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Article:

Optimization of Regional Industrial Layout Under the Background of Low Carbon Economy

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Abstract

While coping with the challenges of global climate change, it is necessary to actively respond to the status of resource security and energy security and other issues, and realize the transformation of the mode of economic development to a low-carbon economy. At present, the intelligent optimization method is used to optimize the industrial structure intelligently. Based on this, combined with the artificial intelligence technology and the industrial distribution theory under the background of low-carbon economy, an intelligent shift-share analysis method of industrial structure was put forward, and the input and output and industrial structure levels were analyzed by computer technology. Then, taking Shenzhen Economic Development Zone as an example, the research and analysis were carried out, and the intelligent optimization algorithm was used to find the coupling point between the low-carbon economy and the industrial structure optimization, so as to select and determine the important industries of the three industries, and achieve the optimization of regional industrial structure and regional industry low-carbon development while maintaining coordinated and healthy development. The results show that the method of intelligent industrial layout optimization is conducive to promoting the coordinated development of economy and environment, and provides a theoretical basis for subsequent research.

Keywords

Artificial intelligence technology; industrial layout; low carbon economy

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Introduction

Low-carbon economy is the inherent requirement and inevitable trend of the world economy and urban development under the condition of resource restriction, environment protection and knowledge economy. The ecological environment is becoming one of the main obstacles to the sustainable development of the global economy and society in the 21st century [1]. With the continuous growth of global population and economic scale, the traditional economic, urban development mode and life style based on carbon energy are facing more and more difficulties and challenges, environmental and ecological problems are becoming increasingly prominent, and resources and energy constraints are becoming increasingly tense [2].

With the development of the application of expert system and the rapid development of computer technology, the expert system itself has some problems such as narrow application field, lack of common knowledge, difficult knowledge acquisition, single reasoning method, no distributed function, and no access to the existing database and so on. In order to get rid of the difficult position, it is necessary to follow the path of integrated development. Therefore, it is necessary to adopt computer technology to optimize layout.

Some scholars believe that industrial systems can imitate the material cycle process of natural ecosystems and establish symbiotic relationships among enterprises. Some scholars believe that the industry ecology can provide opportunities for maintaining the coordinated development of nature, resources and economy, reducing material and energy and production costs, improving product quality, workers' health, operational efficiency and corporate public image, and then using the waste to make a profit [3]. Some scholars believe that industry ecology means that the enterprises in the region can obtain the benefits that can't be obtained in the traditional economic mode through the use of by-products or energy recycling, including the reduction of raw material consumption, the reduction of waste, the improvement of energy efficiency and the increase in the quantity and variety of valuable exports; and it emphasizes the prevention of pollution in all processes, that is, cleaner production [4]. Some scholars believe that the traditional economic development mode is at the expense of a large amount of resources consumption, waste discharge and low efficiency in the process of industrialization, which causes the destruction of the ecological environment and causes the antagonism between human activities and the natural environment. Human activities, resource utilization and natural cycle are integrated into an industrial ecosystem, which requires changing the way of existing resources usage and industrial processes, reducing emissions of waste gases, and changing industries to adapt to the environment rather than changing the environment to adapt to the industry [5]. Some scholars believe that industrial ecosystem is a systematic organization composed of the symbiotic relationships among enterprises, such as waste disposal, excess energy exchange and equipment sharing and so on.

Traditional database technology is limited to the query and retrieval of databases, and can't extract knowledge from it. Knowledge discovery and data mining use database as knowledge source to extract knowledge and improve the use value of data, at the same time, which also open up a new way for knowledge acquisition of expert systems, so as to improve the level of technology and management to reduce the level of carbon emissions, improve the comprehensive utilization efficiency and sustainable supply capacity of energy resources [6]. Ecological health and environmental friendliness are no longer the external conditions and external constraints of economic development, but become the internal driving force of economic development, and the global mandatory governance of the ecological environment is also becoming a mandatory constraint mechanism. In this context, Britain first proposed the development idea of "low-carbon economy", then, Europe and America, Japan and other developed countries followed suit, started a low-carbon revolution with high energy efficiency and low emission as its core, and vigorously developed low-carbon technology, aiming at seizing the opportunities and commanding heights of the low-carbon economy, strengthening regional competitiveness and laying a more solid foundation for sustainable development ability [7].

