

# Location Arrangement Study of Logistics Distribution Center on basis of Customer Satisfaction

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**Abstract**—Since the reform and opening up, especially the 21st century, with China's rapid economic development, the logistics industry has become a sunrise industry in national economy, but also a new economic growth point. At present, Chinese governments at all levels and many companies regard the logistics industry as a major part of new era economic development. Regarding how to improve the core competitiveness of an enterprise or a regional, logistics has become an important factor. It is what we need to implement in the stage about how introduce modern logistics concept in Western countries, modern management model and advanced logistics technology into national and local economic development. Meanwhile, the rapid development of economy makes consumer demand go to personalized and fine direction. Faced with increasingly fierce business competition, customer satisfaction has become increasingly important in the modern logistics and distribution. And the enterprise logistics level affects the level of service to its customers directly, which put forward higher requirements for logistics and distribution activities. Therefore, it will be one of the important directions for future study distribution center location to introduce the logistics distribution center location problem based on the concept of customer satisfaction, through correlation algorithm to build decision-making model based on customer satisfaction, to ensure the distribution center site selection decision objectives consistent with corporate strategic goals, customer expectations as far as possible.

*Keywords*-customer satisfaction; distribution center location; location model; Hierarchy Process

## I. INTRODUCTION

With China's rapid economic development, the logistics industry has become one of the sunrise industries in national economy, but also a new economic growth point. The rapid development of economy makes consumer demand go to personalized and fine direction. Faced with increasingly fierce business competition, customer satisfaction has become increasingly important in the modern logistics and distribution. And the enterprise logistics level affects the level of service to its customers directly, which put forward higher requirements for logistics and distribution activities. Therefore, it will be one of the important directions for future study distribution center location to introduce the logistics distribution center location problem based on the concept of customer satisfaction, through correlation algorithm to build

decision-making model based on customer satisfaction, to ensure the distribution center site selection decision objectives consistent with corporate strategic goals, customer expectations as far as possible.

## II. DISTRIBUTION CENTER LOCATION AND CUSTOMER SATISFACTION INTRODUCTION

### A. Classification of logistics distribution center

There are the following types:

- Professional distribution center. This distribution center is not engaged in the operation of the service delivery, but with distribution as its specialized function. Distribution technology and distribution object has some comprehensiveness in a professional area, conducting the distribution of a variety of materials.
- Flexible distribution center. It has strong adaptability for users, distributing according to different demand, and can change at any time, rather than fixed, specialized distribution center.
- Supply distribution center. This distribution center is usually used for certain users or individuals specially.
- Sales and distribution center. It is a kind of distribution center taking distribution as means sales operations for purpose.
- Urban distribution center. Its scope is limited in the city, usually distributing goods to the final customers through the car transport.
- Regional distribution center. It has a strong inventory preparation and strong radiation, typically the range of its distribution customers is facing the province, the country and even the world.
- Storage-distribution centers. It typically has strong storage function.
- Flow-distribution centers. It is a kind of distribution center with free access or temporary storage way of delivery, but usually has no long-term storage capabilities.
- Processing distribution center. This distribution center mainly processes goods in the distribution and then shipping them out.

## B. Functions of logistics distribution center

As a node of logistics supply link, logistics distribution center has a lot of functions, mainly divided into following aspects:

- Distribution function. Due to the distribution centers having a variety of advanced equipments and facilities, they can make organic combination of products needed by each user for centralized sorting, assembly, and finally delivered to the respective customers.
- Group matching functions. The distribution center usually has more than one customer and each customer has different requirements for goods quality, quantity, variety, models, specifications, delivery time and location, so distribution centers must sort and match group in accordance with the needs of each client in the process of providing services to customers.
- Sorting function. It is a very complex task for distribution center completing a lot of and a wide variety of goods selection in a short time accurately and efficiently, which makes sorting and distribution center has become an indispensable part.
- Storage function. Usually in market economy, market demand cannot be predicted accurately, in order to ensure the normal operation of market demand as well as other aspects of circulation, processing and distribution, the distribution centers should be equipped with the appropriate equipments and storage facilities to store a certain amount of goods in order to cope with forecast market.
- Distribution function. Distribution means the distribution center does sorting, distribution and other operations and send the sorted products to the hands of consignees according to users' orders requirement, and it will also need plans to send a car, the car's line and vehicle load scheduling during the delivery of goods.
- Distribution processing function. In order to facilitate the production or sale, distribution center usually should process the goods more or less as per reasonable distribution rule and customers' requirements in the process of the goods entering consumption field from production field.
- Resource recovery function. Distribution center may produce many resources that can be recovered in the course of the job.
- Information integration function. Distribution center is connected to the upstream suppliers and downstream retailers, so it is the hub of the entire distribution process. It will need the exchange of information connected with the supply and demand sides during its internal work activities, therefore, the distribution center has a relatively complete information integration .
- Demand forecasting function. Self-use distribution centers are often responsible for predicting the amount of stock and delivery in accordance with the purchase and shipment information of logistics

center, and thus to predict market demand for commodities.

