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Research Article

Performance Evaluation of Rural Agricultural Informatization Management Based on Interval Intuition Fuzzy Information

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The scientific evaluation of agricultural informatization construction level has important theoretical and practical significance, especially with the development of "national rural informatization demonstration province construction pilot," and the establishment of a comprehensive evaluation of agricultural informatization results of the index system has become an urgent problem to develop China's agricultural informatization. This paper draws on relevant research results to build an index system for evaluating the performance of agricultural informatization in three dimensions: the external environment, the internal environment, and the operational effect of agricultural informatization, and the study uses SPSS software to conduct factor analysis and improve the constructed index system. Then the interval intuitionistic fuzzy mathematics is applied to construct the RAIM performance evaluation model, which is verified by Hunan Province, and on this basis, the improvement measures of rural agricultural information management construction are proposed.

1. Introduction

Rural Agricultural Information Management (RAIM) refers to the combination of computerized remote sensing and satellite technologies for agricultural information forecasting, including the provision of accurate weather forecasts, agricultural pest and disease forecasts, and crop yield forecasts. The level of agricultural informatization construction is an important indicator to measure in a country or region. Agricultural informatization began to develop gradually in the late 1970s when remote sensing technology was introduced in China. Agricultural informatization development began to have scientific support in the 1980s when the computer center of the Chinese Academy of Agricultural Sciences was established. The level of agricultural informatization construction can be assessed by building a scientific performance evaluation index system for agricultural informatization management. The performance evaluation of agricultural informatization is conducive to the healthy and orderly development of agricultural informatization and the establishment of a correct orientation of agricultural informatization.

The development of agricultural information management is of great significance to improve the contribution of scientific and technological progress, promote agricultural modernization, and achieve the strategic goal of building a moderately prosperous society in all aspects. With the development of information technology, the use of information technology for agricultural services has become more and more common [1]. The purpose of informatization is to apply information technology and equipment to penetrate information resources into all areas of society, to achieve efficiency improvement, and to promote the modernization of economy and society. The performance of rural information management has a direct impact on the development of the "three rural areas" policy. Farmers are the most grassroot level and the largest number of objects in rural information services and are the direct beneficiaries of rural information services. The government, agriculture-related enterprises, agricultural researchers, agricultural educators, agricultural managers, and other agricultural information management supply subjects provide information services for farmers through access to information resources such as networks and databases and are the indirect beneficiaries of

RAIM. As far as farmers are concerned, the performance that can meet farmers' information needs is the focus of information management performance evaluation. Therefore, the evaluation of RAIM performance is an important means to measure whether farmers' production life is secured.

In recent years, related scholars have conducted a lot of research in agricultural information management technology. Zhang et al pointed out that modern agriculture requires efficient and environmental friendly agricultural information management practices to meet the requirements of low carbon agriculture [2]. Tang used the binary fuzzy cluster analysis algorithm to analyze agricultural economic development, applied interval type II fuzzy numbers to the performance evaluation model of agricultural informatization construction, and constructed a cloud computing-based information system for technological agricultural services [3]. Based on this, the relevant theories of fuzzy mathematics are widely used in modern agricultural research and applications [4, 5]. In addition to this, modern information and communication technologies such as IoT technology and machine learning are applied to sustainable agricultural development. Leduc et al proposed a blockchain-based agricultural marketplace platform for solution integrators to understand and measure configuration options to improve platform service capabilities [6]. The multicriteria analysis approach is also used in agricultural decision support systems, where the subjective judgments of decision-makers in the assessment process are approximated using fuzzy number of linguistic variables to achieve performance evaluation [7–9].

In the evaluation of agricultural information management performance, agricultural information management performance refers to the process of getting a certain period or a certain stage of information construction, the result, and its impact, which is a comprehensive reflection of the efficiency, effectiveness, and effect of agricultural information management [10]. The Machlup approach was applied to study the proportion and structure of the knowledge industry in the macro economy, and a set of theoretical methods for calculating the size of the information economy was proposed, which enables the establishment of a structured, multilevel system of multiple evaluation indicators for rural information construction [11, 12]. The informatization index method, which measures the level of informatization development through 11 specific indicators in four categories cannot be calculated by themselves but can be calculated by setting a base year and comparing it with a weighted calculation to obtain the level of the informatization index [13, 14]. In terms of agricultural information management performance evaluation methods, precision agriculture can greatly reduce the implementation time of precision agriculture through the interconnection between agricultural information systems and government information systems, thus improving economic efficiency [15]. Kerry examined the application of information technology in the areas of agricultural economics, agricultural production, and farmers' livelihoods and provided a comprehensive and in-depth study of the impact that information technology has had on agricultural output forecasting [16].

Based on the above analysis, this paper takes the performance evaluation of agricultural informatization in Hunan Province, a demonstration site for agricultural informatization construction, as an example, and establishes an agricultural information management performance evaluation index system from three dimensions: external environment, internal environment, and operational effect of agricultural information management, and then further decomposes each dimension and uses factor analysis to verify and improve the index system. On this basis, the RAIM performance evaluation model is constructed by using interval intuitionistic fuzzy information.

2. Evaluation Index System on Performance Evaluation of RAIM

The implementation subject of agricultural information management is mainly divided into administrative level and market level, covering agricultural administrative departments and agricultural enterprises. The evaluation object of the evaluation index system constructed in this paper is mainly the agricultural information management at the administrative level. The core of agricultural information management performance evaluation includes the determination of evaluation criteria, evaluation index system, and evaluation model.