Related Theory of Industry Layout under the Background of Low-Carbon Economy

Low-Carbon Economy

At present, the low-carbon economy is a frontier economic concept [8]. But there is no uniform definition about the low-carbon economy, and the analysis is not consistent with it. Is low-carbon economy a development model or an economic form, or a combination of the two? Today's academia and policy makers have not yet formed a common and clear understanding of it [9].

Some scholars believe that the low-carbon economy is a way of economic development to reduce greenhouse gas emissions in response to climate change. The economic development mode can effectively reduce carbon dioxide emissions, and can effectively avoid the catastrophic changes in climate, and maintain the sustainable development of human society [10]. Some people think that the low-carbon economy is a kind of economic development model with the lowest economic cost, is the sum of a series of economic forms such as low-carbon development, low-carbon industry, low-carbon technology and low-carbon life and so on, and is a new form of economic development for sustainable development that can improve the self-regulation ability of the earth's ecosystem [11]. Some scholars believe that the low-carbon economy is a kind of economic development model based on the "three-low" (low energy consumption, low pollution and low emission), and is the third great progress in human society after agricultural civilization and industrial civilization. The essence of low-carbon economy is a profound reflection on the mode of modern economic operation, and it is a global energy economic revolutionary activity from the aspects of production and life mode, values and nation equity and so on [12]. To sum up, the concept of low-carbon economy can be defined as: low-carbon economy is an economic development model which takes the low pollution, low energy consumption, low emissions and high effect, high benefit, high efficiency as the basis, and takes the control emissions as a way to prevent catastrophic climate and ensure the sustainable development of mankind [13].

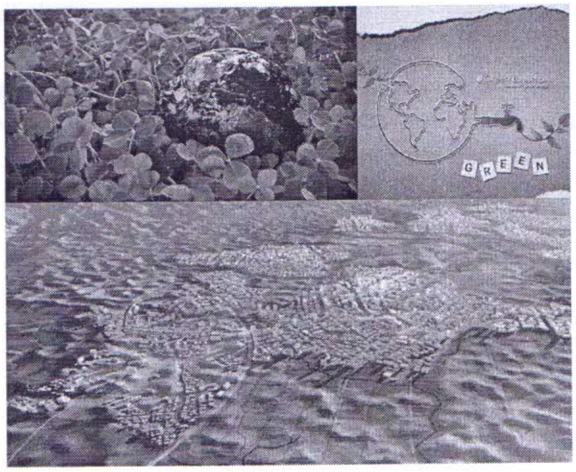

FIG. 1 INDUSTRIAL LAYOUT UNDER LOW-CARBON ECONOMY

Industry Ecology

At the end of the 19th century, under the drive of the idea of sustainable development, a new discipline was developed on the basis of the intersection of traditional social sciences, economics and natural science, namely, the industry ecology.

The deepening of the industrialization process has caused serious environmental pollution and waste of resources while promoting the development of the world economy. As an ecosystem, the self-purification capacity of the earth is limited. When people's demand for energy in nature and waste emissions reach a certain level, the contradiction between human industrial activities and the environment will intensify. When people reflect the shortage of resources and the deterioration of the environment, it is gradually discovered that the waste in the natural system is recycled, therefore, resources and species in nature can sustain sustainable development [14]. The development of the industry can be planned accordingly, only in this way, the problem of limited resources and environmental pollution can be solved. Industry ecology came into being in this situation and developed gradually.

The method of controlling environmental pollution has undergone a long process of evolution. The free emission was implemented in 18th century; in 1960s, people began to realize the environmental problems and carried out the terminal treatment; in 1970s, the solution of environmental problems started from the source, and the concept of cleaner production was proposed; at the end of 1980s, the natural ecological system was imitated to achieve the ecological development of industry. The idea of industrial ecology has been gradually developed and perfected [15].

