Wuhu City accounted for 8%; Fuyang City accounted for 8%; Anqing City accounted for 7%; Chuzhou City accounted for 6%; Huangshan City accounted for 6%; Suzhou City accounted for 5%; Huainan City accounted for 5%; Liu'an City accounted for 4%; Wuhu City accounted for 4%; Huaibei City accounted for 3%; Tongling City accounted for 3%; Huzhou City accounted for 3%; Maanshan City accounted for 3%; Xuancheng City accounted for 2%. Users living in Hefei city account for about one-third of the total filling users, with more users from Hefei city, followed by Wuhu city and Fuyang city, and the number of filling users from other prefecture-level cities are less. (5) Education level: users with college or bachelor's degree account for 79%; users with junior high school or high school education account for 16%;

users with graduate school or above and those with less than elementary school education account for 4% and 1%. It is obvious that users with college or bachelor's degree are more concerned about the content related to agricultural IOT, and middle school or high school students are involved, which is consistent with the analysis of age and political outlook of the filling users in this paper above.

4. Research Results and Analysis

4.1. Reliability and Validity Tests of Measurement Models

First, the reliability of the model is tested. On the basis of the widely used academic standard of Cronbach's alpha coefficient greater than 0.7, the model was tested according to the standard of Corrected Item-Total Correlation of 0.5 proposed by Churchill. The results are shown in Table 2. The five constructs of the model are talent, facilities, industry, ecology, and farmers' income. The coefficient of "a coefficient of the term deleted" is basically at the level of 0.75, which is relatively stable. The CITC values of the analyzed items are all greater than 0.4, which indicates that there is a good correlation between the analyzed items, and also indicates a good level of reliability. In summary, the data reliability is of high quality and can be used for further analysis.

Table 2. Cronbach's reliability analysis

Name	Correction term total correlation (CITC)	The alpha coefficient of the deleted item	Cronbach alpha coefficient
A1	0.605	0.751	0.757
A2	0.620	0.750	
A3	0.633	0.750	
B1	0.643	0.749	
B2	0.655	0.749	
B3	0.665	0.749	
C1	0.621	0.751	
C2	0.655	0.749	
C3	0.609	0.750	
C4	0.572	0.751	
D1	0.632	0.750	
D2	0.654	0.749	
D3	0.612	0.750	
E1	0.614	0.750	
E2	0.622	0.750	
E3	0.697	0.749	
Standardized Cronbach alpha coefficient: 0.952			

Second, exploratory factor analysis and test of applicability. In this study, five variables were preset in the questionnaire design, and exploratory factor analysis was done on the observed variables below the five variables. The results of the analysis showed that "the development of agricultural leisure tourism can be promoted through the construction of agricultural demonstration areas and ecological tourism parks", "the wide application of agricultural Internet of Things requires the establishment of a set of agricultural extension service system to solve technical problems for farmers", "the application of agricultural Internet of things increases the area of machine plowing and machine sowing", "the application of agricultural Internet of things can facilitate farmers to engage in practice, improve agricultural production efficiency and save production costs " four items appear more serious "Zhang Guan Li", be deleted. In addition, taking into account the professional knowledge and research needs, the two items of "increase the willingness to use agricultural Internet of Things and believe that the development of modern agriculture has good prospects" and "the promotion of agricultural Internet of Things can enable farmers to improve their own quality and realize the knowledge of modern farmers" are also deleted. Deleted. The results of the applicability test were obtained after the adjustment, as shown in Table 3, with the KMO test value of 0.927 and the Bartlett sphere test χ^2 The KMO test value is 0.927 and the probability of significance of Bartlett's sphere test is 0.000, which indicates that the feasibility criteria of factor analysis are fully met.

Table 3. KMO and Bartlett's test

KMO value		0.927
Bartlett sphericity test	Approximate cardinality	1500.278
	<i>df</i>	66
	<i>p</i> value	0.000

In addition, the factor analysis extracted a total of five factors, and the variance explained by the five factors were 19.960%,15.923%,14.106%,13.605%,10.655%, and the cumulative variance explained by the rotation was

74.249%>50%. According to the meaning of the items corresponding to each factor, factor 1 was named talent, factor 2 was named facilities, factor 3 was named industry, factor 4 was named ecology, and factor 5 was named farmers' income.

