ANALYSIS OF DIGITAL INFORMATION MANAGEMENT OF GREEN ECOLOGICAL AGRICULTURE IN THE NORTHEAST OF MY COUNTRY UNDER THE ENVIRONMENT OF AGRICULTURAL PRODUCTS E-COMMERCE

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ABSTRACT

With the rapid development of China's regional agriculture, its consumption of energy, the squeezing and encroachment of the environment and the pollution of the ecological environment have been put on the agenda, which stems from the unreasonable management and regulation of the rapidly developing agricultural infrastructure. Aiming at the evaluation index cluster of agricultural management in Northeast China, the main structure of the digital information management platform of green ecological agriculture we built is divided into the variable layer, middle layer and evaluation index layer, which is a superimposed and progressive layer structure design. The results show that compared with 2018, the use index of electronic agricultural products, per capita greening index, soil organic matter content index and per capita water content index increased by 30.34%, 6.14%, 25.34% and 30.26% respectively in 2019. The index of per capita desert land area decreased by 10.97%. The Sustainability Index experienced an unusual decrease in 2017-2018, with a drop of 0.08. Compared with 2018, the green ecological index from 2019 to 2021 increased by 5.94%, 8.58% and 12.87% respectively. This guides the structure and design of China's future agricultural development.

KEYWORDS

Agricultural ecology, green environmental protection, sustainable development, information management, data platform

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1. INTRODUCTION

The development of green ecological agriculture can protect and improve the ecological environment, prevent pollution, maintain ecological balance [1, 2], improve the safety of agricultural products [3], take the road of sustainable ecological development [4], and closely integrate environmental construction with economic development. Combined [5, 6], it can improve the income of agricultural workers while developing agriculture. Green ecological agriculture, in simple terms, is to use the principles of ecology, ecological economics and systematic scientific methods to organically combine the achievements of modern science and technology with the essence of traditional agricultural technology [7, 8], and integrate agricultural production, rural economic development and ecological. It is a new comprehensive agricultural system with ecological rationality and a virtuous cycle of functions that integrates environmental governance and protection, resource cultivation and efficient utilization [9, 10]. There are three main models of green ecological agriculture, mainly including space-time structure type, food chain type and space-time food chain comprehensive type, as shown in Table 1. Ecological agriculture is an agroecological economic complex system. According to the principle of "whole, coordinated circulation and regeneration", the agricultural ecological system and the agricultural economic system are comprehensively integrated to realize the multi-level utilization of natural resources and energy, to achieve the maximum ecological economy overall benefit [11, 12]. At the same time, it can integrate agriculture, forestry, animal husbandry, sideline and fishery industries[13, 14] to form a comprehensive development model of large-scale agricultural production, processing and sales, adapting to the development of the socialist market economy[15]. However, with the rapid rise of China's e-commerce and the rapid development of informatization, the application of various digital high-tech information technology and the analysis and management of modern green ecological agriculture are the inevitable trends in the development of agricultural modernization.

Table 1. Main modes of green ecological agriculture

agricultural model	Features
space-time structure	According to the biological, ecological characteristics and a rationally formed ecosystem of mutually beneficial symbiotic
food chain	A virtuous cycle agro-ecosystem designed according to the energy flow and material cycle laws of the agro-ecosystem
Integrated spatiotemporal food chain	The organic combination of space-time structure type and food chain type is a mode type with moderate input, high output, less

Green ecological agriculture is an inevitable way to realize modern agriculture and efficient and reasonable organization and management are the foundation and guarantee for the development of ecological agriculture. Scientific management concepts, tools and methods are the basic means to achieve green agriculture [16, 17]. Green ecological management reflects the choice of ecological agriculture development model and the innovation of green technology management. Select and manage agricultural production models from the perspective of agricultural product

