Model Confirmation of Logistics Park Land Size Based on Classification of Chinese National Standard

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Abstract

The problem of logistics park land size has always been a difficult one in logistics park planning and construction. And prediction of the amount of the logistics park, the impact on the surrounding traffic and regional traffic matching problem are also related to this issue. The authors summarize the results of previous studies, propose a new idea about research on the land size of the logistics park basing on four categories of Chinese national standard and describe this issue respectively from the micro and macro perspective, so that the study of this problem is more specified and detailed.

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Keywords: logistics park land size; Chinese national standard on logistics park categories; macro and micro methods

1. Introduction

With China’s rapid economic growth, China’s modern logistics industry has become an important support for economic development. In February 2009, the State Council executive meeting examined and approved the inclusion of China’s logistics industry among the top ten industries that are revitalized. Local governments take the development of modern logistics industry as an important strategy which can support sustainable economic development, improve the investment environment, enhance social and...
economic benefits, reduce the social logistics costs as well as fully utilize and integrate social logistics resources from the perspective of social development and industry competition.

Logistics park is an important part of the social logistics system, where the flow of "people", "cargo ", "information ", "cash" gather, and also the inevitable product of regional economic development. An important part of the problem in the construction and development of logistics park is the size of the logistics park. Bad effect will take place in the park's operations and local economy either logistics park land is too small or too large. Thus, it is particularly important to seek appropriate scale of the logistics park for its own and economic development.

China's logistics park planning and construction has great blindness due to the lack of systematic theoretical and scientific planning means and assessment. At present, China has emerged many failed cases, causing huge economic losses to the state and businesses. There are many factors that affect the development of logistics parks; one important factor is the determination of the size of logistics park land. Then we can analyze the amount of logistics, traffic volume, relations between park and its surrounding traffic and matching problems of logistics systems and integrated transport system. This article is based on this background.

2. Classification of the logistics park

According to national standard "Classification and basic requirements for logistics park" carried out in 2008, China's logistics park is divided into four types. When calculate their sizes, different types of logistics parks should be calculate separately because of their different functional modules and land-use parameters.

2.1 Type of freight service

Logistics park of freight service should be selected in airports, seaports or land ports of considerable scales in order to achieve cargo transfer between different modes. Freight hub logistics parks should meet the following requirements:
- Planned relying on air, sea or land transportation hub and converged by at least two different forms of transportation;
- Providing large quantities of cargo conversion facilities to achieve an effective interface between different modes of transport;
- Providing service to the international or regional logistics transport and conversion.

2.2 Type of production service

Logistics park of production service faces to manufacturing industry and provides service for supply chain in enterprises. Production service logistics park should meet the following requirements:
- Planned relying on the economic development zone, manufacturing industries such as high-tech industries;
- Providing integrated logistics services to manufacturing industries;
- Mainly serving in the materials supply and product sales of manufacturing industries.

2.3 Type of business service

Logistics park of business service provides service for commercial circulation industry. It also provides service for circulation of commodities. Logistics park of business service should meet the
following requirements:
  - Planned relying on different large-scale commodity trade market, professional market, provide service for business marketing;
  - Providing service for distribution, transportation, distribution, storage, information processing, distribution and processing of goods;
  - Mainly serving distribution of goods in commercial circulation.

2.4 Type of comprehensive service

Logistics park of comprehensive service has more than two characteristics of the other 3 types logistics park and it provides diverse services. Comprehensive service logistics park should meet the following requirements:
  - Planned relying on urban distribution, manufacturing, commerce and trade circulation and other diverse objects;
  - Located in main urban transport nodes, to provide integrated logistics functional services;
  - Mainly serving in urban distribution and regional transport.

3. Determination of the size of the logistics park land based on micro research ideas

With reference to Yu-Min Li, Xu-Hong Li in their dissertation, I present my idea about improving the modeling approach, in which an empirical equation to determine the size of the logistics park is built, considering the proportion of operating area in the total park area.

\[
s = \left( \frac{L \times \alpha \times i_1 \times i_2}{365q} \right)
\]

Parameter description:
1. Average annual urban freight (L). China's annual freight volume can be obtained from the Statistical Yearbook, thus average daily freight volume of China can be calculated. This paper is to determine the cargo commitment of different logistics parks, so Average annual urban freight must be divided into four parts which match four types of parks. This kind of statistics is of great difficulty, so approximate methods are used to calculate them.

