Evaluation of Competitiveness of Third-Party Logistics Enterprises based on Analytic Hierarchy Process

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Abstract
With the rapid development of e-commerce and information technology, the demand for third-party logistics in the market is also gradually increasing. At the same time, the third-party logistics industry has entered a period of rapid development. At present, my country does not have clear criteria for judging the competitiveness of tripartite logistics enterprises. Only by studying the development of the enterprise in the current environment can we find a way to improve the competitiveness of the enterprise and a feasible way to survive in the contemporary competitive environment. This paper takes a third-party logistics company as the object of analysis, analyzes the index factors that affect the competitiveness of the logistics company, and uses the analytic hierarchy process as the theoretical basis to propose and establish a third-party logistics company’s competitiveness evaluation index system. Lay a theoretical foundation for the evaluation of competitiveness of similar enterprises.

Keywords
Third-party Logistics; Analytic Hierarchy Process; Competitiveness.

1. Introduction
In the context of the epidemic, digital consumption is unstoppable, and the demand for "zero-touch shopping" has promoted the further development of e-commerce. With the rapid development of e-commerce and information technology, the demand for third-party logistics in the market is also gradually increasing. At the same time, the third-party logistics industry has entered a period of rapid development. With the continuous development of e-commerce networks, the scale of online sales and consumption continues to expand. Supply-side and demand-side logistics companies have not fully realized logistics services and supply chain management, and have not kept up with the needs of society. Most industry companies choose to outsource logistics services to third-party companies, so the demand for third-party logistics companies should continue to increase.

In the fierce competition of third-party logistics companies, my country has not clearly defined the competitiveness of third-party logistics companies. Only by studying the development of the enterprise in the current environment can we find a way to improve the competitiveness of the enterprise and a feasible way to survive in the contemporary competitive environment, and to further promote the development of the enterprise.

This article takes a third-party logistics company as an example, analyzes the development status of the logistics company, finds the problems of the company, and discusses the index factors that affect the competitiveness of the company. Finally, the evaluation method of the analytic hierarchy process is used to evaluate the logistics company. It can provide a bit of suggestions for the future development of third-party logistics companies.
2. Basic Theory

2.1. Third-party Logistics and Competitiveness

The Third-party logistics enterprise is the sum of the survival and development capabilities of logistics enterprises. With the globalization of social and economic development and the continuous improvement of my country's opening to the outside world, the continuous improvement of the business of my country's third-party logistics enterprises will form a fiercely competitive market environment, so it is even more important for us to improve our competitiveness. In a market economy, the competitiveness of third-party logistics companies is mainly the management and coordination capabilities of logistics companies, technical capabilities (including electronic information technology), market share and control capabilities, financial staff operations capabilities, service personalization and continuous improvement capability.

2.2. Analytic Hierarchy Process

The basic concept of Analytic Hierarchy Process is to clearly understand the general goal of the multi-functional decision-making problem and the problems that need to be solved at each level of the goal, understand the boundary of the problem, the factors contained and the affiliation between the factors, and the ultimate goal to be achieved based on these Knowing conditions are analyzed, the decision-making issues are hierarchized, and a step-level indicator system is formed from the bottom to the top.

The main application scope of Analytic Hierarchy Process is in decision-making issues. It is mainly used in the scientific field. This method can be used for evaluation in ecological environment protection and scientific production, and it is more used in decision-making programs. In addition, the analytic hierarchy process can also solve many problems in real life, and is widely used in various fields, such as the selection of transportation vehicles and the site selection of houses.

3. Influencing Factors of Third-party Logistics Competitiveness

3.1. Analysis of Influencing Factors

Drawing on the research results of domestic and foreign scholars, in line with the principles of science, system, practicality and feasibility, the evaluation index system is constructed from the level of competition of enterprises. Functional specialization, service personalization, management systemization, and information networking of the third-party logistics relationship, it is concluded that the evaluation of its core competitiveness is mainly from three aspects: business operation level, financial operation level, and enterprise management level as follows.