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production and ecological economics, and research can best reflect ecological benefits and economy. Nowadays, in the field of analysis and management of green ecological agriculture, many experts and scholars have made a lot of discussions. For example, for agriculture and ecological management under uncertain conditions, Chen, J [18] proposed a reliability-based interval multi-objective crop area planning model. The integration, developed considering the economic and ecological benefits of the research system [19, 20], was developed to deal with interval and ambiguous uncertainties. It focuses on crop area optimization, and the interval objective function is to maximize system benefits, maximize watershed area, and maximize system benefits per unit area. Rural agroecosystems have an important impact on the development of China's economy, society and ecological environment at any time. Chen, F [21] took big data as the research background and based on the complex system theory to construct an indicator system for the ecological management system of rural agroecosystems. The fertilizer was used in the experiment, and the consumption, water pollution degree, pest and disease degree, carbon and nitrogen absorption and agricultural economic benefit of the rural agricultural ecosystem in a certain area were taken as the systematic indicators of the ecological management system. Using data mining technology in big data [22, 23], collecting and processing relevant data in the network, analyzing and understanding agricultural ecosystems through complex systems, and finally calculating and analyzing data of various indicators, their research shows that agro-ecological management Institutions have a positive effect on rural agro-ecosystems. In the development of green ecological agriculture, the optimal water distribution model is an effective tool to provide a reasonable water distribution scheme [24], Pan, Q. [25] proposed an interval multi-objective fuzzy interval credible constraint nonlinear programming model, combined with the estimation of ecological vegetation space water demand, to solve the problem of agricultural and ecological water allocation in irrigated areas under uncertain conditions. Excessive fertilization can cause land pollution [26, 27], which is not conducive to the development of ecological agriculture. Li, X. [28] established a linear regression equation to predict the runoff in the study area, and then determine the pollution in the area. Zhu, Z. [29] built a 5G IoT-based agricultural product circulation information system to realize real-time positioning, information sharing and security assurance of supply chain circulation. Liu, X. [30]'s research shows that in agricultural product e-commerce, product quality, brand image, e-commerce platform and logistics distribution have a significant positive impact on customer satisfaction, and have an important impact on the sales of agricultural products. Based on the research of many scholars, we found that in e-commerce, the quality and safety of agricultural products are decisive factors for the sales of products. Through digital information management, we can achieve coordinated development and the environment, and form two virtuous circles in ecology and economy, the unity of the three major benefits of economy, ecology and society. By studying the data in the development of green ecological agriculture, and constructing a green ecological management system model by analyzing these data, data mining, etc., the economic benefits of ecological agriculture can be improved.

The research on green ecological agriculture management is of great significance to the development of ecological agriculture and the solution to various drawbacks and crises brought by modern agriculture. However, in the current e-commerce sales, the safety and quality of agricultural products cannot be presented to customers. Based on this, in our research, we build an information-based digital management platform, which includes developed languages, frameworks and databases. In the digital information management platform, we track and monitor the agricultural product information of green ecological agriculture in Northeast China throughout the whole process, to ensure the safety and quality of the agricultural products during the sale of the agricultural products on the e-commerce platform. In addition, we also discussed the economic benefits of this digital information platform for green ecological agriculture.

2. CONSTRUCTION OF AN INFORMATION DIGITAL MANAGEMENT PLATFORM

To better understand the situation of green ecological agriculture in Northeast China, this chapter mainly introduces the development languages, development frameworks and tools used in the electronic platform of agricultural products, and gives a brief introduction to them according to the situation of green ecological agriculture in Northeast China. The advantages and reasons for selection are analyzed one by one. These theories or tools include: languages, frameworks and databases.

2.1. JAVA LANGUAGES INTRODUCTION

1. There are not many Java language features, and there is no need to consider issues such as multiple inheritance, operator overloading, automatic forced conversion, etc.;
2. Abstract the real green ecological agriculture by Java in Northeast China through classes, represent agricultural products through objects, and extract common attributes and behaviors between things through inheritance;
3. Java can detect type errors in time in the process of compiling the electronic platform for agricultural products, and can automatically recycle garbage so that the memory of the electronic platform for agricultural products does not occupy much space;
4. Java can perform language conversion in the virtual machines corresponding to different agricultural product electronic platforms, and parse and run on different agricultural product electronic platforms;

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5. Java can support the multi-threaded agricultural product electronic platform model to ensure the synchronization between the agricultural product electronic platform threads.

This system uses Java7 to develop the electronic platform for green ecological agricultural agricultural products in Northeast China. As of Java7, the information features of the electronic platform for agricultural products have been reflected, annotated, generic, $J.U.C.$ and concurrency.

2.2. FRAMEWORK CONSTRUCTION PRINCIPLE

The $Spring$ framework in the agricultural product electronic platform adopts a layered structure, which consists of five well-designed electronic $Spring$ framework sub-modules, as shown in Figure 1.