RAIM performance evaluation criteria mainly include scientific, forward-looking, operability, and scalability. Scientificity means that the design of the RAIM performance evaluation index system should accurately define the content of agricultural information management construction, according to the theory of information mining and information dissemination, to realize the three dimensions such as the internal environment, external environment, and operation effect of agricultural information management construction at the administrative level. Evaluation of the scientific nature of the evaluation criteria is embodied in the design of the performance evaluation index dimension. The design of the evaluation index dimension should cover the main work of agricultural information management such as the agricultural information service system, the agricultural comprehensive information service platform, the informatization project of rural professional cooperatives, and the informatization pilot. Forward-looking means that the development of information technology that RAIM relies on presents a leap-forward development of geometric progression. Therefore, the performance evaluation index system of RAIM should be forward-looking and able to predict the future development trend of agricultural information management technology. The emergence of advanced databases such as mobile Internet, sensors, Internet of Things, cloud computing, and big data has brought new changes and upgrades to agricultural production and operation management and has initially shown economies of scale. Operability means that the evaluation index system should be easy for evaluators to operate. The main reasons for restricting the operability of evaluation include that the departments, regions, enterprises, and institutions involved in agriculture all have their own information systems, which are prone to information barriers. Therefore, the RAIM performance evaluation platform needs to be designed in the evaluation process. Scalability is the scalability of the evaluation index algorithm. Clustering algorithms originating from the field of statistics can show high efficiency when dealing with hundreds of pieces of data. It should be considered in the statistics of agricultural informatization evaluation index data.

In the development process of agricultural information management, the agricultural management department needs to be responsible for the statistics, release and management of agricultural and rural economic information, organize information research, the introduction of information technology, the transformation of achievements and technology promotion, monitor and analyze the operation of agriculture and rural economy, and guide agriculture. Information services formulate agricultural informatization talent team construction plans, agricultural and rural economic information systems, and agricultural product market system construction and development plans and organize their implementation. In addition, agricultural information management needs to take advantage of the latest achievements in research and application in the field of modern information technology to comprehensively improve the acquisition, processing, dissemination, and rational use of traditional agricultural scientific and technological information and knowledge, accelerate the transformation of traditional agriculture, and improve the level of decision-making in agricultural production and management. Based on this, this paper decomposes the business functions or multiple business management processes of administrative subjective departments from the three dimensions of external environment, internal environment, and operation effect and builds a theoretical model of agricultural information management evaluation, as shown in Figure 1.

The external environment refers to the political and economic environment in which agricultural information management work is located and plays an important role in the performance evaluation of information management. The external environment includes policy support, technology demand, human capital, and infrastructure construction. The internal environment refers to the units or departments involved in the construction of agricultural information management, involving the supply and demand of the logistics chain, information chain, value chain, and organizational chain of the agricultural information platform. The construction of the agricultural information platform requires a certain investment of human, material, and financial resources. Therefore, the internal environment can be designed and evaluated from four perspectives: the level of information input, the level of supply chain, the level of industrial chain, and the level of organizational structure. The operation effect refers to the analysis of the operation effect of various agricultural information management platforms, including intelligent agricultural production, networked agricultural operation and sales, efficient agricultural administration, and convenient agricultural information services. It includes analysis and evaluation of mobile technology, application of Internet technology, online retail of agricultural products, agricultural e-government platform, and agricultural information service platform, forming a comprehensive performance evaluation of agricultural informatization.

Based on the above evaluation model, taking the agricultural informatization industry value chain as the main line, construct the evaluation index system and realize the process of organic overall evaluation by multiple indicators that characterize the characteristics of various aspects of the evaluation object and their interconnections. The evaluation object refers to the agricultural administrative department at the provincial administrative level. Whether the index system is scientific, standardized, and systematic directly affects the evaluation results. Following the basic principles of systematic, typical, dynamic, concise and scientific, comparable, operable and quantifiable evaluation, in order to establish the performance evaluation indicators of agricultural informatization more scientifically, this paper adopts interviews and questionnaires to investigate the Hunan Province. The province's agricultural information management performance evaluation work has carried out a more in-depth investigation and analysis. On this basis, the agricultural information management performance evaluation index system is established as shown in Figure 2 and explained in detail in Table 1.

The agricultural information management performance evaluation index system constructed in this paper can quantitatively evaluate the development of agricultural informatization from three aspects: external environment, internal environment, and operation effect. On this basis, the weight of the evaluation indicators can be determined through the questionnaire survey and expert interviews, and then the performance evaluation work can be completed. For the interval intuition fuzzy information evaluation algorithm adopted in this paper, the evaluation index model constructed above has too many indicators. In this paper, the common factors in the evaluation indicators are extracted through factor analysis, and the variables of the same nature are combined to reduce the number of variables. Based on this, this paper boils down some multiple variables with intricate relationships into a few comprehensive factors for multivariate statistical analysis, selects three dimensions such as agricultural information management external environment, internal environment, and operating effect, and six subdimensions of unrelated public factors through which the common factors represented by many original variables are reflected. The modified evaluation index system is shown in Table 2.

3. Methodology

In the evaluation of RAIM, the information given by experts is close to IIFI. Compared with traditional fuzzy sets, interval intuitionistic fuzzy sets add "nonsubordination" as a new attribute parameter, which can reflect the fuzzy nature of the objective world more flexibly.

