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Research on the Construction of Urban Logistics Performance Evaluation Index System from the Perspective of Green Development Based on Entropy Weighting Method

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***Abstract*—Green development is the current and long-term development concept. Considering the current high cost, low efficiency and great impact on the resources and environment of the logistics industry, it is necessary to build logistics demand, logistics investment and green logistics. The urban logistics performance evaluation index system with 19 indicators in four aspects of output, environment and resources, selects the sample data in the statistical yearbooks of six central provinces in 2018, and determines the weight of the indicators by entropy method.**

Keywords—green development; urban logistics performance; entropy weighting method; evaluation index system

I. INTRODUCTION

The "Five Developments" concept is that General Secretary Xi's focus on outstanding issues, paying attention to the expectations of the people, field investigations, visits, and summing up the fresh experience of the people.Since the introduction of the five development concepts, the five development concepts have become an important development concept for the "Thirteenth Five-Year Plan" and for a considerable period of time since then. Facing the rapid development of the economy and the transformation of the economic development mode, we will fight the battle against pollution and win the battle against the blue sky. Green development is highly valued. As the pillar industry of economic development, how to achieve sustainable development under the current ecological environment damage, how to protect the ecological environment, reduce energy consumption, and improve resource utilization are the problems facing the logistics industry.From the new development concept and new perspective, the logistics industry needs to focus on reform and development, strengthen supply chain innovation and development, and promote supply-side structural reform.

How is the performance of urban logistics, how effective is the development of logistics industry, how to achieve sustainable development in logistics industry, so far there is no unified evaluation index system as a measurement standard, urban logistics performance evaluation index system, especially the evaluation of urban logistics performance from the perspective of green development The construction of the indicator system is conducive to promoting the introduction of unified standards, and is conducive to promoting the standardization and collection of the index data of the logistics industry. It is also conducive to promoting the logistics industry to think about how to reduce the impact on the ecological environment in the process of improving quality and efficiency, and is conducive to logistics. Enterprises in the operation process to think about how to reduce costs and reduce environmental pollution.

II. RESEARCH REVIEW

Since the introduction of the world's environmental problems, domestic and foreign scholars have begun to incorporate environmental factors into logistics research, especially foreign scholars. For the study of logistics performance, foreign students Chhabra D et al. (2017)[1] take an Indian automobile company as an example. Incorporating green efficiency, safety factor and operational convenience into the evaluation criteria, Zaman K and Shamsuddin S (2016)[2] take European countries as an example, and use energy, environment and health as indicators of green logistics performance evaluation. The 2007-2014 data was selected for analysis.Psaraftis HN (2016)[3] uses the different effects of greenhouse gas and non-greenhouse gas emissions on the performance of marine green logistics as a research point.

Domestic scholar Tian Hongyan (2018)[4] constructed a green logistics performance evaluation index system from four aspects: infrastructure, economy, environment and energy, and operation management. Liu Wei (2018)[5] took Tibet as an example and developed from regional economy. The three aspects of horizontal, logistics infrastructure and logistics industry performance are used to study the contribution of logistics performance to regional economic development. Zhang Linqiang (2017)[6] constructed Henan from four aspects: economic factors, resources, environment and operation management. Provincial Green Logistics Evaluation Index System, Xue Hongsong (2017)[7] started from the development of green logistics in Hubei Province, and established an evaluation index system including environment, resources, economy and technology. Dou Jin (2017)[8] analyzed The impact of logistics infrastructure, economy and information network on logistics demand in Gansu Province, Luo Yao, Li Bomin (2016)[9] found that regional economic development level and infrastructure construction have a significant impact on Xiangxi green logistics. Combining the research results of many scholars on green logistics and

regional logistics performance, scholars believe that economics, infrastructure, environmental factors, information networks, technology, resources, and operation management are the influencing factors of the logistics industry.

III. The Construction of Urban Logistics Performance Evaluation Index System

A. *Evaluation index selection principle*

Since logistics activities run through economic activities, involving a wide range of factors and intricate factors, it is necessary to look for impact indicators from a comprehensive and comprehensive perspective when designing the evaluation index system.(1) Conciseness. The selection of the evaluation index system should take into account the main aspects of the influencing factors as much as possible, so as to study the evaluation objects from different angles, but there are always more or less certain correlations between the factors affecting the same thing. Therefore, when selecting evaluation indicators, we should also consider the systemicity and connectivity between the indicators and try to simplify the indicators as much as possible, so as to avoid the inconvenience and inconvenience of the indicator system, and even the main indicators are not submerged and the key indicators are submerged. Accurate results; (2) operability.The establishment of the indicator system is for subsequent research and use. Therefore, the design of the indicator system should be feasible. The quantitative and evaluable indicators should be selected as much as possible, and the data can be obtained. This will reduce the difficulty of data acquisition during the use of the indicator system. (3) Quantitative and qualitative combination.The qualitative indicators in the evaluation index system are likely to be quantified or classified, but when there are indicators that are difficult to quantify, qualitative indicators can be used instead.

