Study on the Agricultural Informatization Level in Hubei Province: Measurement and Driving Factors

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Abstract

The promotion of the construction of agricultural informatization has become an important way to solve the problem of agriculture, rural areas and farmers. As Hubei Province is an important agricultural province in China, it is of great significance to study the agriculture informatization level and performance in Hubei Province, benefiting the provincial and even the national agricultural information construction. Based on the agricultural informatization data of 16 cities and prefectures in Hubei Province from 2014 to 2015, this paper constructed the index system of agricultural informatization performance in Hubei Province, then used the entropy method to measure the level of agricultural informatization in each city, and used the robust estimation method and FGLS method to estimate the impact mechanism of agricultural informatization performance level in Hubei Province. The results showed that the levels of agricultural informatization in Hubei Province varied with different cities, of which Wuhan and Huangshi showed the highest level while Suizhou and Xianning relatively low. The level of agricultural informatization in Hubei Province was mainly affected by rural household information equipment ownership, agricultural information service agency coverage and agricultural expenditures, with the rural household information equipment ownership as the most important factor.

Keywords: Agricultural Informatization, Performance, Hubei Province, The Entropy Method, FGLS

1. INTRODUCTION

Agriculture is the basis for building a well-off society in an all-round way and realizing modernization, and is also the basic industry ensuring peace and stability. "Internet +" based modern agriculture has offered a new opportunity for China's agricultural development. In the meantime of promoting agricultural informatization, Internet will also have a profound impact on the organizational structure of agriculture, production methods and industrial forms, and bring profound changes to the entire rural economy, society, culture and ecology. As agriculture is the basis of the national economy, agricultural informatization has raise great concerns, with a dominate position in the overall strategy of national information. In particular, since the new rural construction strategic objectives were proposed in 2005, agricultural production has entered a new stage of development, putting forward new tasks and requirements for agricultural informatization. Agricultural informatization is not only an important part of national informatization, but also a new impetus to transform traditional agriculture. According to CNNIC’s 40th China Internet Development Statistics Report, as of December 2015, China's Internet popularization rate reached 50.3%, of which the rural rate reached 31.6%, 34.2 percentage points lower than the urban rate. Promoting the construction of agricultural informatization has become an important way to solve the problems of agriculture, rural area and farmers.

Hubei Province, located in the north-south transition zone, is an important agricultural province because of its climate and terrain characteristics. Hubei Province needs to transform and upgrade its agricultural level urgently. To develop modern agriculture and achieve agricultural modernization, the foundation and prerequisite is to achieve agriculture informatization. Under the background of the structural reform of the supply side, it is of great significance to accelerate the popularization of agricultural information services and lead the development of agricultural modernization by agricultural informatization so as to speed up the development of the "five modernizations" and promote the agricultural development. However, according to the data from National Statistics Bureau, in 2015, there were 259 million households who had access to Internet broadband, of which 24.66% are rural users. Those households in Hubei Province totaled 10 million, of which 15.27% are rural users, far below the national average (National Statistics Bureau database, http://data.stats.gov.cn/). The research on the agricultural informatization construction and development in Hubei Province is not only helpful to expanding the research perspective and enriching relevant theories, but also is very significant for the
development of agriculture in Hubei Province. Also, it is of great practical significance to the agricultural information construction and agricultural and economic development in the six central provinces and beyond.

2. LITERATURE REVIEW

Domestic and foreign scholars mainly study the level of agricultural informatization, information service technology, information technology development and the existing problems. For example, Song and Liu (2013) through the establishment of IDI index system and correlation analysis and regression analysis, analyzed the spatial pattern of regional differentiated informatization development in China, which has found that from 2000 to 2010, the informatization level of China's four plates differed a lot with the ladder-like distribution from east to west. Ye Kun (2014), based on SWOT method, studied the selection of agricultural informatization strategies in China. In addition, scholars also studied the development of regional agricultural informatization in China, such as Qingdao City (Li, 2009), Hubei Province (Wang, 2011), Gansu Province (Lin, 2016), Shaanxi Province (Zhao, 2008; Wang and Wang, 2013), and Hunan Province (Liao et al., 2011; Tan, 2013).

