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Research Article

Digital Technology Boosting Agricultural Supply-Side Constitutive Revolution in Poor Areas Based on the Intelligent Environment of the Internet of Things

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China is a big agricultural country, and China's agricultural development is related to the development of the country. Especially in poor rural areas, the development of agriculture still stays at low-level manual farming. Therefore, with the help of the developed Internet of Things technology, it is necessary for digital technology to develop and reform the rural areas in poverty-stricken areas. This paper aims to promote the supply-side structural revolution of agriculture in poverty-stricken areas by digital technology based on intelligent environment of Internet of Things. Firstly, the KNN intelligent algorithm is improved to improve the accuracy and reduce the time complexity. Then, based on the data support of Internet of Things technology, a prediction model is built, and the parameters are optimized by particle swarm optimization, and finally the best prediction model with high prediction accuracy, good stability and reduced prediction time complexity is obtained. Taking the source area of the Danjiang River in the South-to-North Water Transfer Project as the research object, the total grain output and soybean production demand in this area from 2010 to 2018 were selected, and the change trend of soybean production and demand in this area from 2019 to 2021 was predicted. The experimental data show that the soybean output in this region has increased year by year, with a cumulative increase of 6,985.4 tons from 2010 to 2018. Soybean output sometimes exceeds demand, and sometimes it is less than demand. There will be an oversupply situation in 2019 and 2021, and an oversupply situation in 2020. Therefore, the prediction model of Internet of Things can effectively predict the supply and demand situation of soybean with an accuracy rate of over 90%, which can provide data support for the decision-making of structural change of agricultural supply side in poverty-stricken areas.

1. Introduction

The transformation of agricultural development mode is also an important measure to break the plight of agricultural development and promote agricultural development [1]. It can promote the sustainable development of agriculture, improve the quality and market competitiveness of agricultural products, and accelerate the process of agricultural modernization [2]. In a smart environment of the IoT, the continuous development of digital technology has brought a huge impact on agricultural development. This kind of influence has advantages and disadvantages. Studying how to transform this influence into a driving force for revolution is of great significance for promoting agricultural development and accelerating agricultural modernization.

In order to promote the constitutive revolution of the agricultural supply side, improve the level of agricultural development and farmers' living standards, and create a sustainable, stable and healthy development path for modern agriculture, this article takes the Danjiang water source area of the South-to-North Water Diversion Project as the research object and conducts research based on digital technology in the intelligent environment of the IoT. The innovation points are as follows: (1) Improve the classic KNN algorithm to make it have higher accuracy and lower time complexity. (2) Based on the big data technology and the IoT technology, an improved KNN algorithm is used to establish a forecasting model for the supply and demand of agricultural products, which has a good fitting result. (3) Use the model created in this study to successfully predict soybean yield and demand in a certain area and make policy recommendations for supply and demand.

Firstly, this paper introduces the agricultural supply side, and briefly introduces the Internet of Things, and then improves the KNN intelligent algorithm, which improves the accuracy and reduces the time complexity. Then, the digital technology and its algorithm are described in detail, and the realization of the algorithm is represented by formulas and flow charts. Finally, through the algorithm optimization parameters, taking the source area of the Danjiang River in the South-to-North Water Transfer Project as the research object, the total grain output and soybean production demand in this area from 2010 to 2018 are selected, and the change trend of soybean production and demand in this area from 2019 to 2021 is predicted.

2. Related Work

Poverty alleviation through agricultural policies in poor areas has always been the focus of domestic research in related fields. Li Y conducted a nationwide survey of 2,075 households in 22 poverty-stricken counties in 13 provinces, provided rich statistical data and evidence for his thesis, and used the literature to review the history of poverty alleviation in China's agricultural areas [3]. The year of Gan X research data is too early, and it is of little significance to refer to the rapid development of science and technology. The emergence of big data technology and IoT technology has given new ideas for agricultural research [4]. Ruan J combines granulation technology with genetic algorithm (GA) and support vector machine (SVM) to propose a granular GA-SVM. In the comprehensive predictor, three granular methods are introduced. He decomposed the big data in the agricultural network physical system into small granularity and used genetic algorithm to find the optimal value of SVM penalty parameter and kernel parameter from the reduced particles [5, 6]. Their researches are very important for reference, but the influencing factors considered in the simulation experiments are not comprehensive enough.

3. Digital Technology and Agricultural Supply-Side Constitutive Revolution

3.1. Agricultural Supply-Side Constitutive Revolution

3.1.1. The Need for Revolution. The constitutive revolution of the agricultural supply side is to solve the constitutive imbalance in the agricultural sector. Agricultural constitutive problems and contradictions have become increasingly prominent, and the upgrading of the consumption structure has led to changes in the supply and demand relationship of agricultural products [7]. Some agricultural products are in oversupply, but high-quality green agricultural products are in short supply. Effective supply cannot meet the ever-increasing demand, and the grain production structure has changed. The output of products with high demand is reduced, while the output of products with low demand is increasing. Agricultural costs remain high, and the domestic prices of most agricultural products are higher than international levels. And a large amount of surplus of agricultural products will lead to increased financial pressure on the country. Therefore, constitutive revolutions on the agricultural supply side must be implemented.

The constitutive revolution of the agricultural supply side conforms to the laws of agricultural development at this stage. The internal and external structures and characteristics of agricultural development at each stage are different. When there are contradictions and conflicts between the internal and external structures and characteristics, the development of agriculture will be stagnant or even crisis. At the current stage, the original backward development mode of agriculture must be changed, so it is necessary to promote the constitutive revolution of the agricultural supply side. Pursue an efficient, safe and green modern agricultural production method, adapt the internal structure of agriculture to the new requirements of development, and promote the self-repair and adaptation of agriculture [8, 9]. Persist in constitutive revolutions on the agricultural supply side and cultivate new types of agriculture.

