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# Based on the Location Advantage of Express Logistics Node Location Model Research

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**Abstract:** According to the basic content of location advantage, from the market, transportation, competition environment and other factors, such as four aspects, analysis of location factors influencing express logistics node location. Put forward based on location factors evaluation and location advantages express logistics node location two-phase model of evaluation. An express logistics node location planning as an example for the empirical analysis and related research conclusions.

Keywords: Logistics node, layout model, location factors, location factor

## 1. INTRODUCTION

As the function and evolution of modern logistics, logistics process of product gradually by the demand from the supplier to the point of simple pattern evolution for logistics center from the supplier to the public to demand patterns. Logistics node is an important part of logistics system, is the commodity turnover, sorting, storage, in the library management, distribution processing and information processing, can promote the flow of goods according to the requirements of customers, gain added value, and overcome the logistics process of time and space barriers. Therefore, reasonable choice of logistics node location, can reduce the flow of the supply chain cost, reduce transport path, to speed up the reaction of the whole system, promote the coordination between production and consumption and promote the development of peripheral enterprises and even the city.

Various factors influencing the rationality of logistics node location, generally speaking, the following factors is evaluation of logistics node location is reasonable or not is the focal point must be considered. Rationality traffic convenience factors, economic factors including land price, the existing facilities utilization degree, labor conditions and factors for sustainable development.

In today's e-commerce booming express logistics node as the node is responsible for the freight last transportation more and more important. Now people don't just want to buy real rest assured the goods on the net, more hope logistics time is shortened, better improve the express logistics service. This demand are evident on the express logistics node selection on the traffic convenience and location advantages. And the future of the logistics node location not only need to consider the construction costs, operating costs, transportation costs, also consider the transport time is an important factor. Express logistics node location model is proposed in this paper is an attempt to analyze from the height of the location theory<sup>[1]</sup> on location factors influencing express logistics node layout and location advantages, combined with the spatial distribution of the service object and the purchasing power of the service object to analyze express logistics node location problem.

## 2. THE PROBLEM OF EXPRESS LOGISTICS NODE LOCATION MODEL.

At present, the main research about the location of the logistics nodes are divided into qualitative analysis and quantitative analysis of the two kinds big. Qualitative analysis method is mainly for the analytic hierarchy process (AHP) and fuzzy comprehensive evaluation method to establish evaluation index, and to evaluate each solution, to find the optimal solution; Quantitative analysis methods mainly include gravity method, transportation planning,

the Cluster and CFLP, Baumol - Wolf, mixed 0-1 integer programming method, double programming method and genetic algorithm, etc.

Although in terms of qualitative and quantitative research is more, but there is still insufficient: qualitative analysis method considering many factors, based on the qualitative factors to measure, can be more comprehensive and integrated to the plan of site selection for comparison, but the analysis of the factors which need quantitative description is relatively weak, at the same time, a lot of the deflection caused by subjective judgment evaluation; Determination of location target in the quantitative analysis method based on enterprise logistics cost minimization, not considering the influence of logistics transport time for customers, the enterprises pay more attention to the user experience of reality. In terms of qualitative and quantitative combined with comprehensive analysis, although the accuracy and completeness of facility location complement each other, but because is only the simple sum of two methods can't overcome the fundamental flaws of its existence, also is difficult to close to the real problem.<sup>[2]</sup>

This article is for the customer the most concerned about the research on the logistics transport time, standing on the perspective of the customer to solve the problem and express logistics enterprises should be the most concern in the future. With the constant improvement of CAINIAO network, 24 hours service of the nation's slogan is becoming more and more thorough popular feeling, so to shorten the time of logistics problems become the object of study in this paper. Applies the theory and model of location advantages of the express logistics node selection and evaluation of a systematic study.

### 3. WHAT IS THE LOCATION ADVANTAGE?

Evaluate the express logistics node selection based on location advantage, a certain express logistics node location advantage, and then to the different evaluation of different logistics nodes are compared to choose better express logistics nodes.

Location advantage is the sociology of science (mainly geography and economics) to borrow potentials (potential) of physics concepts to quantitative analysis of geographical phenomenon. Expressed as: geographic space is interaction, mutual influence between different location, surrounding a particular location of all the other location on the overall impact strength of the bit location advantages in the region. The size of the location advantages can be expressed in mathematical formula is as follows:

$$V_i = \sum_{j=1}^n \frac{m_j}{d_{ij}} \quad (1)$$

In equation (1),  $V_i$  is the location advantage of the  $i$ ,  $m_j$  is around  $i$  to all the other parts of the  $j$  supply of locational factors,  $d_{ij}$  is the distance between  $i$  and  $j$ , When in population size indicators on behalf of the  $m_j$ ,  $V_i$  is referred to as the population location advantage of  $i$ , accessibility of the population of the reflect its space. If  $m_j$  on behalf of the other indicators,  $V_i$  is for the location advantage of the indicators. The value of  $V_i$  better means the location of  $i$  better, the greater the potential for development. This article will be based on the research on the formula change.<sup>[3]</sup>