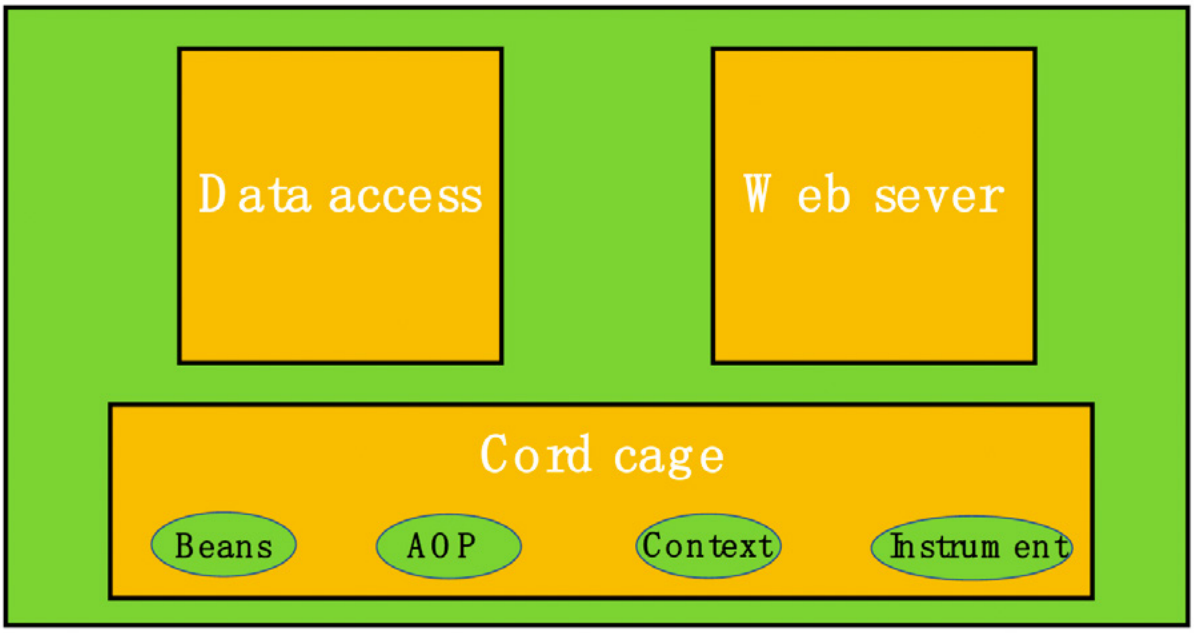

Figure 1. The Framework of the Agricultural Products Electronic Platform

Any module in the agricultural product electronic platform can be used independently, and can also be used in parallel with some modules of other agricultural product electronic platforms. The five electron spring framework submodules are as follows:

1. Bean container. The Bean container is the basis for the electronic Spring framework to realize the IOC layered structure. By reading the XML file or by parsing the language of the agricultural product electronic platform, it generates the agricultural product electronic platform information of green ecological agriculture in Northeast China defined by Bean, and fills it into the core in a container;

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2. Spring AOP module. This module extracts the agricultural product information from the aspects of the business process of the agricultural product electronic platform and encapsulates those behaviors that are not related to the business logic of the agricultural product electronic platform but are required to be called by many functional modules in the agricultural product electronic platform. Duplicate codes in the platform reduce the coupling degree of the electronic platform of agricultural products;

3. Spring DAO module. This module is not related to the specific situation of green ecological agriculture in Northeast China. Through this module system, abnormal semantics in the platform system can be identified;

4. Spring Web module. Common development basic functions such as file uploading and downloading in the agricultural product electronic platform, binding request parameters to objects, etc. are included in this module.

5. Spring MVC framework. This module is used to configure view parsing related to green ecological agricultural products in Northeast China and to define the priority of processing.

2.3. *MYSQL* DATABASE

The database supports the storage engine settings of various electronic platforms, and there are different data types of storage methods within the electronic platforms so the access speeds to the electronic platforms are different. In addition, the creation of a monitoring electronic platform big data will only be used for queries, and will not be added, deleted, or modified. Since the addition of the database supports setting the storage engine at the table level of the electronic platform, combined with the characteristics of green ecological agriculture in Northeast China, different storage engines can be selected for different electronic platforms in a more targeted manner to optimize their performance.