## C. Location methods

Location methods usually include qualitative analysis and quantitative analysis.

### 1) Qualitative analysis

Qualitative analysis is mainly based on aforesaid factors and location principles, relying on the rich experience of experts and management staff, the knowledge and the ability to analyze comprehensively to determine the specific location of the distribution center.

Advantages and disadvantages comparative method, to set out the best, good, general, poor, very poor five levels to rate each program features, then add the scores of each item, the highest score is the optimal solution.

Delphi method takes use of back to back communication to consult the prediction views of panelists, after several rounds of consultation; the prediction tends to concentrate, resulting in the predicted conclusion in line with market trends.

### 2) Quantitative analysis

There are a variety of quantitative analysis methods, such as the center of gravity method, method of transportation problems, output cost and interest analysis, weighted analysis, Baumol-Wolfe model, CFLP models and other methods.

Center of gravity method is a simulation method that considering the need points and resource points in logistics system as the logistics system distributed within a certain range of plane, the demand and amount of resources for each point is respectively considered as the weight of the object, the object center of gravity of the system should be the best set-point as a logistics network, taking use of the method to get the center of gravity position of objects system to determine the logistics network branches. Transportation problem method is used for the conditions of multiple suppliers, multiple clients, with a large range of radiation, and necessary to establish two or more distribution centers.

Output cost and interest analysis is also called break-even analysis or breakeven analysis, through analyzing the relationship among production costs, profits and the number of products to master breakeven, so it can guide the enterprises to minimize the cost of producing the most products with the lowest costs and allow companies to maximize profits.

## D. Elements affecting the location

With the continuous development of logistics industry, distribution center position in the circulation has become increasingly important, and the location of distribution center plays a vital role in the following operation, so it is directly related to the logistics costs, efficiency of distribution and service levels. Thus when you plan to build a distribution center, you should ensure that it can provide the services meeting customers' requirements and achieve customers' satisfaction, while also considering the entire logistics costs, and then determine the location. You should also consider the factors:

### 1) Social factors

Transportation. Transport is one of the important factors that affect the distribution cost and efficiency. It

will need to consider external transport links and access fluency, in order to improve distribution efficiency and reduce logistics costs.

**Industrial layout.** Production, distribution companies, all kinds of development zones and large markets are the direct drivers and source of goods for logistics and distribution services, so we need to consider the layout of the surrounding industrial and commercial layout.

**The flow of goods.** For supply logistics, the distribution center only offers raw materials, components for production enterprises. So it should choose locations near production business to reduce the inventory of production businesses, to be ready to provide services for production companies.

**Human Resources.** Consider all availability, easy availability and cheapness of talents.

**Urban planning and development.** Location of distribution centers should not only comply with the planning of the city, but also consider the speed and direction of the city's expansion.

**Policies and regulations.** Including industrial policy, environmental policy, land policy, incentives and so on.

**Social impact.** Distribution centers should consider the level of coordination between the human environment and the surrounding urban landscape, can not destroy the surrounding urban landscape, in order to avoid a negative impact on society.

#### 2) Natural factors

**Land.** Location, area and land price of distribution center should not only take today's development into account, but also consider future expansion space dock distribution center.

**Geological conditions.** Distribution centers are usually located in high place, which is easy to maintain materials dry, reducing storage costs; if they are near river and sea, please pay attention to the local water level, without overflow of groundwater; land bearing capacity should be high and pay attention to whether existing adverse geological conditions like silt seam, quicksand layer, loose soil.

**Climate impact.** There should be no corrosive gas, dust and radiation heat plant around distribution centers.

**Hydrological conditions:** Distribution centre should select the area away from underground water and ease flooding river basin.

