ANALYSIS AND ASSISTANT PLANNING SYSTEM OF REGIONAL AGRICULTURAL ECONOMIC INFORMATION

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Abstract: For the common problems existed in regional development and planning, we try to design a decision support system for assisting regional agricultural development and alignment as a decision-making tool for local government and decision maker. The analysis methods of forecast, comparative advantage, liner programming and statistical analysis are adopted. According to comparative advantage theory, the regional advantage can be determined by calculating and comparing yield advantage index (YAI), Scale advantage index (SAI), Complicated advantage index (CAI). Combining with GIS, agricultural data are presented as a form of graph such as area, bar and pie to uncover the principle and trend for decision-making which can't be found in data table. This system provides assistant decisions for agricultural structure adjustment, agro-forestry development and planning, and can be integrated to information technologies such as RS, AI and so on.

Keywords: regional agriculture, economic information, comparative advantage, decision-making

1. INTRODUCTION

Now computer has been used to analyze and make assistant decision for agricultural economic information in a large scale. There are many research achievements and application system at home and broad such as continuable

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decision support system for optimizing water and nitrogen management, taxation system for evaluating the effect of nitrogen on environment, basin water use model, vegetation variation model resulted in agricultural policy, microeconomic model for reflecting the land-use change of outskirts between town and suburb, land-cover change model in Honduras, regional agricultural advantage industry analysis and assistant decision-making for planning agricultural development. These systems and models involve matters of land use, crop management, water and soil conservation, hydrology, soil erosion, ES, GIS, environment pollution, water resource distribution, agroecology, social economy and mathematic model(Montas and Madramootoo，1992；Polman and Thijssen，2002；Rosegrant, et al, 2000；Müller and Zeller, 2002；Bell and Irwin，2002；Munroe, et al, 2002; Zhu Ye-ping， 2007， Xue Yan,2007). In the respects of farm management, wood production, oil plants production and deforestation, systems and models such as layout and decision-making support system for moderate farm (AgriSupport II), management information system of cattle farm, decision support system for producing wood block, oil seed production and processing competition model between regions, space-time model of felling tropic forest in South Mexico have been constructed, which used time series aerial images, investigation data of farmers located by GPS, space balance model, competition difference between regions, shadow price, MS Excel and linear programming to resolve corresponding problems(Vance and Geoghegan, 2002; Omoregie and Thomson, 2001; Buehlmann, et al, 2000; Tomaszewski, et al, 2000; Recio, et al, 2003). Van Tongeren et al (2001) evaluated 16 models related to agriculture and trade policy. As to planting structure adjustment, the systems and models of natural resource and planting structure information system in Shanxi, risk decision model, resourceful planting institution decision system, decision support system for adjusting regional planting structure, planting institution decision support system, decision support system of planting structure adjustment and so on involving GIS, statistical analysis, WTO regulation, WebGIS, ecological evaluation model of agricultural resource, model for estimating agricultural productivity level, optimum design model of planting structure and reasonable layout, space data clustering, correlation analysis of space data and time mode analysis have been constructed(Song，2001；Du，2001；Wang，2003；Qin，2002；Peng，2003；Qiao，2003). China Academy of Sciences built continuable agricultural decision support system for Jianli county of Sihu region in 2000(Wang，2000). The researches on analysis and assistant planning system of regional agricultural economic information at home and broad are promoted continuously with the development of information technology. Yet the application of artificial intelligence in macroscopically decision support system is not highly popular. Constructing analysis and assistant planning system of regional agricultural economic information based on artificial intelligence by integrating the theories and technologies of agricultural economy, geography, computer and agronomy will provide help for regional agricultural development as a practical, intelligent and network tool, therefore will contributed to the food safety, yield increase and farmer's income increase.

2. ANALYSIS MODELS FOR REGIONAL AGRICULTURAL ECONOMY

When analyzing regional agricultural economic information, we must first determine the region need to be analyzed, then should confirm the factors. After comparing the relative data from this region with ones from the areas around the region, we can make sure the regional advantage, which would be given full play to plan regional development and forecast the future development to test its feasibility and validity. Aiming at the common problems existed in regional development plan; this study wants to design a decision support system for assisting regional agricultural development and display as a decision-making tool for local government and decision maker. The analysis methods of forecast, comparative advantage, liner programming and statistical analysis are adopted.

