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The Application of AHP in Enterprise Site Selection--Taking Three Squirrels as an Example

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ABSTRACT. *In recent years, Chinese logistics industry has developed rapidly. And the construction of logistics parks in various regions is also in full swing. Some large enterprises, in order to improve service quality and enhance delivery efficiency, are also building their own logistics centers in various places. Three squirrels are typical representatives. However, the construction of a logistics park is a very huge investment, which directly affects the future development plan of the enterprise. How to select a site correctly and reasonably has become a difficult problem for enterprises. Based on a detailed and in-depth analysis of the selection of the site of logistics parks and a large amount of literature, this article constructs an evaluation system and uses the analytic hierarchy process to evaluate. The site selection plan in this article comprehensively considers various factors affecting the development of logistics parks, meets the needs of the development of the logistics industry, and has certain reference value for the site selection of logistics parks for some Internet companies.*

KEYWORDS: *analytic hierarchy process; enterprise site selection; MATLAB; three squirrels*

1. Introduction

Three Squirrels is Chinese first company that is positioned as a pure Internet food brand, and it is also China's largest-selling food e-commerce company. Its main business is casual snacks. In 2012, three squirrels were established in Wuhu. In 2016, the total sales of three squirrels exceeded 5 billion yuan. In 2019, the three squirrels

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announced that their annual turnover exceeded 10 billion yuan. The three squirrels expanded at a rapid rate and quickly became the leader of Chinese snack companies.

In recent years, with the rapid development of Chinese Internet industry, online shopping has become an increasingly important way of consumption for the masses, which has directly catalyzed the prosperity of the food e-commerce industry. Increasing sales volume not only increases profits for enterprises, but also increases the pressure on enterprises in terms of transportation. In order to better serve customers, the three squirrels quickly established a logistics center. How to select the site correctly and reasonably has become a difficult problem for the three squirrels.

For the planning and site selection of logistics parks, this paper selects 10 elements as scoring indicators. Construct the judgment matrix by scoring by experts. And then use MATLAB to calculate the final weight of these indicators. The research results of this article are practical and scientific, and have certain decision-making reference value. The site selection plan in this article provides a reference for some Internet companies to build logistics parks, and meets the needs of companies to maximize profits and serve customers.

2. Construction of the evaluation system

Different types of companies or enterprises have different priorities in terms of site selection. For example, industrial enterprises are transportation-oriented, taking the transportation of raw materials and products as the main considerations, and selecting sites based on the minimization of production and transportation costs. Market-oriented service-oriented companies will choose locations close to the market. For example, catering and retail companies often choose locations close to the market in central business districts, residential areas, and transportation hubs. Raw material-oriented companies have a greater demand for raw materials, so they will choose companies close to the origin of raw materials. However, high-tech enterprises put more emphasis on the needs of scientific and technological talents for the living and working environment, and their locations tend to be in areas with abundant scientific and technological resources and superior living conditions.

As a pure Internet food company, the three squirrels not only inherited the general company’s choice of markets and raw materials when selecting locations, but also took into account the policy environment factors, infrastructure construction level and social public service factors. Therefore, the selection of indicators needs to be more comprehensive and specific. And not neglecting the impact of each indicator.

In order to better select the factors that affect the location of the logistics park. This paper is based on the previous research results, selects the logistics industry policy support strength, Economic policy stability, political environment stability, regional economic level, land price level, availability of labor resources, infrastructure construction, public service level, transportation convenience, location convenience and other influencing factors, and divide them into political

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environments Factors, economic factors, infrastructure and social public service factors. The specific index system is shown in Table 1.

Table 1: Evaluation index system

Target layer	Criterion layer	Scheme layer
Company location(A)	Policy environment factors(B1)	Logistics industry policy support(C1)
		Economic policy stability(C2)
		Political stability(C3)
	economic factors(B2)	Regional economic level(C4)
		Land price level(C5)
		Availability of labor resources(C6)
	Infrastructure and social public service factors(B3)	infrastructure(C7)
		Public service level(C8)
		Transportation convenience(C9)
		Location convenience(C10)

3. The application of analytic hierarchy process in company site selection

3.1 Construct a comparison judgment matrix

The analytic hierarchy process is a subjective weighting method. It decomposes complex issues into several influencing factors, and compares and scores the importance of different factors to get the weight of each indicator. It is a combination of qualitative and quantitative methods and is widely used in decision-making problems.

This article establishes the judgment matrix through expert scoring method. That is, let experts compare and judge each influencing factor in pairs, and score from one to nine according to the importance of each two factors (where 1 means that two factors are equally significant, and 9 means that one factor is very significant to the other. the larger the number, the greater the importance of one factor relative to another), so as to measure the weight of each indicator.

Use MATLAB software to calculate the eigenvector Wi of each matrix, and check the consistency. Among them, the judgment matrix shown in Table 2-5.

Table 2: Judgment matrix A-B

A	B1	B2	B3
B1	1	1/2	1/3
B2	2	1	1/2
B3	3	2	1
$\lambda max=4$,CR= 0.0088 <0.1, pass the consistency check			

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Table 3: Judgment matrix B1-C

B1	C1	C2	C3
C1	1	2	3
C2	1/2	1	1/2
C3	1/3	1/2	1
λmax=4,CR= 0.0088 <0.1, pass the consistency check			

Table 4: Judgment matrix B2-C

B2	C4	C5	C6
C4	1	1/5	1/3
C5	5	1	2
C6	3	1/2	1
λmax=4,CR= 0.0036 <0.1, pass the consistency check			

Table 5: Judgment matrix B3-C

B5	C7	C8	C9	C10
C7	1	1/2	1/4	1/5
C8	2	1	1/2	1/3
C9	4	2	1	1
C10	5	3	1	1
λmax=4,CR= 0.0058 <0.1, pass the consistency check				

3.2 Hierarchical ranking and consistency check

Consistency test is a necessary step of analytic hierarchy process. He is the standard for testing the rationality of the matrix. If the matrix fails the consistency test, then the weights obtained will be wrong, and there is no convincing power.

