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PAPER

A Study of Farmers' Digital Literacy on Their Entrepreneurial Income Based on Hierarchical Multiple Linear Regression

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ABSTRACT

This study focuses on the role of farmers' digital literacy on their entrepreneurial income. Through household interviews and questionnaire distribution, data from 130 farmers in Jianggu Town, Sihui City, Zhaoqing are obtained. On this basis, farmers' digital literacy is categorized into five dimensions, and the effect of each dimension on farmers' entrepreneurial income is empirically tested by means of hierarchical regression analysis. The results show that "the dependence on smartphone and internet," "the level of digital access," "digital information literacy," and "digital creation literacy" can all significantly affect the income level of entrepreneurial farmers. Based on this understanding, this paper puts forward three policy recommendations: to formulate a practical digital literacy cultivation plan; to establish a unified digital aggregation platform; and to popularize digitalization and informatization through multiple channels.

KEYWORDS

digital literacy, farmer entrepreneurship, income

1 INTRODUCTION

Rural progress is an important aspect of national development, and enabling farmers to increase their income levels is an important way to achieve common prosperity. Farmers' participation in innovation and entrepreneurship can effectively improve productivity and employment rates [1] [2]. How farmers enhance their entrepreneurial income is of great significance in promoting rural revitalization. By the end of 2022, the cumulative number of people who have returned to their hometowns and entered the countryside for entrepreneurship and innovation has reached 12.2 million people [3]. Digital technology plays an important role in the flourishing tide of farmers' entrepreneurship, and 55% of the national entrepreneurial projects for returning to the hometowns and villages utilize digital

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technology to establish online stores, live streaming commerce, and contactless distribution. It can be seen that whether digital technology really prompts farmers to improve entrepreneurial income is a matter of concern.

From a productivity perspective, digital technology is an important developmental avenue for increasing productivity. Research has shown that digital technology can effectively improve productivity and achieve sustainable economic growth [1] [4]. At the same time, the application of digital technology has led to an increase in product market demand, which in turn has enhanced supplier revenues and subsequently raised worker incomes [5]. In addition, digital transformation achieves the improvement of income distribution by promoting the service-oriented transformation of industries, increasing labor productivity, and promoting the accumulation of social capital [6] [7].

In the agricultural sector, the development of digital agriculture can effectively improve agricultural production efficiency, promote sustainable agricultural development, enhance farmers' enthusiasm for production, and increase farmers' income [8] [9]. Some scholars' research suggests that the application of big data and artificial intelligence in digital agriculture can help agricultural producers achieve precise detection and scientific planting, improve the efficiency of agricultural production, and reduce the risk of yield reduction caused by natural disasters [10] [11]. Moreover, the development of digitalization has also provided a broad platform for the sale of agricultural products. Rural e-commerce has broken the barriers of time and space in agricultural product sales, reduced information asymmetry, promoted supply-demand matching, adapted to market demand, broadened farmers' sales channels, and further increased farmers' income [12].

In summary, the current study mainly focuses on the impact of digitalization on production efficiency and on farmers' income, etc., but it is less likely to include farmers' entrepreneurship, digital literacy, and farmers' income into the same framework for analysis. Based on this research status quo, this paper intends to construct an indicator system of farmers' digital literacy, on the basis of which the role of farmers' digital literacy on their entrepreneurial income will be analyzed through empirical research.

2 RESEARCH DESIGN

2.1 Data sources

Jianggu Town is located in Sihui City, a county-level city in the Pearl River Delta. Due to its proximity to large cities such as Guangzhou and Shenzhen, many farmers have worked as migrant workers, which has broadened their horizons and increased the entrepreneurial atmosphere in the local area. This is similar to many towns in the Pearl River Delta. Therefore, selecting Jianggu Town as the research site has good representativeness and data accessibility.