3.1.1. Business Operation Level

(1) Market control

With the increase of various customer needs, it is necessary for third-party logistics companies to actively respond to new customer needs and improve service levels. Customer satisfaction has a direct impact on the development of the market. Therefore, to continuously improve the customer service system, logistics companies should quickly respond to customer requirements. The ability to quickly respond to customer requirements can reflect whether the company has sufficient capabilities to meet customer requirements. Bring a good sense of experience to customers, develop new customer service modules, improve the core competitiveness of the company, and fulfill customer requirements as much as possible.

(2) Logistics operation level
As a very important link between the supplier and the final consumer in the product supply chain, the logistics enterprise has an inseparable relationship between the allocation, production, and sales of the three connecting chains and the logistics service level of the enterprise. From the perspective of the overall supply chain, currently, there are more requirements for third-party logistics companies, including diversified, information, and automated services.

(3) Customer experience
Customer service means providing different products and services to customers at different levels, exploring potential strategic partners, and establishing long-term cooperative and symbiotic relationships with customers. The first is to start from the customer’s feelings, provide the best service to the customer, and establish a long-term cooperative relationship with the customer. Of course, the company’s positioning of the customer service is inaccurate, and the loss of customers cannot be avoided. Therefore, there must be customized service projects for different types of customers. While maintaining the relationship with old customers, it must also continue to expand new customers. The corporate management system should also attach importance to customer experience and integrate customer management into the information management system. There must be a customer service dedicated to serving customers and provide customers with professional help.

3.1.2. Financial Operation Level
(1) Profitability
The main operating goal of an enterprise is profitability. By solving financial problems, improving the operating ability of the enterprise, and promoting the stable and lasting development of the enterprise, it mainly analyzes the profit rate of the enterprise, and often considers many factors, such as the return on net assets of the enterprise, Net sales margin, gross margin, return on total assets, etc. To maximize the benefits and enhance its core competitiveness, it is of great significance to the long-term large-scale development of third-party goods, which can meet the needs of third-party logistics services in the current era, and thus can improve the competitiveness of enterprises.

(2) Cost evaluation
The cost of enterprise logistics is mainly composed of loading and unloading fees, transportation fees, storage fees, labor fees, etc. China’s third-party logistics is still in the development stage and a complete logistics financial management system has not been established. The company has its own parts storage center and distribution center, and has the right to provide customers with value-added services such as packaging, transportation, circulation and warehouses.

(3) Enterprise development level
The development level of an enterprise is related to the output capacity, market competitiveness, and operating capacity of the enterprise. The output capacity of the enterprise is the foundation, which can be used as an object of competition and can affect the operating effect of an enterprise. Market competitiveness must be analyzed based on the relationship between supply and demand in the market, as well as the level of market share. The operating capability of an enterprise has a certain relationship with the above-mentioned profitability and cost evaluation, which is mainly reflected in whether the enterprise can operate for a long time.

3.1.3. Enterprise Management Level
(1) Resource management level
The level of resource management is also the key to measuring the quality of an enterprise. Compared with foreign third-party logistics, domestic enterprises have a lower degree of
standardization. For third-party logistics, infrastructure management, human resource management, and management of customer relations are all very important.

(2) Technological innovation ability

The improvement of the business system and the rational distribution of logistics resources are based on the improvement and innovation of modern logistics technology. The technological innovation capability of the logistics industry is an objective need for development, innovation in equipment and facilities and innovation in information systems are both indispensable. As the primary productive force of an enterprise, science and technology means that enterprise competition cannot be separated from the development of scientific and technological innovation. The whole operation process is of great significance.

(3) Corporate culture level

Corporate culture represents the maturity of an enterprise and is the guiding ideology for an enterprise to improve its competitiveness. The more mature the enterprise, the higher the level of corporate culture, and all aspects of the operation of the enterprise are reflected. Therefore, the enterprise must attach importance to the development of cultural level, the corporate culture guides the behavior of employees, unifies the employees' ideology, unites the strength of the employees, and the corporate culture must be accepted by all members of the enterprise and embody the values of an enterprise.