As for the evaluation of agricultural informatization, domestic and foreign scholars have carried out a lot of researches and practices. American economists Machlup and Porat are among the earliest scholars who have begun to quantify the level of informatization. Domestic scholars mainly use the multi-index comprehensive evaluation methods to measure the level of agricultural informatization, such as AHP method, cluster analysis, and DEA method. For example, Wang and Wang (2013) constructed an evaluation model of agricultural informatization for Henan Province, and calculated the general index of agricultural informatization level in Henan Province from 2005 to 2010. The results show that Henan Province saw slightly increasing agricultural informatization level from 2005 to 2010, but still relatively backward in the agricultural informatization construction with little effect. Wang Xin and Li (2014), through the establishment of agricultural informatization evaluation index system and the use of structural equation model, made a reasonable evaluation on the agricultural informatization level in the northern region of China, which has found that China's agricultural information construction as a whole is on the rise, with the level of agricultural informatization in different cities and provinces uneven. Yang et al. (2016) made an overall assessment of the level of agricultural informatization in Liaoning Province from four aspects: rural network infrastructure construction, agricultural e-commerce development, rural e-government implementation, and the policy formulation and regulatory system establishment.

Some scholars have studied the factors influencing the agricultural informatization level. For example, Liu et al. (2016) built the agricultural informatization index system, and then studied the driving forces of the agricultural informatization level. The results show that there are significant regional differences in farmers’ ownership of computers, rural broadband access and rural per capita library collection, which are the main reasons for differentiated informatization levels in eastern, central and western China.

The research on the measurement of agricultural informatization level and its influencing factors provides a rich reference for this paper, but there are still the following shortcomings: (1) The current research focuses on the overall agricultural informatization level of the whole country or a province, but without the level of cities and the research on urban agricultural informatization level in the "Internet+" era. (2) There are no enough researches on measurement of agricultural informatization level in Hubei Province and the impact factors, and the current researches are limited to the status quo of agricultural informatization and influencing factors without the quantitative analysis of the specific agricultural informatization level of cities; (3) The agricultural informatization level is measured mainly by subjective methods such as expert ratings and AHP method, which has room for errors. (4) The driving forces for in-depth study of agricultural information technology level are not enough.

Therefore, based on the data of 16 cities in Hubei Province from 2014 to 2015, this paper built the agricultural informatization evaluation index system for Hubei Province, and used the entropy method to measure the level of agricultural informatization in Hubei Province. On this basis, the FGLS model was adopted to analyze the mechanism of various factors on the level of agricultural informatization performance of various cities in Hubei Province, and put forward the countermeasures and suggestions to improve the level of agricultural informatization in Hubei Province (He et al., 2017; Dadelo et al., 2016).
3. RESEARCH METHODS AND MODELS

3.1 Hubei Province agricultural informatization performance level evaluation model

The premise to analyze the agricultural informatization performance level is to build an agricultural information evaluation index system. The establishment of the agricultural informatization performance level index system requires not only the basic principles of systematicness, objectivity, representation, feasibility, operability and comparability, but also the combination of the direct and indirect evaluation as well as the combination of macro, medium and micro agricultural performance level evaluation indicators. By using the National Informationization Index Structure Plan and the philosophies of Liang (2012), Wang and Wang (2013), and Han and Zhang (2015), and by taking full account of the practice of agricultural informatization construction in Hubei Province, this paper chose four primary indexes and 17 secondary indicators to construct the agricultural informatization level evaluation index system for Hubei Province (see Table 1).

3.2 The entropy method

When calculating the comprehensive value of each index, we need to consider the weight of each index, and the index weighting methods consist of subjective weighting and objective weighting methods. Subjective weighting method refers to expert scoring, while objective weighting method has principal component analysis method and entropy weight method. As an objective weighting method, the main principle of entropy weight method is to calculate the entropy weight of each index according to the degree of variation of each index value, then use the entropy weight to correct the numerical values of each index, and finally get the index comprehensive value.

In the theory of information, assuming that the system may be in a variety of different disorder states and the probability of occurrence of each disorder state is $P_j (j = 1, 2, ..., m)$, then the system's entropy value can be expressed as:

$$e_j = - \sum_{i=1}^{n} P_{ij} \cdot \ln P_{ij}$$

$P_{ij}$ is the probability of occurrence for each system. When $P_{ij} = 1/n$, the opportunities for each system are the same, leading to $e_{\text{max}} = \ln n$.

