Research on Selection of Business Enterprise Distribution Model Based on AHP

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Abstract. Distribution plays an important role in electric enterprises. This article analysis characteristics of distribution model of business enterprises, sorts out three major factors which influence the distribution model of the business enterprise, constructs the distribution model selection model using the AHP method to calculate the weight of the various factors to different distribution model, obtains the important degree of the different distribution model to the enterprise, which provide basis for decision makers.

Introduction

In 2010 China B2C market share witnessed a historical high at ￥104 billion, with the intensified development trend, market share was ￥650 billion in 2013. Climbing unceasingly along with the customer demand for online shopping, business enterprise have higher requirements in logistics distribution, that is, linkage between the virtual transaction to the entity transaction in electronic commerce by the real deal put forward higher demand [1]. In electronic commerce, electronic can realize the process of business, the entire sales is supported by physical distribution. So how to choose efficient and economic logistics distribution method is an urgent problem for many electric business enterprises. This article attempts to use the AHP method to discuss distribution model selection problem, and provides the basis for the business enterprise decision makers.

Analysis of distribution model of business enterprise

At present, the logistics distribution models e-commerce enterprises can choose in China contain self-supporting logistics, TPL (the third party logistics), logistics alliance and so on [2]. The advantages and disadvantages of various distribution models are showed in table1. According to characteristics of various distribution model, how to select the appropriate model has become a key issue that business enterprise have to deal with, to make sure that goods can reach to the destination in safe, fast, and convenient ways.

Table1. advantages and disadvantages of various distribution model

Distribution model	Advantages	Disadvantages
Self-supporting logistics	Link process integration Strong ability to control logistic	Expensive cost Low degree of specialization
Self-supporting& Part outsourcing	Efficient allocation of distribution resources	Depend on coordination between logistics and distribution enterprises
TPL	Enjoy the professional service	Information leakage risk Service rely too much on TPL
Logistics alliance	Low cost of investment	Higher level of administration and related organization coordinated ability

Process of AHP Used in Distribution Model Selection

Factors Affecting the Distribution Model Selection. Based on the analysis of characteristics of logistics distribution mode, three aspects are put forward as indexes to evaluate, which are the consideration of the enterprise for the logistics management capabilities, the influence of logistics for enterprise and the cost advantage the enterprise has [3].

Steps of AHP Used in Distribution Model Selection. Firstly logistics distribution model selection should be divided according to the hierarchy to, then weight with the quantitative information can be decide on the basis of clearing inner link between each layer elements, and comprehensive scores of each distribution mode can be calculated to provide the corresponding service of logistics distribution model selection [4]. Using AHP to construct logistics choice model, the concrete steps are as follows:

(1) Set up a hierarchical structure model. The structure model of the selection of logistics distribution model of the business enterprise can be described in figure1.
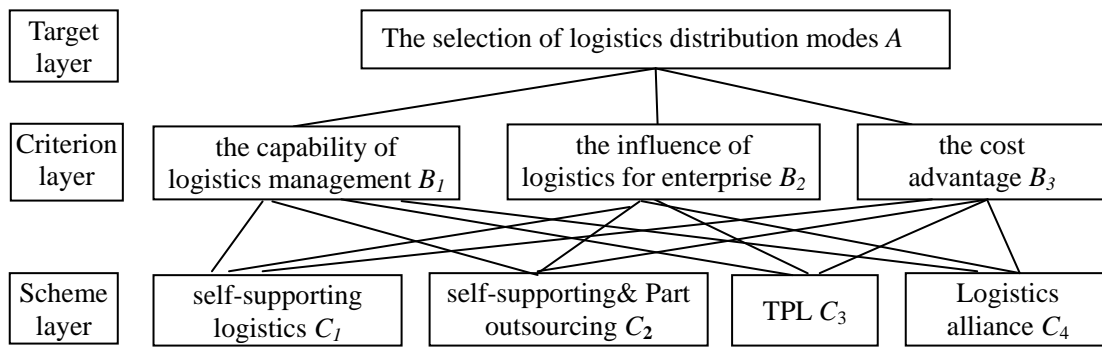

Fig.1 the selection of logistic distribution model

(2) Construct judgment matrix (i.e. pairwise comparison matrix). A comparison matrix B is created from the expert scoring. Let n be the number of elements at a certain level [5]. The upper triangular components of the comparison matrix a_{ij} (i< j = 1,…,n) are 9, 8, .. , 2, 1, 1/2, …, or 1/9. These denote intensities of importance from activity i to j. The lower triangular components a_{ji} are described with reciprocal numbers as $a_{ji}=1/a_{ij}$.

