

## **Research on the Evaluation System of Provider for the Third Party Logistics Based on Analytic Hierarchy Process**

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**Abstract:** With the development of the global economic integration business model, many enterprises increase their own business income by enhancing their core competence. But currently in the process of selecting third-party logistics provider, many enterprises are still in the original state, either simply by the way of price competition, or depending on the conventional experience to choose provider. Based on this background, this research presents an evaluation mode for third-party logistics provider based on Analytic Hierarchy Process (AHP).

### **Introduction**

In the context of today's global integration of business, Competition is not only the competition between enterprises, but the competition between supply chain and supply chain. Due to global economic integration, the third party logistics service promotes the core competence of enterprises by completing the subsequent business operations. Under such a business background, the third party logistics industry has developed rapidly [1-2]. But in our country, the third party logistics is still in a low level. The provider of the third party logistics have to pay more attention to improving their own advantages, to provide better and better service for customer [3-4].

As the third party logistics service providers occupy more and more important position in the operation of enterprises, it is an important decision for each enterprise to choose the logistics service providers which are suitable for their own development. Enterprises and logistics service providers complement each other and form a joint force, which is beneficial to both sides [5-6]

Through the survey of more than 80 enterprises in Shanghai region, we find that these enterprises tend to choose the domestic third party logistics service providers. However, in the process of choosing the third party logistics service providers, most companies do not have an appropriate selection criteria. When choosing logistics service providers, most enterprises usually choose the price index. However, compared with physical purchasing, logistics service has its own characteristics. It is very inappropriate to use a simple indicator to select a logistics service provider.

### **Construction of the Evaluation System for Third-Party Logistics Service Provider**

Compared with the current enterprises to take the qualitative decision-making approach and empiricism to third party logistics service providers to evaluate and choice, this paper focuses on determining the weight factor of the third party logistics service provider based on the analytic hierarchy process (AHP), the reason using the AHP is that the AHP is a combination of qualitative and quantitative method, consistent with the evaluation characteristics of third party logistics service provider.

#### **Summary of Analytical Hierarchy Process**

Analytical Hierarchy Process (AHP) is a qualitative and quantitative combination of decision analysis method that first proposed by the US operations scientist Professor T.L.Satty. By using this method, decision makers can decompose the complex problems, then getting a number of levels, the

basic data were compared with each other. Then the decision makers can get different weights that will provide data basis for the final decision.

**Evaluation index of Third-Party Logistics Service Supplier Hierarchy Model**

Through looking up the literature and investigating related enterprises, it is found that there are four main problems between the third party logistics providers and customers in the process of service. Such as service quality, cost control, enterprise stability and logistics operation level etc. Therefore, we can use the above four factors to design the evaluation index.

Firstly, the most basic index is the quality level of the delivery service. Timely and complete accurate product delivery to customer requirements and ensure the delivery location, certificate is issued in good condition, the third party logistics service provider's main responsibility, which will directly affect the relationship between logistics companies and clients. Only when the rate of punctuality, breakage rate and accuracy is guaranteed, the further cooperation and development can be maintained.

Secondly, under the premise of ensuring the quality of logistics services, the lower the service cost, the better. When the customer carries out the third party logistics service decision, the ideal condition is to select a superior supplier for a long-term strategic partnership.

The third is the stability of logistics service companies. A company's reputation, scale, reputation and customer third party logistics service providers, is more likely to bring information to customers, so as to form a solid relationship of cooperation between the two sides

Finally, as an additional consideration, in the integrated logistics level, the promotion of modern operation is considered as a major reference factor.

**Establish Hierarchical Structure Diagram**

According to the above four indicators, a hierarchical structure chart (Figure 1) is build. The model can be used to evaluate the optimal selection among the available suppliers. Under the assistance of AHP, a comprehensive evaluation was conducted.