3.1.2. Basic Content of Revolution. The constitutive revolution of the agricultural supply side is not only the adjustment of the economic structure and the transformation of the development mode but also a revolution that combines the characteristics of the agricultural field. Carry out production around consumer demand, improve the adaptability of the supply structure of the agricultural product market, and optimize the allocation of resources [10–12].

The primary task of the constitutive revolution on the agricultural supply side is to solve the problem of food supply, which is a necessary foundation for economic development. Not only to meet consumer demand but also to ensure food security. On the premise of ensuring food security and effective supply, according to regional characteristics, adjust the structure of agricultural products according to local conditions to achieve the maximum benefit of resource allocation [13]. When adjusting the supply and demand structure, we must follow the objective laws of economic development to achieve sustainable agricultural development.

Constitutive revolutions on the agricultural supply side need to improve the quality of agricultural products, strengthen the safety and quality supervision of agricultural products, and use modern technology to strengthen the supervision of all links from production to sales of agricultural products to ensure their safety. At the same time, we must eliminate low-end products, provide more green organic foods, adapt to the transformation and upgrading of agricultural structure, and create high-quality agricultural products brands.

The constitutive revolution of the agricultural supply side should also promote the integration of primary, secondary, and tertiary industries in rural areas and coordinate their development [14]. Promote the upgrading and construction of processing links and circulation facilities for agricultural products. Develop the tertiary industry in the rural areas, extend the industrial chain, improve the mechanism for linking farmers' interests, and generate income for farmers.

3.1.3. Ways to Realize Revolution. The constitutive revolution of the agricultural supply side is not simply to adjust the types and quantities of agricultural products but to better meet the high-level needs of consumers and improve the competitiveness of agricultural products. Therefore, constitutive revolutions on the supply side must be carried out from multiple perspectives to achieve the goal [15].

Stimulate the vitality of agricultural and rural development and continue to deepen various rural revolutions. Deepen the revolution of the rural collective property rights system, ensure the rights of farmers, and clarify the ownership of rural collective assets. Accelerate the establishment of a complete new management system and cultivate new agricultural management and service entities. Improve the agricultural support and protection system, improve the mechanism for continuous growth of agricultural investment, guide financial investment, and implement an agricultural insurance system. Promote the overall development of urban and rural areas, make up for shortcomings in rural development, and achieve a balanced allocation of urban and rural resources. Strengthen and innovate rural social governance, improve the level of rural grassroots management, build a service-oriented government, and improve the level of villager autonomy.

Promote the green development of agriculture and promote the construction of modern ecological circular agriculture pilot projects. Do a good job in the prevention and control of agricultural pollution, reduce agricultural water waste and fertilizer pollution, and increase the utilization rate of agricultural waste. Increase the treatment of existing problems in the agricultural ecological environment and repair the damaged agricultural ecology. Promote the conversion of farmland to forests and grassland, and implement a system of cropland rotation and fallow. At the same time, according to the actual situation in different regions, starting from environmental issues, we will build modern ecological agriculture development models in different regions.

Ensure the quality and safety of food and carry out the construction of a national agricultural product quality and safety demonstration zone. Improve the level of supervision and improve relevant laws and regulations on agricultural security. Develop a green and sustainable agricultural economy, realize energy conservation and emission reduction, and promote the standardization of agricultural production. Strengthen law enforcement and improve market access and risk control management systems. Strengthen the construction of organizational leadership system and strengthen policy support.

3.2. Targeted Poverty Alleviation in the Context of Agricultural Supply-Side Constitutive Revolutions

3.2.1. The Link between the Agricultural Supply Side and Targeted Poverty Alleviation. This measure of targeted poverty alleviation meets the requirements of agricultural supply-side constitutive revolutions. The poverty alleviation work involves improving people's livelihood and developing the economy, and it also coincides with the strategy of supply-side revolution. Insufficient effective supply is the main constitutive problem in the economic system. The important goal of advancing supply-side revolution is to make up for the shortcomings of development and improve people's living standards [16]. The issue of agriculture, rural areas, and farmers is the shortcoming of economic development. The consumption power of poor areas is low, but the consumption margin of poor people is relatively high. More energy must be devoted to improving rural infrastructure, improving the level of regional public services, adjusting the rural industrial structure, and increasing employment opportunities. From the perspective of supply and demand, doing a good job in targeted poverty alleviation can effectively promote constitutive revolutions on the agricultural supply side.

Targeted poverty alleviation requires constitutive revolutions on the agricultural supply side. The utilization rate of poverty alleviation funds in rural areas is not high, because some areas have failed to reasonably study the poverty status in order to obtain quotas in poor areas and cannot accurately implement specific poverty alleviation projects [17]. The supply-side constitutive revolution should optimize the supply pattern of poverty alleviation when adjusting the structure, increase effective supply and improve the quality of supply, and increase the utilization rate of targeted poverty alleviation funds. When carrying out industrial poverty alleviation, it is necessary to guarantee the funds provided for poverty alleviation and ensure that the funds are used in place. Therefore, the constitutive revolution of the agricultural supply side can solve the problem of the imbalance between supply and demand for poverty alleviation solved by precision poverty alleviation and play a supporting role.