This research team conducted research in Jianggu Town from July 13th to July 17th, 2024. 180 questionnaires were put out, and 130 valid questionnaires were obtained, with a recovery approach efficiency of 72%. The definition of entrepreneurial farmers is as follows: (1) Cultivation households (more than 10 acres of cash crops such as fruits, vegetables, seedlings, and Chinese herbs; more than 30 acres of grain, oil, cotton, etc.; more than 10 acres of family-managed forest land). (2) Farming households (annual output of 30 pigs, piglets 100 or more; more

than 10 beef cattle, annual output of three or more; 50 meat goats, annual output of 50 or more; dairy cows 10 or more; more than 200 rabbits; broiler chickens, ducks, geese, etc., the annual output of 100 or more; ducks, eggs, egg chickens, 100 or more; breeding of seafood, aquaculture, annual profit of 30,000 yuan or more). (3) Founding agricultural economic cooperative organizations or professional associations (attracting more than 10 households). (4) Non-agricultural business (including but not limited to catering, logistics, passenger transportation, handmade products, agritainment, rural tourism, grocery stores, retail of agricultural and sideline products, processing of agricultural and sideline products, agricultural services, barbering, etc., with an annual profit of more than 30,000 yuan).

2.2 Variable setting and descriptive design

Variable setting

1. Explained variables: Entrepreneurial income levels are an explained variable. Since income information is more sensitive, it is easy to make the interviewed farmers resistant during the interview. Therefore, in the questionnaire design of this study, farmers are not required to inform the specific income but only need to answer an approximate score range. Consequently, this study measures the level of entrepreneurial income of the interviewed farmers through the method of hierarchical assignment, which can be seen in the definition and description of variables in Table 1.
2. Explanatory variables: According to existing research, digital literacy includes but is not limited to the ability to retrieve, process, analyze, and apply information, as well as the ability to use and manage digital technology reasonably [13]. Cognitive tests can be used to assess an individual's performance in specific digital tasks, such as problem-solving skills and computational thinking [14] [15].

   This study focuses on the impact of the digital literacy of farmers on their entrepreneurial income. Based on the existing research about the definition of digital literacy, this study designs five dimensions, including "dependence on smartphone and internet," "the level of digital access," "digital information literacy," "digital application literacy" and "digital creation literacy" to examine the digital literacy of farmers. Each dimension includes secondary variables, and the specific secondary variables are shown in Table 1. The secondary variables under the above five dimensions are proposed to be fitted into five primary variables for subsequent regression by the entropy method.
3. Control variables: In this study, four variables are proposed as control variables: "age," "literacy level," "number of family laborers," and "training in digital means." According to experience, it is easier for young people to get started with digital tools than middle-aged and elderly people; the higher the literacy level, the greater the learning ability, making it easier to learn digital devices; the greater the number of family laborers, the more land they tend to share, facilitating the initiation of agricultural enterprises; and participation in digital tools training can enhance farmers' proficiency with digital tools. Consequently, these four variables are employed as control variables in this survey.