Table 1 shows the comparison of the terminal governance, cleaner production and industrial ecology in terms of production times, thinking methods and resource consumption and other aspects, so that the links and differences among them can be understood more deeply.

TABLE 1 COMPARISON OF TERMINAL GOVERNANCE, CLEANER PRODUCTION AND INDUSTRIAL ECOLOGY

Comparative content	End treatment	cleaner production	Industrial Ecology
Generation Era	1960s	1970s	1980s
Application level	Industrial Enterprise	enterprise	
control process	control process	control process	Logistics, energy flow and information flow analysis
Product output	No significant change	increase	increase

Economic performance	reduce	increase	increase

The Practical Basis for The Formation of the Industrial Structure Theory

The formation and development of industrial structure theory is closely related to the practice of industrial structure policy. After the Second World War, Japan, as a defeated country, was in ruins, and the economy was on the verge of collapse. How to heal the wounds of war, rebuild and revitalize the economy was a serious problem faced by the Japanese government. The Japanese government designed the approach of industrial structure elevation and determined the leading industries in different periods through the planning of industrial structure supererogation development goals, and ensured the rise of the leading industries through a series of government policies, so as to guide the entire national economy to develop according to the fixed goal. The industrial structure policies implemented by the Japanese government in different periods have contributed to the rapid growth of the country's economy. After a short period of postwar years, Japan's economic development has completed the course of one hundred or two hundred years that the western developed countries can go through.

The "Asian miracle" of Japan has attracted wide attention from economists, politicians and world organizations all over the world. Economists in various countries have studied carefully the successful experiences of the economy and found that: the industrial structure policies of Japan have played an important role in the completion of this economic revival. Thus, the concept of industrial policy has become popular all over the world and promoted the study of the theory of industrial structure.

Through the study of the above theories, it can be seen that research on the ecological industry is not deep enough in China, but the research history is very long. The relations among the above theories can be represented by the following Figure:

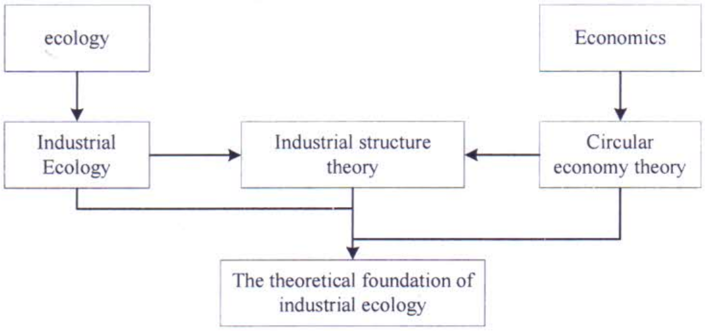

FIG. 2 THE RELATION AMONG INDUSTRIAL THEORIES

Industry Layout Optimization Method

Shift-Share Analysis Method of Industrial Structure

The shift-share analysis method is a method which is used to analyze the location and structure of industry, and it can be used to analyze the influence of structural change and economic growth. The main idea of the method is to link the economic growth to the background areas that affect economic growth, and further divide the economic growth into two aspects of sharing and transferability. Shared growth refers to the amount of the growth of the average growth rate of the background area in a given period of time in the study area, and it is a standard parameter for measuring the economic growth deviation in different regions. Transfer growth refers to the amount of growth due to the transfer of resources between departments and regions, and it is the differential value between the amount of regional economic growth and the amount of share. If the actual growth rate of the region is higher than the average level of the background area, the total transfer amount of regional economy is positive, otherwise it is negative.