#### E. Main factors affecting customer satisfaction in the location

There are many factors that not only affect businesses or distribution centers' level of services, but also affect customer satisfaction for enterprises and distribution centers, thereby affecting customer loyalty, the affecting aspects:

**Goods perfectness ratio.** When the customer accept distribution service, the distributed goods perfectness depends on the facilities of distribution centers and whether the environment situations of distribution centers are safe.

**Time factor.** It's the most important factor affecting customer satisfaction on distribution centers, so it should be considered fully.

### III. DECISION-MAKING METHOD OF LOCATION---ANALYTIC HIERARCHY PROCESS (AHP)

#### A. Introduction

The so-called AHP refers to the approach taking a complex multi-objective decision making as a system, and decompose the target into multiple targets or guidelines, and then decompose into multiple indicators (or criteria, constraints) various levels, using qualitative indicators fuzzy quantization method to calculate single hierarchical arrangement (weights) and total arrangement, as the target (multiple indicators), multi-program systems optimized decision-making.

Analytic hierarchy process is to decompose decision problems into different hierarchies according to the arrangement of total goals, sub-goals of each layer, evaluation criteria to specific ready scheme, and then use judgment matrix eigenvectors approach to get the prior weight of the elements of each level on certain element of last level, finally use weighted sum approach to conduct hierarchical merging the final weight of each alternative schemes on the general object, and the greatest final weights is the optimal solution.

#### B. Steps of analytic hierarchy process

##### 1) build up hierarchal structure model

Based on deep analysis of the actual problem, decompose the related factors into several levels according to the different attributes from the top to bottom. Many factors of the same level belong to the upper hierarchy or affect the upper layer, while governing the next dominant factors or being affected by the factors of down level. The uppermost level is the target level, usually only one factor, the bottom level is usually scheme or objects level, there are one or several levels in the intermediate, typically as criteria or index level.

##### 2) Build judgment matrix

Judgment matrix is the basic information of AHP, but also an important basis for weight calculation. Starting from the second level of hierarchical model, for each element in the same level belong to the upper level (or influencing)subordinate, using pair comparison method and 1-9 comparative scale building comparison array until the lowermost level.

The element  $a_{ij}$  in judgment matrix A means the ratio of  $i$  and  $j$  relative importance, having the following relationship,

$$A_{ij}=1/a_{ji} \quad a_{ii}=1,2,3,\dots, n$$

Obviously, if the ratio value is higher, the importance of  $i$  is higher.

TABLE I. QUANTIZED VALUE

element divide element	quantized value
same importance	1
slight importance	3
higher importance	5
much higher importance	7
Extremely higher importance	9
the median of two adjacent judgments	2, 4, 6, 8

### 3) Calculate weight vector and do check consistency

For each pairwise comparison matrix, to calculate the largest eigenvalue and corresponding vector, we shall use coincident indicator, random coincident indicator and consistency ratio to do check consistency. If passing the check, the eigenvector is weight vector: if not, pairwise comparison matrix needs to be rebuilt.

$$C.I. = \frac{\lambda_{\max} - n}{n-1} \quad (1)$$

Higher coincident indicator C.I. value means the more judgment matrix diverging crash consistency; lower C.I. value means the more judgment matrix closing to crash consistency. Usually, when the order n of judgment matrix is higher, the diverging value of crash consistency indicator C.I. value is higher; otherwise, the value will be lower.

When  $n < 3$ , judgment matrix has crash consistency. The ratio of judgment matrix coincidence indicator C.I. and the same order average random consistency index R.I. is called Consistency Ratio C.R.

$$C.R. = \frac{C.I.}{R.I.} \quad (2)$$

When  $C.R. < 0.10$ , we can think judgment matrix has acceptable consistency. When  $C.R. \geq 0.10$ , judgment matrix needs to be adjusted and corrected, make it meet  $C.R. < 0.10$ , thus having satisfied consistency.

### 4) Calculate combination weight vector and do combination check consistency

Calculate the bottom combination weight vector for the target and using the formula to do combination weight vector. If passed, make decision according to the results expressed by combination weight vector, unless reconsider model or rebuild those pairwise comparison matrix with higher consistency ratio.

### 5) Conclusion

At last, get the total arrangement for the general objective of each scheme. Therefore, we can get the optimized schemes through the above calculation and analysis.

## IV. CONCLUSION

In this paper, we start to study the location issues of location from two aspects of distribution centers and customers. The earlier chapters analyze the basic theory of distribution centers and common location models and

methods, and build multi-objective location distribution center model on the basis of customer satisfaction. The paper also compare with traditional distribution center location model which only considers only the cost through actual cases.

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