2. Commitment proportion of social public freight logistics (i_1). China's annual freight volume is undertaken largely by public logistics companies, mainly third-party logistics companies, which are the most important targets of logistics parks. In order to obtain the true attractive logistics volume, investigation of outsourcing services willing of those shipper companies must be done.

Since emergence of third-party logistics in Europe and America in the 1980s, it has got rapid development, now market share of third-party companies has been considerable for the entire market.

Table 1. The proportion of current 3PL market in some countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Japan</th>
<th>USA</th>
<th>France</th>
<th>Germany</th>
<th>England</th>
<th>Holland</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion(%)</td>
<td>80</td>
<td>57</td>
<td>27</td>
<td>23</td>
<td>34</td>
<td>25</td>
<td>20</td>
</tr>
</tbody>
</table>

In China, as the market economy system gets better and the enterprise reform deepens, corporate self-restraint mechanism enhances and outsourcing demand for logistics services is increasing. Especially with the entry of foreign companies and market competition, awareness of the importance of logistics from enterprises gradually deepens which is taken as "the third profit source". And professional, multi-function third-party logistics demand is increasing.

3. proportion of public logistics access to the logistics park (i_2). Public logistics enterprises provide
the most qualitative and efficient logistics services in order to minimize logistics costs. They complete their regional and even global logistics network layout mostly from their own interests. The construction of logistics parks provides a good platform for those logistics companies, but we cannot say the logistics park will be able to fully meet all the needs of logistics companies. In a long period of time, there will still be some cargo stowage markets and trading centers that will divert part of the third-party logistics. But the good location conditions, traffic conditions and logistics industry cluster effect of Logistics Park make us believe that it has a great temptation to third-party logistics enterprises, and this temptation will continue to be strengthened with the logistics industry developing.

(4) Ratio that operational area takes up the entire park area (q). Learning from the German experience in the construction of logistics parks and warehouses and yards of Chinese architectural design specification, its value is generally between 60% and 85%.

(5) Productivity parameter of unit land $\bar{Y}$ ($\text{m}^2 \cdot \text{t}$). Learning from Japan's experience in the construction of logistics parks and taking into account China's reality, with reference to the author’s master thesis research on the value, the parameter $\alpha$ of China's four types logistics park are estimated for:

<table>
<thead>
<tr>
<th>Type</th>
<th>(ton/km$^2$.d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of freight service</td>
<td>33.37</td>
</tr>
<tr>
<td>Type of production service</td>
<td>37.54</td>
</tr>
<tr>
<td>Type of business service</td>
<td>42.91</td>
</tr>
<tr>
<td>Type of comprehensive service</td>
<td>50.1</td>
</tr>
</tbody>
</table>

Through the acquisition of the above parameters, logistics park land size thus can be planned. This method is from the micro point of view to calculate logistics park land. Although perfect in theory, in the calculation process, acquisition of large number of data and correction are the difficulties in planning.

4. Determination of the logistics park land size based on macro research perspective

Logistics park land size is not only closely related to the amount of logistics, but also to macro economic factors such as the level of regional economic, regional traffic environment, the level of regional trade. The focuses of this section are analyzing the relationship between logistics park planning and construction and economic development, regional transportation, regional trade; determining the planning model adapted to China's development; realizing the harmony development between logistics park planning and construction and economics.

4.1 Idea on determination of the logistics park land size based on macro research perspective

The research idea is from the benchmark theory of industry. The size and function of newly constructed logistics park must refer to those successful logistics park and combine with their own economic, transportation, trade and other conditions. Therefore, a set of evaluation indicators are set to reflect the impact of the macro-scale factors on the logistics park land, and the new logistics park are compared with the benchmark ones. Especially, the benchmark for Logistics park in the initial stage can be a success of a logistics park; after development of logistics, the benchmark can be a type of average value of the logistics park in some region, which is a dynamic process.