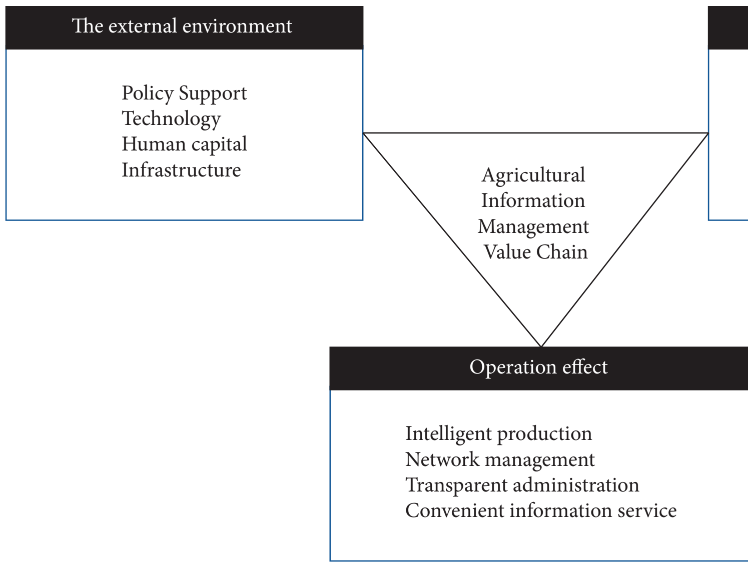

FIGURE 1: Theoretical model of agricultural information management performance evaluation.

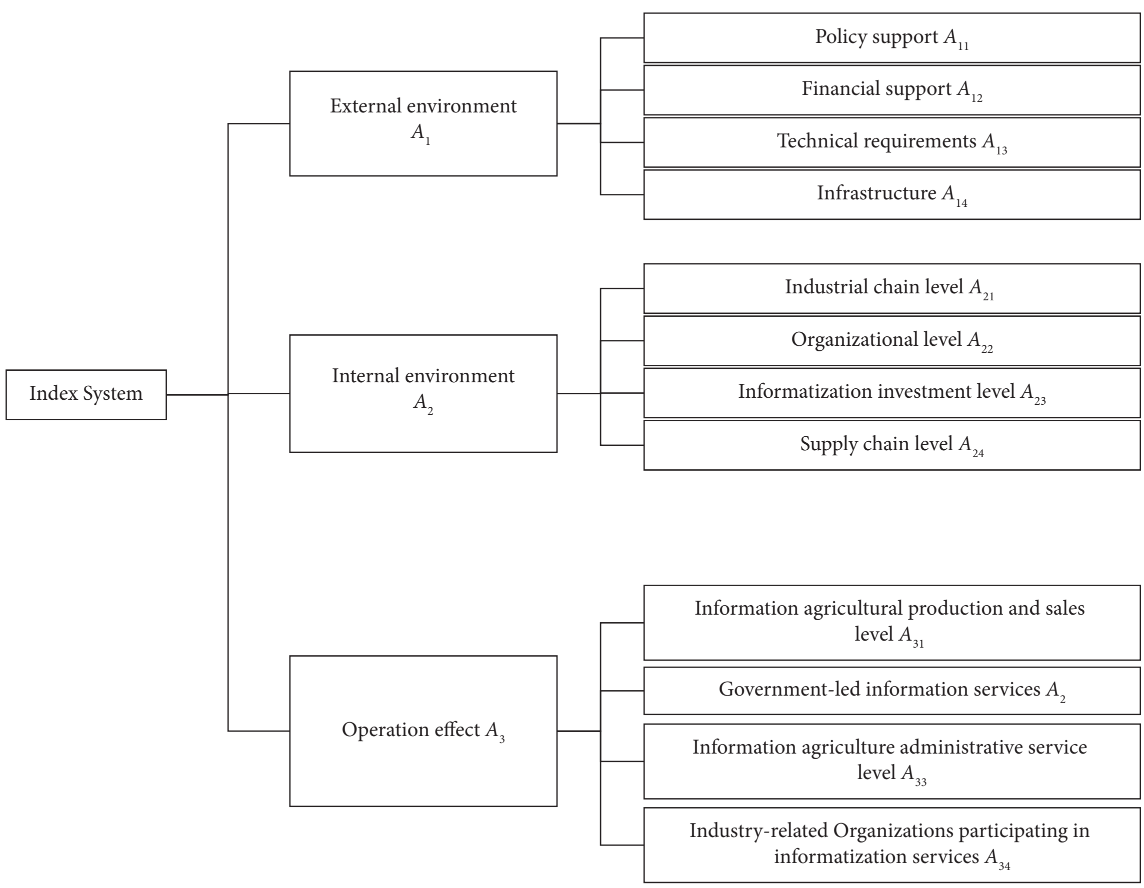

FIGURE 2: RAIM evaluation index.