3. MODEL VALIDATION

With the popularization of various smart mobile devices, the promotion of agricultural information and the promotion and sale of agricultural products can solve the problems of difficulty in obtaining rural information, low commercialization, and unsalable commodities. The functional test of this system is mainly based on black boxes. Testing is the main means. Therefore, iterative training is very necessary for the underlying data of the agricultural product electronic platform, and the model operation accuracy can be tested through iterative training. The details are as follows:

1. Accuracy. Precision is the proportion of positive classes that resolve to samples identified as positive classes. The specific calculation process is as follows:

$$Precision = \frac{TP}{TP + FP} \quad (1)$$

Among them, TP is a true example, and FP is a false positive example.

2. Recall rate. Used to solve for the proportion of all positive class samples that are correctly identified as positive classes. The specific calculation process is as follows:

$$\mathrm{Re}\,call = \frac{TP}{TP + FN} \quad (2)$$

Among them, FN is a false negative example.

3. Accuracy is a metric used to evaluate classification models. Simply put, it is the proportion of the total number of correct predictions by the model. The calculation process is as follows:

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad (3)$$

Among them, TN is a true negative example.

We compared the different accuracy comparison models, took into account the background of the agricultural product electronic platform and other backgrounds, adopted appropriate algorithms for evaluation, and finally considered the accuracy rate. In Figure 2, as the number of iterations increases, the training accuracy in the input agricultural product information is also increasing. When the number of iterations is 50, the accuracy of 97.33% is reached, and then the accuracy tends to stabilize; the number of iterations is 25. The second time, the test set accuracy reached 95.34%. As the number of iterations increases to 50, the accuracy rises to 97.52%, which shows that our agricultural product electronic platform has high prediction accuracy for the underlying data. The description of the data set parameters is shown in Table 1.

Table 1. The relationship between iteration accuracy and the number of interactions

Number of interactions	Iteration accuracy
12.5	90.55
25	95.34
37.5	96.59
50	97.33
62.5	97.35
75	97.41
87.5	97.48
100	97.52

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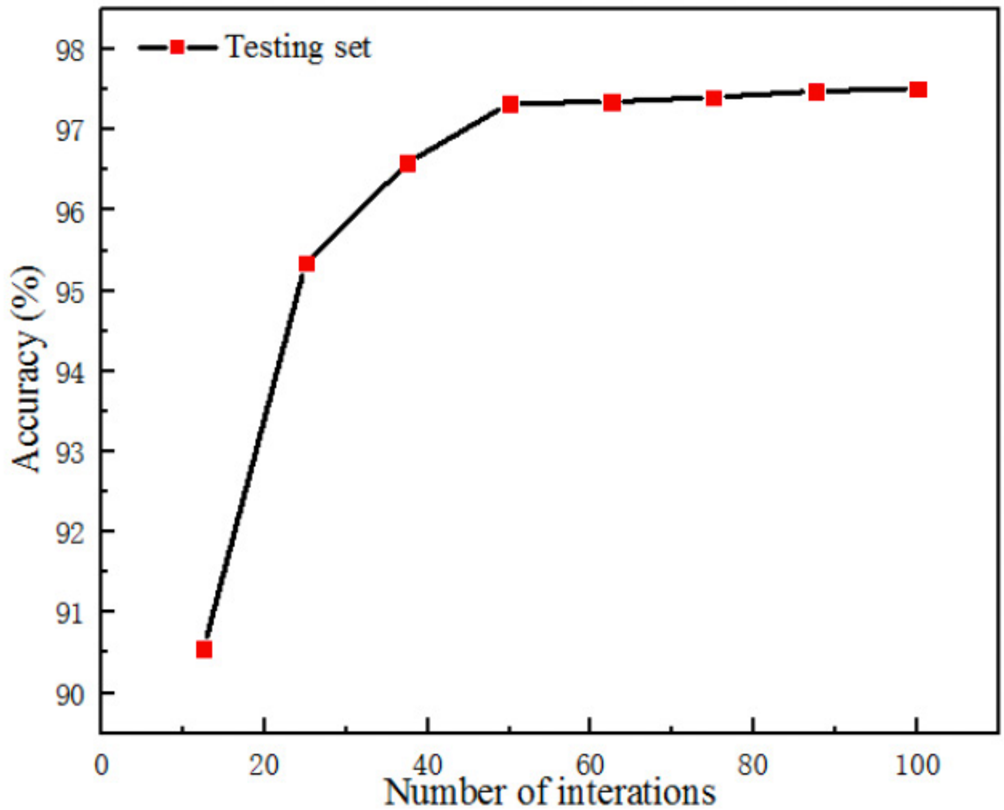