(1) Data standardization. Since each indicator has a positive impact on the level of agricultural informatization, there is no need for coherent processing of indicators. Further, each variable is normalized to eliminate the influence of the dimension. Considering the covariance and dimensionlessness of each index, the variable normalization method is used to standardize the variables. The variable deviation normalization formula is

$$R_j = \frac{a_j - \min \{a_j\}}{\max \{a_j\} - \min \{a_j\}},$$

$R_j$ denotes the jth secondary index, with $R_j \in [0,1]$. $\max \{a_j\}$ is the maximum value of the sample, while $\min \{a_j\}$ is the minimum value of the sample.

(2) Calculate the proportion of indicators. First, the specific proportion of each index in each sample is calculated according to the initial evaluation matrix $R = (R_{ij})_{nm}$ after normalization:

$$P_{ij} = \frac{R_{ij}}{\sum_{j=1}^{m} R_{ij}} (P_{ij} \neq 0)$$

$R_{ij}$ is the normalized value of the jth secondary index of the ith sample $i = 1, 2, ..., n; j = 1, 2, ..., m$.

(3) Calculate the entropy value of the index. Calculate the information entropy of the jth index as:

$$E_j = -k \sum_{i=1}^{n} P_{ij} \cdot \ln P_{ij}$$
E_j is the information entropy of the jth secondary index, and n is the total number of samples. \( k = 1 / \ln n \).

When \( P_{ij} = 0 \), \( \lim_{P_{ij} \to 0} P_{ij} \cdot \ln P_{ij} = 0 \).

4) Calculate the entropy weight of the index, and further calculate the entropy weight of each index. The entropy weight \( W_j \) of the jth secondary index is calculated as:

\[ W_j = \frac{(1-\varepsilon_j)}{\sum_{j=1}^{n} (1-\varepsilon_j)} \]  \hspace{1cm} (3)

5) Calculate the comprehensive value of the index system. According to the initial evaluation index value and the index entropy weight after the standardized treatment, the comprehensive weight \( Z \) of the agricultural informatization level is calculated as:

\[ Z = \sum_{i=1}^{n} R_{ij} \cdot W_j \]  \hspace{1cm} (4)

3.3 FGLS estimation method

When the sample has heteroskedasticity, the OLS estimator is no longer the optimal linear unbiased estimator. Therefore, a certain method is needed to eliminate the effect of heteroscedasticity. The commonly used method is weighted least squares estimation (WLS) or feasible generalized least squares estimation (FGLS), with the latter more commonly used.

First, the agricultural informatization level decision model is expressed as:

\[ \ln y_{it} = \beta_i \ln x_{it} + e_i \]  \hspace{1cm} (5)

Among them, \( y_{it} \) is the agricultural informatization level of the ith city in the t period, and \( x_{it} \) is the influencing factor of agricultural informatization level in each city. Estimate the above equation to obtain the estimated value \( \hat{y}_{it} \) and the residual \( e_i \).

Then, the fitting value \( \hat{g}_{it} \) is obtained by regression with the residual square term in the logarithmic form \( \ln e_i^2 \) as the dependent variable and \( x_{it} \) as the dependent variable. Further let \( \hat{h} = \exp(\hat{g}) \). With the weight of \( 1/\hat{h} \), use WLS to estimate equation (5), and the FGLS estimator is obtained.

4. DATA SOURCES AND PROCESSING

4.1 Data source for agricultural informatization level measurement

This paper selects statistical data of 16 cities and prefectures of Hubei (excluding the Shennongjia forest region) in 2014 and 2015 for related research. The reason is that our country has begun the integration of urban and rural household budget survey reform since 2012, leading to old method before 2014 and new method after 2014. Therefore, the data of 2014-2015 are not comparable with the data of 2013 and the previous survey data of rural households.