First, check the consistency of all the matrices to get the consistency index:

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

n is the order of the matrix, $\lambda_{\max}$ is the maximum eigenvalue of the matrix. We then calculate the consistency ratio of the matrix by (2):

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} \tag{2}$$

The value of RI is shown in the following table. When CR is less than 0.1, the matrix is considered reasonable and passes the test.

Table 6: Standard values of average random consistency index RI

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.52	0.89	1.12	1.26	1.36	1.41	1.46	1.49

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Using MATLAB to calculate the weight vector of each judgment matrix and test them. The results show that all 6 matrices pass the test. The weight of each indicator is shown in Table 7:

Table 7: The weight of each index

Criterion layer		Scheme layer		Analytic hierarchy process weight
index	weight	index	weight	weight
Policy environment factors(B1)	0.1634	Logistics industry policy support(C1)	0.5396	0.0882
		Economic policy stability(C2)	0.2970	0.0485
		Political stability(C3)	0.1634	0.0267
economic factors(B2)	0.2970	Regional economic level(C4)	0.1095	0.0325
		Land price level(C5)	0.5815	0.1727
		Availability of labor resources(C6)	0.3090	0.0918
Infrastructure and social public service factors(B3)	0.5396	infrastructure(C7)	0.0824	0.0445
		Public service level(C8)	0.1579	0.0852
		Transportation convenience(C9)	0.3499	0.1888
		Location convenience(C10)	0.4098	0.2211

Use MATLAB to calculate the combination weights of the scheme layer to the target layer and sort them. The 10 company location indicators are in order: logistics industry policy support (0.0882), economic policy stability (0.0485), political environment stability (0.0267), Regional economic level (0.0325), land price level (0.1727), availability of labor resources (0.0918), infrastructure construction (0.0445), public service level (0.0852), transportation convenience (0.1888), location convenience (0.2211).

3.3 Result analysis

① From the perspective of the first level indicator, infrastructure and social public service factors have the largest weight, while policy environment factors have the smallest weight, indicating that in the selection of a logistics park, a suitable geographic location and traffic environment are the first considerations the elements of. Policy and environmental factors have little impact on the location of logistics parks.

②From the perspective of the weight of the plan level to the target level, location convenience has the largest weight, followed by transportation convenience, indicating that the company's primary consideration is geographic location when selecting a location. Whether the location is convenient and whether the transportation is convenient are the most important factors affecting the company's location selection.

③ Because the economic policies and political environment of different regions have been in a stable state for a long time, the stability of economic policies and the stability of the political environment take less weight. There is a large gap in the

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support for the logistics industry between different regions, so the logistics industry policy support has a greater weight.

4. Conclusion

Location selection will directly affect the company's revenue and costs, and plays a very important role for an enterprise. Reasonable site selection will help companies save costs and increase revenue. The wrong location may bring great resistance to the future operation of the company, and even indirectly lead to the bankruptcy of the company. Especially for the site selection of a large-scale park such as a logistics center, the initial investment cost is very large. Once the investment fails, the loss is difficult to estimate. Therefore, the location of the logistics park is particularly important.

The results of the above model show that when selecting a location for an enterprise, the first consideration is the convenience of location and the convenience of transportation. These factors directly affect the cost of the enterprise. For the logistics and transportation department of an enterprise, the biggest expenditure is on transportation. Therefore, by choosing the geographic location of the enterprise reasonably, the expenditure on transportation can be effectively reduced. Secondly, what enterprises need to consider is the level of land prices and the availability of labor resources, which are essential elements for enterprise production and operation. Compared with remote areas, developed areas have huge geographical advantages, but their disadvantages are also obvious, such as high land prices and high wages for workers. These factors also affect the cost of business operations. In addition, the local public service level and logistics industry policy support also have a greater impact on the location of the logistics park. For the same enterprise or project, different regions have different levels of support, which is largely affected by the subjective attitude of local governments. Therefore, choosing a local government that is more enthusiastic and willing to provide more guarantees is more conducive to the development of enterprises and the construction of logistics parks.

The location of urban logistics parks is a relatively complex issue, involving all aspects of the city's policies, transportation, economy, etc., and the impact of various factors must be comprehensively considered. If the logistics park is set up in a location with better economic development, developed transportation, and complete infrastructure and public services, it may face higher rents. If there is no substantial income, it will be difficult for the company to maintain it. Therefore, when selecting the location of the logistics park, we should start from as many angles as possible, and comprehensively consider the pros and cons of all aspects. Only in this way can we make the best choice.

For the selection of models, it is difficult to determine the location problem with a single method. Generally, qualitative and quantitative methods should be used to decide comprehensively in combination with the true circumstances of the city. This paper uses the analytic hierarchy process to study the location of logistics parks, which is an attempt to study the location of logistics parks. Through practical tests,

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this is a relatively feasible method. However, there are still many methods suitable for the site selection of logistics parks, which require further exploration and exploration.

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