3.1. Intuitionistic Fuzzy Set and Related Algorithms.

(1) Suppose X is a nonempty set, then $A = \{\langle x, \mu_A(x), \nu_A(x)\rangle | x \epsilon X\}$ is an intuitionistic fuzzy set. $\mu_A(x)$ and $\nu_A(x)$ are the subordination and nonsubordination of element x in X, respectively, where $\mu_A(x) \in [0, 1]$, $\nu_A(x) \in [0, 1]$, and $0 \leq \mu_A(x) + \nu_A(x) \leq 1$ are satisfied. In addition, $1 - [\mu_A(x) + \nu_A(x)]$ indicates that x belongs to the hesitation degree of X. Due to the complexity and vagueness of objective things, the values of $\mu_A(x)$ and $\nu_A(x)$ are often difficult to be expressed by exact real values. It is more appropriate to express

Table 1: Explanation of the RAIM evaluation index.

	Index	Explanation
External environment	Policy support	Including the perfection of policy documents, the status quo of agricultural informatization development planning.
	Financial support	Including the cost support and government investment required for the construction of agricultural information management
	Technical requirements	Including information management platform requirements, new technology requirements, and talent requirements
	Infrastructure	Including information service system, information service platform, informatization engineering, and informatization pilot work
Internal environment	Industrial chain level	Including the output value of the agricultural information industry and the proportion of the added value of the agricultural information industry in GDP
	Organizational level	Including agricultural information management organization setting, agricultural information management development, management and service personnel, and agricultural information management training
	Informatization investment level	Including agricultural information management special budget, hardware investment, and software investment
	Supply chain level	Including agricultural information management logistics chain, information chain, value chain, and organization chain
Operation effect	Information agricultural production and sales level	Including the intelligentization of agricultural production and the construction of network channels for operation and sales
	Government-led information services	Including the level of government-led informatization construction and the effect of information management
	Information agriculture administrative service level A_{33}	Including the timeliness and efficiency of agricultural information administration
	Industry-related organizations participating in informatization services	Agricultural information management including industry organizations, professional associations, research institutions, and teaching organizations

Table 2: Revised evaluation index system of RAIM.

Indicators I	Indicators II	Index
External environment A_1	Government-related indicators A_{11}	Policy support A_{111}
		Financial support A_{112}
	Development foundation A_{12}	Technical requirements A_{121}
		Infrastructure A_{122}
Internal environment A_2	Organizational conditions A_{21}	Industrial chain level A_{211}
		Organizational level A_{212}
	Hardware condition A_{22}	Informatization investment level A_{221}
		Supply chain level A_{222}
Operation effect A_3	The effect of government operation A_{31}	Information agricultural production and sales level A_{311}
		Government-led information services A_{312}
	Industrial operation effect A_{32}	Information agriculture administrative service level A_{321}
		Industry-related organizations participating in informatization services A_{322}

them by interval numbers. Therefore, the intuitionistic fuzzy sets are expanded to interval intuitionistic fuzzy sets.

(2) The interval intuitionistic fuzzy set on the set X is defined as $I = \{\langle x, \mu_A(x), \nu_A(x)\rangle | x \epsilon X\}$, where $\mu_A(x)$ and $\nu_A(x)$ denote the subordination interval and nonsubordination interval of the element x, and $0 \leq sup\mu_A(x) + sup\nu_A(x) \leq 1$. The ordered interval pair $(\mu_A(x), \nu_A(x))$ is called the interval intuitionistic fuzzy number (IIFN), which is abbreviated as ([a, b], [c, d]) for convenience, where $[a, b] \in [0,1]$, $[c, d] \in [0, 1]$, $b + d \leq 1$. Let $a_1 = ([a_1, b_1], [c_1, d_1])$, $a_2 = ([a_2, b_2], [c_2, d_2])$ be any two IIFNs, then the calculation rules are given as

$$a_1 a_2 = ([a_1 + a_2 - a_1 a_2, b_1 + b_2 - b_1 b_2], [c_1 c_2, d_1 d_2]), \quad (1)$$

$$a_1^\theta = \left(\left[1 - (1 - a_1)^\theta, 1 - (1 - b_1)^\theta\right], \left[c_1^\theta, d_1^\theta\right]\right), \theta > 0, \quad (2)$$

(3) Let $\tilde{a} =<$ [a, b], [c, d] $>$ be an IIFN, and its score function $S(\tilde{a})$ is shown in equation (3). The magnitude of the score function $S(\tilde{a})$ reflects the difference between the midpoint of the affiliation interval and the midpoint of the nonaffiliation interval. If the value of $S(\tilde{a})$ is larger, it means that the degree of affiliation is high, and the corresponding IIFN is also larger.

$$S(\tilde{a}) = \frac{1}{2}[(a+b)-(c+d)], S(\tilde{a}) \in [-1,1]. \quad (3)$$

If $S(\tilde{a}) = 1$, then $\tilde{a}$ is the largest IIFN < [1, 1], [0, 0] >. If $S(\tilde{a}) = 0$, then $\tilde{a}$ takes the smallest value < [0, 0], [1, 1] >. The exact function of the IIFN is defined as shown in equation (4).

$$H(a) = \frac{a+b+c+d}{2}, H(a) \in [0,1]. \quad (4)$$

H(a) reflects the size of the sum of the midpoints of the affiliation interval and the midpoints of the nonaffiliation interval, and the larger the sum of the affiliation and nonaffiliation, the smaller the hesitation, and thus the more accurate the IIFN a is greater. The magnitude of the score function and the exact function of the two IIFNs can be compared to establish the sequential relationship between the IIFNs. If $S(\tilde{a}_1) < S(\tilde{a}_2)$, then $\tilde{a}_1 < \tilde{a}_2$, and the case of $S(\tilde{a}_1) = S(\tilde{a}_2)$ is given as

$$\begin{aligned} H(\tilde{a}_1) = H(\tilde{a}_2) \longrightarrow \tilde{a}_1 = \tilde{a}_2, \\ H(\tilde{a}_1) < H(\tilde{a}_2) \longrightarrow \tilde{a}_1 < \tilde{a}_2. \end{aligned} \quad (5)$$

