

Research on Regional Industrial Layout and Structural Adjustment and Upgrading under Digital Economy

Han Yu¹, Lei Lei^{2, *}

¹ BYD Company Limited, Shenzhen, Guangdong Province 518116, China

² School of Civil Engineering, Xuzhou University of Technology, Xuzhou, Jiangsu Province 221000, China

* Corresponding author: Lei Lei (Email: e_i27094@163.com)

Abstract: Digital transformation promotes the change of urban governance. Based on the concept of "system", this paper focuses on exploring the influencing factors and evaluation indicators of the industrial structure adjustment and energy production and consumption structure adjustment of green smart cities in the new era under the promotion of digital economy, providing a strong theoretical basis for the comprehensive evaluation of the influencing factors in the later period.

Keywords: Digital Economy; Industrial Layout; Adjust and Upgrade.

1. Introduction

Digital economy is a more advanced and sustainable new economic form following agricultural economy and industrial economy [1]. It is not only an important factor affecting China's and even the global economic development in the current and future stages, but also a key weight in building a new pattern of regional economic development in China.

From the perspective of the scale of digital economy, the overall scale of China's digital economy will rise from 2.6 trillion yuan in 2005 to 39.2 trillion yuan in 2020; The share of digital economy in GDP will increase from 14.2% in 2005 to 38.6% in 2020. It can be seen that the contribution of the digital economy to China's national economy has been significantly improved. From the growth rate of the digital economy, the growth rate of China's digital economy in 2020 is 9.7%, 6.7% higher than the nominal growth rate of GDP in the same period, about 3.2 times the nominal growth rate of GDP in the same period. From the perspective of regional development of the digital economy, in 2020, the overall scale of the digital economy in 13 provinces exceeds 1 trillion yuan, and the overall scale of the digital economy in eight provinces exceeds 500 billion yuan. The digital economy is becoming a new engine driving regional economic growth [2].

2. Research Status of Regional Economy and Industrial Development Empowered by Digital Economy

At present, the digital economy has become a new driving force for economic growth, which has played a role in promoting the growth of the regional economy. For example, Yang Wenpu (2021) used the method of panel data model and panel threshold model to investigate the relationship between the digital economy and regional economic growth, and believed that the impact of the digital economy on regional economic growth is nonlinear. Specifically, the digital economy has a stronger promoting effect on the economic growth of developed areas than that of backward areas, and the promoting effect on the tertiary industry is stronger than that of the secondary industry. In areas with a high degree of digital economic development, this promoting effect will be

stronger [3]. Secondly, the impact of digital economy on regional economic development has certain regional heterogeneity. For example, Liu Xielin et al. (2021) pointed out that due to the difference in regional absorptive capacity, developed regions can obtain more benefits from digitization than less developed regions, so digitization will further widen the development gap between cities [4-5]. Finally, the digital economy has brought a new path for the coordinated development of regional economy. For example, Huang Jinfang (2021) demonstrated through empirical research that in the context of the digital economy, the relationship between the development of the Internet and the regional economic gap presents an inverted U-shaped relationship. Before the inverted U-shaped inflection point, the development of the Internet will increase the gap between regional economies, while after the inflection point, the development of the Internet will help narrow the gap between regional economies. Furthermore, it was pointed out that strengthening the construction of the Internet in the digital economy era, guiding the orderly flow of labor factors in the market, and striving to cross the inverted U-shaped inflection point will be conducive to the coordinated development of regional economy [6].

3. Research on Influencing Factors of Regional Industrial Layout and Adjustment and Upgrading of Production and Consumption Structure Under Digital Economy

The development trend of digital transformation in the new era and the construction demand of green smart cities have promoted the green transformation of regional industrial layout and production and consumption structure. China's economy has gradually shifted from the original high-speed growth stage to the stage of high-quality development. Enabling by digital, adhering to the new development concept of "innovation, coordination, green, open and sharing" in the process of industrial transformation, and adhering to the sustainability in the process of structural adjustment and upgrading are important paths to promote high-quality economic development.