B. *Construction of urban logistics performance evaluation index system*

In view of the extensive nature, complexity and diversity of logistics activities, the researcher believes that the urban logistics performance evaluation index system should include logistics demand, logistics infrastructure, logistics output and environment.

1) Logistics needs

Demand drives consumption, and logistics demand is one of the main factors driving economic growth. Economic development in turn promotes the development of logistics industry. The size of demand directly affects regional logistics performance.The direct influencing factors of logistics demand are economic development level, industrial structure, consumption level, consumption concept, investment, technological innovation, supply level, technology development, human resource accumulation, politics, social environment, internal and external trade relations, international environment, etc. .This paper selects indicators that reflect logistics demand from a comprehensive, concise, and quantifiable perspective, including regional GDP (x11), per capita GDP (12), and total secondary industry's share of gdp. (x13), the proportion of the tertiary industry to the proportion of gdp (x14), total foreign investment (x15), total retail sales of social consumer goods (x16), of which the total value of the secondary industry accounts for the proportion of gdp and the total of the three industries The proportion of the value of gdp has a high correlation, and the index with high correlation is deleted. Therefore, the proportion of the tertiary industry to the total amount of gdp is taken to reflect the logistics demand.

2) Logistics investment

In terms of measuring performance, referring to the general theory of input-output, input mainly refers to the input of production factors, namely, human, financial and material resources.In terms of manpower, this paper uses the number of employees in the logistics industry to reflect the manpower input. However, since there is no data from the logistics industry alone, the number of employees in the transportation industry and the warehousing postal industry in the state-owned economy and the urban collective economy is used as the number of employees in the logistics industry. In terms of material resources, this paper uses the network mileage of the logistics industry and the number of postal business outlets as indicators to reflect the logistics input. Since there is no indicator of the network mileage of the logistics industry, this paper will integrate the transportation mileage of roads, railways, inland rivers and aviation. The specific treatment method will be The mileage of transportation by various modes of transportation is converted into the mileage of one mode of transportation. In terms of financial resources, in addition to using the fixed assets investment in the logistics industry to reflect the financial input indicators, since this paper is based on the perspective of green development, the ecological protection and environmental governance of fixed assets investment as a financial resource reflecting green development and ecological environment. Input indicators. Therefore, this paper selects the number of employees in the logistics industry x21, the fixed assets investment in the logistics industry x22, the network mileage in the logistics industry x23, the ecological protection and environmental management fixed assets investment x24, following the principle of simplicity, comprehensiveness and quantifiability. The number of postal business outlets x25 reflects the logistics investment.

3) Logistics output

Logistics industry output is a direct reflection of logistics performance. It is the result of logistics activities under the circumstance of demand and reasonable human, financial and material input. The relative efficiency of logistics input and output is the focus of coordinated development of regional logistics. The added value of the logistics industry is the economic benefit obtained from the factor input of the logistics industry for a period of time. The value of the value reflects the level of economic benefits and is the most direct quantification of the output obtained after the investment in the logistics industry. The freight volume and cargo turnover are the main indicators reflecting the output of the logistics industry. The cargo turnover is related to the freight volume and the transportation distance. It is an indicator to measure the transportation scale of the regional logistics industry, and is also used to reflect the development achievements of the logistics industry. Due to the rapid development of express delivery business, it plays an increasingly important role in the

logistics industry. Therefore, this paper selects express delivery volume as a representative indicator of logistics industry output. Due to the lack of logistics industry indicators, the postal industry express business volume is used. As a courier business volume. Therefore, based on the principle of selecting indicators, this paper selects freight volume x31, cargo turnover x32, logistics industry added value x33, postal industry express business volume x34 to reflect the logistics output.