4.2. Research Based on Structural Equation Modeling

4.2.1. Evaluation of the Overall Fitness of The Equation Model

Based on the theoretical model in the previous section, the SEM structural equations were chosen to analyze "talent --> facilities", "talent -- industry ", "Talent - Ecology", "Facilities - > Industry ", "Facilities --> Ecology", "Facilities --> Farmers' Income " "Industry --> Farmer Income", "Ecology - -> Farmer Income " for a total of 8 paths. The analysis results found that the cardinality of freedom value was 3.039 (judged as <3), the RMSEA value was 0.284, judged as <0.10, and the NNFI value was 0.887, judged as >0.9, and the model fit was poor.

Set the MI indicator > 20 and add the path of high MI indicator. In the process of two adjustments, the analysis results of the model show that the standardized regression coefficients of "talent->facilities", "facilities-->farmers' income "The standardized regression coefficient of "industry->farmers' income" is -0.073, which is too small, so two paths are deleted.

After the adjustment, Table 4 details the main fitness indicators obtained from the structural model test. As shown in Table 3, the chi-square value of the modified model is 0 (judgment criterion > 0.05), the chi-square degree of freedom ratio is 2.7 (judgment criterion < 3), the chi-square degree of freedom ratio meets the fitness criterion, and the chi-square value is not met. In addition, the TLI value of the value-added fitness criterion is 0.923, which is higher than the fitness threshold, and the RMR value of the absolute fitness index is 0.029, which is lower than the fitness threshold. Besides, other indicators in the model basically meet the corresponding judgment criteria. Three absolute fit indices, RMSEA, GFI and GFI, meet the standard requirements, and the overall fit of the model is high; from the value-added fit indices, IFI=0.945, CFI=0.944 and NFI=0.915 all meet the

corresponding criteria. It can be seen that the overall fit of the modified model is good, and the setting of this theoretical model is acceptable.

Table 4. Model fitting indicators

Commonly used indicators	χ^2	<i>df</i>	<i>p</i>	Cardinality of freedom ratio χ^2/df	GFI	RMSEA	RMR	CFI	NFI	NNFI
Judgment Criteria	-	-	>0.05	<3	>0.9	<0.10	<0.05	>0.9	>0.9	>0.9
Value	129.577	48	0.000	2.700	0.931	0.077	0.029	0.944	0.915	0.923
Other indicators	TLI	AGFI	IFI	PGFI	PNFI	SRMR	RMSEA 90% CI			
Judgment Criteria	>0.9	>0.9	>0.9	>0.9	>0.9	<0.1	-			
Value	0.923	0.889	0.945	0.573	0.666	0.042	0.061 ~ 0.093			
Default Model: $\chi^2(66)=1531.404, p=1.000$										

4.2.2. Results of Testing the Research Hypothesis

The structural relationships between the latent and observed variables and the estimated values of their standardized path coefficients are shown in Table 5. It can be seen that all five of the paths are significant at the 0.001 level,

the absolute values of the standardized regression coefficients of all five paths are between 0 and 1, and the standardized regression coefficients between each latent variable and the observed variable are >0.4, which meet the criteria. The actual obtained models and standardized path coefficients are shown in Figure 2.

Table 5. Summary table of modified model path coefficients

X	→	Y	Non-normalized path coefficient	SE	<i>z</i> (CR value)	<i>p</i>	Standardized path coefficient
A	→	C	0.386	0.138	2.795	0.005	0.425
A	→	D	0.607	0.168	3.605	0.000	0.544
B	→	C	0.390	0.123	3.184	0.001	0.477
B	→	D	0.410	0.153	2.685	0.007	0.409
D	→	E	0.992	0.091	10.958	0.000	0.829
A	→	A2	1.044	0.103	10.180	0.000	0.652
A	→	A1	1.000	-	-	-	0.632
B	→	B2	1.000	-	-	-	0.699
B	→	B1	0.779	0.072	10.794	0.000	0.631
C	→	C3	1.187	0.118	10.054	0.000	0.705
C	→	C2	1.106	0.115	9.631	0.000	0.668
C	→	C1	1.000	-	-	-	0.651
C	→	C4	1.040	0.112	9.293	0.000	0.640
D	→	D2	0.958	0.091	10.543	0.000	0.670
D	→	D1	1.000	-	-	-	0.699
D	→	D3	0.843	0.081	10.355	0.000	0.658
E	→	E1	1.000	-	-	-	0.842