### 4. THE ESTABLISHMENT OF THE MODEL .

In determining the logistics node, the location decision should be careful to consider to choose location factors, and to make location decisions on the appropriate steps. Usually, in the process of choice if you already have a reservation site or location, should be first put forward by system planning, and a limiting factor for the planning process; If there is no predetermined location, can be formed on the system planning, the choice of location scheme, necessary correction system planning, to match the actual land and block the size of the

restrictions. The steps are as follows:

- Select the appropriate express logistics location, if in a city for example to select the appropriate express logistics location, in which large range as choose express the presence of a main business, for example with some administrative region, city or in the south of the city, north or east.

- Area divided into a specific location to a certain range according to the actual land use and the limitation of the block area are divided into several different areas.

- To determine the locationIn a specific area to determine logistics park at site.

Here, we use level model to find the best candidate area, then secondary model is the best candidate for the regional geographical advantages, to complete the layout of the best choice.

#### 4.1 The primary model

The primary model is established for the purpose of is to determine the target cities all logistics location is set the best area of logistics park, the results can be more best. The model expression is as follows:

- Must consider the location factor is determined. According to the domestic and foreign logistics and distribution center location factor analysis and the research results show that the main locational factors of consider the following four aspects: Market factors, the main consideration of the service object, type, size and layout; Traffic factors, including and services object space distance and location where traffic conditions; Competitive environment, it mainly refers to the same kind of the express logistics node scale and with this node space distance, the related resources acquisition, as well as the basic unit of distribution; Other factors, including natural factors and government decree;

- Then according to the influence degree of various influence factors on the project determine its score, evaluation standard. Table 1 combined process of the city location factors of city individual scoring criteria, including specific projects can be set up according to the city;<sup>[4]</sup>

- Then the scores are multiplied further evaluation, If the result is greater than  $3^n$  is a good location, Score between  $3^n \sim 2^n$  as general location, scoring less than  $2^n$  is bad location (n is the number of items examined) ;

- Based on the above score, as well as the logistics position within the population, industrial and commercial facilities, geographical distribution and scale to elect candidates.

**Table 1. City location factors individual scoring criteria**

Location factors	Score			
	4	3	2	1
Population size	More than 100 thousand people	100-150 thousand people	50-10 thousand people	Less than 10 thousand people
Industrial and commercial scale	Annual throughput of more than 1 million	Annual throughput of 80-60 ten thousand	Annual throughput of 60-40 ten thousand	Annual throughput of less than 40 ten thousand
Traffic factors	Close to the market, close to the origin or into the direction of distribution logistics, near the important transport corridor.	Close to the market, or near the origin or into the direction of distribution logistics, or near the important transport corridor.	Origin of goods distribution logistics is relatively close to the market or into the direction, or is tight in the important transport corridor.	Don't close to the market, the origin or into the direction of distribution logistics, or adjacent important transport corridor
The competitive environment (distance of nearest competitors)	Greater than 6 km	3-6km	1-3km	0-1km
Natural factors	The terrain slope or slightly sloping	Cities is a bit high, no slope	flat	Low-lying, water area
The main land property	Land for commercial services	Industrial land	Residential land	Suburban farmland

## 4.2 The secondary model

Here is the main application of the model in order to have in the city of the construction of the express logistics node location advantages and then set up, she is from the above basic model changes location advantages. This model takes into account the economic development level of different district of the city and the construction of infrastructure, and traffic situation of each district to the logistics node. The area here is not practical in a residential area, but only an abstract concept of community, there may include actual living residential areas, universities and colleges, factories, enterprises and institutions such as a densely populated place.

$$v_i = \sum_{j=1}^m v_{ij} = \sum_{j=1}^m H_j \exp(-T_{ij}) \quad (2)$$

$$T_{ij} = L_{ij} / R_{ij} \quad (3)$$

In equation (2),  $v_i$  represents the express logistics node i location advantage;  $V_{ij}$  represents the j location advantage contribution to express logistics node i amount;  $H_j$  represents the economic index of j;  $T_{ij}$  stands for collecting and distributing system impedance of j and i express logistics nodes; m represents the number of city community;  $L_{ij}$  on behalf of the express logistics node I and area j transport distance;  $R_{ij}$  representatives express spatial accessibility of logistics nodes i and j ;

$$R_{ij} = \sum_{k=1}^n N_k C_k$$

(4)

$N_k$  is the number of channels between nodes and logistics community in the first k modes of transport ( rail, road , river , etc. ),  $C_k$  is the weighting factor of the first k modes of transport , Weight factor according to the mode of transportation of the unit transportation cost between the community and express logistics nodes .<sup>[5]</sup>