3.1. Analysis of influencing factors

From the perspective of digital economy and green city construction, the industry in the new era begins to pay attention to the sustainability of social development, which requires the development of green industry while taking into account a certain economic growth. The cost of environmental governance will be recorded into the cost of industrial development, and the benefits generated by industrial innovation need to make up for this part. This also requires that in the process of industrial development, more manpower and energy should be invested in environmental protection, low-carbon and other sustainable development elements. In the process of development and innovation, the comprehensive strength of industry will also be effectively improved.

Based on the scientific connotation and mechanism of high-quality development, starting from the new development concept and sustainable development strategy, through the combination of questionnaire survey and expert scoring, the influencing factors of regional industrial layout and production and consumption structure adjustment and upgrading under the digital economy are qualitatively analyzed from the aspects of personnel, technology, capital and ecology.

Specifically, in terms of personnel, the development demand that is bound to conflict with the original development mode will be generated in the process of industrial transformation and structural adjustment, which requires the injection of "fresh blood", namely the investment and change of talents under the new situation; From the perspective of technology, on the basis of the existing stage of knowledge reserve, how to change the way of thinking, carry out technological innovation, how to realize the optimal allocation of the change and reorganization of new and old talents, and then promote technological innovation and innovation output; from the perspective of capital, the innovation and change of talents, technology and equipment require increased cost input, how to effectively use resources on this basis, and then meet the goal of improving production income of the industry; from the perspective of ecology, the requirements of green, energy saving and emission reduction in the new era have promoted the development of ecological civilization. In the process of industrial production and transformation, the investment in environmental protection and garbage treatment will further improve the production cost of the industry.

That is to say, for the industrial layout, namely the production and consumption structure, its adjustment and upgrading are closely related to personnel, technology, capital, ecology and other aspects, and there is also an interactive relationship between these influencing factors.

3.2. Indicator System Construction

In order to make the indicator system more scientific and standardized, when constructing the comprehensive evaluation indicator system of influencing factors for regional industrial layout and adjustment and upgrading of production and consumption structure under the digital economy, based on the principles of systematic, dynamic, scientific and operable, four first-level indicators of "personnel", "technology", "capital" and "ecology" are determined. Among them, "personnel" includes talent investment, personnel change and reorganization, "technology" includes technological innovation, technological change and innovative output, "capital" includes personnel change

investment, technology and equipment change investment, resource optimal allocation and ecological treatment investment, and "ecology" includes greening coverage, garbage treatment and policy measures. There are 12 second-level indicators in total.

3.3. Analysis of comprehensive evaluation methods

Evaluation usually refers to the decision-making activities of the human subject to evaluate and compare the value of the evaluated object according to certain criteria. According to the different characteristics of the evaluated objects, it is often necessary to choose a comprehensive evaluation method that is suitable for the evaluated situation.

(1) Analytic hierarchy Process

Analytic Hierarchy Process (AHP), as a decision-making method, was first proposed in the 1970s by the American operations research scientist Professor T.L. Saaty. In this method, the problem to be decided is clearly decomposed into multiple hierarchical structures, and the corresponding matrix is constructed, and then the feature vector of the relevant judgment matrix is solved for it, so as to obtain the priority weight of each reference factor in different levels. This priority weight is calculated relative to the element of the previous level. Therefore, the influence weight of each alternative decision scheme relative to the decision target is obtained step by step. The detailed steps are shown in Figure 1.