Note: → indicates regression influence relationship or measurement relationship

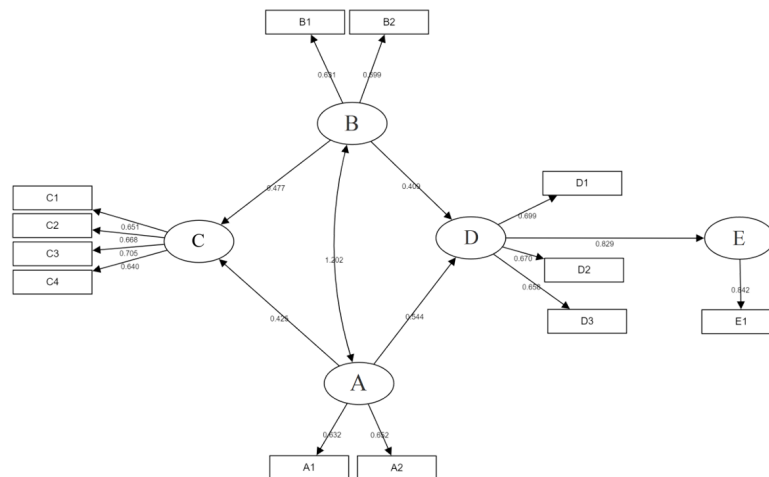


Figure 2. Actual obtained model and normalized path coefficients

4.3. Analysis of Mediating Effects

From Table 6, it can be seen that there is not only an indirect effect but also a direct effect of "facilities-->ecology->farmers' income". There is only an indirect effect of "talent->ecology->farmers' income". "Facilities-->ecology->farmers' income" c' is significant and is a partial mediating effect. Facilities can directly affect farmers' income, and there is also a part of facilities that indirectly affect farmers' income by affecting ecology. "Talent --> ecology --> farmers' income" c' is insignificant and fully mediated. Talent affects farmers' income indirectly by affecting ecology.

->farmers' income" c' is significant and is a partial mediating effect. Facilities can directly affect farmers' income, and there is also a part of facilities that indirectly affect farmers' income by affecting ecology. "Talent --> ecology --> farmers' income" c' is insignificant and fully mediated. Talent affects farmers' income indirectly by affecting ecology.

Table 6. Summary of intermediary role test results

item	c Total effect	a	b	a*b Intermediary Effect Value	a*b (Boot SE)	a*b (z-value)	a*b (p-value)	a*b (95% BootCI)	c' Direct effect	Test conclusion
Facilities => Ecology => Farmers' income	0.618**	0.435**	0.484**	0.210	0.053	3.987	0.000	0.068 ~ 0.276	0.408**	Some agents
Talent => Ecology => Farmers' income	0.208**	0.340**	0.484**	0.165	0.044	3.713	0.000	0.056 ~ 0.228	0.043	Full Agency

* $p < 0.05$ ** $p < 0.01$

4.4. Analysis of Results

Combining the results of the model operation and the results of the analysis of mediating effects, the mechanism of the role of agricultural Internet of Things in modern agriculture can be obtained.

According to professional knowledge and relevant theories, agricultural Internet of Things is a kind of technical mode of intelligent agriculture, which needs to form a specific role form through two basic premises of talents and facilities, and act in production and life, and finally act on farmers through the performance of two main subjects, industry and ecology. Farmers are the main body of modern agricultural development, and the most direct performance of modern agricultural development is the increase of farmers' income.

First, the two basic prerequisites of talent and facilities are used as the starting point, which have a significant positive impact on industry and ecology respectively.

In terms of talent, talent has a significant positive impact on industry with a standardized regression coefficient of 0.425, and hypothesis 2 in the previous section is verified. Talent has a significant positive impact on ecology with a standardized regression coefficient of 0.544, and hypothesis 1 is verified.

In terms of facilities, facilities have a significant positive impact on industry with a standardized regression coefficient of 0.477, and hypothesis 5 is verified. Facilities have a significant positive impact on ecology with a standardized regression coefficient of 0.409, and hypothesis 7 is verified.

Talent and facilities are closely related, and they belong to the correlation relationship, and hypothesis 3 is not verified. Both industry and ecology, as the manifestation of modern agriculture, can be influenced by talents and facilities, which indicates that the chain of action of modern agriculture is relatively complete.

Second, talent and facilities are used as the starting point, and ecology is used as the influence link to have a significant positive impact on farmers' income, respectively.

In terms of talent, talent can have an indirect positive effect on farmers' income through the path of "talent->ecology->farmers' income", and its standardized The standardized regression coefficients are 0.544 and 0.829, respectively, and the indirect effect is very significant, and hypothesis 8 is verified.

In terms of facilities, facilities can have an indirect positive effect on farmers' income through the path of

"facilities->ecology->farmers' income", with standardized In addition, facilities can also directly affect farmers' income, and the direct effect of facilities on farmers' income is 0.408 according to the mediated effect, which is more significant compared to the mediated effect (0.210).

