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Optimizing systems and Reducing hunger

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Abstract: *Now the agricultural system is developing at a high speed, but the global food system is still lack its stability and durability. This paper proposes an evaluation model for agricultural systems to evaluate the existing global food systems based on analytic hierarchy process are used to analyze. Large and small geographical area, development and the level of food systems in developing countries were sorted, China, Britain, Haiti, Canada, India. Then, we use the BP neural network prediction model, to interpret the policy changes and propose new policy methods. Finally, the corresponding advantages and disadvantages are given by comparing the data deviation and the weight ratio of the model before and after optimization.*

Keywords: *AHP, EWM, back propagation, comprehensive evaluation*

1. Introduction

Higher levels of agricultural production and agricultural standards often support a country or region's comprehensive level of development to some extent. Maximizing economic benefits is often the main goal in food distribution, but the consequence is that 821 million people worldwide are still hungry [1] Food security as an important indicator of the health of the system should be taken into account.Both in rich countries and in countries with low GDP levels, the existence of this phenomenon reminds us that we should upgrade the existing evaluation system and take into account the environment, policies and the ability to respond to certain emergencies.

2. System evaluation model

2.1 Analysis of relevant factors AHP

In order to comprehensively analyze the work of the food system and its results, the effectiveness of a national health care system is analyzed from four aspects: food production resources, utilization level, economic benefit, availability and stability.

In terms of grain production resources, if we want to reflect the health index of the grain system, we must first look at the area of cultivated land available to citizens. On this basis, the overall agricultural area of the country should also be taken into account. The grain resources, grain yield, grain yield and grain production index produced in cultivated land can reflect the land efficiency and the problems caused by resources in many ways. Population growth is relatively inefficient in terms of production resources, and the growing population makes allocation more structured, so we take it into account.

After the index of production resources of the food system is guaranteed, we need to evaluate the overall utilization level of the system, which can reflect the health of the distribution of the system. As we mentioned earlier, we now have food that allows no one to starve, but we can not guarantee that everyone will eat enough. So in response to this problem, we first include the hunger index recognized by the United Nations. On this basis, not only the distribution of hungry people can reflect the problem of hunger, the proportion of undernourished people, the efficiency of distribution level will affect the efficiency of food distribution and thus affect the sustainable development goals.

The main objective now is, of course, the economic benefits of agriculture, which should also be the focus of our preliminary assessment of the regions.The first is the total GDP of the country, the GDP growth of the country can still reflect the economic level of agriculture to some extent, and the developed and high quality agricultural economy can often play a role in promoting other

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economic systems. Besides, the improvement of agriculture's economic level can also be shown in attracting employment. If the state has preferential policies for the food system and the employment of farmers, then the Instead of carries out pure consumer consumption in the city, and the input of agriculture for grain output is more popular. The last point is the increase of purchasing power per capita, which reflects the role of the grain system on the average individual at the macro level and is an important indicator of agricultural production.

In terms of availability and stability, it is necessary to select the factors of sustainable supply of agriculture and its consideration in sustainable development. The first reflection is the supply of human protein, which can reflect the supply efficiency of grain system in human body. Dietary energy, supply adequacy, per capita food supply changes naturally also take into account. Finally, we first consider the amount of carbon dioxide per capita produced in agriculture, a small part of the attempt to explore the food system in sustainable development and environmental protection, which remains to be optimized.

Accordingly, the hierarchy of the following metrics is obtained (see Table 1).

