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Research on adaptability of logistics distribution mode based on entropy weight method

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Abstract: *Because there are many factors affecting the adaptability of logistics distribution mode, it is difficult to analyze its adaptability. The accuracy of qualitative analysis of the adaptability of logistics distribution mode by existing methods is low, and the consistency coefficient of analysis results is low. Therefore, a study on the adaptability of logistics distribution mode based on entropy weight method is proposed. Through the analysis of its influencing factors, select the regional economic development level A1, the logistics distribution market demand scale A2, the enterprise service level A3, the logistics cost A4 and the importance of logistics to the enterprise A5 as the analysis indicators, calculate the index weight by using the entropy weight method, calculate the adaptability coefficient by using the evaluation function combined with the index weight, and realize the qualitative analysis of the adaptability of the logistics distribution mode according to the evaluation criteria. Experiments show that the consistency coefficient of the analysis results of the design method is higher than that of the traditional method.*

Keywords: *entropy weight method; Logistics distribution mode; Adaptability; Qualitative analysis; Consistency coefficient*

1. Introduction

In recent years, the e-commerce industry and the logistics industry have developed rapidly as emerging industries. The transformation of consumers' shopping habits and consumption concepts has put forward higher requirements for the demand for logistics distribution. Logistics distribution is an important link in the process of e-commerce transactions, and the logistics capability also indirectly represents the service capability of an e-commerce enterprise, Therefore, in the process of operation and management, e-commerce enterprises and logistics enterprises need to regularly evaluate and analyze the adaptability of the current logistics distribution mode, select the appropriate logistics distribution mode according to the analysis results, or adjust and optimize the original logistics distribution mode, which plays an important role in controlling logistics costs and improving logistics service capacity, Therefore, the adaptability evaluation of logistics distribution mode has become an important means for e-commerce logistics enterprises to ensure service quality. There are many factors affecting the adaptability of logistics distribution mode. The current evaluation method has low accuracy in the comprehensive analysis of influencing factors in practical application, resulting in the inconsistency between the evaluation results and the actual situation of the adaptability of logistics distribution mode. The evaluation results cannot be used as the basis for e-commerce logistics enterprises to choose logistics distribution mode and cannot meet the management needs of e-commerce logistics enterprises, Therefore, the research of logistics distribution mode based on entropy weight is proposed. This test uses entropy weight method to evaluate the adaptability of logistics distribution mode, forming a new evaluation method, which provides a reference basis for the adaptability analysis of logistics distribution mode.

2. Adaptability analysis of logistics distribution mode based on entropy weight method

2.1. Analysis of logistics distribution mode influencing factors

To analyze the adaptability of logistics distribution mode, we should first clarify its influencing factors and comprehensively judge the adaptability of logistics distribution mode from many aspects. According to personal experience and collected references, the influencing factors are divided into five

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categories, including regional economic development level A_1, logistics distribution market demand scale A_2, enterprise service level A_3, logistics cost A_4 and logistics importance to enterprises A_5 [1]. The determination of regional economic development level is mainly based on the consumption level of regional residents and the coverage of logistics terminal service outlets; The evaluation of the market demand scale of logistics distribution is mainly determined according to the delivery quantity of items and the collection quantity of items; The service level of logistics enterprises is determined according to the distribution capacity and service quality of logistics enterprises, and the logistics cost is determined according to the investment cost, distribution cost and selection cost; The importance of logistics to enterprises is determined according to the economic strategic position of logistics in logistics enterprises and self-supporting ability. The above five influencing factors are selected as the primary indicators, and each sub factor is taken as the secondary indicators to build the adaptability evaluation index system of logistics distribution mode.

2.2. Weight calculation of influencing factors based on entropy weight method

Use the 1-5 scoring method to score the selected secondary indicators. 1-5 points respectively mean low, low, general, high and high. Logistics experts score each secondary indicator according to the actual situation, and add the secondary indicator scores to obtain the primary indicator score corresponding to the secondary indicator [2]. The comparison data column R is formed according to the index score, and then the difference between the evaluation objects in the comparison data column R is analyzed by using the entropy weight method, and the entropy value of the evaluation index is calculated by using the judgment matrix. The following table is the weight calculation matrix based on the entropy weight method.