Construct a capital supply end focusing on policy loans. Because there are many targets for poverty alleviation and the government is under greater financial pressure, it is possible to appropriately introduce capital from policy banks to provide funds for targeted poverty alleviation. Policy capital can first inflow capital into poverty-stricken areas that require investment in order to improve the economic and social development of the poverty-stricken areas, without first considering whether it is profitable. These policy capitals can guide social funds to flow to poor areas.

Build a funding supply end focusing on poverty alleviation projects. We are currently in the stage of comprehensive poverty alleviation. In this stage, poverty alleviation is very complicated. An important part of poverty alleviation is various poverty alleviation projects. Joint policy banks and government departments to contact poverty alleviation projects and poor households. The government and policy banks use funds to support poverty alleviation projects, activate poverty alleviation projects, and increase income for poor households.

3.2.2. Implementation Methods of Precision Poverty Alleviation. Improve the rural financial organization system and enhance the supply capacity. Speed up the development of rural service finance and effectively supply poverty alleviation funds for agricultural production. Carry out diversified poverty alleviation, integrate multiple financial capital into the rural poverty alleviation capital market, and create multiple channels for rural poverty alleviation. Strengthen rural mortgage loans and integrate into the coordination of the insurance industry.

Improve the rural financial risk protection mechanism. Improve credit protection in rural areas and expand information sharing in rural credit. Promote related product evaluation activities to encourage farmers' credit level. Establish and improve the structure of risk compensation, issue more loan lines to Mingmin, and establish a loan disposal system involving multiple financial institutions. Strengthen coordination with the insurance industry to reduce the harm of risk accidents.

Change service concepts and innovate rural financial service products and service methods. Promoting the rapid development of rural financial services on the Internet can reduce the cost of agricultural development and solve the problem of high financing costs in rural areas. Promoting rural information exchange and mobile platform information sharing can ensure the healthy and stable growth of agriculture-related industries.

Improve the overall quality and cultural level of agricultural subjects. Farmers have insufficient financial awareness, insufficient awareness of risk resistance, and lack of initiative to participate in rural finance [18, 19]. Therefore, it is necessary to improve the training mechanism to improve farmers' understanding of financial knowledge. Strengthen the financial management education of village cadres and guide farmers to effectively distinguish illegal and fraudulent activities. Carry out relevant knowledge lectures to enable farmers to master more financial knowledge and enhance their credit awareness. Establish a monitoring system and feedback system with a high degree of participation of farmers, and maintain a good rural financial environment.

3.3. Digital Technology

3.3.1. Agricultural Big Data. Agricultural big data takes the agricultural field as the core and integrates data under the macroeconomic background, including data on production, import and export, and prices. From a geographical point of view, agricultural big data takes domestic data as the core and international agricultural data as a reference. Domestic data is even more detailed to provincial and municipal data, providing reference for precise regional research [20]. In addition to statistically accurate data, it also includes information on agricultural economic entities, investment information, and mass media information. The realization of agricultural big data must first construct and integrate professional data resources in the agricultural field, and then make an orderly plan for the professional sub-field data resources.

The application of agricultural big data is very wide, mainly in agricultural situation monitoring, agricultural product monitoring and early warning, agricultural decision-making, and the establishment of rural integrated information service system [21, 22]. Agricultural situation monitoring is to monitor changes in the farmland environment, crop yields, and natural disasters, and to predict changes in the natural environment such as climate one step in advance. By analyzing and collecting weather-related data, combining elements such as weather simulation and land analysis, the accuracy of natural disaster prediction is enhanced. A combination of remote sensing technology and crop simulation technology is used to monitor the growth of crops and estimate their yields.

Agricultural big data provides data support for agricultural product market monitoring and early warning, and related technologies are also conducive to the comprehensive collection of agricultural product information, which makes agricultural product quality monitoring more accurate. Big data processing technology has real-time nature. Once a problem occurs in agricultural products, it can be controlled in time to prevent its scope of influence from expanding and improve the efficiency of the early warning mechanism [23]. Faster data acquisition can speed up the flow of agricultural product market information and reduce the risk of asynchrony of information.

3.3.2. Agricultural IoT. The emergence of the agricultural IoT has promoted the development process of agricultural informatization and modernization and promoted the application of precision agriculture. The structure of the agricultural IoT is generally divided into the perception layer, the transmission layer and the application layer [24]. The sensing layer is distributed with a large number of sensing devices, such as sensors and video collectors, which can accurately collect relevant information of farmland. The transmission layer uses a variety of information transmission methods such as wireless sensor networks for data transmission to promote the diversified transmission of agricultural information. The application layer gathers a large amount of data, processes it, and uses artificial intelligence operation terminals to accurately manage and regulate agricultural production.

When the agricultural IoT works normally, both the transmission layer and the perception layer need to use spectrum. The sensor node collects data and then transmits it at a low rate. Commonly used communication technologies include ZigBee technology and Wi-Fi technology [11]. Real-time monitoring of high-definition cameras requires high-speed communication. Commonly used communication technologies include WiMax technology and ultra-wideband technology.

The function of the transport layer is to transmit data information and command information of the IoT. The wireless communication technologies commonly used at present include cellular mobile communication technology and broadband wireless access technology. When the number of working nodes in the perception layer is small, the spectrum resources used by the communication technology can meet the requirements for correct data transmission. If the number of working nodes in the sensing layer increases, the available spectrum resources will be tight, and the failure rate in transmission will increase, resulting in the inability to obtain work information in time. IoT agriculture is shown in Figure 1.