Descriptive statistics

Table 1. Description of variables and descriptive statistics

The Primary Variable	The Secondary Variable	Definition and Description of Variable Descriptions	Minimum Value	Maximum Values	Average □	Standard Deviation □
Income from entrepreneurship in 2023		0 = loss, 1 = ¥20,000 and below, 2 = ¥30,000 – ¥50,000, 3 = ¥60,000 – ¥100,000, 4 = ¥11,000 – ¥200,000, 5 = ¥21,000 – ¥500,000, 6 = ¥500,000 and above	0.000	6.000	2.031	1.535
Dependence on smartphones/ Internet	information retrieval (including news reading, online searches, weather forecasts, etc.)	Score 1–5 from lowest to highest, with 5 indicating the highest dependency program	1.000	5.000	3.277	1.457
	work (online meetings, e-mail, etc.)	Score 1–5 from lowest to highest, with 5 indicating the highest dependency program	1.000	5.000	2.346	1.559
	learning (including online courses, learning resources, e-books, etc.)	Score 1–5 from lowest to highest, with 5 indicating the highest dependency program	1.000	5.000	2.446	1.505
	entertainment (watching short videos, listening to music, playing games, etc.)	Score 1–5 from lowest to highest, with 5 indicating the highest dependency program	1.000	5.000	3.231	1.507
	social (WeChat, QQ, etc.)	Score 1–5 from lowest to highest, with 5 indicating the highest dependency program	1.000	5.000	3.469	1.453
The level of digital access	smartphone ownership	1 = Yes 0 = No	0.000	1.000	0.838	0.369
	use the internet function	1 = Yes 0 = No	0.000	1.000	0.808	0.396
	have a computer	1 = Yes 0 = No	0.000	1.000	0.569	0.497
	have broadband	1 = Yes 0 = No	0.000	1.000	0.746	0.437
	the ability to download mobile apps independently	1 = Yes 0 = No	0.000	1.000	0.615	0.488
Digital Information Literacy	use the cellular network to browse and search for the data or information	Scale of 1–5 from low to high, with 5 indicating very proficient	1.000	5.000	2.954	1.391
	the data or information collected can be documented	Scale of 1–5 from low to high, with 5 indicating very proficient	1.000	5.000	2.762	1.424
	make online purchases through apps	Scale of 1–5 from low to high, with 5 indicating very proficient	1.000	5.000	2.908	1.512
Digital Application Literacy	use cell phone communication software (QQ or WeChat) to communicate with family and friends	Scale of 1–5 from low to high, with 5 indicating very proficient	1.000	5.000	3.408	1.345

(Continued)

Table 1. Description of variables and descriptive statistics *(Continued)*

The Primary Variable	The Secondary Variable	Definition and Description of Variable Descriptions	Minimum Value	Maximum Values	Average □	Standard Deviation □
	use cell phone network to look up information to solve real world problems	Scale of 1–5 from low to high, with 5 indicating very proficient	1.000	5.000	2.946	1.410
	use mobile apps related to your career	Scale of 1–5 from low to high, with 5 indicating very proficient	1.000	5.000	2.700	1.487
Digital Creative Literacy	Ability to use a cell phone to express opinions on the internet	Scale of 1–5 from low to high, with 5 indicating very proficient	1.000	5.000	2.362	1.245
	Ability to use mobile video software to create or publish your own short videos	Scale of 1–5 from low to high, with 5 indicating very proficient	1.000	5.000	2.100	1.120
Age		1 = 18 and under, 2 = 19–24, 3 = 25–30, 4 = 31–40, 5 = 41–50, 6 = 51–60, 7 = 60 and over	1.000	7.000	5.200	1.668
Education background		1 = elementary school and below, 2 = junior high school, 3 = high school/ middle school/higher vocational, 4 = college, 5 = bachelor's degree, 6 = master's degree and above	1.000	6.000	2.331	1.343
Number of family laborers		Actual number	1.000	11.000	3.069	1.371
Training in digital tools		1 = Never participated, 2 = Self-study, 3 = Participation	1.000	3.000	1.315	0.694

1. Entrepreneurial income in 2023: The mean value is 2.031, indicating that the average entrepreneurial income of the respondents is between 30,000 and 100,000 yuan, which is low for entrepreneurship, but for agricultural production, the income level is already high. The standard deviation of 1.535 indicates that the distribution of the sample is more concentrated, resembling the shape of an olive.
2. In terms of dependence on smartphones and the internet, the average dependence of information retrieval is 3.277, with a standard deviation of 1.457, indicating that respondents have a moderate dependence on smartphones and the internet for information retrieval with some inter-individual variability. As to the work variable, with a mean dependence level of 2.346 and a standard deviation of 1.559, it indicates a low dependence on work, but with some inter-individual variability. Learning, with a mean dependence level of 2.446 and a standard deviation of 1.505, is similar to the variable of work, with a medium to low level of learning dependence and significant variability. Entertainment, with a mean dependence level of 3.231 and a standard deviation of 1.507, is similar to the variable of information retrieval and is moderately high, with significant inter-individual variability. Social, with a mean dependence level of 3.469 and a standard deviation of 1.453, has the highest level of dependence on socialization, and the individual differences are relatively small.