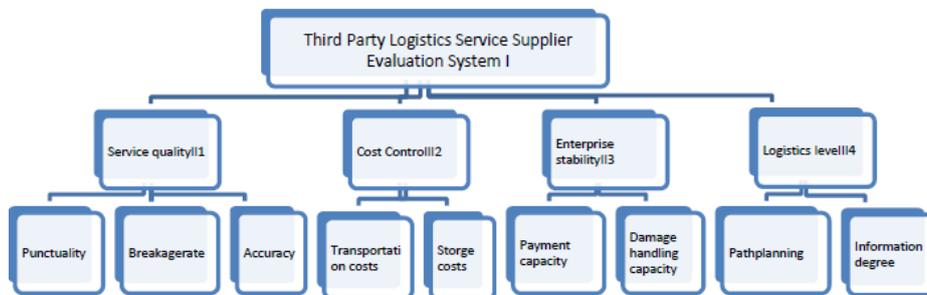


Figure1 Hierarchical Structure Diagram

**Consistency is Checked by Judgment Matrix**

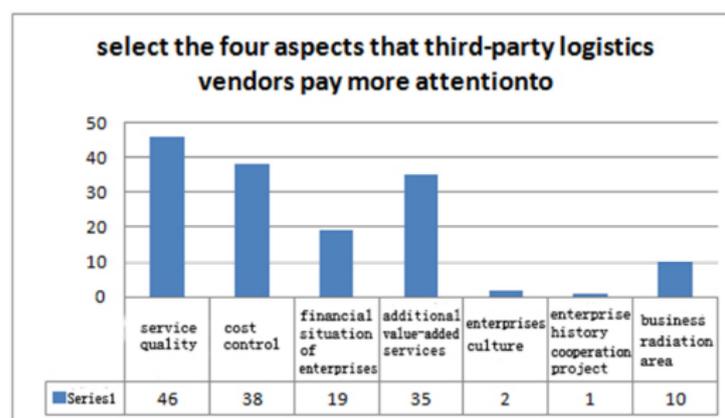
The obtained hierarchical structure chart is consulted by the experts concerned, and the importance of the above four factors is preliminarily obtained. Through the 1~9 scores represent the corresponding importance (Table 1), construct the judgment matrix of the whole structure, and calculate the weight vector between the two factors, and then judge the consistency through the size of the weight vector.

**Table1 1~9Numbers Represent Meanings**

Score	The relationship between the two
1	equally important
3	one of the more important factors
5	one of the factors is clearly important
7	one of the factors is intensively important
9	one of the factors is extremely important
2,4,6,8	the corresponding intermediate value of the corresponding two ends

On the basis of consulting expert advice, with the consideration of the factors that the entity enterprise chooses the third-party logistics service provider, it can strengthen the proportion of each factor's importance share in this method. By getting the various industries in the third-party logistics services having a higher demand for the response of the enterprises, that is, considering the factors when selecting the suppliers, we can control more accurately, the questionnaire was designed to investigate nearly 80 enterprises in different industries in China, aiming at the different needs of different industries, from the manufacturing, retail, service and pharmaceutical sectors, a total of nearly 50 enterprises were selected to investigate the factors of supplier demand.

From the survey results and expert opinions, we can see the following conclusions: in the seven levels listed and supplemented, nearly 95% of enterprises consider the quality of logistics services as a consideration, secondly, 76% of the enterprises choose cost control and 70% of the enterprises selected additional value-added logistics level, finally, 38% enterprises pay attention to the stability of third-party logistics service provider (Figure 2).



**Figure2 Four Important Levels of Share**

A similar conclusion can be drawn from the survey data for each level: in terms of quality of service, punctuality accounts for 45% of the importance of third-party logistics services, the damage rate accounts for 30% of the importance, and the remaining 25% was occupied by accuracy (Figure 3).