The data of this paper are mainly from the "statistical yearbook of Hubei province" (2014-2015), "Hubei Rural Statistical Yearbook" (2014-2016), Statistical Yearbook of cities and prefectures in Hubei Province, and data from national economic and social development statistical bulletin of every area. Because that the the number of rural telephone users in Suizhou city in 2015 in "Suizhou Statistical Yearbook (2016)" was greatly different from that in 2014 and significantly higher than that of rural households in Suizhou City, it was regarded as outliers in this paper, and replaced with 2013-2014 corrected value. Despite the missing data of Ezhou agriculture, forestry and water affairs expenditures, the proportion of agricultural expenditure was calculated in line with the data from “Report on the Ezhou City 2015 Budget Implementation and 2016 Budget Draft”. Other missing data will be supplemented by the relevant data from the cities’ national economic and social development statistics communiqué and Provincial Bureau of Statistics.
Using the urban and rural consumer price index to convert the per capita traffic and transportation expenditure and per capita education, cultural and entertainment expenditure of rural residents into 2014 constant price data to eliminate the impact of inflation.

4.2 Influencing factors of agricultural informatization level

Agricultural informatization index, which means the level of agricultural informatization in cities and prefectures, is calculated by the entropy weight method. The average telephone ownership of per 100 rural households means the number of information equipment owned by rural residents in cities and prefectures. Also, the average computer ownership of per 100 rural households means the number of agricultural information equipment owned by various cities and prefectures in Hubei province. The education level of rural labor force in this paper refers to the high school or above in this paper. Generally speaking, rural labor forces who receive higher education can more easily understand and utilize information equipment and new technologies, which is more helpful to improving the level of agricultural informatization. The coverage rate of rural information service providers, represented by the ratio of village-based information service providers to the total number of villages in each city, reflects the proportion of information service institutions owned by rural villages in different cities. Agricultural finance expenditure refers to the financial expenditures in agriculture, forestry and water supplies expenditure with the unit of 100 million RMB. All the data in this paper are from the Statistical Yearbook of Hubei Province, the Huber Rural Statistical Yearbook, and the statistical yearbook of each city.

5. EMPIRICAL RESULTS

5.1 Calculation of agricultural informatization level in Hubei province

Descriptive statistical analysis of variables was performed. The results are shown in the table. From the statistical results, the agricultural informatization indexes have great numerical difference but relatively small standard deviation, indicating that cities’ agricultural informatization indexes have certain differences. And the agricultural informatization level in different cities should be deeply and respectively considered.

Table 1 Descriptive Statistical Analysis of Variables

<table>
<thead>
<tr>
<th>Primary indicators</th>
<th>Secondary indicators</th>
<th>Mean value</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development and Utilization of Agricultural Information Resources</td>
<td>Rural telephone subscriber percentage (%)</td>
<td>30.91</td>
<td>10.33</td>
<td>13.14</td>
<td>54.28</td>
</tr>
<tr>
<td></td>
<td>Average telephone ownership of per 100 rural households(set)</td>
<td>29.33</td>
<td>12.92</td>
<td>8.00</td>
<td>61.83</td>
</tr>
<tr>
<td></td>
<td>Average cell phone ownership of per 100 rural households(set)</td>
<td>204.20</td>
<td>48.96</td>
<td>70.00</td>
<td>251.00</td>
</tr>
<tr>
<td></td>
<td>Average color TV ownership of per 100 rural households(set)</td>
<td>110.69</td>
<td>23.59</td>
<td>42.00</td>
<td>136.67</td>
</tr>
<tr>
<td></td>
<td>Average computer ownership of per 100 rural households(set)</td>
<td>24.38</td>
<td>6.39</td>
<td>14.00</td>
<td>37.50</td>
</tr>
<tr>
<td>Agricultural information infrastructure</td>
<td>The number of agricultural information networks</td>
<td>5.53</td>
<td>4.02</td>
<td>1.00</td>
<td>15.00</td>
</tr>
<tr>
<td></td>
<td>Coverage rate of rural information service providers(%)</td>
<td>4.07</td>
<td>3.96</td>
<td>0.10</td>
<td>12.63</td>
</tr>
<tr>
<td></td>
<td>The average number of new rural information service institutions per village</td>
<td>0.96</td>
<td>1.12</td>
<td>0.00</td>
<td>5.90</td>
</tr>
<tr>
<td>Agricultural information talents</td>
<td>Proportion of agricultural information service personnel (%)</td>
<td>0.51</td>
<td>0.93</td>
<td>0.02</td>
<td>3.60</td>
</tr>
<tr>
<td></td>
<td>The proportion of rural labor forces with high school and higher degree</td>
<td>32.48</td>
<td>4.43</td>
<td>23.93</td>
<td>41.08</td>
</tr>
<tr>
<td></td>
<td>The proportion of labor force aged 21</td>
<td>69.66</td>
<td>3.91</td>
<td>60.07</td>
<td>76.08</td>
</tr>
</tbody>
</table>
The entropy method is used to calculate the agricultural informatization level index system of Hubei Province from 2014 to 2015, and the comprehensive value of agricultural informatization level in Hubei Province in 2014 and 2015 is shown in the table.