3.3.3. KNN Algorithm. The changes in the supply and demand of agricultural products have obvious characteristics of time series. Time series are natural sorting sequences. The IoT prediction model established based on this format can predict future values through existing observations [25]. Generally, linear graphs are often used to visually analyze time series. There are many IoT prediction models for time series, and neural network algorithms, support vector machines, Bayesian algorithms, and nearest neighbor algorithms are often used [26].

The nearest neighbor algorithm (KNN) performs predictive analysis by comparing the similarity between the prediction tuple and the training tuple. The training tuple is described by n attributes and has a known classification label. Each training tuple is a function of n-dimensional space, as shown in Formula (1):

$$f(Y) = f(y_1, y_2, \cdots, y_n). \tag{1}$$

Among them, $f(Y)$ is the classification label, and $y_1, y_2, \cdots y_n$ represents the attribute value. In this way, all training tuples are stored in the n-dimensional pattern space. When predicting a certain prediction tuple, because the prediction tuple has the same format as the training tuple. The KNN algorithm will find the k training tuples that are closest to the unknown tuple in the pattern space. These k tuples are the position tuple and the k nearest neighbors. The similarity is calculated using the Euclidean distance formula, as shown in Formula (2):

$$dist(Y_1, Y_2) = \sqrt{\sum_{i=1}^{n} (y_{1i} - y_{2i})^2} \tag{2}$$

Calculating the two tuples $Y_1 = (y_{11}, y_{12}, \cdots, y_{1n})$ and $Y_2 = (y_{21}, y_{22}, \cdots, y_{2n})$, the smaller the calculated similarity measure, the higher the similarity.

Although the KNN algorithm is a classic predictive model algorithm, it also has some problems. The Euclidean distance formula is used to measure similarity. Each attribute value is assigned the same weight. Therefore, once there is noisy data or different attribute values have different values, it will seriously affect the prediction accuracy. When selecting the value of k, it needs to be determined experimentally. The prediction error of the training tuple is evaluated from $k = 1$. With the continuous change of the value of k, the value of k with the smallest training error is selected to construct the IoT prediction model. It is highly complex, time-consuming, and requires user guidance. Therefore, the KNN algorithm needs to be improved in this research.

3.3.4. Deep Learning Algorithm. Machine learning is to learn through algorithms, so that the machine can draw rules from a large amount of historical data, so as to intelligently identify and automatically judge new samples. In 2003, Bengio et al. proposed the word vector method, using neural networks to build language models. Subsequently, many researchers proposed different word vector training models on this basis. In 2008, the American researchers Collobert and Weston of NEC Lab began to adopt the structure of word vector and multilayer one-dimensional convolution for four typical natural language processing: part-of-speech tagging, sentence segmentation, named entity recognition, and semantic role tagging. Domain issues. They used the same model for different tasks and achieved results comparable to classic algorithms in terms of accuracy (Collobert and Weston 2008). In 2009, the SemanticHashing method proposed by Salakhutdinov et al. applies deep learning to the field of text understanding and analysis. This method implicitly obtains the semantic connection between words in the large-scale text reconstruction training process, so that the feature mapping more reasonable. With the rise of deep neural networks in recent years, people have begun to try to use deep learning methods to solve the problem of text classification. Since Word2Vec in 2013, deep learning has developed rapidly in the field of natural language processing. At present, most of the natural language processing tasks that have achieved important results are in the category of text understanding, such as text classification, machine translation, document summarization, and reading comprehension. The network structure of the convolutional neural network is shown in Figure 2.

The most widely used application of deep learning is convolutional neural networks. Convolutional neural network is a multilayer neural network, each layer in the network is a transformation, commonly used convolution transformation and pooling transformation, each transformation is another feature expression of the input feature; each layer is composed of multiplelayer. It consists of a two-dimensional plane, which is composed of five parts: input layer, convolution layer, downsampling layer, fully connected layer, and output layer.

(1) Input layer: as shown in Figure 2, the input layer of the convolutional neural network is a word vector file, in which the figure shows a part of the screenshot of the matrix in which all words in the data set are arranged in sequence (from top to bottom), if the matrix is $n \times k$, it means that there are n words in the file, and the dimension of the vector is k

(2) Convolutional layer: the input layer obtains several feature images through the convolution operation of the convolutional layer. If the size of the convolution window is $h \times k$, then h represents the number of vertical words, and k represents the dimension of the word vector number. Through a certain size

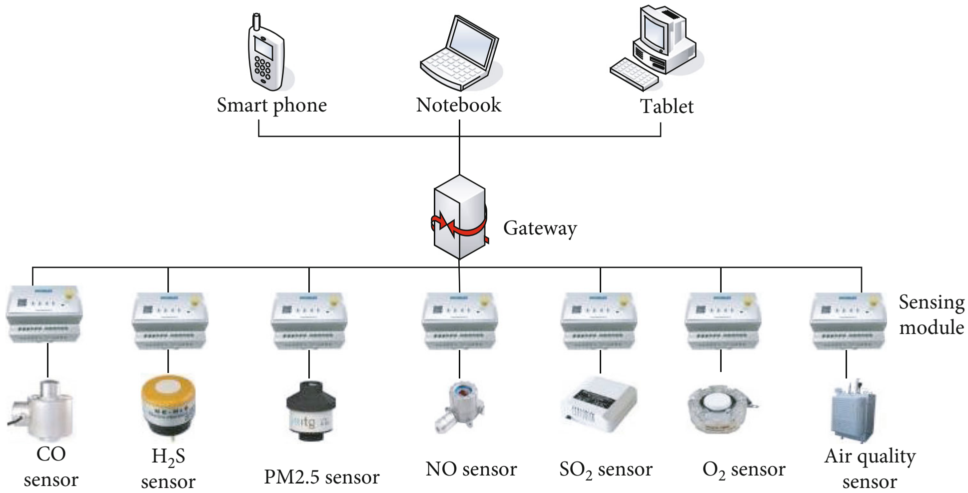

FIGURE 1: IoT agriculture.