3.2. Integration Operators for IIFI. Based on the above algorithm, the weighted arithmetic average operator and weighted geometric average operator of IIFNs can be obtained. Let a_j (j = 1,2, ..., n) be a set of IIFN, and let F: $\Omega^n \longrightarrow \Omega$ be

$$F_w(a_1, a_2, \ldots, a_n) = \sum_{j=1}^{n} w_j a_j, \quad (6)$$

F is the weighted arithmetic mean operator of IIFNs. Ω is the set of all IIFNs, $w = (w_1, w_2, \ldots, w_n)^T$ is the weight vector of a_j, and $w_j \in [0, 1]$, $\sum_{j=1}^{n} w_j = 1$. In particular, if $w = (1/n, 1/n, \ldots, 1/n)^T$t, F is called the arithmetic mean operator of IIFNs. Let G: $\Omega^n \longrightarrow \Omega$ be as shown in equation (7). Similarly, G is the weighted geometric average operator of IIFNs.

$$G_w(a_1, a_2, \ldots, a_n) = \prod_{j=1}^{n} a_j^{w_j}. \quad (7)$$

The emphasis of weighted geometric average operator and weighted arithmetic average operator of IIFNs is different. The former emphasizes the role of individual, while the latter focuses on the influence of group.

3.3. RAIM Evaluation Method Based on IIFI. Let $X = \{x_1, x_2, \ldots, x_m\}$ be the evaluation object set of RAIM, and $U = \{u_1, u_2, \ldots, u_n\}$ be the evaluation index set of RAIM. In the fuzzy environment, let the evaluation value of the object x_i of RAIM under the evaluation index u_j be $r_{ij} = ([a_{ij}, b_{ij}], [c_{ij}, d_{ij}])$, where i = = 1, 2, ..., m; j1, 2, ..., n. $[a_{ij}, b_{ij}]$ represents the satisfaction degree interval of the evaluation expert for x_i about u_j, and $[c_{ij}, d_{ij}]$ represents the corresponding dissatisfaction degree interval. Thus, the evaluation information given by the evaluation experts constitutes the IIFN evaluation matrix, which is recorded as $R = (r_{ij})_{m\times n}$. The RAIM evaluation process is shown in Figure 3.

Step 1. Using the weighted arithmetic average operator of equation (5) and the addition and number multiplication algorithms to aggregate the i-th row of the evaluation matrix, the experts' composite index value for RAIM object x_i is obtained as

$$z_i(w) = F_w(r_{i1}, a_{i2}, \ldots, a_{in}) = \sum_{j=1}^{n} w_j r_{ij}. \quad (8)$$

Step 2. Calculate the score function $S(z_i)$ for the composite attribute value $z_i(w)$ using Equation (3). If the value of $S(z_i)$ is the same, the exact function $H(z_i)$ is further calculated by using equation (4).

Step 3. Based on the magnitude of the score function $S(z_i)$ and the exact function $H(z_i)$, the strengths and weaknesses of the RAIM of different subjects can be evaluated.

4. Results and Discussion

The development of the digital economy is an important strategic choice for rural development today to grasp new opportunities for industrial change. In order to improve information infrastructure, build smart agriculture, and rapidly develop agricultural e-commerce, it is important to gradually apply big data in rural agriculture and understand the existing level of RAIM in rural areas. Hunan Province is a large agricultural province in China, and this paper selects relevant informatization demonstration sites as evaluation objects and applies the IIFI evaluation method.

4.1. Experimental Results. For the sake of ensuring the authenticity and reliability of the data, this paper invited people from government, technology companies, and digital agriculture innovation application base construction to conduct interviews and research. A total of 400 questionnaires were distributed, 353 were returned, and 345 were valid. The preceding analysis yielded six key indicators related to RAIM: government-related indicators, development foundation, organizational conditions, hardware condition, and the effect of government operation. Ten agronomy experts participated in the initial weighting of the evaluation indicators. The weight vector of the indicator is $w = (0.20, 0.12, 0.22, 0.16, 0.10, 0.20)^T$. The questionnaire data were organized to obtain the IIFI for each RAIM subject, and its evaluation information matrix is shown in Table 3.

According to the results of Table 1 and the algorithm of IIFN, the calculation process of the composite index value is shown in equation (9)–(13), taking object x_1 as an example.