Generally speaking, the eastern and central regions such as Wuhan City, Huangshi City, Yichang City, Xiangyang City, Jingzhou City, Ezhou City, Jingmen City and Xiantao City, have higher agricultural information level, while Suizhou City, Xianning City, Tianmen City, Huanggang City, Xiaogan City, Enshi (Enshi Tujia and Miao Autonomous Prefecture) and Shiyan City has lower agricultural information level.

From 2014 to 2015, the overall level of agricultural information in Hubei Province improved, of which Tianmen City and Huanggang City saw a slight decline. In 2014, Wuhan City and Huangshi City has a higher level of agricultural informatization, with Huangshi City the highest. In 2015, Wuhan City saw the highest level of agricultural informatization by surpassing Huangshi City.

### Table 2 2014-2015 Agricultural Information Levels of Cities and Prefectures in Hubei Province

<table>
<thead>
<tr>
<th>Region</th>
<th>2014</th>
<th>2015</th>
<th>Region</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wuhan City</td>
<td>127.73</td>
<td>148.92</td>
<td>Jingzhou City</td>
<td>111.32</td>
<td>119.45</td>
</tr>
<tr>
<td>Huangshi City</td>
<td>133.08</td>
<td>144.23</td>
<td>Huanggang City</td>
<td>87.92</td>
<td>83.8</td>
</tr>
<tr>
<td>Shiyan City</td>
<td>57.53</td>
<td>58.38</td>
<td>Xianning City</td>
<td>74.09</td>
<td>88.41</td>
</tr>
<tr>
<td>Yichang City</td>
<td>109.96</td>
<td>126.25</td>
<td>Suizhou City</td>
<td>85.21</td>
<td>91.29</td>
</tr>
<tr>
<td>Xiangyang City</td>
<td>108.95</td>
<td>120.5</td>
<td>Enshi City</td>
<td>57.12</td>
<td>64.08</td>
</tr>
<tr>
<td>Ezhou City</td>
<td>106.17</td>
<td>112.49</td>
<td>Xiantao City</td>
<td>105.13</td>
<td>107.96</td>
</tr>
<tr>
<td>Jingmen City</td>
<td>104.83</td>
<td>109.45</td>
<td>Qianjiang City</td>
<td>106.49</td>
<td>107.44</td>
</tr>
<tr>
<td>Xiaogan City</td>
<td>75.58</td>
<td>82.59</td>
<td>Tianmen City</td>
<td>87.93</td>
<td>86.68</td>
</tr>
</tbody>
</table>

From the table, the levels of agricultural informatization in various regions of Hubei Province have been improved to a certain extent. In 2014, Wuhan City and Huangshi City had the highest level of agricultural informatization, while Shiyan City, Enshi, Xiaogan City and Xianning City showed the lowest level. In 2015, Wuhan City, Huangshi City and Xiaogan City had the highest level of agricultural informatization, while Enshi and Shiyan City showed the lowest level. From 2014 to 2015, the levels of agricultural informatization in Xiaogan City and Xianning City were improved.
5.2 Study on the Influencing Factors of Agricultural Informatization Level in Hubei Province

To further analyze the influencing factors of agricultural informatization in Hubei Province, the stepwise regression method was used to estimate the original model, thus leading to the decision model of agricultural informatization level in Hubei Province:

\[
\ln ag_i = \alpha_0 + \alpha_1 \ln pho + \alpha_2 \ln cop + \alpha_3 \ln edu + \alpha_4 \ln ins + \alpha_5 \ln agf + \epsilon(6)
\]

Among them, \( ag_i \) is the level of agricultural informatization, \( \ln pho \) for the average telephone ownership of per 100 rural households, \( \ln cop \) for the average computer ownership of per 100 rural households, \( \ln edu \) for the education level of rural labor force, \( \ln ins \) for the agricultural information service organization coverage, and \( \ln agf \) for the fiscal expenditure in agriculture.