The total transfer growth of any region can be divided into structural transfer growth (which is also called proportional transfer growth, industrial mixed transfer growth) and regional transfer growth (which is also called differential transfer growth). The structural transfer growth refers to the regional transfer growth caused by the regional industrial structure deviating from the industrial structure of background area, if the regional specialization sector is higher than the high speed growth sector in the background regional economy, its value is positive. The concrete manifestation of locational transfer growth caused by the production factor, endowments and other location factors is the difference of the growth obtained between the actual growth amount of an industrial sector in a region and the average growth of the corresponding sector in the background area. The regional growth value of a region with regional advantages is generally positive, otherwise it is negative.

The formula for calculating the data in the shift-transfer analysis method is as follows:

Shared growth:

$$N_i = \left[\left(E_t - E_0\right)/E_0\right] \times E_{j0} \tag{1}$$

Structural growth:

$$P_j = \sum\left[\left(E_{it} - E_{i0}\right)/E_{i0} - \left(E_t - E_0\right)/E_0\right] \times E_{ij0} \tag{2}$$

Locational growth:

$$D_j = \sum\left[E_{ijt} - \left(E_{it}/\mathrm{E}_{i0}\right) \times E_{ij0}\right] \tag{3}$$

Transfer growth:

$$S_j = E_{jt} - \left(E_t / E_0\right) \times R_{j0} = P_j + D_j \tag{4}$$

Total output value growth:

$$G_j = N_j + S_j \tag{5}$$

Where E_{j0} and E_{jt} represent the total output value of the j region at 0 and t, respectively; E_0 and E_t represent the total output value of the background area at 0 and t, respectively; E_{ij0} and E_{ijt} represent the total output value of the i industry in j region at 0 and t, respectively; E_{i0} and E_{it} represent the total output value of the i industry in the background area at 0 and t.

On the basis of the above, the following data can be further calculated:

Shared incremental contribution rate:

$$H_n = N_i/G_j \times 100\% \tag{6}$$

Structural incremental contribution rate:

$$H_p = P_j/G_j \times 100\% \tag{7}$$

Locational incremental contribution rate:

$$H_d = D_j/G_j \times 100\% \tag{8}$$

Input-Output Method

The method is a quantitative analysis method created by the famous American economist W. Leontief. Input refers to the raw materials, energy, fixed assets and labor that are consumed by the product. Output refers to the distribution direction of the product after it is produced. Because the various sectors of the national economy are not independent, which are interrelated and interdependent, and form an organic whole, the development of each industry means that it will affect the development of other related industries. The input-output method can be used to analyze the regional economic dependence and economic structure and other aspects. And the input-output method can be used to calculate the coefficient of sensitivity and the influence of the regional industry, and the result can indicate the relation and degree between industries. The calculation of the coefficient of sensitivity and the influence can be derived from the following formula:

Coefficient of sensitivity:

$$v_i = n\left(\sum_{j=1}^{n} q_{ij}\right) \Big/ \sum_{i=1}^{n}\sum_{j=1}^{n} q_{ij} \tag{9}$$

Where v_i represents the sensitivity coefficient of the i industry, which reflects the extent of the impact of other industries in the i region; q_{ij} is the element of Leontief matrix $(I-A)^{-1}$ in the input-output table; and n is the number of industries.

Influence coefficient:

$$u_i = n\left(\sum_{i=1}^{n} q_{ij}\right) \Big/ \sum_{i=1}^{n}\sum_{j=1}^{n} q_{ij} \tag{10}$$

In which, u_i is the influence coefficient of j industry, which reflects the extent of j industry influenced by other industries; q_{ij} is the element of Leontief matrix $(I-A)^{-1}$ in input-output table; and n is the number of industries.

Analytic Hierarchy Process

The relevant parts of the policy are decomposed at the hierarchical level, including goals, programs and guidelines and so on, and then the further quantitative and qualitative calculations are carried out based on the results of the decomposition. This method proposed by the United States operational research expert, Professor Satie at the University of Pittsburgh in 1970 is used to analyze the weight of decisions.

The basic steps of analytic hierarchy process are:

Identifying problem: that is to understand the scope of the problem, the factors involved, and the relationships among the factors.