(3) Establish the sequence hierarchy and check the consistency. In order to simplify the calculation, this article uses the summation method of weighted algorithm to solve matrix. Firstly normalization processing of column vector in the judgment matrix B, and calculate their arithmetic mean value approximately as the weight vector, which is represented by formula (1):

$$\omega_i = \frac{\sum_{j=1}^{n} a_{ij}}{n\sum_{k=1}^{n}\sum_{j=1}^{n} a_{kj}} \quad (i=1, 2, …, n) \tag{1}$$

The consistency of the comparison matrix B is measured by the following consistency index (CI)

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{2}$$

It should be noted that $CI \geqslant 0$ holds. And if the value of CI becomes smaller, then the degree of consistency becomes higher, and vice versa. The consistency of the judgment matrix is satisfied if CR（consistency ratio）<0.1 holds. Also CR is defined as

$$CR = \frac{CI}{RI} \tag{3}$$

(4) Rank overall hierarchy sequencing and check the consistency. The overall ranking weights of each layer elements on the target layer are respectively calculated, and integrated into the weight of

single criterion according to a top-down principle. Then comprehensive test of consistency judgment should be conducted layer by layer.

$$CR = \frac{a_1 CI_1 + a_2 CI_2 + \cdots + a_m CI_m}{a_1 RI_1 + a_2 RI_2 + \cdots + a_m RI_m} \quad (4)$$

Finally the comprehensive scores of different modes can be calculated based on the weight vector and the expert scoring, which help the decision maker choose the best logistics distribution mode.

Application of AHP in Distribution Model Selection

This section describes an example that how a business enterprise apply AHP to select the logistics distribution model.

Hierarchical structure model can be shown above. Then judgment matrix should be established. A number of professional logistics field experts can be invited to judge the factors listed in figure 1.

Through judge these factors influence on enterprises to choose the logistics distribution model of target A , which are the capability of logistics management B_1, the influence of logistics for enterprise B_2 and the cost of advantage B_3, their relative importance of each can be listed, which formulated into table 2, that is the comparison matrix B of criterion layer.

Table2. comparison matrix B

A	B_1	B_2	B_3
B_1	1	1/3	1/5
B_2	3	1	1/2
B_3	5	2	1

At the same time judgment matrix of the four distribution modes and the three influencing factors can be obtained respectively, which are shown in table3-5.

Table3. judgment matrix of the capability of logistics management and distribution modes:C_1

B_1	C_1	C_2	C_3	C_4
C_1	1	1/3	1/2	1/3
C_2	3	1	1	1/2
C_3	2	1	1	1
C_4	3	2	1	1

Table4. judgment matrix of the influence of logistics for enterprise and distribution modes: C_2

B_2	C_1	C_2	C_3	C_4
C_1	1	3	5	1/5
C_2	1/3	1	2	1/3
C_3	1/4	1/2	1	1
C_4	5	3	1	1

Table5. judgment matrix of the cost of advantage and distribution modes: C_3

B_3	C_1	C_2	C_3	C_4
C_1	1	1/3	1/5	1/3
C_2	3	1	1/2	1/2
C_3	6	3	1	1/5
C_4	3	2	5	1

Rank the sequence hierarchy and check the consistency. Set a matrix of B as an example,

eigenvectors H = (0.1, 0.3, 0.54)T, largest eigenvalue λmax ≈ 3.083, consistency index: CI = (3.083-3) / (3-1) ≈0.0415, RI3 = 0.58, consistency ratio CR = 0.0415 / 0.58 ≈ 0.071 <0.1. So H can be used as the weight vector.

The weight vector Hx , the largest eigenvalue lambda x and consistency index CIx can be calculated from the judgment matrix Cx, results are shown in table 6.

Table6. analysis and calculation table of the sequence hierarchy in scheme layer

H	0.1	0.3	,0.54
Hx	0.14 0.43 0.36 0.44	0.23 0.64 0.14 0.43	0.34 0.45 0.26 0.13
λx	3.0212	2.9108	3.0832
CIx	0.0106	0.0446	0.0416
RIx	0.58	0.58	0.58
CR	0.0182	0.0768	0.0717

Rank overall hierarchy sequencing and check the consistency. According to the experiment results, the model of logistics distribution pass a combination of consistency test, for comprehensive test of consistency ratio CR <0.1.

The comprehensive score of combination weight vector in A scheme for C1 can be calculated:

0. 14×0. 1+0. 23×0. 3+0. 34×0. 54=0. 2666

Similarly, the score C2 in A is 0.478, C3 in A is 0.2184, C4 in A is 0.243. That is:

0.478 (C_2) > 0.2666 (C_1) > 0.243 (C_4) > 0.2184 (C_3)

Therefore, from the short and medium term point of view, the third party logistics distribution model is more appropriate to the company for the benefits it brought is highest.

Conclusion

The example application of AHP in logistics distribution model selection for the business enterprise proved to be feasible, what need to pay attention to is that the result of hierarchy analysis is subjective, the decision maker need to make timely, correctly adjustment and the strategic target according to the actual internal situation of the company in the actual operation. Besides, with the development of electronic commerce, how to integrate resources to develop great logistics of electronic commerce will be worth doing further research.

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