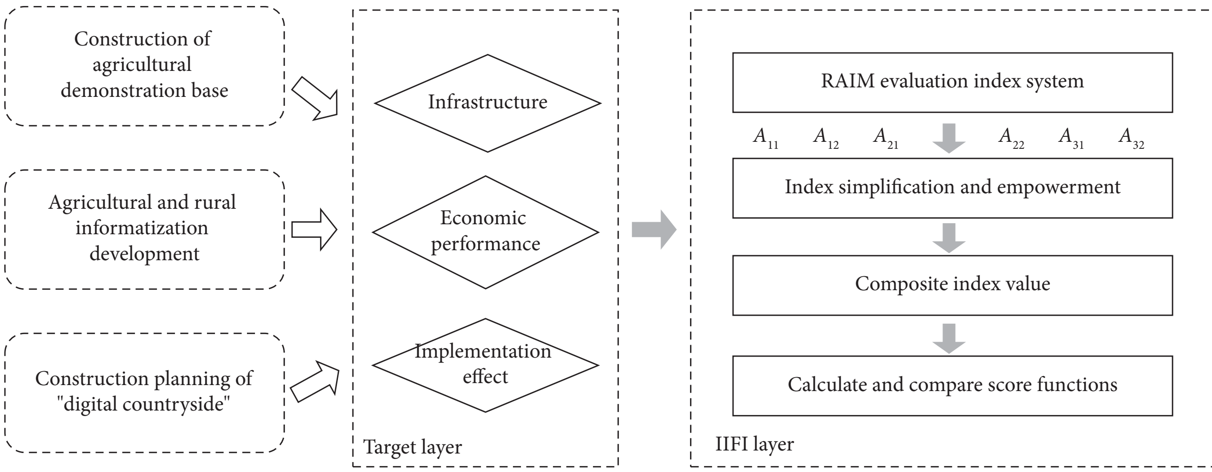

Figure 3: RAIM evaluation process based on IIFI.

$$\prod_{j=1}^{6}\left(1-a_{1j}\right)^{w_j} = (1-0.4)^{0.2}(1-0.6)^{0.12}(1-0.6)^{0.22}(1-0.4)^{0.16}(1-0.5)^{0.1}(1-0.3)^{0.2} = 0.5294, \quad (9)$$

$$\prod_{j=1}^{6}\left(1-b_{1j}\right)^{w_j} = (1-0.5)^{0.2}(1-0.8)^{0.12}(1-0.7)^{0.22}(1-0.6)^{0.16}(1-0.7)^{0.1}(1-0.5)^{0.2} = 0.3670, \quad (10)$$

$$\prod_{j=1}^{6}\left(1-c_{1j}\right)^{w_j} = 0.2^{0.2}0.1^{0.12}0.2^{0.22}0.1^{0.16}0.2^{0.1}0.2^{0.2} = 0.1647, \quad (11)$$

$$10pt\prod_{j=1}^{6}\left(1-d_{1j}\right)^{w_j} = 0.3^{0.2}0.3^{0.12}0.3^{0.22}0.2^{0.16}0.5^{0.1}0.3^{0.2} = 0.2959, \quad (12)$$

$$z_1(w) = \sum_{j=1}^{6} w_j r_{ij} = \left\{\left[1-\prod_{j=1}^{6}\left(1-a_{1j}\right)^{w_j}, 1-\prod_{j=1}^{6}\left(1-b_{1j}\right)^{w_j}\right], \left[\prod_{j=1}^{6}\left(1-c_{1j}\right)^{w_j}, \prod_{j=1}^{6}\left(1-d_{1j}\right)^{w_j}\right]\right\}$$
$$= \{[0.4706, 0.6330], [0.1647, 0.2959]\}. \quad (13)$$

Similarly, the composite index values for all objects can be derived as shown in equation (14)–(17).

$$z_2(w) = \{[0.4740, 0.6074], [0.1730, 0.3080]\}, \quad (14)$$

$$z_3(w) = \{[0.6141, 0.7405], [0.1822, 0.3096]\}, \quad (15)$$

$$z_4(w) = \{[0.5901, 0.5853], [0.2027, 0.3321]\}, \quad (16)$$

$$z_5(w) = \{[0.4937, 0.6341], [0.2031, 0.3880]\}. \quad (17)$$

Finally, using (3), we calculate the score function $S(z_i)$ for each subject. The results are shown in equation (18)–(22).

$$S(z_1) = \frac{(0.4706+0.6330)}{2} - \frac{(0.1647+0.2959)}{2} = 0.3215, \quad (18)$$

$$S(z_2) = \frac{(0.4740+0.6074)}{2} - \frac{(0.1730+0.3080)}{2} = 0.3002, \quad (19)$$

$$S(z_3) = \frac{(0.6141+0.7405)}{2} - \frac{(0.1822+0.3096)}{2} = 0.4313, \quad (20)$$

$$S(z_4) = \frac{(0.4740+0.6074)}{2} - \frac{(0.2027+0.3321)}{2} = 0.3193, \quad (21)$$

Table 3: Decision matrix.

	A_{11}	A_{12}	A_{21}
x_1	([0.4, 0.5], [0.2,0.3])	([0.6, 0.8], [0.1,0.3])	([0.6, 0.7], [0.2,0.3])
x_2	([0.4, 0.6], [0.1,0.3])	([0.5, 0.7], [0.3,0.5])	([0.5, 0.6], [0.1,0.3])
x_3	([0.5, 0.6], [0.3,0.4])	([0.7, 0.8], [0.1,0.2])	([0.6, 0.8], [0.3,0.4])
x_4	([0.3, 0.5], [0.3,0.4])	([0.5, 0.6], [0.1,0.2])	([0.4, 0.5], [0.3,0.4])
x_5	([0.4, 0.5], [0.2,0.3])	([0.6, 0.8], [0.2,0.4])	([0.5, 0.6], [0.3,0.5])
	A_{22}	A_{31}	A_{32}
x_1	([0.4, 0.6], [0.1,0.2])	([0.5, 0.7], [0.2,0.5])	([0.3, 0.5], [0.2,0.3])
x_2	([0.5, 0.6], [0.3,0.4])	([0.6, 0.7], [0.2,0.3])	([0.4, 0.5], [0.1,0.2])
x_3	([0.7, 0.8], [0.1,0.3])	([0.6, 0.7], [0.1,0.2])	([0.6, 0.7], [0.2,0.3])
x_4	([0.5, 0.6], [0.3,0.5])	([0.5, 0.6], [0.2,0.4])	([0.4, 0.7], [0.1,0.2])
x_5	([0.4, 0.5], [0.3,0.5])	([0.4, 0.7], [0.2,0.4])	([0.6, 0.7], [0.1,0.3])

Table 4: Evaluation results based on the fuzzy cross-entropy method.