Through the above formula putting the data between urban areas and express logistics node into it can be concluded that the logistics node location advantages. This, in turn, can make the comparison of the candidate of logistics node. Also need to pay attention to the above formula is  $H_j$  means economic indicators for community j, could use the average house prices to replace, because prices can represent most of the level of household income. Then income level also can represent of such resident.<sup>[6]</sup> For express industry which is a very important data, because consumption level there are many factors, such as income level, level of education, credit conditions, etc., but these data are hard to obtain, especially in China, everyone is not willing to reveal their basic situation. So I decided to instead of the district economic indicators in house prices.<sup>[7]</sup>

## 5. EXAMPLES OF VERIFICATION.

An express logistics company in Dalian to meet the needs of Shahekou District express material flow of the whole plans to build a number of express logistics nodes. Through the study of logistics research and analysis, proposed in the region to establish a express logistics node. According to the trend of urban development, on the basis of analysis of the express logistics demand forecasting, according to the scope of express logistics service object properties, service and other characteristics in the region is divided into five to choose express logistics nodes, respectively by I, II, III, IV, V. According to the locations of the above model, to establish the primary

model to determine scores of the five candidate regions.



Figure 1. ShaHeKouOu candidate logistics nodes

According to the primary model, the operation steps are as follows:

1) Must consider the location factor is determined. Because of logistics industry in Dalian to enter on the policies and land administrative examination and approval are lean, so the logistics will be the basis of investigation and forecast of the location factor mainly lock in market, transportation, competition environment, natural conditions and land use in nature, such as listed in Table 2.<sup>[8]</sup>

2) According to the influence degree of various influence factors on the project determine its score, such as in Table 2.

3) Establish criteria. As the candidate area more than 200, with the result of scoring points results in 200-50 as the general area, according to the score, I, II, III for area are candidate regions, regional IV, and V is the general location.

Table 2. Location factors of individual grade

Common area	Location factors					Total
	Market factors	Transportation factors	Competitive environment	Natural factors	Nature of land	
I	3	3	4	3	3	324
II	4	3	3	2	4	288
III	2	3	3	4	4	288
IV	2	3	3	4	2	144
V	2	2	3	2	4	96

The highest score of three areas I have indicated in Figure 1, I, II and III are three candidates out of the area. If the express logistics company to first try to shorten the logistics delivery time for the customer experience, so for the three logistics nodes establish secondary model.

Known Shahekou District several logistics area respectively. A, B, C, D, E. As shown in figure 2.

There are many universities in A and B area. When data into the formula to note is that there is a university community, how to determine its economic indicators? University is a high density high purchasing power of the community that is different from other communities, so to have regional economic indicator of the university of statistics according to most expensive in the study area.

Table 3. Economic indicators of city districts

City districts	A	B	C	D	E

Economic indicators	22 thousand Yuan	22 thousand Yuan	12 thousand Yuan	17 thousand Yuan	22 thousand Yuan
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**Table 4. The distance of I, II, III three candidates to each transportation district**

	A(10km)	B(10km)	C(10km)	D(10km)	E(10km)
I	0.47	0.61	0.75	0.45	0.13
II	0.82	0.25	0.45	0.15	0.32
III	0.97	0.53	0.21	0.27	0.46

The data in Table 3 is  $H_j$ . The data in table 4 is  $L_{ij}$ . Then above the collected data into the formula(2) and (3), then you can calculate the area for I, II, III three candidate transport node location contribution amount, and concluded that the three express logistics node location advantages.

**Table 5. Every district for contribution amount of logistics node location and locational advantages of each logistics node**

	$V_{Aj}$	$V_{Bj}$	$V_{Cj}$	$V_{Dj}$	$V_{Ej}$	Locational advantage
I	1.38	1.20	0.57	1.08	1.93	6.15
II	0.97	1.71	0.77	1.46	1.60	6.51
III	0.83	1.29	0.97	1.30	1.39	5.79

Locational advantage of I,II and III is 6.15, 6.51,and 5.79. Location advantage the greater the more suitable for a selected express logistics nodes. According to the I, II, III location advantages can know choose II as Shahekou District logistics nodes is the most can satisfy the needs of customers.

## 6. CONCLUSIONS

Through the above based on the location advantage for the analysis and research of the express logistics node location problem, and combining the examples, can draw the following conclusion:

- Logistics node location, in combination with the practical situation of city, after detailed analysis, only in the full analysis of the specific conditions and under the condition of supply and demand, to plan out a reasonable logistics park layout;<sup>[9]</sup>

- Express logistics node location has the characteristics of the space location advantages of the location theory is the study of integrated application of technology. Specific data and index of the selected directly affects the reliability of the express logistics node location model conclusion;

- Location advantage can not only express logistics node provides the theory basis for site selection, and for its guidance, the construction scale, service functions, operation and the subsequent planning, etc.<sup>[10]</sup>

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