The construction of hierarchical structure model: the grouping of the elements of the problem is carried out, each group is taken as a level and arranged according to the form of the highest layer, several middle layer and the lowest layer, and then the sketch map of hierarchy structure is determined.

The construction of judgment matrix: this is an important step in analytic hierarchy process. The analysis matrix description is based on the elements in the previous iteration and can represent the importance of the element relative to other elements. Therefore, when the matrix factors are compared, the parameters listed in the following table can be referenced for assignment:

TABLE 2 SCALE OF JUDGMENT MATRIX, CONSTRUCTION FACTOR AND MUTUAL IMPORTANCE

Factor specific factor	Quantization value
Equally important	1
Slightly important	3
Important	5
Strongly important	7
Extremely important	9
The median value of two adjacent judgments	2,4,6,8

Hierarchical single order: the hierarchical single ordering can determine the weighted value of the connection between the element importance of this layer and the upper layer, which can be used as the basis for sorting the importance of relations between two layers of elements. Consistency testing can be used to determine whether the matrix is consistent.

Hierarchical total ordering: it refers that all hierarchical single order results in the same hierarchy are used to determine the importance weights of all the elements at the previous level for this hierarchy. The hierarchical total ordering is done from top to bottom.

Consistency test: in order to evaluate the consistency of the computation results of hierarchical total ordering, consistency checking is needed.

The calculation steps of analytic hierarchy process (AHP):

The calculation methods of analytic hierarchy process include the root method and integral method. In this paper, the root method is adopted to calculate, and the calculation procedure and formula are as follows:

The product of each row element of the judgment matrix is calculated:

$$M_i = \prod_{j=1}^{n} b_{ij} \left(i = 1,2,3,\ldots n\right) \tag{11}$$

The n root mean square of M_i is calculated:

$$\overline{w} = \sqrt[n]{M_i} \left(i = 1,2,3,\ldots n\right) \tag{12}$$

The normalization of vector $\overline{w}$ is carried out:

$$w_i = \overline{w} \Big/ \sum_{i=1}^{n} \overline{w_i} \left(i = 1,2,3,\ldots n\right) \tag{13}$$

The maximum eigenvalue is calculated:

$$\lambda_{\max} = \sum_{i=1}^{n} \frac{(AW)_i}{nW_i} \tag{14}$$

The consistency index of judgment matrix is calculated:

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{15}$$

When n>2, the random consistency ratio of judgment matrix is calculated:

$$CR = \frac{CI}{RI} < 0.01 \tag{16}$$

The consistency test of the evaluation of the total level is carried out:

$$CI = \sum_{j=1}^{m} a_j CI_j ; RI = \sum_{j=1}^{m} a_j RI_j ; CR = CI/RI < 0.01 \tag{17}$$

Indicators used in analytic hierarchy process indicate that when the analytic hierarchy process is used to determine the key industries of the second industry, location quotient, the industrial contribution rate, labor productivity, sensitivity coefficient, influence coefficient, comparative labor productivity, coefficient of demand income elasticity, employment absorption rate, employment rate of investment creation, rate of return on cost, the contribution rate of total assets, GDP energy consumption per unit, and the comprehensive utilization rate of industrial solid waste of a total of 13 specific indexes are selected. In addition to the sensitivity coefficient and influence coefficient introduced earlier, the calculation of the remaining 11 specific indexes is as follows:

Location quotient:

$$S_{ij} = \frac{Y_{ij} / Y_i}{Y_j / Y} \tag{18}$$

In the formula, S_{ij} is the location quotient of j industry in i region; Y_{ij} is output value of the j industry in i region; Y_i is the gross output value of i region; Y_j is the national output value of j industry; and Y is the national gross output value.

Industry contribution rate:

$$W_{ij} = Y_{ij} / Y_i \tag{19}$$

In the formula, W_{ij} is the industry share rate of j industry in i region; Y_{ij} is the output value of j industry in i region; and Y_i is the gross output value of i region.