The idea that calculates logistics park land size under the influence of macroeconomic factors is:
(1) Establishment of indicators and constraints
Assume there are n factors that impact the logistics park macroscopically, denoted as F_1 ... F_n, whose impact weight is \( \alpha \); the secondary factors are denoted as F_{1m}...F_{nm}, whose impact weight is \( \beta \),

\[
\sum_{i=1}^{n} \alpha_i = 1, \quad \sum_{j=1}^{m} \beta_j = 1
\]

(2) Determine the weight \( \alpha \) and \( \beta \) subjectively or objectively.

(3) Use the non-dimensionless method to fit different measurement units and scientific methods to get composite score.

(4) Plan and design the size of land for logistics park based on the use of analogy of international region and comparison of national region method after determining the composite score.

4.2 Model building on determination of the logistics park land size based on macro research perspective

Through the preceding analysis, we can draw a formula that explains the relations between new logistics park and benchmark:

\[
S_n = \frac{\sum_{i=1}^{n} \alpha_i \sum_{j=1}^{m} \beta_j F_i}{\sum_{i=1}^{n} \alpha_i \sum_{j=1}^{m} \beta_j F_i} \times S_b
\]

(2)

which St.

\[
\begin{align*}
\sum_{i=1}^{n} \alpha_i &= 1 \\
\sum_{j=1}^{m} \beta_j &= 1
\end{align*}
\]

(3)

In the formula,

\[
\sum_{i=1}^{n} \alpha_i \sum_{j=1}^{m} \beta_j F_i
\]

is composite indicator result for new logistics park,

\[
\sum_{i=1}^{n} \alpha_i \sum_{j=1}^{m} \beta_j F_i
\]

is composite indicator result for the benchmark logistics park. \( S_b \) refers to the benchmark logistics park land size. Under the standard of China's national logistics park classification, it can represent benchmark logistics park land size of any class, and the corresponding \( S_n \) refers to new logistics park land size.

Calculation method on determination of the logistics park land size based on macro research perspective

(1) Indicators establishment. Establish an evaluation system in accordance with demand, F_1 ... F_n are macroeconomic factors 1 – n that affect the construction of logistics parks, secondary factors are recorded as F_{1m}...F_{nm}. For example, F_1 are selected to be GDP, then F_{11}, F_{12}, F_{13} may represent the primary industry, secondary industry and tertiary industry output value.

(2) Determine the weight of indicators. Indicators’ weights can be determined by the combination of subjective and objective methods. Subjective methods commonly contain linear analysis, regression analysis and other methods; objective methods commonly contain data envelopment analysis, genetic algorithms, ant colony algorithm and other methods. In order to determine the weights, expert evaluation is usually taken into consideration when using subjective method, several experts that are famous in their field are chosen to determine the weight. The final scores are determined by them through several rounds.

(3) Calculating method of indicators. As the dimensions of the indicators differ, which means non-dimension process is needed after the identification and weighting of indicators, to get the indicators
normalized. A reference-worthy method to calculate the indicator index is: make the maximum value of an index as a benchmark and the index is 1, then calculate the corresponding index of other region by comparing with the benchmark index.

(4) The selection of benchmark logistics park. The key step to plan a new logistics park land size is how to select the correct benchmark; usually the following points are mentioned:

The logistics park that is chosen to be benchmark must have similar characteristics with the goal park. Developing countries never try to learn from logistics parks that come from the most developed areas, because under the restriction of economics and operational efficiency, the results will only get mere copycat. Chongqing’s Park is more proper to be a benchmark than Shanghai’s park when the goal park is from Chengdu.

As different types of logistics parks generate different volume of logistics, when choosing a benchmark park, we must choose park of the same type as much as possible.

5. Conclusions

In conclusion, the author proposes two kinds of methods from micro and macro perspective when planning logistics park on the basis of earlier studies, two methods have their advantages and disadvantages and application conditions:

In those areas that the development of logistics is not mature and the total economy is small, micro approach should be taken in planning their logistics park land size. First predict the volume of cargo and logistics and then calculate the land size.

In those areas that the development of logistics is mature and the total economy is large, macro approach should be adopted in planning their logistics park land size. Establish a suitable model system to compare the two regions and solve logistics and land size.

Acknowledgements

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