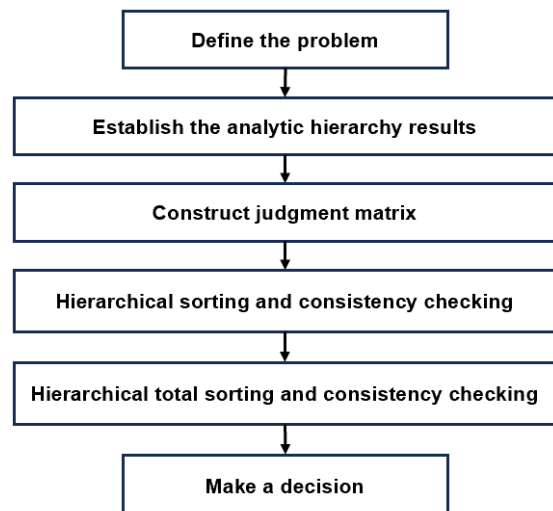


Figure 1. Basic steps of AHP

(2) Rank and ratio method

Rank Sum Ratio (RSR) was proposed in 1988 by Professor Tian Fengtiao, a Chinese statistician, as an analytical method combining parametric statistics and non-parametric statistics. This method evaluates the quality of things according to the size of RSR, that is, ranking the benefit index from small to large, ranking the cost index from large to small, calculating the rank-sum ratio, and finally statistical regression and ranking. Through rank transformation, the dimensionless statistic RSR is obtained, and the RSR value is used to directly sort or rank the evaluation object, so as to make a comprehensive evaluation of the evaluation object. It can be applied to statistical prediction, factor and correlation analysis, differential classification and decision analysis. The detailed steps are shown in Figure 2.

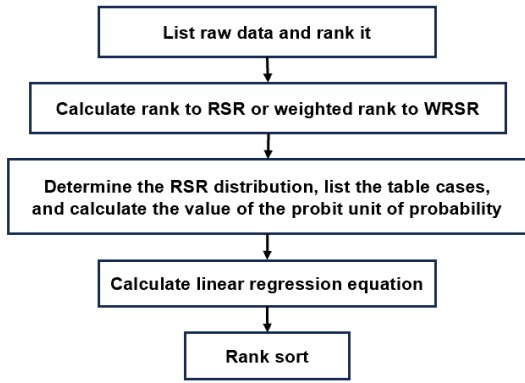


Figure 2. Basic steps of RSR

(3) Technique for Order Preference by Similarity to Ideal Solution

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), is a method that can make full use of the original data information, namely, based on the normalized original data matrix. The comprehensive evaluation method is to find out the good and bad schemes, and accurately reflect the gap between the evaluation schemes by calculating the distance between the evaluation subject and the good and bad schemes. The detailed steps are shown in Figure 3.

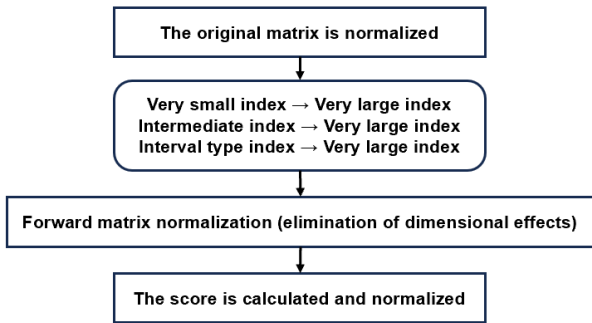


Figure 3. Basic steps of TOPSIS

(4) Artificial Neural Network method

Artificial Neural Networks (ANNs) is a model established for information processing. In the process of construction, ANNs imitates the neural network of human brain and abstracts it, so it is called artificial neural network. ANNs is the arrangement of processing elements. This operational model is composed of many processing elements and the connections between processing elements to form a network. Among them, the neuron represents a specific output function, also known as the excitation function. The connection between neurons represents the weight held by the signal through the connection, also known as the weight. For different problems, due to the different network connection modes established and the different weight values and incentive functions assigned, the final output will also change. Based on the self-learning, adaptive and fault-tolerant abilities of neural networks, a qualitative and quantitative integrated evaluation model which is closer to human thinking mode is constructed. The trained neural network gives the evaluation ideas of experts to the network in the form of connection weights, so the network can not only simulate the quantitative evaluation of experts, but also avoid human errors in the evaluation process. The detailed steps are shown in Figure 4.

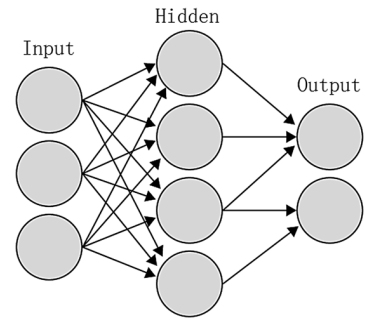


Figure 4. Basic steps of ANNs

(5) Decision-making Trial and Evaluation Laboratory method

Decision-making Trial and Evaluation Laboratory (DEMATEL) is an effective method to identify and analyze the causal chain components of complex systems between regional industrial layout and factors affecting the adjustment and upgrading of production and consumption structure. The method uses graph theory and matrix tools to analyze the system, quantifies the logical relationship between the components of complex system, and then obtains the direct influence matrix. Then, the influence degree, the influence degree, the cause degree and the centrality degree of each component element are calculated, and the correlation between each component element is analyzed according to the obtained results, so as to determine the position and influence degree of the component element in the complex system.