3.2. Index System Construction

This paper constructs an index system based on the factors affecting the competitiveness evaluation of third-party logistics enterprises, including three first-level indicators and 9 second-level indicators. As shown in the table below.

<table>
<thead>
<tr>
<th>Table 1. Influencing factors between layers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target level</strong></td>
</tr>
<tr>
<td>Level of core competitiveness of logistics enterprises A1</td>
</tr>
<tr>
<td>Business operation level B1</td>
</tr>
<tr>
<td>Logistics operation level C2</td>
</tr>
<tr>
<td>Customer Experience C3</td>
</tr>
<tr>
<td>Financial operation level B2</td>
</tr>
<tr>
<td>Cost evaluation C5</td>
</tr>
<tr>
<td>Cost of supporting facilities C6</td>
</tr>
<tr>
<td>Enterprise management level B3</td>
</tr>
<tr>
<td>Corporate culture level C8</td>
</tr>
<tr>
<td>Information technology level C9</td>
</tr>
</tbody>
</table>

4. Weight Calculation of Evaluation System based on Analytic Hierarchy Process

Based on the analytic hierarchy process, the judgment matrix is constructed, and the weights of different feature indicators are calculated using the maximum Eigen-root method.

4.1. Building a Judgment Matrix

The judgment matrix is established according to the relevant indicators, and the experts in the relevant field will analyze and compare each indicator layer by layer according to the judgment matrix 1-9 scale table, and score the relative importance of the two indicators respectively, and obtain the relative importance of each indicator and other indicators. 10 experts in the industry were selected to analyze the questionnaire, and the weights of each indicator system were calculated according to the results of the questionnaire, and finally the judgment matrix was obtained. The judgment matrix is shown below the table.
A_1 = \begin{pmatrix} 1 & \frac{1}{5} & 3 \\ \frac{1}{5} & 1 & \frac{1}{3} \\ \frac{1}{3} & \frac{1}{3} & 1 \end{pmatrix} \tag{1}

B_1 = \begin{pmatrix} 1 & \frac{1}{3} & \frac{1}{2} \\ \frac{1}{3} & 1 & 2 \\ 2 & \frac{1}{2} & 1 \end{pmatrix} \tag{2}

B_2 = \begin{pmatrix} 1 & 1 & \frac{1}{3} \\ 1 & 1 & \frac{1}{5} \\ 3 & 5 & 1 \end{pmatrix} \tag{3}

B_3 = \begin{pmatrix} 1 & \frac{1}{5} & \frac{1}{3} \\ \frac{1}{5} & 1 & \frac{1}{5} \\ 3 & \frac{1}{3} & 1 \end{pmatrix} \tag{4}

Carry out the weighted average of the above judgment matrix to get A_1, B_1, B_2, B_3. The priority vectors are as follows:

\[ W_i = (0.637, 0.105, 0.258)^T \]
\[ W_1 = (0.163, 0.540, 0.297)^T \]
\[ W_2 = (0.185, 0.156, 0.659)^T \]
\[ W_3 = (0.105, 0.637, 0.258)^T \]

To check the consistency of the evaluation index system, the specific steps are: perform operations based on the relevant data in the judgment matrix, calculate the maximum characteristic root \( \lambda_{\text{max}} \) of the matrix, and calculate the AW_i of the matrix A_1:

\[ \text{AW}_i = \begin{pmatrix} 1 & \frac{1}{5} & 3 \\ \frac{1}{5} & 1 & \frac{1}{3} \\ \frac{1}{3} & 3 & 1 \end{pmatrix} \begin{pmatrix} 0.637 \\ 0.105 \\ 0.258 \end{pmatrix} = \begin{pmatrix} 0.935 \\ 0.318 \\ 0.785 \end{pmatrix} \]

The maximum characteristic root \( \lambda_{\text{max}} \) is:

\[ \lambda_{\text{max}} = \frac{1}{3} \begin{pmatrix} 0.935 & 0.381 & 0.785 \\ 0.637 & 0.105 & 0.258 \end{pmatrix} = 3.0385 \]

And calculate the consistency index CI of the n-order matrix according to the following formula.

\[ \text{CI} = (\lambda_{\text{max}} - n)/(n-1) \]