Table 1: Calculation matrix of index entropy based on entropy weight method

R	Regional economic development level A1	Demand scale of logistics distribution market A2	Enterprise service level A3	Logistics cost A4	Importance of logistics to enterprises A5
Regional economic development level A1	1	2	2	3	3
Demand scale of logistics distribution market A2	1/3	1/3	2	2	3
Enterprise service level A3	1/3	1/3	1/3	2	2
Logistics cost A4	1/3	1/3	1/3	1/3	2
Importance of logistics to enterprises A5	1/3	1/3	1/3	1/3	1/3

The entropy value of each index is obtained by using the above judgment matrix, and then the weight of the index is calculated by combining the score of each index and the adaptability correlation coefficient with the logistics distribution mode. The calculation formula is:

$$\varpi_{R1} = -k\sum_{j} y \ln w \tag{1}$$

In formula (1), ϖ_{R1} represents the index weight value in comparison data column R; Entropy Index k; j represents the total number of indicators in comparative data column R; y refers to index scoring; w represents the correlation coefficient between the index and the adaptability of logistics distribution mode [3]. The weight can be obtained from the above formula.

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2.3. Adaptability evaluation of logistics distribution mode

According to the index weight value, the evaluation function is used to comprehensively analyze each index, which is expressed as follows:

$$f(x)=\sum_{j}\varpi_{R1}hq \tag{2}$$

In formula (2), $f(x)$ represents the adaptability coefficient of logistics distribution mode; h represents the relative difference between the evaluation index and the reference data; q represents the evaluation coefficient, which is usually taken as 0.15 [4]. The adaptability coefficient calculated by the above formula ranges from - 1-0. The closer the adaptability coefficient is to 0, the higher the adaptability of the logistics distribution mode is. This time, five levels of high, high, general, low and low are set according to the actual demand. When the adaptability coefficient is between - 0.2-0, the adaptability level of the logistics distribution mode is high; When the adaptability coefficient is between - 0.4 and - 0.2, the adaptability level of logistics distribution mode is high; When the adaptability coefficient is between - 0.6 and - 0.4, the adaptability level of logistics distribution mode is general; When the adaptability coefficient is between -0.8 and -0.6, the adaptability level of logistics distribution mode is low; When the adaptability coefficient is between - 1 and - 0.8, the adaptability level of logistics distribution mode is low [5]. According to the above standards, the qualitative analysis of the adaptability of logistics distribution mode is realized.

3. Experimental demonstration and analysis

The experiment takes an e-commerce logistics enterprise as the experimental object. The enterprise has five existing logistics distribution modes. The adaptability of these five logistics distribution modes is rated and analyzed by using this design method and traditional methods. According to the above process, the indexes are comprehensively analyzed. The experiment is carried out in five times and the experimental data are recorded. The experiment takes the structural consistency coefficient analyzed by the two methods as the experimental results, records the analysis results for five times in the experiment, compares and analyzes them with the actual situation by using guad software, and calculates the consistency coefficient. The consistency coefficient indicates the degree of consistency of the results with the actual situation. The higher the coefficient, the higher the degree of consistency and the higher the analysis accuracy. Therefore, through the comparative analysis of the consistency coefficient of the two methods, to judge the feasibility and effectiveness of the design method, the calculation data of guad software are shown in the table below.

Table 2: Comparison of consistency coefficients of analysis results of the two methods

Number of experiments	Design method	Traditional method
for the first time	0.989	0.584
The second time	0.999	0.625
third time	0.973	0.257
Fourth time	0.968	0.578
Fifth time	0.998	0.564

It can be seen from the data in the above table that the consistency coefficient of the analysis results of the design method is above 0.95, and the maximum consistency coefficient can reach 0.999, indicating that the analysis results of the design method are basically consistent with the actual situation; The maximum consistency coefficient of the analysis results of the traditional method is only 0.625 and the minimum is 0.257. The consistency coefficient of the design method is higher than that of the traditional method. Therefore, through comparative analysis, it is verified that the design method is better than the traditional method in terms of accuracy, which can effectively ensure the accuracy of the adaptability analysis of the logistics distribution mode, and is more suitable for the adaptability evaluation and analysis of the logistics distribution mode.

4. Conclusions

This time, taking the entropy weight method as the theoretical basis and optimizing and innovating

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it on the basis of traditional methods, a new adaptability analysis method of logistics distribution mode has been formed, which can provide accurate data basis for the selection and adjustment of logistics distribution mode, help to reduce the operating cost of e-commerce logistics enterprises, and help to improve the logistics service ability of e-commerce logistics enterprises, which has good practical significance.

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