When using decision laboratory analysis for systematic evaluation, it can often be improved by integrating interpretive structure models (ISM). ISM is a method used to reveal the relationship structure of complex systems. Through some basic assumptions and directed graphs, we can judge the direct influence relationship between the components of the system, construct the adjacency matrix, and then obtain the reachable matrix through Boolean logic operation. Then, the reachable matrix is decomposed into hierarchical subsystems by human-machine combination, so that the whole complex system is decomposed into hierarchical subsystems, so as to get a clear and multi-level hierarchical structure model, and hierarchical directed graph is used to reveal the structure of the complex system.

The detailed steps are shown in Figure 5.

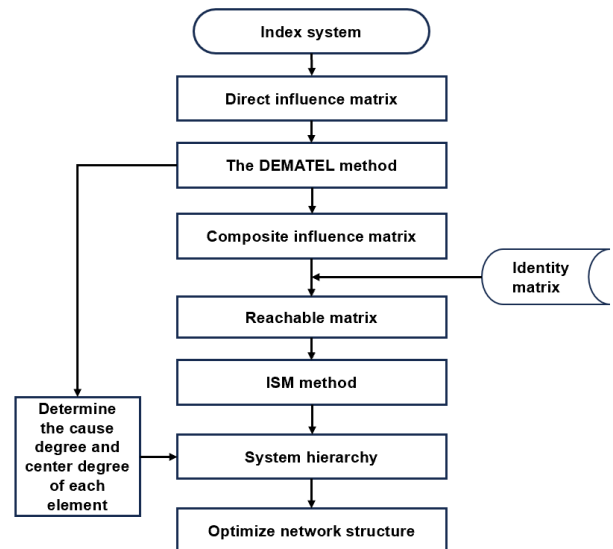


Figure 5. Basic steps of ISM-DEMATEL method

The analytic hierarchy process (AHP) can clearly construct the correlation framework model among the influencing factors, but in the process of quantitative analysis of these influencing factors, it is easy to have significant errors in the quantitative evaluation results due to incomplete information or difficulty in quantifying factors. Rank and ratio method, it is mainly to evaluate the good and bad grade of things, and then carry out statistical prediction, identification classification and decision analysis. Approximate ideal solution sorting method is used to compare the gap between comprehensive evaluation schemes, and then choose the appropriate evaluation scheme. It is a comparison of good and bad schemes on the basis of full use of original data. The artificial neural network method integrates the characteristics of data adaptive and self-learning dynamic evaluation, and can reconstruct the network data structure when the data is transformed. However, in practical application, the evaluation deviation is often large because the number of data samples is insufficient. Through quantitative analysis, the decision laboratory analysis method can obtain the relevant parameters among the influential factors of the study, including the degree of cause and the degree of center, and on this basis determine the interaction between the factors, so as to achieve the purpose of quantitative description. However, the direct impact matrix usually constructed by the decision laboratory analysis method does not consider the complexity of the decision environment and the uncertainty of the expert judgment information.

4. Conclusion

In the process of empowering green smart cities in the new era with "digitalization and intelligence", it promotes the reform of urban governance and can realize energy conservation and emission reduction from production to consumption, the whole industrial chain and the whole life scene. In the subsequent research, It can further comprehensively evaluate the development level of China's digital economy from five aspects: the overall development

level of digital economy, digital foundation, digital industry, digital application, and digital innovation, and analyze the impact of digital economy on regional economic growth, industrial structure upgrading, and employment structure improvement from a spatial dimension. It provides an effective theoretical and practical basis for further exploring the measures of regional economy and industrial transformation and development under the empowerment of digital economy.

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