Comparative labor productivity:

$$R_{ij} = \frac{Y_{ij} / Y_i}{L_{ij} / L_i} \tag{20}$$

In the formula, R_{ij} is the comparative labor productivity of j industry in I region; Y_{ij} is the output value of j industry in i region; Y_i is the gross output value of i region; L_{ij} is the labor force of j industry in i region; and L_i is the total social labor force in the i region.

Coefficient of income elasticity of demand:

$$E_{ij} = \frac{\Delta Q_j / Q_i}{\Delta N_i / N_i} \tag{21}$$

In the formula, E_{ij} is the coefficient of income elasticity of demand of j industry in i region; $\Delta Q_j / Q_i$ is the growth rate of demand for the j industry, which is placed by the total output value of the industry in this paper; and $\Delta N_i / N_i$ is the per capita disposable income growth rate of urban and rural areas in the i region.

Contribution rate of total assets:

$$Z_j = \frac{A_j + B_j + C_j}{D_j} \tag{22}$$

In the formula, Z_j is the contribution rate of total assets of j industry; A_j is the total profit of j industry in the region; B_j is the total tax amount of the j industry in the region; C_j is the interest payment of j industry in the region; and D_j is the average asset of j industry in the region.

Optimization of the Industrial Structure and Spatial Layout under the Background of Low-Carbon Development

Overall Optimization of Industrial Structure

The analysis took Shenzhen as the research background area, and took the Shenzhen Economic Development Zone as the research area. In order to further understand the impact of industrial structure change on the regional economic development in 4 cities under the jurisdiction of Shenzhen Economic Development Zone, Nanning City, Beihai City, Qinzhou City and Fangchenggang City were listed as subjects. A total of 5 areas studied were identified with Shenzhen as the study area. Taking into account the difficulty of data acquisition and the consistency of caliber in each region and other factors, 2003 was taken as the base year, and 2009 was taken as the target year.

TABLE 3 SHENZHEN AND GULF ECONOMIC ZONE

	2003				2009			
Guangxi	Total output value	primary industry	secondary industry	tertiary industry	Total output value	primary industry	secondary industry	tertiary industry
Futian	2821.11	658.78	984.08	1178.25	7759.16	1458.49	3381.54	2919.13
Nanshan	869.96	224.46	252.45	393.07	2493.00	443.37	912.17	1137.46
Luohu	502.53	95.65	148.46	258.42	1524.72	212.38	527.46	784.88
Qinzhou	155.33	69.78	37.17	43.38	396.18	114.04	141.38	140.76

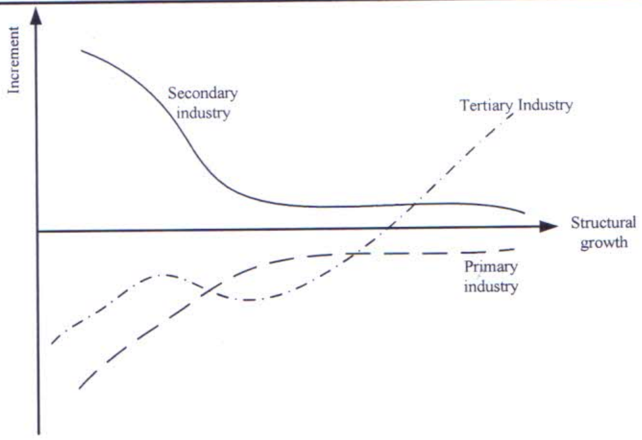

FIG. 3 STRUCTURAL GROWTH

Through the further calculation of the growth volume, the statistical chart of growth contribution rate of various regions was obtained.