Figure 2. Iterative Accuracy Graph

4. RESULTS AND ANALYSIS

For the development of green ecological agriculture in China, the rural revitalization strategy has greatly improved the level of regional agriculture. This improvement is related to economic benefits and the structure of agricultural allocation. However, the substantial development of agriculture is still a double-edged sword. With the rapid development of China's regional agriculture, its consumption of energy, the squeezing and encroachment of the environment and the pollution of the ecological environment have been put on the agenda. This problem largely stems from the unreasonable management and regulation of the rapidly developing agricultural infrastructure. Therefore, the demand and management of green ecological agriculture in China is a top priority.

First of all, the conventional evaluation indicators of regional sustainable utilization of agricultural resources can be used as the main evaluation indicators and guiding principles for the demand and management of green ecological agriculture in China, which provides a solid foundation for us to establish an effective management system. For the evaluation index cluster of agricultural management in Northeast China, we can regard the index cluster as a series of variables that are correlated and complementary and have strong responsiveness to the sustainable utilization of agricultural natural resources and agricultural socio-economic resources. The number of elements in the variable population is large, but they are all basically continuous

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distributions, so they can form an indicator vector or indicator matrix. A series of indicators formed by various digital information outputted by the spatial database. We have built an evaluation system for the demand and management of China's green ecological agriculture before and introduced the construction principles and methods in the digital system. Among them, several index systems stored in the index library include the content of sustainable utilization of agricultural resources. In specific applications, they can be called directly through the user interface of scientific engineering, and then input into the evaluation model.

Specifically, the main structure of the digital information management platform of green ecological agriculture we built is divided into variable layer, middle layer and evaluation index layer, which is a superimposed and progressive layer structure design. The variable layer includes the utilization rate of electronic agricultural products, per capita green area, per capita desert land area, soil organic matter content and per capita water resources content. The hidden environmental variables in the middle layer are determined as natural population growth rate, desertification development rate, soil organic matter loss rate, water resource decay rate, and vegetation index. For the final evaluation index layer variables, we chose the sustainable development index and the green ecological index as the final comprehensive evaluation index.

4.1. INFLUENCE OF VARIABLE LAYER PARAMETERS OF DIGITAL INFORMATION MANAGEMENT PLATFORM

According to the collection of a large amount of relevant data in 2017, we have continuously revised and learned the forecasting module in the digital information management platform of green ecological agriculture, and used the digital information management platform to analyze various data of the variable layer during 2017-2021. Data collection and mining were carried out. This data collection and mining comes from multiple sources of information such as provincial agricultural bureaus, environmental bureaus and local regional monitoring points in the Northeast region. After processing the data, the platform retains data points that are useful for future evaluation metrics. The annual average data collected from 2017 to 2021 were normalized after screening to facilitate subsequent analysis and to build multiple regression curves. The results of the analysis are shown in Figure 3. It is observed that the use index of electronic agricultural products, the per capita greening index, the soil organic matter content index and the per capita water content index all show an upward trend over the years, while the per capita desert land area index shows a decreasing index. Among the related variables, one variable is regarded as the dependent variable, and one or more other variables are regarded as independent variables, and a statistical analysis method is used to establish a linear or nonlinear mathematical model quantitative relationship between multiple variables and use sample data for analysis. The overall trend of each variable parameter has a large change range from 2018 to 2019. It is observed that compared with 2018, the use index of electronic agricultural products, per capita greening index, soil organic matter

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content index and per capita water content index in 2019 are observed. Up 30.34%, 6.14%, 25.34% and 30.26% respectively. The index of per capita desert land area decreased by 10.97%. This shows that from 2018 to 2019, the management and control of green ecological agriculture in Northeast China achieved a more significant effect. In the following 2019-2021 years, the changes in per capita greening index, soil organic matter content index, per capita water content index and per capita desert land area index tended to be stable, which indicates that the management of green ecological agriculture in this region is in the realization of the underlying structure. After the transformation, the government began to carry out stable development, which is conducive to further evaluating the advantages and disadvantages brought about by the structural transformation and providing guidance for subsequent development.