4) Environment and energy

Ecological and environmental issues are increasingly being addressed and valued. The Central Economic Work Conference proposed that the goal of air pollution control is to reduce the total discharge of major pollutants, improve the overall quality of the ecological environment, and the ecological environment as a non-replicable resource. A good ecological environment is the most inclusive and fairest public resource. Protecting the environment and strengthening the construction of ecological civilization are one of the important contents for building a beautiful China and realizing the Chinese dream. The logistics industry considers its impact on the environment and ecology in the process of speeding up efficiency, reducing costs, and transforming and upgrading. In the process of rapid development of the logistics industry, the energy consumption, waste gas, waste discharge, and environmental protection investment The situation, the harmless treatment of waste, waste, and wastewater discharge are the direct manifestations of the logistics industry's impact on the environment and ecology. Therefore, the principle of selection of indicators in this text selects logistics industry energy consumption x41, logistics industry wastewater discharge x42, logistics industry co2 emissions x43, unit gdp energy consumption x44 as an indicator of the reaction environment.Due to the lack of indicators in the logistics industry, it was expanded to replace the index value of the logistics industry with the relevant indicator values of the whole industry.

TABLE I URBAN LOGISTICS PERFORMANCE EVALUATION INDEX SYSTEM FROM THE PERSPECTIVE OF GREEN DEVELOPMENT

	Level 1 indicators	Level II indicators	Level 1 indicators	Level II indicators
Urban Logistics Performance Evaluation Index System from the Perspective of Green Development	Logistics needs	Gross Regional Product x11	Logistics output	Freight volume x31
		Per capita GDP ×12		Cargo turnover x32
		The proportion of the tertiary industry to the proportion of gdp x13		Logistics industry gdp / logistics industry added value x33
		Total foreign investment x14		Postal industry express business volume x34
		Total retail sales of consumer goods x15		
	Logistics investment	Number of employees in the logistics industry x21	Environment and energy	Logistics energy consumption x41
		Logistics industry fixed assets investment x22		Logistics wastewater discharge x42
		Logistics industry network mileage x23		Logistics co2 emissions x43
		Ecological protection and environmental governance fixed assets investment x24		Unit gdp energy consumption x44
		Number of postal business outlets x25		

IV. THE ENTROPY WEIGHTING METHOD

There are many methods for determining weights. Commonly used are subjective and objective weighting. Subjective weighting method has expert ranking method, analytic hierarchy process, etc. Objective weighting has principal component analysis method, entropy method, neural network analysis method, etc. In this paper, the commonly used entropy method is used to weight the index. The steps of determining the weight by the entropy method:

Let the system have n evaluation indicators, there are m objects to be evaluated, xij(i=1,2,...,m;j=1,2,...,n) is the i-th evaluation object in the jth The value under the evaluation indicator. Then, an m×n-order evaluation index value matrix X=(xij)m×n can be formed.

A. Standardization processing

Due to the different dimensions between the indicators, it is necessary to standardize the numerical matrix of the evaluation indicators and standardize the positive indicators:

$$z_{ij} = \frac{x_{ij} - x_{\min}}{x_{\max} - x_{\min}} + 0.01 \quad (1)$$

Standardization of negative indicators:

$$z_{ij} = \frac{x_{\max} - x_{ij}}{x_{\max} - x_{\min}} + 0.01 \quad (2)$$

among them z_{ij} Standardized x_{ij} , $x_{\max}$ 、 $x_{\min}$ Indicates the maximum and minimum values of similar indicators for different evaluation objects. The normalized value plus 0.01 here is to avoid meaningless[10] of the logarithmic calculation when entropy is obtained.

B. Calculate the proportion of the jth indicator of the i-th evaluation object to the j-th indicator h_{ij} .

$$h_{ij} = \frac{z_{ij}}{\sum_{i=1}^{m} z_{ij}} \quad (3)$$

C. Calculate the entropy value of the indicator.

The entropy of the output of the jth evaluation indicator is

$$h_j = -\frac{1}{\ln m} \sum_{i=1}^{m} h_{ij} \ln h_{ij} \quad (4)$$

D. Calculate the index weights.

Weight of the jth indicator

$$\omega_j = \frac{1-h_j}{\sum_{i=1}^{n}(1-h_j)} \tag{5}$$

V. USE THE ENTROPY METHOD TO DETERMINE THE INDEX WEIGHT

A. Select data

This paper selects the sample data of the logistics industry in the six provinces in central China in 2017. Since there is no separate data related to the logistics industry, this study uses the transportation, warehousing and postal industry data as the logistics industry data.Data sources such as China Statistical Yearbook, Anhui Statistical Yearbook, Henan Statistical Yearbook, Shanxi Statistical Yearbook, Hubei Statistical Yearbook, Hunan Statistical Yearbook and Jiangxi Statistical Yearbook .The specific data is slightly.