The model technologies used in the system include the technologies of time series forecast, non-liner forecast, comparative advantage analysis of agricultural economic data, measure and calculate analysis of agricultural economy, dynamic correlation analysis for agricultural economic data, development index analysis of agricultural economy, special analysis for agricultural economic data and so on.

2.1 Input-output analysis model for agricultural economy

From the angle of entire agricultural economic system, by using input-output analysis method and equation, input-output analysis model analyzes the relationship among planting, forestry, stockbreeding, fishery and the other sections, and analyzes the input-output quantity relationship between agricultural sections and the sections of other industry, explores the economic connection between agriculture and other sections, among the each section in agriculture quantificational based on input-output tables of provinces.

2.2 Analysis of agricultural industry structure

Combination proportion and mutual relationship of farming, forestry, animal husbandry, fishery and their internal sections are analyzed.

The 6 layers are listed as below.

1. The ratio of single industry i.e. farming, forestry, animal husbandry or fishery to total industries.
2. The ratio of one production to the other in certain industry. For example, the proportion of bread corn and cash crop production in total farming as a whole; the proportion of cattle cultivation and livestock and poultry output in total animal husbandry.
3. Agricultural products structure, i.e. the proportion of different agricultural product in the same category.
4. Variety structure in the same agricultural product.
5. Quality structure in the same variety of agricultural product. For example, the number of high quality Fuji apple among the total ones.
6. Time structure for the same agricultural product to come into market.

2.3 Comparative advantage analysis

According to the comparative advantage theory, production factors, natural resources, specialization level, and their changing regional difference generate the comparative advantage among regions, which is weighted with the economic competitiveness of certain goods produced by a nation, region, manufacturer or person compared with other producer. Through calculating below comparative advantage indexes, the author analyzes the regional advantage industry and provides planning service.

Yield advantage index (YAI)

$$Aij=(yij/yi)/(Yj/Y)\times 100 \quad (1)$$

Where, Aij is the YAI of j crops in region i, yij is the average yield of j crops in region i, yi represents the average yield of all crops in region i, Yj represents the yield of j crops around China and Y represents the average yield of all crops around China. Relative comparative advantage under 100 means there is no advantage in this region. Relative comparative advantage above 100 means there is advantage in crop yield.

Scale advantage index (SAI)

$$Bij=(sij/si)/(Sj/S)\times 100 \quad (2)$$

In this formula, Bij is the SAI of j crops in region i, sij is the planted area of j crops in region i, si represents the planted area of all crops in region i, Sj represents the planted area of j crops around China and S represents the planted area of all crops around China. In fact SAI is the ratio of the proportion of planted area of certain crop in total areas in a province to the proportion of planted area of certain crop in China, i.e. location quotient. In general, location quotient above 100 indicates this province possesses fair specialization centralization. The more the location quotient is, the higher the specialization centralization is.

Complicated advantage index (CAI)

$$Cij=(Aij\times Bij)2 \qquad (3)$$

YAI represents agricultural comparative advantage from the angle of productivity mainly.

2.4 Space analysis of regional agricultural economy

Agricultural economic data are combined with GIS in order to make full use of its analysis and expression ability to deal with data directly. Agricultural data are presented as a form of graph to uncover the pattern and trend for decision-making which can't be found in table.

The author divided the agricultural economic data to two grades according to area. One is the data of different province, city and autonomous region. The other is the data of different county in certain province or city. These data are analyzed and expressed with special map of GIS, which include three types in accordance with rendering mode.

They are: Areal map, which groups the total records according to area, and gives each record corresponding color and symbol. The group number can be adjusted in order to reach optimum effect. Bar chart, which includes several variables to distinguish the colors and analyze at the same time. Bar height represents the variable value. In general bar chart with 4 to 6 bars performs well. Pie chart is also multi-variable special map.

2.5 Optimum model for regional agricultural development

The main body of agricultural structure adjustment is farmer, yet it is government in planned economy age. Government adjusts purchase price and farmer changes the variety and planted area according to market price. Agricultural structure adjustment aims to the most income of farmer, and not the highest amount of agricultural products. The target function of liner programming model is the highest farmer's income. Farmer gets the highest income through adjusting the decision varieties of planted area of crop and labor input. The regulative direction and quantity can be determined after comparing the planted area with that before adjustment. So farmer's income should be calculated.