3. Regarding the level of digital access, the mean value of 0.838 indicates that the majority of respondents own a smartphone. The variable of "use the internet function", with a mean value of 0.808, indicates that most respondents use the internet function of their smartphones. The variable of "have a computer", the average value is 0.569, indicating that the popularity of computers at home is lower than that of smartphones. The variable of "have a broadband," with an average value of 0.746, indicating that most respondents have broadband service at home. The variable of "the ability to download mobile apps independently," with a mean value of 0.615, indicating that most respondents can download apps independently, but a certain percentage of respondents do not have this skill yet.
4. In terms of digital information literacy, the average proficiency in browsing and searching for information on cell phone networks is 2.954, with a standard deviation of 1.391, indicating that respondents have a certain degree of proficiency in searching for information, but there are significant differences between individuals. The average proficiency in recording and collecting information is 2.762 with a standard deviation of 1.424, showing that respondents are slightly less proficient in recording and collecting information, with significant differences among individuals. The average proficiency of online purchases is 2.908, and the standard deviation is 1.512. The proficiency of online purchases is similar to that of information browsing and searching, but with a greater difference.
5. In terms of digital application literacy, the average proficiency level of "use cell phone communication software" is 3.408, with a standard deviation of 1.345, indicating that respondents are highly proficient in the use of cell phone communication software. The average proficiency level in "looking up information to solve problems" is 2.946, with a standard deviation of 1.410, indicating that respondents are moderately proficient in utilizing the internet to solve practical problems. The average proficiency in "using career-related apps" is 2.700, with a standard deviation of 1.487, showing that the proficiency in using career-related apps is slightly lower, with significant individual differences.
6. In terms of digital creation literacy, the average proficiency level of "expressing opinions" is 2.362 with a standard deviation of 1.245, indicating that the respondents' proficiency in publishing opinions on the internet is low, and the inter-individual differences are small. In terms of "creating short videos," the average proficiency level is 2.100 with a standard deviation of 1.120, indicating that respondents' proficiency in creating short videos is the lowest, with small inter-individual differences.
7. As for other variables, the mean of "age" is 5.200, with a standard deviation of 1.668, indicating that the sample is mainly concentrated in the age range of 41–60 years, but there is a wide distribution of age. The mean value of "education background" is 2.331 with a standard deviation of 1.343, showing that most of the respondents have a low level of literacy, but there is a wide distribution from low to high. The mean value of "number of family laborers" is 3.069, with a standard deviation of 1.371, indicating that on average there are three laborers in the respondent households, but there is a wide variation in the number of laborers among households. The mean of "training in digital tools" is 1.315, with a standard deviation of 0.694, indicating that the majority of respondents have not participated in formal digital training, but some have upgraded their skills through self-study or other means.

2.3 Reliability and validity tests

Reliability test

Table 2. Results of reliability test

Title	Item	Cronbach's Alpha
Dependence on smartphones, internet	5	0.885
The level of digital access	5	0.838
Digital Information Literacy	3	0.939
Digital Application Literacy	3	0.907
Digital Creative Literacy	2	0.740

The Cronbach's alpha is the most commonly used reliability test method for analyzing the reliability of attitude and opinion questionnaires (scales). Perform reliability testing separately for the five items: "dependence on smartphones and the internet," "the level of digital access," "digital information literacy," "digital application literacy," and "digital creation literacy."

The results of the test are shown in Table 2. The Cronbach's alpha of dependence on smartphones and the internet is 0.885, which is higher than the recommended standard of 0.8, indicating that the scale has high internal consistency and high reliability. The Cronbach's alpha of digital access level is 0.838, which is also higher than the recommended standard of 0.8, indicating that the scale has high reliability and good internal consistency. The Cronbach's alpha of digital information literacy is 0.939, much higher than 0.8, which indicates that the internal consistency of the scale is very strong and the reliability is very high. The Cronbach's alpha of digital application literacy is 0.907, again much higher than 0.8, indicating high reliability and excellent internal consistency of the scale. The Cronbach's alpha of digital creation literacy is 0.740, between 0.7 and 0.8, which does not meet the 0.8 standard but still indicates good reliability and acceptable internal consistency of the scale.