By using BP heteroscedasticity to test the original model, the p-value of BP test was 0.0468. And the variance hypothesis was rejected at the significance level of 5%, which indicated that the original model had heteroskedasticity. Therefore, based on the OLS estimation, this paper used OLS robust standard error method and feasible generalized least squares estimation (FGLS) to estimate the model.

Although results from the OLS robust standard error are more robust, they generally have good properties with large samples, and FGLS estimates are more effective, given that FGLS estimates are better. At the same time, when the FGLS estimation method is adopted, the \( R^2 \), \( R_{adj}^2 \) and F statistic values are the largest, which also shows that the FGLS estimation method is better.

The level of agricultural informatization in Hubei Province is affected by the informationization equipment of rural residents, the education level of rural labor force, the coverage rate of agricultural information service institutions and the expenditure of agricultural finance, among which the rural household information equipment ownership is the most important influencing factor. If the household computer ownership increases by 1%, the agricultural informatization level will increase by 0.571%. The main reason is that home computers as one of the most important way to access Internet information, help to timely and effective understand the agricultural production conditions, climate, market supply and demand, and national policy information, thereby promoting the development of the agricultural industry. The second principal reason is the rural home phone ownership, for each additional 1% ownership improves 0.091% agricultural information level. Home telephones as a means of effective communication and access to agricultural production-related information, help to solve the agricultural production, processing, sales and other problems encountered in the process. At the same time, the telephone enables households to purchase agricultural materials and equipment more conveniently, thus raising the level of agricultural technology.
Table 3 Estimation Results of Agricultural Informatization Level in Hubei Province

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>OLS_Robust</th>
<th>FGLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lnpho</td>
<td>0.156</td>
<td>0.156</td>
<td>0.091</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(1.742)</td>
<td>(1.965)</td>
</tr>
<tr>
<td>Lnedu</td>
<td>0.204</td>
<td>0.204</td>
<td>0.169</td>
</tr>
<tr>
<td></td>
<td>(0.824)</td>
<td>(1.188)</td>
<td>(1.246)</td>
</tr>
<tr>
<td>Lnis</td>
<td>0.030</td>
<td>0.030</td>
<td>0.048**</td>
</tr>
<tr>
<td></td>
<td>(1.222)</td>
<td>(1.273)</td>
<td>(2.421)</td>
</tr>
<tr>
<td>Lncop</td>
<td>0.480***</td>
<td>0.480**</td>
<td>0.571***</td>
</tr>
<tr>
<td></td>
<td>(3.249)</td>
<td>(2.191)</td>
<td>(5.311)</td>
</tr>
<tr>
<td>Lna4f</td>
<td>0.109**</td>
<td>0.109**</td>
<td>0.090**</td>
</tr>
<tr>
<td></td>
<td>(2.917)</td>
<td>(3.048)</td>
<td>(3.125)</td>
</tr>
<tr>
<td>Cons</td>
<td>1.498</td>
<td>1.498</td>
<td>1.603***</td>
</tr>
<tr>
<td></td>
<td>(1.844)</td>
<td>(2.554)</td>
<td>(3.622)</td>
</tr>
<tr>
<td>R²</td>
<td>0.656</td>
<td>0.656</td>
<td>0.816</td>
</tr>
<tr>
<td>R²(adj)</td>
<td>0.590</td>
<td>0.590</td>
<td>0.781</td>
</tr>
<tr>
<td>F</td>
<td>9.910</td>
<td>13.639</td>
<td>23.076</td>
</tr>
</tbody>
</table>

Note: the value in the bracket refers to the statistic t. * indicates the significance level of 10%, ** the significance level of 5%, and *** the significance level of 1%.