Explanation on the network mileage index data of the logistics industry: Since the transportation mode of the logistics industry mainly includes railways, highways, waterways, aviation and pipelines, the nature of different modes of transportation and transportation capacity are different, so this article converts the mileage of various modes of transportation into The mileage of road transportation is as follows:

$$\sum_{\text{Various modes of transport}} \frac{\dfrac{\text{Cargo volume by mode of transport}}{\text{route mileage by mode of transpor}}}{\dfrac{\text{Cargo throughput}}{\text{length of road routes transported by road}}}$$

Description of the energy consumption of the logistics industry and the indicators of waste water and exhaust emissions: replace the energy consumption and emissions of the logistics industry with the consumption and emissions of the industry.

B. Using entropy method to determine index weights

1) According to the steps of the entropy weighting method, first normalize the data, and then bring in (Equation 3-4) to calculate the entropy of the 19 indicators as shown in Table 2.

The weights of each secondary indicator and the weight of the primary indicator according to the entropy value are shown in Table 2.

TABLE II ENTROPY OF URBAN LOGISTICS PERFORMANCE EVALUATION INDICATORS FROM THE PERSPECTIVE OF GREEN DEVELOPMENT

Level 1 indicator	**Level II indicators**	**Indicator type**	**Entropy value h_j**	**Weight w_j**	**First-level indicator weight**
Logistics needs	Gross Regional Product (x11)	Positive	0.8351	0.0429	0.2958
	Per capita GDP (x12)	Positive	0.6985	0.0783	
	The proportion of the tertiary industry to gdp (x13)	Positive	0.6940	0.0795	
	Total foreign investment (x14) billion US dollars	Positive	0.8498	0.0390	
	Total retail sales of consumer goods (x15) billion	Positive	0.7841	0.0561	
Logistics investment	Number of employees in the logistics industry (x21)	Positive	0.6268	0.0970	0.2985
	Investment in fixed assets of the logistics industry (x22) billion yuan	Positive	0.8312	0.0439	
	New fixed assets investment in the logistics industry (x22)	Positive	0.8136	0.0484	
	Logistics industry network mileage (x23) (km)	Positive	0.8229	0.0460	
	Investment in fixed assets of water conservancy, environment and public facilities (x24)	Positive	0.8780	0.0317	
	Number of postal business outlets (x25)	Positive	0.8787	0.0315	
Logistics output	Freight volume (x31) tons	Positive	0.7499	0.0650	0.2805
	Cargo turnover (x32) billion tons of kilometers	Positive	0.6214	0.0984	
	Logistics industry added value (x33)	Positive	0.7100	0.0754	
	Postal industry express business income (x34) billion yuan	Positive	0.8392	0.0418	
Environment and energy	Logistics energy consumption (x41) (Wanton standard coal)	Inverse	0.9045	0.0248	0.1252
	Logistics wastewater discharge (x42) tons	Inverse	0.8788	0.0315	
	NOx emissions from the logistics industry (x430,000 tons	Inverse	0.8818	0.0307	
	Logistics industry unit gdp energy consumption (x44)	Inverse	0.8530	0.0382	

2) Analysis of results

Analysis of entropy calculation results: Entropy value is a number between 0-1, and the value of the value represents the size of urban logistics performance information represented by the indicator. The calculation results show that the entropy values of each index are above 0.6, indicating that the selected The indicators are good and can represent most of the information on urban logistics performance. Among the entropy values of the 19 indicators, the energy consumption of the logistics industry (x41) has the largest entropy value, which can better reflect the information of urban logistics performance.

Analysis of weight calculation results: Since the weight indicates the importance of indicators to urban logistics performance, in terms of logistics demand, the tertiary industry's total value accounts for the largest weight of gdp, and the weight of per capita GDP is second, indicating that these two The index has a great role in the evaluation of urban logistics performance. In terms of logistics investment, the number of employees in the logistics industry is the largest,

indicating that it has the greatest effect on the evaluation of urban logistics performance; in terms of logistics output, the cargo turnover (x32) has the largest weight. It shows that this index plays the most important role in urban logistics performance evaluation; in terms of environment and energy, the index weight is not very large, which may also be related to the selected indicators are non-logistics data, four sub-level indicators of environment and energy. The weight of the three indicators is less than 0.1252, which is less than the weight of logistics, logistics input and logistics output. The three indicators of logistics demand, logistics input and logistics output occupy roughly the same weight in the whole evaluation index system. 30%.In the whole index system, the energy consumption of logistics industry is the smallest, and this index has the least effect on urban logistics performance evaluation.

VI. CONCLUSION

Based on the research of relevant green logistics and urban logistics performance at home and abroad, this paper analyzes the factors affecting urban logistics performance from the perspective of green development, follows the principle of index selection, selects the influencing factors, and constructs four first-level indicators. Evaluation index system for level indicators.The sample data in the statistical yearbooks of the provinces in the 2018 provinces were selected, and the entropy weighting method was used to empower the evaluation indicators.

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