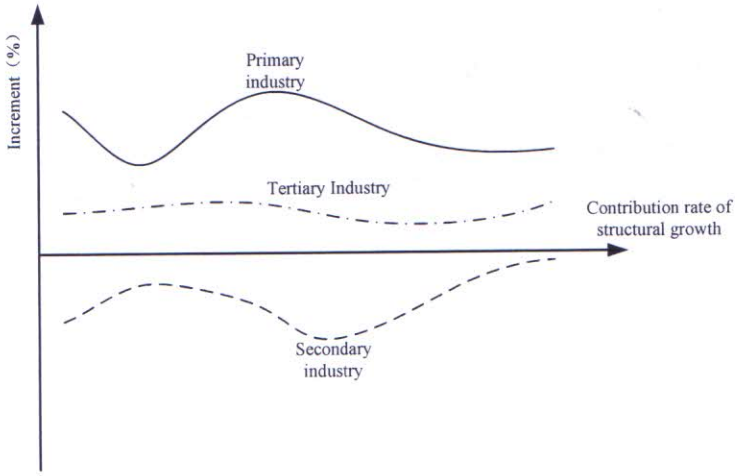

FIG. 4 GROWTH CONTRIBUTION RATE CHART

As can be seen from the Figure above, the shared growth of Shenzhen Economic Development Zone and 4 cities under its jurisdiction was great, the economy in Shenzhen Economic Development Zone, Futian District, Luohu District, Nanshan District, Yantian District of the 5 regions obtained great growth with the Shenzhen's average growth rate of growth.

In the contribution rate of locational growth, the tertiary industry of Shenzhen Economic Development Zone > secondary industry > primary industry. This shows that the industrial structure of the Shenzhen Economic Development Zone is optimizing from "tertiary industry- secondary industry- primary industry ".

Primary Industry Structure and Spatial Layout Optimization

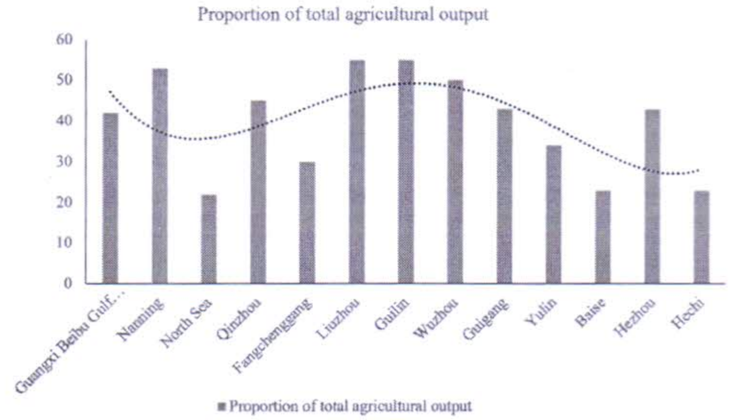

FIG. 5 THE PROPORTION OF AGRICULTURE IN THE PRIMARY INDUSTRY

From the point view of the sorting of Shenzhen Economic Development Zone and other cities, the proportion of agriculture of total output value of the primary industry ranked 9 in the 11 comparative regions in Shenzhen Economic Development Zone. Compared with Chongzuo City which ranked first in the proportion of agriculture's total output value of the primary industry in Shenzhen, the proportion of agriculture in total output value of primary industry in Shenzhen Economic Development Zone accounted for 60.71% of the proportion of agriculture's total output value of the primary industry in Chongzuo City; compared with Yulin City which ranked 11 in the proportion of agriculture's total output value of the primary industry in Shenzhen, the proportion of agriculture in total output value of primary industry in Shenzhen Economic Development Zone accounted for 1.16 times of the total output value of the primary industry in Yulin City. It can be seen that the proportion of agriculture in total output value of primary industry in Shenzhen Economic Development Zone is relatively low.

Secondary Industrial Structure and Spatial Layout Optimization

In order to make the selected key industries achieve the requirements of low-carbon economic development and industrial economic development, the following hierarchical structure model was constructed.

After consulting with experts, the index of each layer of the program was compared and scored, and the two-two judgment matrixes between the layers and indexes were obtained. The weights of each index were calculated by the method of square root, and the consistency test was carried out.