If CI=0, it means that the judgment matrix has complete consistency. If CI is close to 0, it has satisfactory consistency. The larger the CI value, the lower the consistency of the indicators in the corresponding matrix. Then refer to the following formula to calculate the consistency ratio CR embodied in the judgment matrix:

\[ \text{CR} = \text{CI}/\text{RI} \]

In the formula, the RI index represents the average random consistency of the matrix, which is obtained by solving the arithmetic average after multiple calculations. It is generally believed
that when CR<0.1, the consistency level is acceptable. Otherwise, appropriate modifications must be made and substituted into the formula to get:
CI=0.019256, CR=0.033199<0.1, so it can pass the consistency test.

4.2. Sorting by Level
According to the calculation results, the evaluation data table of Z logistics enterprise is as follows.

Table 2. Weights of Evaluation Indexes of Logistics Enterprise Competitiveness

<table>
<thead>
<tr>
<th>First level indicator</th>
<th>Weights</th>
<th>Second level indicator</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business operation level</td>
<td>0.637</td>
<td>Market control</td>
<td>0.163</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Logistics operation level</td>
<td>0.540</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Customer Experience</td>
<td>0.297</td>
</tr>
<tr>
<td>Financial operation level</td>
<td>0.105</td>
<td>Profitability</td>
<td>0.185</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost evaluation</td>
<td>0.156</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost of supporting facilities</td>
<td>0.659</td>
</tr>
<tr>
<td>Enterprise management level</td>
<td>0.258</td>
<td>Human resource level</td>
<td>0.105</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corporate culture level</td>
<td>0.637</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Information technology level</td>
<td>0.258</td>
</tr>
</tbody>
</table>

According to the above calculation process, the sequential calculation results are sorted again according to the interaction between the indicators of each layer, as shown in Table 3.

Table 3. Summary of the impact on the target layer

<table>
<thead>
<tr>
<th>Index layer C</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
<th>C6</th>
<th>C7</th>
<th>C8</th>
<th>C9</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>0.637</td>
<td>0.163</td>
<td>0.054</td>
<td>0.297</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B2</td>
<td>0.105</td>
<td>0</td>
<td>0</td>
<td>0.185</td>
<td>0.156</td>
<td>0.659</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B3</td>
<td>0.258</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.105</td>
<td>0.637</td>
<td>0.258</td>
</tr>
<tr>
<td>Total sort</td>
<td>0.104</td>
<td>0.034</td>
<td>0.189</td>
<td>0.019</td>
<td>0.016</td>
<td>0.069</td>
<td>0.011</td>
<td>0.164</td>
<td>0.666</td>
</tr>
</tbody>
</table>

From the perspective of business operation level, customer experience accounts for the largest weight, which shows that the logistics service module has a strong competitiveness, followed by a high degree of market control, but the level of logistics operations is relatively low, as a professional third-party logistics. The supply chain management must be strengthened, and the cost of supporting facilities is relatively high, followed by the profitability of the enterprise, which shows that the future development of the enterprise has a long-term nature.

At the level of corporate management, the level of resource management and corporate culture need to be improved, which is able to improve or control the collaboration capabilities of buyers and sellers of logistics products, and maximize the influence of resource allocation. To let corporate culture play its role, it is necessary to combine corporate culture with specific work. Corporate culture plays an important role in the long-term development of the company due to the participation of all members. On the whole, the level of information technology innovation occupies the largest weight and is highly competitive.
5. Conclusion

This article takes a third-party logistics company as the object of analysis, analyzes the index factors that affect the competitiveness of the logistics company, and combines the characteristics of functional specialization, service individualization, management systemization, and information network of the third-party logistics relationship. Establishing a third-party logistics enterprise competitiveness evaluation index system including three dimensions: business operation level, financial operation level, and enterprise management level. At the same time, the theoretical basis of the analytic hierarchy process is established, and the weight coefficients of different indicators are calculated. The research results show that, on the whole, the level of information technology innovation has the largest weight and plays a decisive role in the competitiveness of third-party companies.

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References