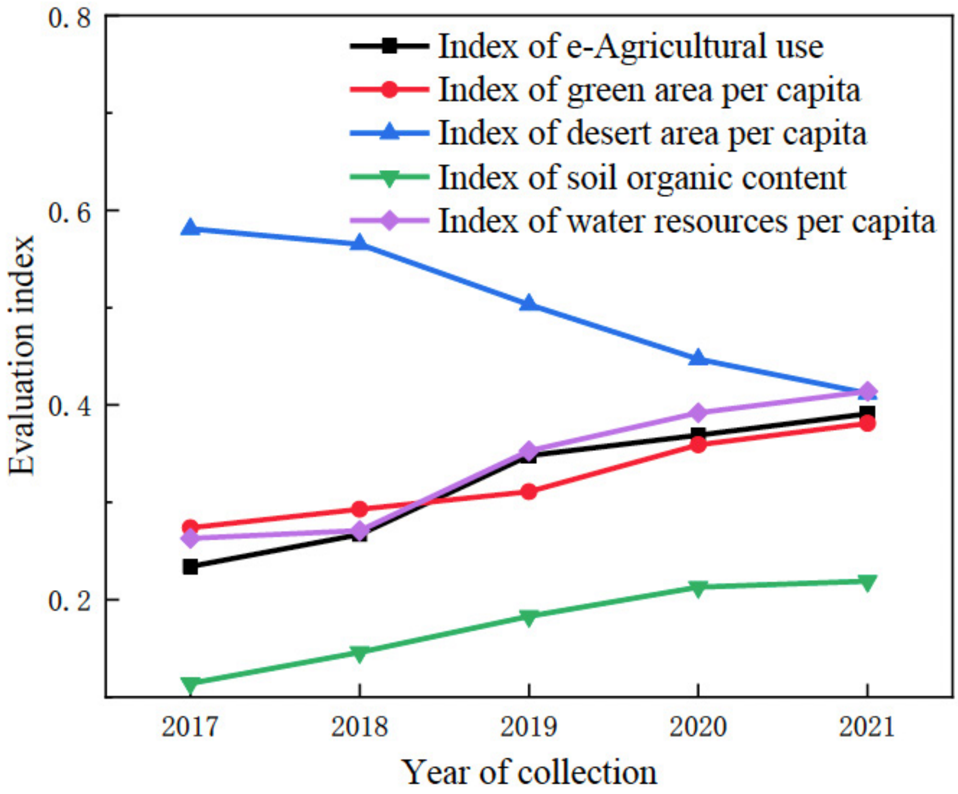

Figure 3. Changes of each index in the variable layer with years

4.2. SUSTAINABLE DEVELOPMENT ASSESSMENT OF GREEN ECOLOGICAL AGRICULTURE

Then, we forecast the variable layer data for the period 2017-2021 after using the data collected in 2017 to revise the learning of the forecasting module within the digital information management platform of green ecological agriculture. Effective analysis data has been obtained. In this section, we use the prediction module in the digital information management platform of green ecological agriculture to analyze the output layer variables we care about. Among them, the changing trend of the

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sustainable development index over the years is shown in Figure 4. An unusual decrease in the Sustainability Index was observed during 2017-2018, with a decrease of 0.08. This is inconsistent with the trend change results of the variable layer in Figure 3.

Therefore, we judged and analyzed the results according to the data changes in the middle layer. We found that the excessively large development area of farmland makes the corresponding soil and water resources environment polluted to a certain extent, which eventually leads to the reduction of the sustainable development index. And with the improved measures, in 2019, the observed sustainability index increased by 0.013, compared to the growth rate of 4.28% in 2018. This shows that the implementation of the adjustment measures of control is feasible. From 2019 to 2021, the growth of the sustainable development index also stabilized, at 0.317, 0.319 and 0.322, respectively.