In summary, the application of agricultural Internet of things to promote the development of modern agriculture is obvious, and talent and facilities play the role of "engine" is to promote the development of agricultural power source. The indirect positive impact of talents and facilities on farmers' income through ecology can show that the application of agricultural Internet of Things can accomplish the ultimate goal of modern agriculture development, which is to drive farmers to achieve income growth and get rid of poverty and wealth. In addition, talents and facilities, as power sources, strongly drive the development of industry and ecology, showing the vitality of modern agricultural development.

5. Conclusion and Policy Recommendations

5.1. Research Findings

Research shows that the following problems exist in the current agricultural Internet of Things in the process of promoting the development of modern agriculture that need to be solved, specifically analyzed as follows.

5.1.1. Insufficient Development Momentum of The Industry

The principle of the engine is energy conversion, i.e., the conversion of heat energy into kinetic energy. From the model, it can be seen that industry and ecology are the two main expressions of modern agriculture, and talents and facilities can influence farmers' income through ecology to benefit the people, while the relationship between industry and farmers' income is discrete and fails to effectively influence farmers' income. It can be seen that talents and facilities as the "engine", in the process of converting into kinetic energy in the industrial link problems, resulting in the lack of industrial development kinetic energy. This paper should take the performance of agricultural Internet of Things in the industry as a starting point to explore the problems of agricultural Internet of Things in terms of industrial structure, industrial integration status, and industrial chain supply.

5.1.2. Insufficient Strength of Talent-related Measures

The intermediary effect shows that talent is fully

intermediary to farmers' income, that is, it can only indirectly and positively affect farmers' income through ecological ties, while facilities can have a direct positive impact on farmers' income, which shows that talent is not launched enough. Talent measures should start from introduction and cultivation. One of them is closely related to farmers' income is the cultivation of talents, which is usually manifested in life by strengthening farmers' vocational skills training and trying to cultivate farmers into modern knowledgeable farmers. Farmers, whose ability to master farming skills is more difficult to cultivate due to their own quality, ideology and environmental conditions, should consider this aspect.

5.2. Policy Recommendations

In response to the problem of insufficient industrial development momentum and talent measures, the market players need to coordinate planning and work together at the government, enterprise and farmer levels to solve the problem.

5.2.1. Policy Level

IoT as high-tech has the characteristics of high income and high risk, to empower the development of IoT industry,[13] the government needs to increase the intensity of financial investment, accelerate the construction of preferential policy system for the development of agricultural IoT applications, give preferential and relief to IoT enterprises in taxation, guide IoT enterprises and social capital to enter the agricultural field, according to the different application areas of products and market maturity to develop different Subsidy standards, to stimulate the enthusiasm of enterprises to invest in agricultural Internet of things. Expand the application field of agricultural IOT.

To solve the problem in terms of talents, we need to start from both cultivating and introducing talents. The government should provide policy subsidies and benefits for IoT technology R&D personnel. Set up a program to introduce agricultural IoT talents and support them through policies to guide IoT technical talents to invest in IoT construction and application to create a high-quality IoT talent team. Open internship positions to improve the practical operation ability of IoT talents. The government should strengthen the publicity and guidance of agricultural IoT to raise the attention of the whole society to agricultural IoT and attract relevant talents to invest in agricultural IoT.

5.2.2. Corporate level

To empower the development of IoT technology,[14] relevant technical departments should focus on the application of agricultural IoT and the urgent needs of the industry, and focus major efforts on solving common key technologies such as agriculture-specific sensors, agricultural information processing, agricultural intelligent decision-making and cloud services. Integrate scientific research planning and projects, bases, talents and other elemental resources to organize major agricultural science and technology research and development of key technologies. In addition, enterprises should expand the application field and scope of agricultural Internet of Things, improve the popularity of agricultural Internet of Things technology and promote the development of agricultural Internet of Things.

In order to solve the problem of IoT technical talents, enterprises should provide life protection for IoT and other related talents through enterprise welfare (such as accommodation and medical protection) to solve the worries of IoT talents and devote themselves to IoT application fields. IoT companies cooperate with universities to provide

financial support for universities to train IoT technical talents. Enterprises should improve the company's reward and punishment mechanism to ensure the completion of the work of the company's departments, the agricultural Internet of Things departments for the company's assessment, training high-quality Internet of Things technology talent.