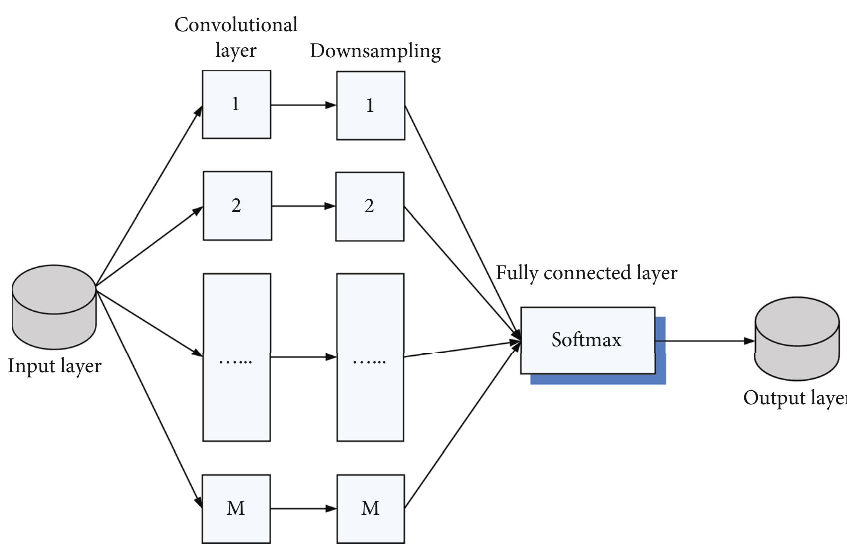

FIGURE 2: Network structure of convolutional neural network.

of the convolution window, a number of feature images with a column number of 1 will be obtained

(3) Downsampling layer: next is the downsampling layer. The output of the final downsampling layer is the maximum value of each feature image, that is, a one-dimensional vector

(4) Fully connected layer: the output of the one-dimensional vector of the downsampling layer is connected to a Softmax layer in a fully connected way

(5) Output layer: output classification probability

4. Experiments on Algorithm Improvement and Prediction Model Establishment

4.1. KNN Algorithm Improvement. In order to improve the accuracy of prediction, reduce time complexity, solve the problem of weight distribution, and the selection of k value, the KNN algorithm is improved. The supply and demand of agricultural products have the characteristics of time series. Therefore, when forecasting, the role of attribute values is increasing but not linearly. We regard the attribute value of the prediction sequence as the value of the abscissa of the binomial function, and the weight value as the value of the ordinate, and obtain the Euclidean distance formula of the binomial function, as shown in Formula (3):

$$dist(Y_1, Y_2) = \sqrt{\sum_{i=1}^{n} \left(ai^2 + bi + c\right)\left(y_{1i} - y_{2i}\right)^2}. \quad (3)$$

Among them, a, b, c are all binomial coefficients, and i is the attribute value dimension of the prediction sequence. By combining the Euclidean distance formula and the binomial function, the weight distribution problem of attribute values can be solved.

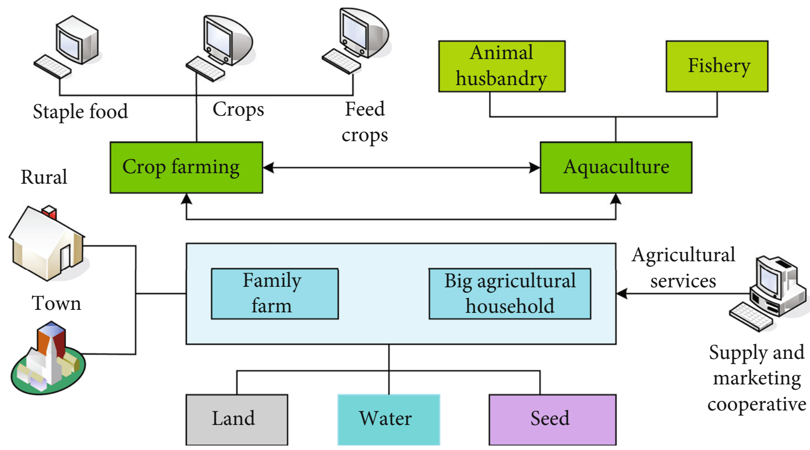

Figure 3: Revolution of the agricultural supply side of the IoT.

4.2. Models for Forecasting the Supply and Demand of Agricultural Products

4.2.1. Data Collection. Take the Danjiang water source area of the South-to-North Water Diversion Project as an example. Soybean production and demand in this area from 2010 to 2018 can be obtained from the agricultural and sideline product database in this area. The amount of data in the database is very large, and the accuracy of the data is also very high. Therefore, it is very conducive to the application of data mining and can provide strong data support for the establishment of the agricultural product supply and demand IoT prediction model for this study.

Due to the large amount of data in the database, the relevant data needs to be imported into the local SQL Server database, and then it can be put into use through further processing and analysis.