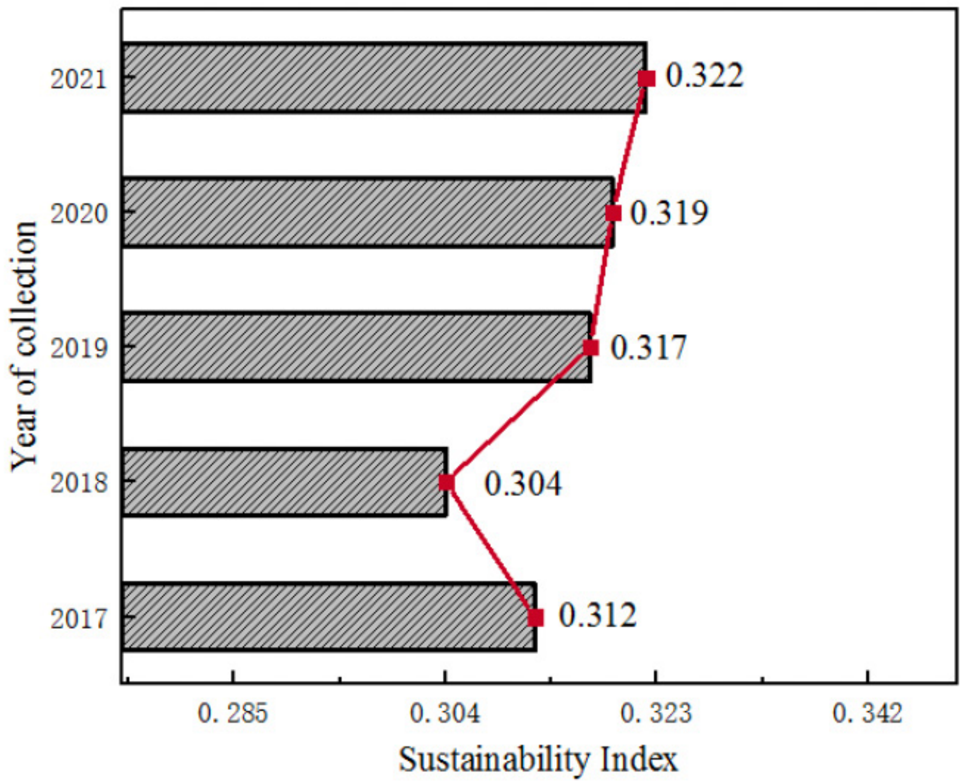

Figure 4. Changes in the sustainable development index over the years

4.3. GREEN ECOLOGICAL ASSESSMENT OF GREEN ECOLOGICAL AGRICULTURE

Finally, we use the prediction module in the digital information management platform of green ecological agriculture to analyze the changes in the green ecological index with the development year. The results are shown in Figure 5. A smaller increase in the green ecological index was observed during 2017-2018, at only 2.36%. As can be seen from Figures 3 and 4, this period is a critical stage for

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structural and policy regulation. During the period from 2018 to 2019, the green ecological index has been significantly improved, which is due to the comprehensive results of the agricultural environment, the abundance of soil nutrients and water resources in Figure 3, which are conducive to green and sustainable development. It was observed that compared with 2018, the green ecological index from 2019 to 2021 increased by 5.94%, 8.58% and 12.87% respectively.