5.2.3. Farmer Level

The lack of understanding of agricultural IOT technology and related knowledge by farmers is one of the reasons for the lack of kinetic energy in the development of agricultural IOT industry. For this reason, the relevant departments need to increase the technical training of agricultural Internet of Things,[15] so that agricultural operators are familiar with the application effect and advantages of agricultural Internet of Things, and promote the development of China's agriculture in the direction of high yield, high efficiency and high quality. Comprehensively popularize the knowledge of agricultural IOT, train in various forms, from various angles and in all aspects, effectively improve the scientific and cultural quality of farmers, adopt the method of combining theory and practice, organize agricultural business subjects to apply the theoretical knowledge related to agricultural IOT technology to practice, expand the popularization of agricultural IOT, and empower the development of IOT industry.

For the problem of agricultural IOT talents, the best solution at the farmer level is to strive to become IOT technical talents. For farmers engaged in agricultural IOT, they should take the initiative to understand and learn the knowledge of agricultural IOT, actively participate in the training program of agricultural IOT technology carried out by relevant departments, master the operation method of IOT technology, and become highly skilled personnel of modern agriculture. As there are differences in the development of agricultural IOT technology in each province, farmers should study the excellent demonstration bases in each province, learn from the technical methods of other regions and improve the relevant technology by combining with the actual local situation to create exclusive agricultural IOT technology and promote the regular development of agricultural IOT technology in agriculture. The exchange of experience among farmers ensures the common progress of farmers nationwide and promotes the development of agricultural IOT.

Acknowledgment

[Fund Project] This project is funded by the Undergraduate Scientific Research Innovation Fund Project of Anhui University of Finance and Economics (Project No.:XSKY22073).

References

- [1] Zhu Chuanpeng, He Zhiquan. How can digitalization contribute to the revitalization of Henan's countryside? What the provincial CPPCC members have to say" [N]. Dahe.com, 2022.
- [2] Li Jin,Feng Xian,Guo Meirong. Research on the Theory, Model and Policy of Agricultural Internet of Things [M]. :China Agricultural Science and Technology Press, 2018.
- [3] Ding Liangjiao. Research on the development of "Internet + agriculture" and its impact on agricultural restructuring [D]. Zhejiang University of Technology and Business,2018.
- [4] Zhang Zhichao. Design of GIS-based soil measurement recipe internet of things in key module implementation [D]. Nanjing Agricultural University,2016.

- [5] Li Jin,Guo Meirong,Gao Liangliang. Agricultural Internet of Things Technology Applications and Innovative Development Strategies [N]. Journal of Agricultural Engineering, 2015.
- [6] Ge WJ, Zhao CHJ. Research on the current situation and development countermeasures of agricultural Internet of Things research and application[J]. Journal of Agricultural Machinery, 2014, 45(7):222-230.
- [7] Anhui Provincial Department of Agriculture and Rural Affairs. Agricultural and rural modernization plan of Anhui Province for the 14th Five-Year Plan [R]. Hefei, Anhui Province: Anhui Department of Agriculture and Rural Affairs and Anhui Provincial Development and Reform Commission, 2022.
- [8] Yin Jianguang. [Rural revitalization] Blowing the charge of "rural revitalization" with "agricultural Internet of things"-Hebei News[EB/OL].[2018.5.24]. http://comment.hebnews.cn/2018-05/24/content_6893719.htm.
- [9] Qi Zhiyue . The Central Document No. 1 continues to focus on "three rural areas" How can the Internet of Things help rural revitalization? -Smart Manufacturing Network [EB/OL]. [2018.2.6]. <https://www.gkzhan.com/news/detail/108184.html>.
- [10] F.Gao,T.Jia. The current situation and improvement strategies of big data application in agricultural Internet of Things [J]. Agricultural Engineering,2018,8(10):41-43.
- [11] Chen Jianfa. Application and prospect of Internet of things technology in rural revitalization [J]. Rural Science and Technology,2021,12(25):121-123.
- [12] Chen Zhi,Qiu Yunqiao. Reflections on digital agriculture to help rural revitalization[J]. Sichuan Agriculture and Agricultural Machinery,2019(06):6-8.
- [13] Li Jin, Guo Meirong, Gao Liangliang. Agricultural Internet of things technology application and innovative development strategy[J]. Journal of Agricultural Engineering, 2015, 31(S2):200-209.
- [14] Li Wei. Research on the promotion and application of agricultural Internet of Things in the Yellow River Delta Agricultural Highlands [D]. Shandong:Shandong Agricultural University, 2019.
- [15] Zhou Aijun, Miao Xiaolong. Current situation and countermeasures of agricultural Internet of things development in Rudong County[J]. Modern Agricultural Science and Technology, 2022(4):232-234.