Overall, the Cronbach's alpha of all the scales is above 0.8, except for the "digital creative literacy" scale, whose Cronbach's alpha is slightly lower but still within the acceptable range, indicating that these scales have good internal consistency, high reliability, and are suitable to be used in the study.[1]

Validity tests. In this survey, the validity test is also done for all the question items in Richter's scale with a KMO value of 0.910. If the KMO value is higher than 0.8, it means that it is very suitable for information extraction (indicating good validity from one side); if this value is between 0.7 and 0.8, it means that it is more suitable for information extraction (indicating good validity from one side); if this value is between 0.6 and 0.7, it means that it is possible to perform information extraction (a side note of average validity); if this value is less than 0.6, it indicates that information is more difficult to extract (a side note of low validity). As can be seen from Table 3, the KMO value is 0.910, which is much higher than the recommended standard of 0.8, indicating that the items in the scale are highly correlated and very suitable for factor analysis, thus verifying the structural validity of the scale. The p-value of the Bartlett's test of sphericity is 0.000, which is significantly

[1] The Cronbach's alpha that is higher than 0.8 indicates high reliability; if this value is between 0.7 and 0.8, it indicates good reliability; if this value is between 0.6 and 0.7, it indicates acceptable reliability; if this value is less than 0.6, it indicates poor reliability.

lower than 0.05, indicating that there is a significant correlation between the items in the scale, which makes the scale suitable for factor analysis.

Table 3. KMO and Bartlett test of sphericity

KMO Value		0.910
Bartlett-test of sphericity	approximate chi-square (math.)	2084.293
	df	153
	p-value	0.000

Entropy method. Through the entropy method, the items under "dependence on smartphones and internet," "the level of digital access," "digital information literacy," "digital application literacy," and "digital creation literacy" questions are fitted into five variables to participate in the regression, and the fitted variables are "dependence on smartphones and internet," "the level of digital access," "digital information literacy," "digital application literacy," and "digital creation literacy." The specific steps are as follows:

1. The normalization process of data aims to make:

$$X'_{ij} = \frac{X_{ij} - \min(X_{1j}, X_{2j} \ldots X_{nj})}{\max(X_{1j}, X_{2j} \ldots X_{nj}) - \min(X_{1j}, X_{2j} \ldots X_{nj})}, i = 1,2 \ldots n, j = 1,2 \ldots m$$

Get the data X'_{ij}, meaning the ith normalized sample under the jth indicator.

2. Calculate the weight of the ith sample under the jth indicator for that indicator so that:

$$P_{ij} = X'_{ij} / \sum_{i=1}^{n} X'_{ij} \quad i = 1, \ldots, n, j = 1, \ldots, m$$

3. Calculate the entropy value of the jth indicator so that:

$$e_j = -k \sum_{i=1}^{n} p_{ij} \ln(p_{ij}), \text{ where } k = 1/\ln(n) > 0, \text{ and } e_j \geq 0$$

4. Calculate the information entropy redundancy value to make:

$$d_j = 1 - e_j$$

5. Calculate the indicator weights to make:

$$w_j = d_j / \sum_{j=1}^{m} d_j$$

6. Calculate the sample score to make:

$$s_i = \sum_{j=1}^{m} w_j . p_{ij}$$

s_i which is the specialization level of the ith sample.

A total of five questions are analyzed for the "Dependence on smartphones, interne," and their weights are 0.152, 0.288, 0.252, 0.169, and 0.139, and the weights of the indices are relatively uniform, all around 0.200.

A total of five questions are analyzed for "The level of digital access," and their weights are 0.103, 0.124, 0.324, 0.170, and 0.280, and the weights of each index are relatively even, around 0.200.