The agricultural expenditure in cities and counties in Hubei Province with the significance level of 1% has a significant positive impact on the level of agricultural informatization. For every 1% increase in agricultural expenditure, the level of agricultural informatization will increase by 0.090% - 0.109%. On the one hand, agricultural financial expenditure will help improve the rural infrastructure conditions and the agricultural production environment, thereby increasing the ownership of rural information equipment. On the other hand, agricultural public expenditures finance the establishment of agricultural databases and agricultural management information system, provides Internet network technology such as IoT for leading enterprises and family farms, and improves the level of rural e-commerce, thereby enhancing the level of agricultural informatization.

The coverage rate of information service agencies at the significance rate of 5% has a significant positive impact on the level of agricultural informatization. Each additional 1% coverage rate of information services will increase the agricultural informatization level by 0.030% - 0.048%. With a wider information service agencies coverage, farmers engaged in agricultural production and management process can more easily master relevant information technology, to improve the level of agricultural informatization, and further to advance agricultural production efficiency and agricultural output growth. Moreover, the educational level of rural labor has a positive but little impact on the level of agricultural informatization. The possible reason is that the educational level of rural labor force in the statistical data mainly refers to the educational level of all rural labor force, not labor force engaged in agricultural activities.

6. CONCLUSION AND SUGGESTIONS

Based on the latest data, this paper established the evaluation index system of agricultural informatization level in Hubei Province, and used the entropy weight method to estimate the agricultural informatization level of 16 cities in Hubei Province from 2014 to 2015. On this basis, the driving factors of agricultural informatization in Hubei Province were analyzed. The results of the study are as follows: (1) Different cities in Hubei Province show differentiated agricultural informatization levels based on significantly different indicators, with Wuhan and Huangshi having the highest level but Suizhou City, Xiangning City and Tianmen City a relatively low level. (2) The level of agricultural informatization in Hubei Province is affected by the informationization equipment of rural residents, the education level of rural labor force, the coverage rate of agricultural information service institutions and the expenditure of agricultural finance, among which the rural household information equipment ownership is the most important influencing factor. If the household computer ownership increases by 1%, the agricultural informatization level will increase by 0.571%. (3) The agricultural fiscal expenditure and the coverage of information service institutions in Hubei Province have a significant positive impact on the level of agricultural informatization. 1% increase of each at different time will lead to the improvement of the agricultural informatization level in Hubei Province by 0.090% and 0.048% respectively.
On this basis, this paper proposes the following suggestions to promote the level of agricultural informatization in Hubei Province:

(1) Strengthen agricultural and rural information infrastructure construction.

At the occasion of the structural reform of the agricultural supply side and the national rural informationization piloting, we shall speed up the rural information infrastructure construction, continuously improve the basic informatization level of farmland water conservancy, and agricultural production, picking, processing and sales, and better develop and utilize rural informatization resources. Also, we shall actively promote the implementation of the "broadband China" strategy, realize the fiber coverage of the villages without access to broadband, and bring satellite communications, mobile cellular and other information coverage on remote areas, so as to improve rural Internet broadband access rate and coverage and reduce rural post and telecommunications costs.

(2) Speed up the development of low levels of agricultural information

On the basis of accelerating the construction of infrastructure in the regions with lower level of agricultural informatization, we will also develop Suizhou City, Xianning City, Tianmen City and Enshi Prefecture with low agricultural informatization level led by those at a higher level such as Wuhan City, Huangshi City, Yichang City and Jingzhou City, to form a good spatial information spillover effect and promote regional synergistic development. At the same time, the cities and prefectures with low level of agricultural informatization shall proactively visit and learn from those with higher level to introduce advanced experience and high-level technical personnel, and to improve their agricultural informatization level.

(3) Increase financial expenditures in agricultural informatization and bring information into the village households

Through "Internet +", we shall innovate agricultural financial and insurance products, and enhance the capacity of supporting agriculture with credit and insurance services. We shall also promote the development of the information services such as development and utilization of agricultural data and online marketing of agricultural products, actively promote the access of information into the village households, and develop it into a "Internet + agriculture" demonstration project by taking it as a key project of modern agricultural development. Additionally, we shall strengthen the informatization construction of agricultural and rural social service departments, establish the system for bringing information into the village households, and gradually form a perfect development mechanism of top-down co-ordination and bottom-up construction. At the same time, we shall encourage and guide the three major telecom operators, e-commerce, information technology companies and financial institutions to promote information’s access into villages, improve the agricultural and rural information market operating mechanism, and advance the agricultural and rural informatization level.

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