4.2.2. Data Preprocessing. There may be omissions in the data collection of the database, such as failure to collect in time during legal holidays. When users perform operations, there may also be improper operations, resulting in data duplication, errors, and missing fields. In order to correct these errors, the data needs to be cleaned up to ensure the practicality and accuracy of the final model. Use a programming language to eliminate duplicate data and deal with errors and missing data. Figure 3 shows the revolution of the agricultural supply side of the IoT. In the greenhouse control system, the temperature sensor, humidity sensor, pH sensor, illumination sensor, CO2 sensor, and other devices of the Internet of Things system are used to detect physical parameters such as temperature, relative humidity, pH value, illumination intensity, soil nutrients, and CO2 concentration in the environment, so as to ensure that crops have a good and suitable growing environment. The realization of remote control enables technicians to monitor and control the environment of several greenhouses in the office. Wireless network is used to measure the best conditions for crop growth.

At the same time, in order to be more intuitive and clear in the analysis, this study uses data cube technology for data integration. The data cube can analyze the collected data from multiple angles, divide it according to the attributes of the supply and demand data of agricultural products, and select the four-dimensional matrix, which are agricultural product output, agricultural product type, time, and demand.

Due to the inconsistent quantification range of the collected data, the output and demand of different types of agricultural products at different times vary greatly. In order to enhance the scalability of the IoT prediction model and accelerate the convergence of the KNN algorithm in this paper, a unified quantization mapping between [0,1] is performed on the data, and the normalization formula is shown in Formula (4):

$$f(e) = \frac{e}{e_{\max} + a}. \tag{4}$$

Among them, e is the demand for the product, $e_{\max}$ is the highest historical demand for the current product collected, and a is a self-defined variable, generally a small value. The value of a in this study is 0.2.

The standardized matrix is

$$S = \left(S_{\mathrm{ij}}\right) n \times p. \tag{5}$$

Calculate the pairwise correlation matrix P.

$$P = \left(P_{ij}\right)_{p\times p} = \frac{X^T \times X}{n-1}, (i, j = 1, 2, \cdots, p), \tag{6}$$

Among them

$$\mathrm{P}_{ij} = \frac{1}{N-1} \sum_{i=1}^{N} \left(Y_{ti} - Y_{tj}\right). \tag{7}$$

4.2.3. Model Establishment. Firstly, we must optimize the parameters of the IoT prediction model, use the improved KNN algorithm in this research to construct the IoT prediction model, and then use the PSO algorithm to optimize the

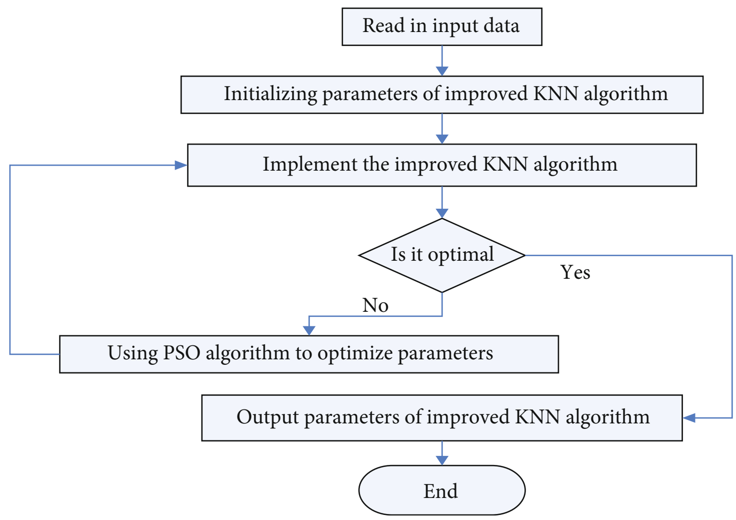

FIGURE 4: Flow chart of the optimization process of predictive model parameters.

parameters, because it is a random search algorithm based on group cooperation developed by simulating the foraging behavior of birds. It can play a very good role in optimizing parameters, and it plays a significant role in the model and finally get the best IoT prediction model with high accuracy, stability, and reduced prediction time complexity. The process of parameter optimization is as follows:

As shown in Figure 4, optimization is performed according to the process, and the parameters that minimize the training error are selected to establish a forecast model of agricultural product supply and demand based on the KNN algorithm to obtain the predicted value.

5. Discussion on Model Prediction Results

5.1. Improved Algorithm Fitting. In the parameter optimization process, we selected the parameters with the largest training error. After establishing the IoT prediction model, we tested the fitting results of the algorithm. In the experiment, we selected a variety of algorithms to optimize, among which PSO, ant colony algorithm, genetic algorithm, and other common optimization algorithms were compared and analyzed, and finally the best ones were selected for display. The fitting results in an experiment are as follows:

As shown in Figure 5, the improved KNN algorithm has been optimized for parameters, which greatly reduces the time complexity and improves the accuracy of the algorithm compared with the traditional KNN algorithm. It can be seen that the sequence in the figure is very stable. After training and parameter optimization, all the effective information of the time series is retained, which can achieve the optimization effect. Compared with the traditional KNN algorithm, it has more advantages in predicting the supply and demand of agricultural products. Good fitting effect.

5.2. Forecast of Soybean Supply and Demand. This paper selects the data from 2010 to 2018,and selects the data of Danjiangyuan water source of South-to-North Water Transfer Project, so as to reduce the errors of soybean output, soybean trading volume and other data. Narrow the scope to facilitate data tracking, so that the solution is more reliable. However, due to geographical limitations, the forecast results cannot be used as national results. And the data source of the article is the website of regional statistics bureau.