	A_{11}	A_{12}	A_{21}	A_{22}	A_{31}	A_{32}
Index weight	0.20	0.15	0.20	0.15	0.10	0.20
	x_1	x_2	x_3	x_4	x_5	
Fuzzy efficiency	0.503	0.482	0.544	0.493	0.479	

$$S(z_5) = \frac{(0.4937 + 0.6341)}{2} - \frac{(0.2031 + 0.3880)}{2} = 0.2684. \tag{22}$$

Since the values of $S(z_i)$ are different from each other, it is not necessary to calculate the exact function $H(z_i)$ of the combined attribute values. The currently selected evaluation objects are ranked according to the magnitude of the score function, and the larger the score function, the better. The results of the RAIM phase ranking for the five villages are $x_3 > x_1 > x_4 > x_2 > x_5$.

To demonstrate the applicability of the model constructed by the author, this study selects the fuzzy cross-entropy evaluation method for comparison [17]. The evaluation result is shown in Table 4 and Figure 4, indicating that the method of fuzzy mathematics is applicable to the evaluation of RAIM.

5. Discussion

Information is an element, an important variable, that changes the traditional way of life of farmers and agricultural production, creating marginal diminishing cost benefits. The promotion of information technology in rural areas not only enables farmers to learn the skills and knowledge but also optimizes the rural environment. This paper deeply analyzes and summarizes the current RAIM situation and relevant facts and refines a set of proven evaluation indicators. At the same time, the evaluation method based on IIFI is verified by examples. After this, the evaluation results are landed to the suggestions of the path of rural informatization construction so that the theory is used to serve the practice.

Agricultural information construction has made great progress, but RAIM still faces many difficulties and future challenges. Most of the agricultural websites are located in cities, and few of them reach into rural areas, resulting in uneven distribution of information resources as well as widening the gap between the strong and weak. The current average overall number of IT personnel per village is less than 5, which cannot meet the needs of RAIM in terms of both quantity and quality.

Among the results of indicator weights, governmentrelated indicators and organizational conditions are the most important. Grassroot government inputs guide investment so that most farmers are beneficiaries, and the government plays a role in planning, investment, policy guidance, and supervision. Rural informatization is a complex project related to multiple fields, and policy support and financial support are also essential. As information service subjects are becoming more and more diversified, the gradual diversification of service forms has become an objective requirement for the development of information technology. The Hunan provincial government has launched cooperation with technology companies and banks to jointly promote RAIM when there is insufficient investment in the development of rural informatization in the province.

According to the overall situation of rural areas today and the x_3 villages with the best performance in RAIM, if we want to quickly promote the process of agricultural informatization and improve the comprehensive capacity of RAIM, the core is to improve the information technology awareness and information science and technology level of farmers and managers. Therefore, education and training are the basis for tuning up the capacity of RAIM. We should pay great attention to the actual rural areas and carefully study the level of agricultural productivity, science and technology, product marketing level, and the state of farmers' minds at all levels in local areas, and develop education planning in a targeted manner. Carry out skills training for farmers in planting, breeding, and processing of agricultural products so that each farmer can master 2–3 practical techniques. In addition, the construction of rural infrastructure should be strengthened and rural culture should be prospered.

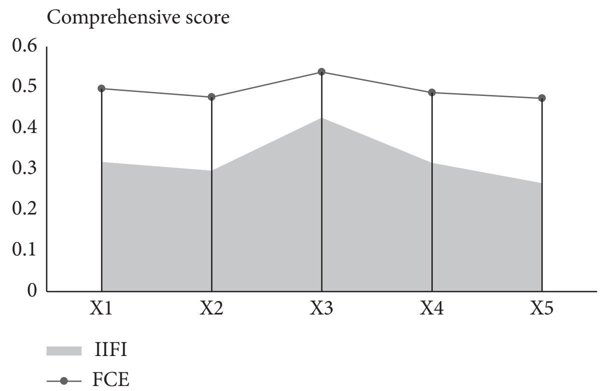

Figure 4: Comparison results of IIFI and FEC.