The common formula for liner programming model is:

$$\text{Max } Z = \sum_{i=1}^{n} \qquad (4)$$

Restriction conditions are:

$$a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n \le \qquad (5)$$

$$a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n \le \qquad (6)$$

$$a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n \le \qquad (7)$$

$$x_1 \ge 0, x_n \ge 0, \ldots, x_n ; \qquad (8)$$

When planning agricultural structure, a large of liner programming models is adopted. The models resulted from different angle are various. Even if in the same model the parameters of aij, bj and ci vary with the application region. Researcher must modify the model parameters on the basis of regional characteristics in a practical analysis.

3. SYSTEM ARCHITECTURE

Constructing agricultural information platform should consider the performance factors of practicability, safety, standardization, advance and extensibility and so on.

The system uses the popular light weight Java EE SSH frame as basic technology structure. System architecture is based on B/S structure, which is apt to deploy and maintain has lower requirement for client. Interface and operation are easy to separate because of the clear program structure.

Because a large quantity of factors and algorithms are involved in this system, this study emphasizes system design and technology realization. The specific functions will depend on later research. Considering the system extensibility, system designs multi-subsystems structure based on knowledge. After allocating the task of every subsystem, the system tries to resolve different problems by using same knowledge. System structure that includes 5 layers of basic information, information management, task requesting, task assignment and communication, user is shown in Fig 1. Each layer consists of some subsystems which can be added and deleted further.

Analysis and assistant planning system of regional agricultural economic information proposed in this study can not only be used for forecast and decision making by analyzing the industry structure of farming, forestry and animal husbandry in different region, but also be applied to analyze the matters of agricultural structure adjustment, returning plough land back to forest and grassland, agro-forestry production planning and provides assistant decision.

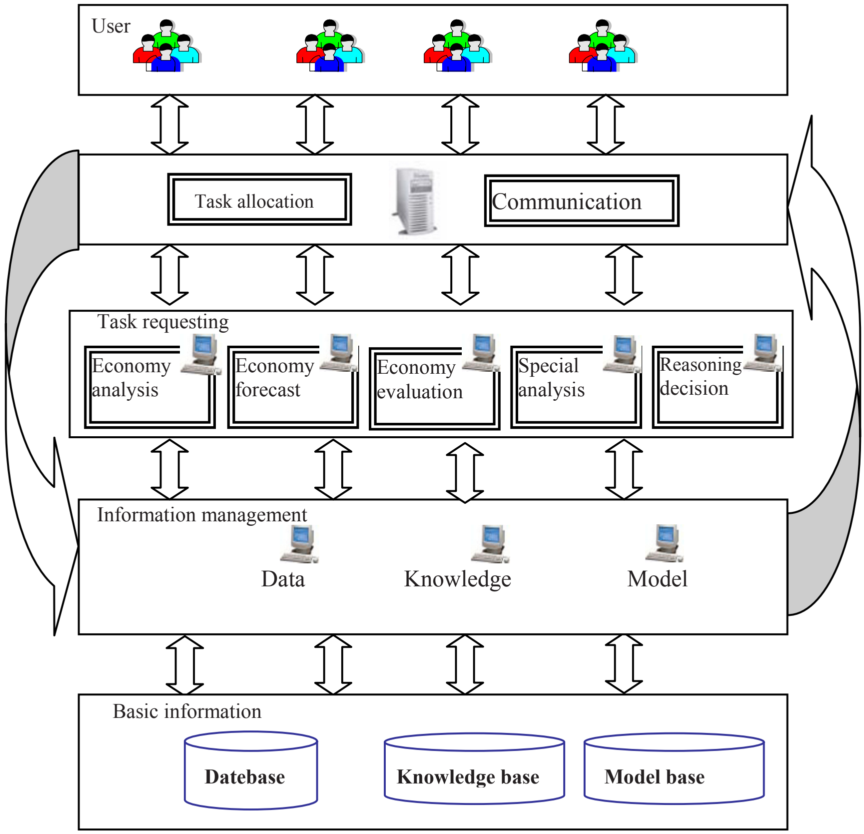

Fig 1. System architecture

4. CONCLUSION

As we know, BP neural network can be used to predict the stress-strain relationship for oilseeds, which not only overcomes the difficulty for theoretical model development, but also avoids requiring considerable technique and experience for nonlinear regression analysis. No more than 0.0084 maximum error showed that the model predicted the stress-strain relationships with highly accuracy. In view of the predicted results and the simple model consisting of input and output layer with one node, and hidden layer with five nodes, the method of stress-strain prediction for oilseeds by using artificial neural networks is both feasible and effective.

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