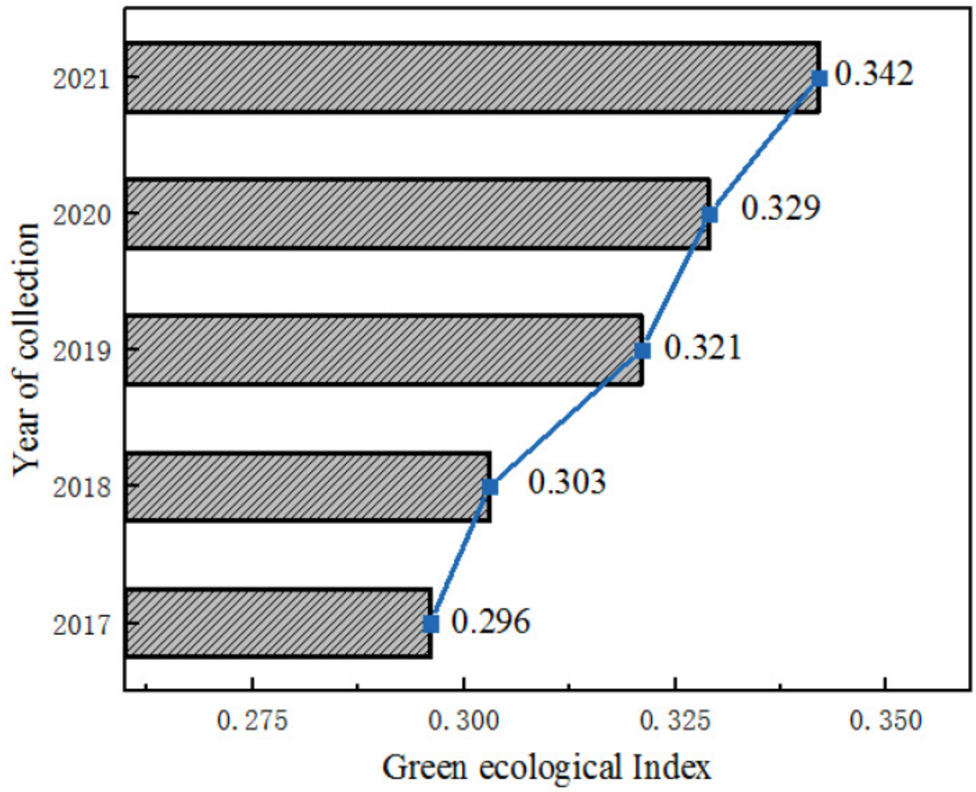

Figure 5. Changes of Green Ecological Index with Years

5. DISCUSSION

With the rapid development of China's regional agriculture, its consumption of energy, the squeezing and encroachment of the environment and the pollution of the ecological environment have been put on the agenda. This problem largely stems from the unreasonable management and regulation of the rapidly developing agricultural infrastructure. Therefore, the demand and management of green ecological agriculture in China is a top priority. This provides a solid foundation for us to establish an effective management system. Aiming at the evaluation index cluster of agricultural management in Northeast China, the main structure of the digital information management platform of green ecological agriculture we built is divided into a variable layer, middle layer and evaluation index layer, which is a superimposed and progressive layer structure design. We focus on the analysis of the variable layer and the evaluation index layer. The conclusions are as follows:

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1. The overall trend of each variable parameter has a large change range from 2018 to 2019. Compared with 2018, the use index of electronic agricultural products, per capita greening index, soil organic matter content index and per capita water content index increased respectively in 2019 by 30.34%, 6.14%, 25.34% and 30.26%. The index of per capita desert land area decreased by 10.97%. This shows that from 2018 to 2019, the management and control of green ecological agriculture in Northeast China achieved a more significant effect. In the following 2019-2021 years, the per capita greening index, soil organic matter content index, per capita water resource content index and per capita desert land area index tended to stabilize;

2. The sustainable development index dropped abnormally during 2017-2018, with a drop of 0.08. This is inconsistent with the trend change results at the variable level. This is due to the excessive development of cultivated land, which pollutes the corresponding soil and water resources to a certain extent, which ultimately leads to a decrease in the sustainable development index. And with the improved measures, in 2019, the Sustainability Index rose by 0.013, compared to 4.28% in 2018. This shows that the implementation of the adjustment measures of control is feasible. From 2019 to 2021, the growth of the sustainable development index also stabilized, at 0.317, 0.319 and 0.322 respectively;

3. from 2017 to 2018, the growth rate of the green ecological index was small, only 2.36%, because this period was a key stage of structural and policy regulation. During the period from 2018 to 2019, the green ecological index has been significantly improved, which is a comprehensive result of the improvement of the agricultural environment, soil nutrients and water resources, which is conducive to green and sustainable development. Compared with 2018, the green ecological index from 2019 to 2021 increased by 5.94%, 8.58% and 12.87% respectively.

In the process of ecological compensation, the government should coordinate and integrate ecological compensation funds, give unified leadership to ecological compensation activities, coordinate management and operation, and establish a supervision mechanism to make the process of ecological compensation open and transparent. Barriers, it is necessary to transform the ecological compensation mechanism of a single element into a comprehensive compensation mechanism centered on the entire region and make overall planning and coordinated promotion, but in the selection of compensation objects, precise compensation must be implemented, and the compensation area must be selected reasonably, taking into account the local area. To meet the needs of the development of residents and enterprises, it is necessary to innovate in the way of ecological compensation, strengthen the participation of the people, pay attention to the will of the people before compensation, and incorporate the participation of the people into the evaluation system of the implementation effect of ecological compensation, to improve the participation of the people, to better play the positive force of public participation.

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