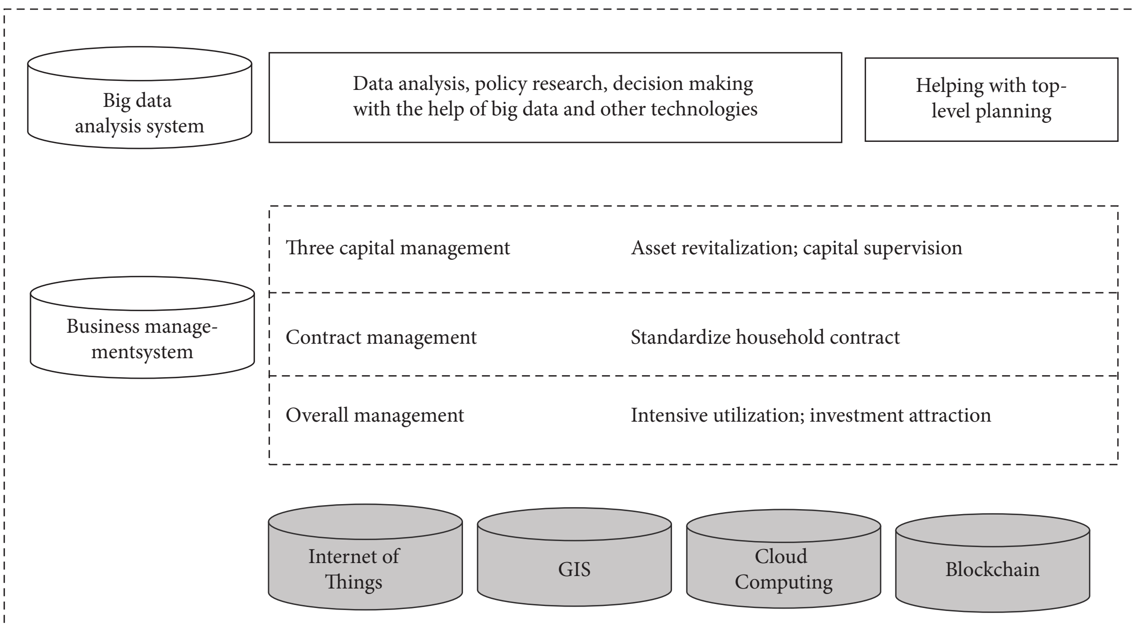

Figure 5: RAIM enhancement framework.

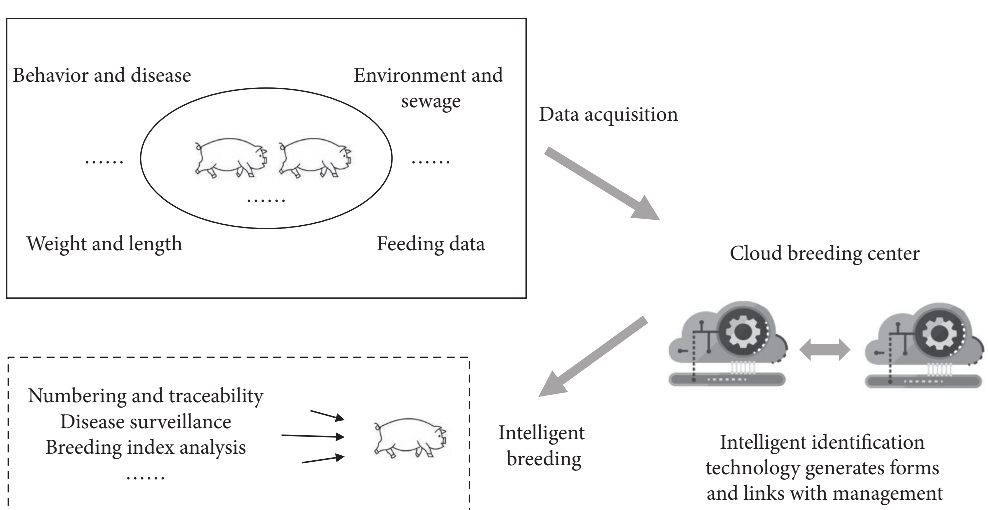

Figure 6: "Cloud" breeding process.

As shown in Figure 5, the development of information technology in rural agriculture requires not only technological progress but also the management ability to progress with it. The development of RAIM should also work toward digitalization. Apply Internet of Things technology (information sensors, radio frequency identification technology, and global positioning system) to view temperature, soil moisture, and other information in greenhouse in real time and monitor and manage remotely. Real-time condition and location information is available for transportation tracking, video monitoring, and automatic alarms. Achieve the optimal allocation of resources without affecting agricultural efficiency. In terms of animal breeding, the efficiency of RAIM can be greatly improved by establishing a "cloud breeding center," and its process is shown in Figure 6.

6. Conclusion

Agriculture is an indispensable prerequisite for the development of any other industry and is the source of supply for the survival of life. Traditional agricultural operations are experiencing the impact of market fluctuations, global economic competition, and other factors. Therefore, traditional production methods are demanding to go for innovation in the context of new times. Efficient RAIM is of great benefit to both rural and agricultural development. In this paper, based on the concept of uncertain weighted arithmetic average operator and the interval intuitionistic fuzzy number algorithm, the score function and the exact function are introduced to establish the interval intuitionistic fuzzy number sequential relationship in the fuzzy information environment, considering that the evaluation of RAIM may give IIFI. Based on the weights of the six evaluation indexes given by experts in different fields, we established the IIFI-weighted average operator evaluation model, and the empirical analysis shows the effectiveness of the method. Based on the evaluation method, we make an in-depth discussion and put forward the promotion means of RAIM. This study has important theoretical and practical significance for the comprehensive evaluation of RAIM. Information technology is advancing, and the evaluation index system of RAIM needs further depth. In the future, we can expand the scope of research, obtain more research data, and mine more agricultural development information through machine learning and other big data technologies.

Data Availability

The labeled data set used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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