TABLE 4 QUASI - TEST HIERARCHY

	B1	B2	w
	0.6667	0.3333	
C1	0.0665	0.0000	0.0437
C2	0.3903	0.0000	0.2602
C3	0.1828	0.0000	0.1218
C4	0.0655	0.0000	0.0437
C5	0.2958	0.2500	0.2806
C6	0.0000	0.7500	0.2500

TABLE 5 THE FINAL WEIGHT OF EACH INDICATOR

	C1	C2	C3	C4	C5	C6	Weights
	0.0314	0.2324	0.0994	0.0514	0.3354	0.2500	
D1	0.6483						0.0204
D2	0.2297						0.0072
D3	0.1220						0.0038
D4		0.7500					0.1743
D5		0.2500					0.0581
D6			0.2500				0.0248
D7			0.7500				0.0745
D8				0.2500			0.0129
D9				0.7500			0.0386

D10	0.2500		0.0838
D11	0.7500		0.2515
D12		0.8000	0.2000
D13		0.2000	0.0500

Therefore, the measures for the optimized development of the secondary industry were obtained: the state needs to vigorously develop the ferrous metal smelting and rolling processing industry, pharmaceutical manufacturing industry, petrochemical Industry and coking industry, chemical raw materials and chemical manufacturing, electricity production industry, sugar industry, transportation equipment manufacturing, food processing industry, non-ferrous metal smelting and rolling processing industry and tobacco processing industry with low-carbon effect and good comprehensive performance of industrial effect. The more forward the choice of the industrial sector is, the more obvious the comprehensive benefits of the two aspects of low-carbon development and industrial development are.

Tertiary Industrial Structure and Spatial Layout Optimization

In view of the fact that the low-carbon economy scholars believe that the communication and transportation industry is not a low-carbon industry, the optimization measures of the tertiary industry were summed up: the state needs to vigorously develop the post industry, leasing and business services industry, health care, social security and social welfare, scientific research institutions, wholesale and retail trade, information transmission, computer services and software industry, accommodation and catering industry, finance and insurance industry. For the development of the transportation industry, under the current energy structure and technical conditions, moderate guidance should be conducted to play the role of transportation services and provide services for the development of other industries, so as to solve the current situation of large greenhouse gas emissions in transportation by means of clean energy and scientific and technological innovation.

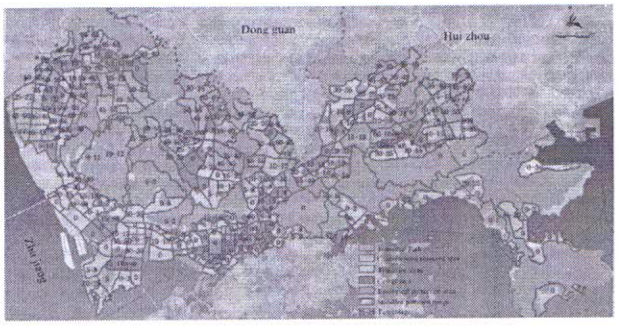

FIG. 6 INDUSTRIAL LAYOUT OPTIMIZATION RESULTS

Conclusions

On the basis of discussing the theories of industrial ecology and low-carbon economy and combining the artificial intelligence technology, the shift-share analysis method of industrial structure was proposed in this paper, and an intelligent analysis of industrial distribution was made; through the analysis of the data, the input-output and the analytic hierarchy structure of the industry layout were obtained; and then combined with the optimization algorithm, an industrial ecology evaluation index system with low-carbon economy content was constructed. The index system can reflect the ecological level of each industry reasonably and scientifically. In addition, according to the principal component analysis, a comprehensive model was constructed to evaluate the ecological level, and the combination of theory and practice was used to evaluate the ecological level of industry; at the same time, combined with the application of intelligent optimization algorithm and intelligent technology in industrial theory, the present situation of industrial structure, the historical development and the characteristics of industrial spatial distribution in Shenzhen Economic Development Zone were analyzed, and relevant optimization measures were put forward. The results show that the model can effectively promote industrial development, improve economic efficiency, and provide an effective reference for subsequent analysis.

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