Table 1: Indicators of evaluation at all levels

Level I indicators	Secondary indicators	Level 3 indicators
Food System Assessment Index	Food production resources	Per capita cultivated land
		Agricultural land
		Population growth
		Average grain production
		Grain production
		Grain yield
		Freshwater per capita
		Food production index
	Utilization level	Hunger index
		Average of 3 years of prevalence of malnutrition
		Incidence of heat loss at retail distribution level
	Economic benefits	GDP
		Employment of women in agriculture
		Agricultural male employment
		GDP per capita (in purchasing power equivalent)
	Availability and stability	Average protein supply
		Changes in per capita food supply
		Dietary energy supply
		Supply adequacy ratio
		Carbon dioxide per capita

2.2 Data Selection and Analysis Processing

On the basis of the distribution of total food expenditure per capita published by the W or ld database, World Bank and the Food and Agriculture Organization of the United Nations, as well as the degree of GDP, economic development and social security of each country, and taking into account the randomness and fairness of national selection, Five countries with three different levels of food system perfection were selected as the evaluation objects. The food system is perfect: Britain, Canada. The grain system is relatively perfect: China. Food systems are incomplete: India, Haiti.

In order to accurately analyze and evaluate the advantages and disadvantages of grain systems in different countries, this paper is based on the measures selected from four aspects: grain production resources, utilization level, economic benefit, availability and stability. According to the grey correlation between the metric and the comprehensive evaluation and the entropy difference expressed by the uncertainty confusion of the data of each evaluation index, the grey correlation analysis and entropy weight method evaluation model will be established to evaluate and compare the grain system of each country comprehensively.

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Based on the established evaluation index system, collect and analyze the data. Data sequences for evaluation criteria in n countries form the following matrix

$$(X_1', X_2', \cdots, X_n') = \begin{pmatrix} x_1'(1) & x_2'(1) \cdots & x_n'(1) \\ x_1'(2) & x_2'(2) \cdots & x_n'(2) \\ \vdots & \vdots & \vdots \\ x_1'(m) & x_2'(m) \cdots & x_n'(m) \end{pmatrix}$$

Where m is the number of metrics, here m=20, representing the data of five countries, namely, China, the UK, India, Canada, Haiti, etc.

2.3 Combined Analysis of Grey Association Method and Entropy Weight Method Based on Analytic Hierarchy Process

According to the evaluation model of each country's business system, we draw out the concept of this method, and use this method as our measure of the degree of evaluation of each country's relative food system. The grey correlation method and entropy weight method based on analytic hierarchy process are used to give the corresponding evaluation criteria.

Entropy is a measure of system disorder. This concept was introduced in 1948 as a basic quantity of information theory to describe the magnitude of uncertainty. According to the characteristics of entropy, the randomness and disorder degree of an event can be judged by calculating entropy value, or the dispersion degree of an index can be judged. The greater the dispersion degree of the index, the greater the influence of the index on the comprehensive evaluation. Because of the different historical, political, economic and cultural backgrounds of the development of food systems in various countries, it is not suitable to use uniform standards for comparative measurement and has the characteristics of disorder. Therefore, the entropy weight method is used to determine the weight of the index. The principle of entropy weight method is to quantify and synthesize the information of each unit to be evaluated.

For the grey correlation evaluation model used next, because the relationship between each index and the overall evaluation is more complex and has certain mutual influence, the grey correlation evaluation model is considered to analyze and evaluate the food systems of various countries. Grey correlation evaluation is a branch of grey system theory, which is widely used in the comprehensive evaluation of things and phenomena affected by many interrelated factors.

According to the standardized and modified data of the measurement standard of the food evaluation system, the weight score of the overall evaluation elements of the food system in five countries is obtained by using the grey correlation method and the entropy weight method, as shown in Table 2.