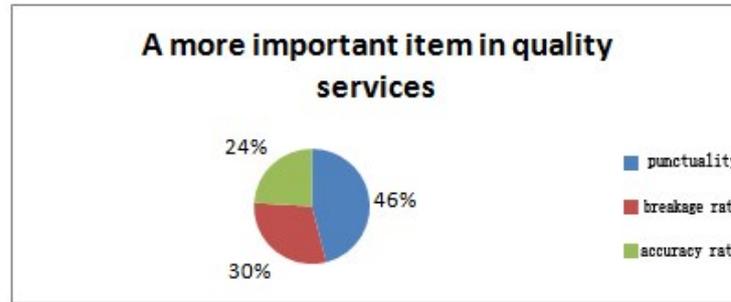


Figure3 Impact of Various Factors on Quality of Service

And in the other three levels, the two factors there is a more linear relationship between the two, customer enterprises in the cost control of the transport costs and storage costs pay a considerable degree of attention, each about 50% (Figure 4).

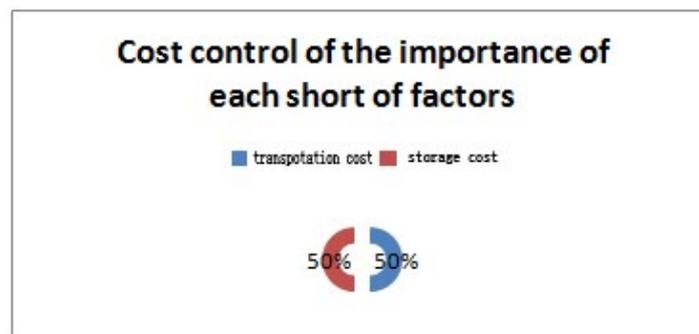


Figure4 The extent of each factor affects the main cost control

For the stability of third-party logistics services enterprises, paying attention to the ability enterprises taking up 68% of all, the remaining 32% focus on the processing capacity of the damaged (Figure 5):

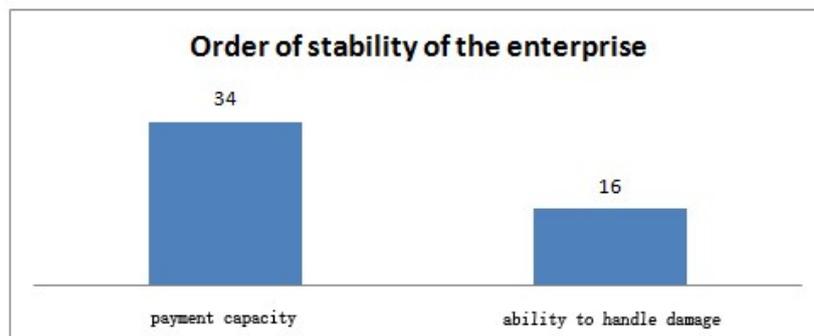


Figure 5 Influence of each factor on the stability of third-party logistics supplier enterprise

Finally, in terms of value-added logistics level, the optimization ability and information degree of the distribution path occupy 56% and 40% respectively, the remaining 4% of the enterprise is to add the addition of additional processing capacity (Figure 6).

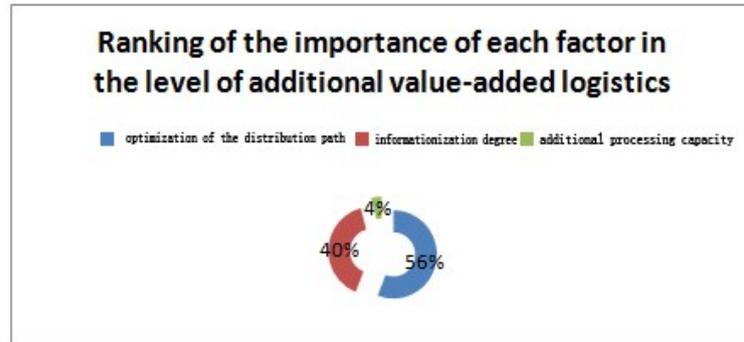


Figure6 Impact of various factors on the additional value-added logistics business

Combining the hierarchical structure chart with the expert opinion and the actual data, the scores obtained represent the important relation, and the following judgment matrix is obtained (Table2 and Table3)