The weights of the three questions of the "Digital information literacy" are analyzed, and their weights are 0.296, 0.344, and 0.360, respectively, and the weights of the indices are relatively uniform, all around 0.333.

The weights of the three questions of the "Digital application literacy" are analyzed, and their weights are 0.244, 0.332, and 0.423, respectively, and the weights of the indices are relatively uniform, all around 0.333.

The weights of the two questions of the "Digital creative literacy" are analyzed, and their weights are 0.505 and 0.495, respectively, and the weights of the indices are relatively even, around 0.500.

3 ANALYSIS OF RESULTS

Table 4. VIF test results

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6
Dependence on smartphones, Internet	1.000	1.482	2.361	2.768	2.840	2.957
The level of digital access	–	1.482	1.720	1.811	1.828	1.879
Digital information literacy	–	–	2.639	4.481	4.503	4.668
Digital application literacy	–	–	–	5.371	5.694	6.439
Digital creative literacy	–	–	–	–	2.043	2.233
Age	–	–	–	–	–	1.802
Education background	–	–	–	–	–	1.653
Training in digital tools	–	–	–	–	–	1.598
Number of family laborers	–	–	–	–	–	1.104

The VIF test is done on the variables involved, and the results of the test are shown in Table 4: The VIF values of all the variables are less than 10, indicating that there is no problem of multicollinearity among the variables.

Table 5. Impact of digital literacy on farmers' entrepreneurial income

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6
a constant (math.)	0.701** (2.271)	0.410 (1.340)	0.285 (0.940)	0.323 (1.057)	0.171 (0.553)	–0.113 (–0.138)
Dependence on smartphones/ internet	0.472*** (4.709)	0.233** (1.998)	0.001 (0.010)	0.060 (0.382)	0.004 (0.027)	–0.020 (–0.124)
The level of digital access		1.418*** (3.588)	1.010** (2.426)	1.103** (2.581)	1.011** (2.394)	0.918** (2.150)
Digital information literacy			0.368*** (2.638)	0.481*** (2.647)	0.453** (2.526)	0.449** (2.464)

(Continued)

Table 5. Impact of digital literacy on farmers' entrepreneurial income *(Continued)*

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6
digital application literacy				–0.200 (–0.972)	–0.311 (–1.492)	–0.332 (–1.503)
digital creative literacy					0.349** (2.236)	0.298* (1.831)
age						0.019 (0.208)
Education background						0.235** (2.139)
Training in digital tools						–0.114 (–0.546)
Number of family laborers						0.034 (0.388)
sample size	130	130	130	130	130	130
R^2	0.148	0.226	0.267	0.272	0.300	0.327
Adjusted R^2	0.141	0.214	0.249	0.249	0.272	0.276
F Value ☐	*F* (1,128) = 22.173, p = 0.000	*F* (2,127) = 18.551, p = 0.000	*F* (3,126) = 15.266, p = 0.000	*F* (4,125) = 11.681, p = 0.000	*F* (5,124) = 10.644, p = 0.000	*F* (9,120) = 6.465, p = 0.000
☐R^2	0.148	0.078	0.040	0.006	0.028	0.026
☐*F* value ☐	*F* (1,128) = 22.173, p = 0.000	*F* (1,127) = 12.872, p = 0.000	*F* (1,126) = 6.957, p = 0.009	*F* (1,125) = 0.945, p = 0.333	*F* (1,124) = 5.000, p = 0.027	*F* (4,120) = 1.168, p = 0.328

Note: *p < 0.1, **p < 0.05, ***p < 0.01 t-values inside parentheses, Dependent variable: entrepreneurial income in 2023.

This study examines the role of explanatory variables on the explained variables by means of hierarchical regression analysis. As can be seen from Table 5, there are six models involved in this hierarchical regression analysis. The independent variables in model 1 are dependence on smartphones and the internet; model 2 adds the level of digital access to model 1; model 3 adds digital information literacy to model 2; model 4 adds digital application literacy to model 3; model 5 adds digital creation to model 4; and model 6 adds control variables to model 5—age, education background, training in digital tools, and number of family laborers—and the dependent variable of the model is income from entrepreneurship in 2023.