Table 2: Evaluation score by country

Nations	China	UK	Haiti	Canada	India
Gray corr e lative method	0.5785	0.5953	0.2252	0.603	0.3605
Entropy method	0.2278	0.1986	0.1049	0.3179	0.1508
Combination	0.4032	0.397	0.1651	0.4605	0.2557

2.4 Model optimization and prediction

Corresponding to the previous model, our conclusion is roughly consistent with our sense at the economic level, but to analyze the corresponding structural problems, we still need to adjust the model accordingly. Food security and sustainable development are threatened by the problems of the current food system. The Food and Agriculture Organization of the United Nations (FAO) has defined "food security" three times, in 1974," anyone can get enough food at any time for survival and health "and 1983," anyone can buy and afford the basic food they need at any time"[8], as well as the 1996 definition :" To enable all people at all times to have access, materially and economically, to adequate, safe and nutritious food to meet their dietary needs and food preferences for a positive and healthy life "[9-10]The early definition of food security was limited to the supply dimension, with a major emphasis on national and global food supplies. However, studies have found that adequate food supplies at the national or global level do not in themselves guarantee food security at the household level owing to inadequate food distribution or physical, economic or sociocultural barriers to food access[11-12]This led to a shift in the 1983 definition to focus on

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household and individual access to food, with policy concerns about food security gradually taking into account income, expenditure, market and price factors[13]The third definition further expands the connotation and extension of food security by taking into account food hygiene and health standards, as well as nutritional balance, and by introducing human rights and sociocultural factors[14]Therefore, we need to establish a food security-oriented food system evaluation program.

We use the adaptive momentum gradient descent method and the Ploak-Ribiere conjugate gradient method lr optimize by WTO data, and adjust the corresponding elements of our model in the discussion.

The optimized country data are shown below:

Table 3: Optimized score

Nations	China	UK	Haiti	Canada	India
Gray corr e lative method	0.5417	0.6029	0.2230	0.6467	0.4156
Entropy method	0.2195	0.1858	0.0979	0.3316	0.1653
Combination	0.3806	0.3944	0.1605	0.4892	0.2905

By establishing a prediction model based on BP artificial neural network, the influence of the change and improvement of various metrics on the food system is effectively evaluated. Based on this, the suggestions for the improvement of the food system are given.

The assessment of national food systems involves a large number of indicators and many uncertainties, to predict it effectively, BP artificial neural network model is a better solution. In order to eliminate the influence of randomly generated values on the accuracy of the model, randomly generated 1000 initial weights, And through these 1000 initial weights, by testing BP neural networks, Screening out the best prediction models, then the correlation value is predicted by the prediction model results. 9 indexes selected as input units BP artificial neural network model, the food system comprehensive evaluation score as the output value of the only neural unit, five neural units were selected as the middle layer. The food systems of different countries can be considered completely different and independent, therefore, four countries (Canada, Haiti, Britain, and India) were selected as training samples, the data of the remaining 1 country (China) are used as test samples. Mat lab to train the network, the predicted and actual values of the network training process can be obtained and error curves (Fig 1).

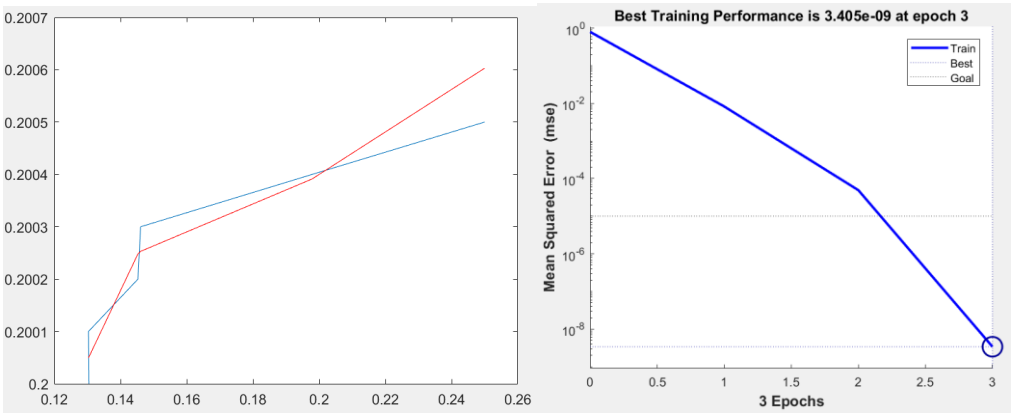

Figure 1: The predicted, actual values and error curves

3. Results analysis

We have established a more comprehensive model for the evaluation of the national food system, in which we optimize our priority on the basis of the original multi-factor.