Table2 I-II Judgment Matrix

I	II1	II2	II3	II4
II1	1	2	3	2
II2	1/2	1	2	3
II3	1/3	1/2	1	1
II4	1/2	1/3	1	1

Table3 II-III Judgment Matrix (a, b, c, d)

(a)

II1	III1	III2	III3
III1	1	2	2
III2	1/2	1	1
III3	1/2	1	1

(b)

II2	III4	III5
III4	1	1
III5	1	1

(c)

II3	III6	III7
III6	1	4
III7	1/4	1

(d)

II4	III8	III9
III8	1	3
III9	1/3	1

According to the judgment matrix, the corresponding judgment vector and consistency ratio are obtained, first, the formula is used,

$$W_{ij} = \sqrt[j]{\prod_{i=1}^j A_{ij}} \tag{1}$$

Calculate the proportion of each layer and the judgment vector of each factor, and then get the final weight vector,

$$\omega = W_{ij} / \sum_i^j W_{ij} \tag{2}$$

On this basis, combine

$$CR = \frac{\sum_{j=1}^n \frac{(\sum_{i=1}^n W_{ij}) / W_j}{W_j} - n}{n-1} \tag{3}$$

This formula, calculate the proportion of consistency, to determine whether there is a high consistency.

Table4 Percentage of Judgment Vector and Consistency of Each Factor

Hierarchical relationship	Judgment vector value $W_{ij}$	Weight vector $\omega$	Consistency ratio CR (requirement $CR < 0.1$ )
III1	2	(0.435, 0.286, 0.139, 0.139)	0.0674
II2	1.316		
II3	0.639		
II4	0.639		
III1	1.58	(0.5, 0.25, 0.25)	0
III2	0.7937		
III3	0.7937		
III4	1	(0.5, 0.5)	0
III5	1		
III6	2	(0.8, 0.2)	0
III7	0.5		
III8	1.732	(0.75, 0.25)	0
III9	0.577		

According to the consistency of the proportion of the standard, by repeatedly adjusting the factors on the previous level of the important points, and ultimately we can get all consistent with the consistency test of the judgment vector (Table 4).

**Comprehensive Ranking of Evaluation Indicators**

By combining the values of the first level--the target layer with the criterion layer and the second

level--the weight vector of the criterion layer and the factor layer, the formula is formulated

$$a = \omega_{ij} * \omega_{ij} \tag{4}$$

we get the weight of each factor corresponding to the importance of the existence of other factors in the field(Table 5), and then affect the importance of the factors of the small indicators for the importance of supplier services.

**Table5 Comprehensive Evaluation Index Weight**

Criterion Layer	Service quality III1	Cost control II2	Firm stability II3	Logistics level II4	Comprehensive weight
weight Factor layer weight	0.435	0.286	0.139	0.139	
Punctuality III1	0.5				0.2175
BreakagerateIII2	0.25				0.10875
AccuracyIII3	0.25				0.10875
Transportation costsIII4		0.5			0.143
StoragecostsIII5		0.5			0.143
Payment capacityIII6			0.8		0.1112
Damage handling capacityIII7			0.2		0.0278
PathplanningIII8				0.75	0.10425
Information degreeIII9				0.25	0.03475

Through the weight table, in the logistics service process, the importance degree of each factor can be obtained through the normalized comprehensive weight, and within the overall service level, it plays a different role. Among them, the most important punctuality rate accounts for 21.75% of the whole logistics distribution process, Once again, as the economic indicators of transportation costs and warehousing costs account for 14.3% of the proportion, and so on. Through the above weight distribution, for the logistics service provider and the logistics service demand side, the intangible logistics service can get more comprehensive and accurate evaluation, It enables third-party logistics service provider to understand the aspects that can be worked hard to correct, and to make the logistics service demander grasp the quality level of the received services more accurately ,thereby enhancing the supervision and consumption experience, On this basis, to improve the level of third-party logistics services in China.

**Conclusion**

In this paper, based on the analysis of third-party logistics supplier market, solving problems and threats by AHP, we get third-party logistics supplier evaluation system which is more suitable for our country.

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