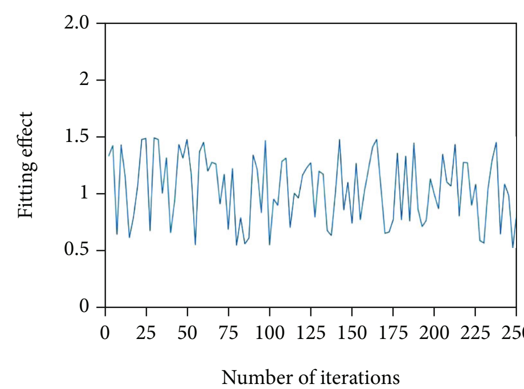

FIGURE 5: The fitting results of the improved KNN algorithm.

TABLE 1: Total grain production and soybean production and demand from 2010 to 2018.

Year	Total grain output (ton)	Total yield of soybean(ton)	Soybean trading volume(ton)
2010	46152.4	10174.1	9784.5
2011	45287.3	10818.5	9883.2
2012	47242.7	11402.4	12085.3
2013	49801.4	12133.7	13705.4
2014	50398.8	13584.9	11248.7
2015	52871.5	14705.3	11967.1
2016	54661.7	15412.6	15490.4
2017	57113.9	16591.4	12907.5
2018	60107.7	17159.5	13817.4

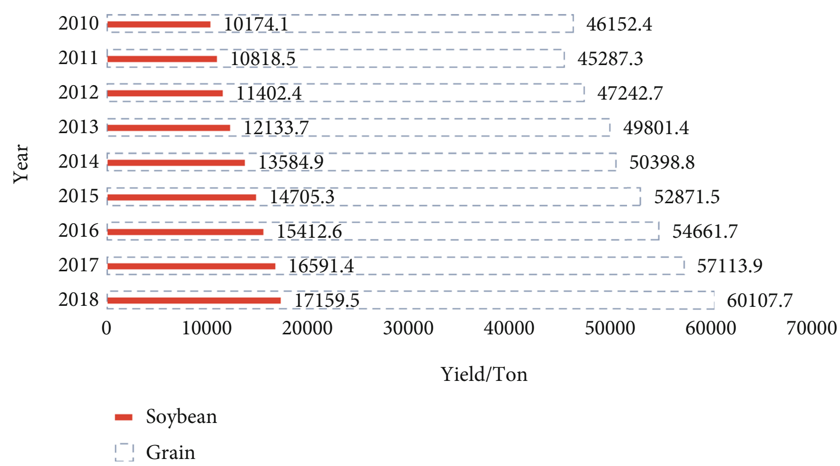

Figure 6: Soybean production and total grain production.

5.2.1. *Supply and Demand of Soybeans.* Core data of this paper: global soybean output, global soybean import, global soybean export, global soybean crush, and global soybean stock. Taking the Danjiang water source area of the South-to-North Water Diversion Project as the research object, select the total grain output, soybean output, and demand in the region from 2010 to 2018 to predict and analyze the change trend of agricultural product output and trading volume. The total grain output, soybean output, and demand are shown in Table 1.

As shown in Table 1, the total grain output in the region has shown a general trend of continuous growth. Taking the Danjiang water source area of the South-to-North Water Diversion Project as the research object, only in 2011 was a slight decrease of 865.1 tons compared with 2010, and it continued to increase in other years. Soybean production in the region is also increasing year by year, with a cumulative increase of 6985.4 tons from 2010 to 2018. The demand for soybeans does not show a trend of increasing year by year. The demand for soybeans does not show an increasing trend year by year, sometimes the supply exceeds demand, and sometimes the supply is less than demand.

Soybean is the main food crop in this area. The relationship between soybean output and total grain output is as follows.

As shown in Figure 6, taking the Danjiang water source area of the South-to-North Water Diversion Project as the research object, the overall change trend of the total grain output in the region from 2010 to 2018 is increasing, and soybean production has increased year by year. It can be said that with the increase in soybean production, grain production is also increasing, because soybean is the main crop in the region, the proportion of soybean output to grain output in this region is between 23% and 29%, and the proportion is increasing every year, and its output directly affects the total amount of food in the entire region. Water quality change trend is show in Table 2.

Table 2: Water quality change trend.

Water quality index	Rank correlation coefficient	Trend
pH	−0.25	Decline
DO	0.097	Rise
COD	0.824	Rise
NH3-N	0.582	Rise

Pay more attention to moderate scale operation. Focusing on solving the problem of "who will farm the land," various policy objectives are focused on the development of moderate scale operations, focusing on supporting new business entities such as farmer cooperatives, family farms, and leading enterprises. The number of new business entities is showing an explosive growth trend. The changes of operating entities are shown in Table 3.

Table 3: The changes of operating entities.

Subject name	2017	2018	2019	2020
Leading agricultural enterprise	91 09	9220	9100	9000
Farmer cooperatives	98869	13 1554	150000	17000
Family farms	30000	38000	41000	49000

In order to compare the changes in supply and demand per year more intuitively and clearly, the soybean production and demand are plotted as a bar graph for comparison. The results are as follows.

As shown in Figure 7, taking the Danjiang water source area of the South-to-North Water Diversion Project as the research object, in 2010, 2011, 2014, 2015, 2017, and 2018, soybean production exceeded demand, indicating that supply exceeded demand. In 2012, 2013 and 2016, the output of soybeans was less than the demand, showing that the supply exceeded demand. The improved KNN algorithm is used to predict and estimate the data from 2010 to 2018, which is similar to the actual demand, indicating that the agricultural product supply and demand prediction model established by the improved KNN algorithm has a good fitting effect, and the improved KNN algorithm can be used for agricultural products in the next few years. Supply and demand forecast.