We can see that if the evaluation model is weighted and the elements are optimized, some numerical changes are caused. The reason is that we have changed the target and allocation path of the original system. This has led to changes in the ratings of our countries. The adjustment of our parameters is an aspect of macro-measurement, but also changes in government policies, such as the cultivated land policy, which we can give more cultivated land to some resonance without a

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source of livelihood, because this can save not only economic expenditure on social minimum security, but also effectively guarantee basic food security (as long as the people on the cultivated land work hard, we assume that he will not starve to death); Food purchase policy: the government often has its own plan to buy food, such as granaries and price control, but a healthier and more stable purchase policy is what we need. The best counter-example is that Indian farmers riot because they can't stand the government's volatility policy, which is of great concern. Similarly, good food distribution will make less food wasted and make the environment cleaner.

Such a system, according to our calculations, takes about 4-5 years to form such a more perfect food system in developed countries, while developing countries need 7-10 years, because the distribution system of developed countries is mature and mechanization is popularized. Developing countries need to pay more attention to food issues while carrying out your development.

From our model, changing the priorities of the food supply system improves the stability and persistence of the food system, but the corresponding economic benefits will be reduced. In our model, it can be seen that using the latter score to remove the previous score, there will be about 5% loss rate. That is why many countries are reluctant to reprioritize. However, countries around the world are trying to make their own changes, to eliminate those who are still facing hunger, to make more people more secure, and to improve their national food security index, using the prediction model we have developed to predict with data from 2000 to 2005, we can see that in 2011 six years later, the situation has improved significantly. For the further prediction of the present situation, we predict that there will be better development after 7-8 years. If the structure is adjusted accordingly, according to our model, the loss rate of about 5% economic loss will be compensated after 5 years. Developed countries were able to focus more on solving those problems because of their developed economies, high quality of life and more adequate food supplies. Developing countries, because of their complex national conditions, face more and different problems, and need to make more important policy adjustments, but are also moving towards a more stable and sustainable development path.

In the early stage, the proportion of total medical expenditure to GDP, the proportion of total government health expenditure to total government expenditure, and the three measures of total per capita medical expenditure can better and quantitatively reflect the level of pre-investment in the country. After the normal operation of the health care system, people will be fairly allocated resources to improve their health status. It is manifested in the birth rate of doctors, the availability of health facilities, the coverage of medical insurance, the density of doctors, the density of nurses, the number of beds per 10,000 people. Only when everyone enjoys more doctors, nurses' care and more medical equipment can the health condition be greatly improved. The health care system is valued because of its long-term benefits. Later, when individual medical conditions are met, the overall indicators of a country will be improved. As reflected in the increase in life expectancy per capita, the mortality rate for children aged 5 years has decreased, as has the mortality rate for adults aged 15~60 years.

Through these factors, we can also model AHP, evaluate it by grey management and entropy weight method, and finally use neural network method to predict.

4. Evaluation

4.1 Advantages of the model

The model uses accurate and up-to-date databases to ensure the reliability of the results. Our hypothesis is reasonable and effective, and the results have high reference value and can be applied to real life immediately.by the assessment process of analytic hierarchy process, grey correlation method, entropy weight method and further optimization of BP neural network, we have established a new system for food evaluation by using the means of health assessment of commercial system. Both our evaluation model and the prediction model quantify the level of the food system so that it visually shows the results of the model.

4.2 Disadvantages of the model

If our system can be further applied to the food evaluation system, we should not only distinguish the development degree of the food system, but also optimize the model parameters

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according to the further distinction that can be made according to the land population, climate topography, agricultural model, import and export country, etc.

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