In model 1, the value of the regression coefficient of dependence on smartphones and the internet is 0.472 and shows significance (t = 4.709, p = 0.000 < 0.01), which implies that dependence on smartphones and the internet will have a significant and positive relationship with entrepreneurial income in 2023.

In model 2, the value of the regression coefficient of digital access level is 1.418 and shows significance (t = 3.588, p = 0.000 < 0.01), which implies that the level of smartphones and the internet hardware will have a significant positive impact on entrepreneurial income in the 2023 relationship. Meanwhile, the level of dependence on smartphones and the internet still has a significant positive impact on entrepreneurial income.

In model 3, the value of the regression coefficient of digital information literacy is 0.368 and shows significance (t = 2.638, p = 0.009 < 0.01), implying that information accessibility will have a significant positive relationship with entrepreneurial

income in 2023. At this time, the significance of the impact of dependence on smartphones and the internet on the level of entrepreneurial income has changed significantly and is no longer significant. Whereas the effect of digital access level on entrepreneurial income remains significant.

In model 4, the effect of digital application literacy on entrepreneurial income is not significant with the addition of digital application literacy, and the significance of the other variables did not change significantly.

In model 5, the value of the regression coefficient of digital creativity literacy is 0.349 and shows significance ($t = 2.236$, $p = 0.027 < 0.05$), which implies that creativity will have a significant and positive relationship with entrepreneurial income in 2023. Meanwhile, the effect of digital access level and digital information literacy on the level of entrepreneurial income remains significant.

In model 6, after adding control variables such as age, education background, training in digital tools, and number of family labors to model 5, the significance of digital creation literacy, the level of digital access, and digital information literacy does not change significantly. At the same time, literacy level has a significant positive effect on the level of entrepreneurial income.

To summarize, the results of the analysis show that in the research area, the dependence on smartphones and the internet, the level of smartphones and the internet hardware, the ability to access information, and the ability to create will have a significant and positive impact on the relationship of entrepreneurial income in 2023.

4 CONCLUSION

This study focuses on the role of farmers' digital literacy on their entrepreneurial income. Through household interviews and questionnaire distribution, data from 130 farmers in Jianggu Town, Sihui City, Zhaoqing are obtained. On this basis, farmers' digital literacy is categorized into five dimensions, and the effect of each dimension on farmers' entrepreneurial income is empirically examined through the method of hierarchical multiple linear regression. The results show that "the dependence of smartphone and internet," "the level of digital access," "digital information literacy," and "digital creation literacy" can all significantly affect the income level of entrepreneurial farmers. Based on this realization, the following policy recommendations are proposed:

1. Formulate practical digital literacy cultivation programs. The government should enhance top-level design and policy support, create a program that aligns more closely with the digital literacy development of rural farmers, which suits the current circumstances in the countryside, strengthens the cultivation of fundamental knowledge of digital literacy for farmers, and accelerates the training of new professional farmers to support the improvement of rural residents' digital literacy.
2. Establish a unified digital aggregation platform. The establishment of a unified digital aggregation platform can effectively reduce the cost of farmers' access to information, and the government can use the platform to screen and integrate the information received by farmers, minimizing the emergence of false and misleading information. The digital village development strategy should be implemented to promote the development of the digital village platform, playing

a holistic role in building a new system of large-scale markets, governance, and services within the digital village.

3. Popularize digitalization and informatization through multiple channels. Regular lectures should be organized, and professionals or volunteers should be invited to explain to villagers how to use smartphones, computers, and other devices, as well as how to surf the internet safely, access information, do online shopping, make payments, and perform other basic operations. Popular science videos represent another popular learning method for farmers. By utilizing short video platforms, a series of concise and easy-to-understand tutorials can be produced on how to use various digital tools and services, as well as how to safely and effectively use the internet in daily life.

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