5.2.2. *Forecast Results.* Therefore, it is necessary to make a reasonable forecast of soybean production and demand so

Figure 7: Comparison of soybean production and demand.

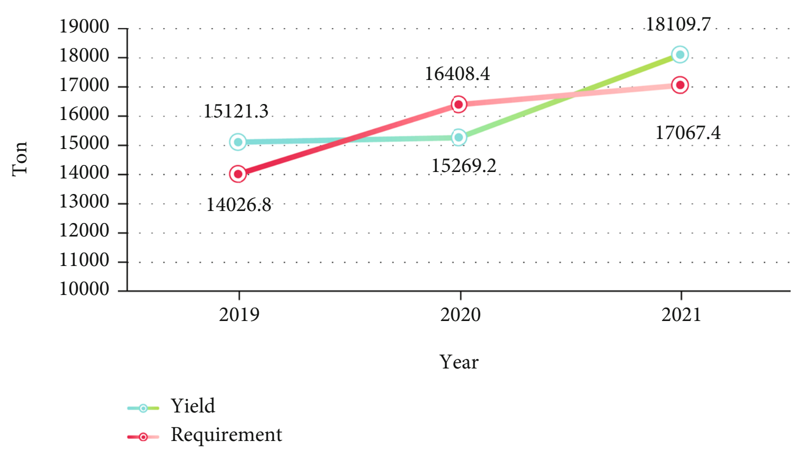

Figure 8: Forecast of soybean production and demand.

that the government can make targeted adjustments to avoid the decrease in farmers' income caused by the decline in soybean prices caused by oversupply. It also circumvents the soaring soybean price that occurs when supply exceeds demand and protects consumer rights. Using the agricultural product supply and demand forecasting model based on the improved KNN algorithm in this study, the supply and demand of soybeans from 2019 to 2021 are predicted. The forecast results are as follows.

As shown in Figure 8, forecast of agricultural product supply and demand forecast model established by improved KNN algorithm. As can be seen from Figure 8, the predicted soybean output is generally on the rise, but it will decrease slightly in 2020, which may be due to the sudden change of data caused by the epidemic situation, while the demand for soybeans has been on the rise. Taking the Danjiang water source area of the South-to-North Water Diversion Project as the research object, there will be an oversupply situation in 2019 and 2021 and there will be an oversupply situation in 2020. Therefore, in 2019 and 2021, the government can appropriately intervene in the demand for soybeans in the market and purchase some soybeans to avoid oversupply of soybeans and low prices. In 2020, we will release stocks of soybeans appropriately to increase the supply of soybeans on the market and avoid too little supply of soybeans and high prices.

5.3. Government Policy Recommendations. In response to the above experimental results, we can also use fiscal policies to support agriculture to promote the supply-side constitutive revolution of agriculture, increase agricultural output value, and improve people's living standards in poor areas.

To properly handle the relationship between the government and the market, the market plays a decisive role, and the invisible hand of the government has to play a macro control role. Give full play to the constitutive guiding role of finance, guide the flow of resources, and increase fiscal support for agriculture. At the same time, increase investment in agricultural science and technology to improve the quality of agricultural products and the efficiency of agricultural production. These measures are all benefited from the successful prediction of soybean yield and demand by the improved KNN algorithm. With these predicted data, we can make policy recommendations for supply and demand.

Increase investment in the education of agricultural producers, improve the cultural level and labor skills of agricultural producers, and carry out relevant training courses through the establishment of relevant training schools. Not only training skills but also a reasonable transmission of national financial support policies, so that agricultural producers understand the direction of national policies.

6. Conclusions

Taking the Danjiang water source area of the South-to-North Water Diversion Project as the research object, the constitutive revolution of the agricultural supply side is not only the adjustment of the economic structure and the transformation of the development mode but also a revolution that combines the characteristics of the agricultural field. The primary task of the constitutive revolution of the agricultural supply side is to solve the problem of food supply, which is a necessary foundation for economic development. Under the premise of ensuring food security and effective supply, realize the maximum benefit of resource allocation. When adjusting the supply and demand structure, we must follow the objective laws of economic development and realize the sustainable development of agriculture. The constitutive revolution of the agricultural supply side should improve the quality of agricultural products and strengthen the safety and quality supervision of agricultural products. The constitutive revolution of the agricultural supply side also needs to promote the integration of primary, secondary, and tertiary industries in rural areas, develop the tertiary industry, extend the industrial chain, improve the mechanism for linking farmers' interests, and generate income for farmers.

Accurately predict the supply and demand of agricultural products through predictive models and provide data support for government decision-making. The government can appropriately intervene in the market and conduct macro control. Purchase some agricultural products when the supply exceeds demand and avoid oversupply leading to too low prices, and farmers' income cannot be guaranteed. When the supply is short of demand, it will appropriately release the stock of agricultural products to increase the supply on the market, so as to avoid too little supply and cause the price to soar, damage the interests of consumers, and cause chaos in the market.

Due to limited time and knowledge, this article takes the Danjiang water source area of the South-to-North Water Diversion Project as the research object and does not consider many factors that affect the supply and demand of agricultural products in the forecast. The supply and demand of agricultural products is not only an interinfluencing relationship but also the adjustment of other factors. Therefore, the IoT prediction model created in this article can only predict data from a small area and cannot predict national data.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there is no conflict of interest with any financial organizations regarding the material reported in this manuscript.

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